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## VENU GOVINDARAJU

*Vice President for Research and Economic Development*

University at Buffalo, The State University of New York (SUNY)

January 2, 2025

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SUNY Distinguished Professor  
Computer Science and Engineering  
<http://research.buffalo.edu>

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### **EDUCATION**

1992	Ph.D. Computer Science, University at Buffalo, SUNY
1988	M.S. Computer Science, University at Buffalo, SUNY
1986	B.Tech. Computer Science and Engineering, Indian Institute of Technology Kharagpur

### **EXECUTIVE POSITIONS**

*University at Buffalo, SUNY*

1/16 – Present	<b>Vice President for Research and Economic Development (VPRED)</b>
1/20 – Present	Operations Manager (OM), Research Foundation on SUNY Flagship UB Campus
1/23 – Present	Director/PI, NSF National AI Institute for Exceptional Education (9 university consortium)
7/13 – 8/15	Director, Computational Data Science and Engineering
1/07 – 8/15	Director, Strategic Strength in Information and Computing Technology
1/04 – Present	Director, Center for Unified Biometrics and Sensors (CUBS)
1/94 – 1/04	Associate Director, Center for Document Analysis and Recognition (CEDAR)

### **ACADEMIC POSITIONS**

*Department of Computer Science and Engineering, University at Buffalo, SUNY*

11/10 – Present	SUNY Distinguished Professor
09/08 – 11/10	UB Distinguished Professor
08/02 – Present	Full Professor
08/00 – Present	Associate Professor (Tenure)
06/92 – 8/00	CEDAR Research Scientist, Senior Scientist (1994) and Principal Scientist (1996)

### **STEERING COMMITTEES CHAIR (UB Provost charge)**

2023 – 2024	Research Administration Steering Committee, “How to reduce administrative burden on PIs”
2022 – 2023	Regional Economic Hub positioning (Build Back Better, Tech Hub, NSF Engines)
2022 – 2023	Storage, security, and access of research data strategy
2020 – 2021	Disciplinary Excellence Initiative (recommendations for one-time, significant investments)
2018 – 2020	Safeguarding University faculty assets and interests

### **EXTERNAL LEADERSHIP**

6/23 – Present	Co-chair, SUNY Artificial Intelligence Task Force
3/23 – Present	President’s Delegate, AAU Task Force on Expanding U.S.-India University Partnerships
2020 – Present	Director, Empire Discovery Institute (Drug Discovery Consortium), New York State
2019 – Present	Advisor, SUNY-IBM Artificial Intelligence Research Alliance
2018 – 2020	Executive Committee, APLU Council on Research
2015 – 2024	Board Member, Hauptman Woodward Institute, NY
2015 – 2016	President, IEEE Biometric Council
2014 – 2021	Advisor, Institute for Development and Research in Banking Technologies, India

## KEY LEADERSHIP ACCOMPLISHMENTS

### Transformational Impact

- ✓ **65% increase in annual research expenditures during VPRED tenure (2014-24)**
- ✓ **Pivotal role in Buffalo's participation of the Buffalo-Rochester-Syracuse Tech Hub \$40M semiconductor manufacturing and innovation award**
- ✓ **Pivotal role in UB's participation in the \$400M Empire AI consortium of SUNY, CUNY, Cornell, NYU, Columbia, RPI and Simmons Foundation (2024)**
- ✓ **PI on \$20M National NSF/IES AI Institute for Exceptional Education (2023)**
- ✓ **Shepherded UB-IIT collaboration across emerging technology areas leading to the US-Indio Global Challenges Institute (2023)**

- **LEADERSHIP in “AI for SOCIAL GOOD”**

- Co-chairing the SUNY AI Task force that is providing system wide leadership in: i) **creation of a new department**, AI and Society, at SUNY R1 campuses, ii) a **system wide virtual center**, and iii) a SUNY specific private LLM for researchers and students.
- Identify departments and focus areas annually that align with UB's strategic vision to facilitate **high profile hires** under SUNY's Empire Innovation Program (on behalf of the UB Provost).
- **Congressional Delegation (October 2024, January 2025):** Hosted SUNY Chancellor and the Western New York Congressional Delegation to engage with the AI research taking place at UB as Empire AI takes shape.
- **SUNY, NYS Science & Technology, NYS Assembly (July 2024):** Hosted a roundtable discussion with SUNY Chancellor, New York State legislators and UB experts to showcase UB's leadership in AI.
- **Empire AI Consortium Visit (July 2024):** Hosted Empire AI consortium members at UB campus and engaged in strategic conversations and explored sites for the future home of the Empire AI supercomputing.
- **AI Aspirations (June 2024):** The work of UB and the National AI Institute for Exceptional Education was presented at AI Aspirations, a White House-organized event, which showcased American AI innovation. <https://ai.gov/aspirations/>
- **AI Expo for National Competitiveness (May 2024):** Upon invitation of the National Science Foundation, presented the National AI Institute for Exceptional Education's work to close educational gaps for children through AI was highlighted. <https://expo.scsp.ai/>
- **UB-IBM Event (May 2024):** Engaged with IBM leadership that showcased the opportunities of AI in industry.
- **Empire AI Roundtable (April 2024):** Represented SUNY at a roundtable organized by New York State Governor Kathy Hochul to discuss New York's Empire AI initiative.

- **ADMINISTRATION**

- Introduced a new Chief Compliance Officer position and established a standing committee which includes MDs and social scientists to streamline **IRB Management**.
- Chairing a high-level team of vice provosts, deans, and senior staff to position UB as the leader in **integrating scholarship and innovation with industry needs, commercialization, workforce diversity, STEM pipelines, and jobs** to create a regional economic tech hub in Western New York (2022-23).
- Identified and cultivated technical leaders across campus to ensure preparedness to respond competitively to high value, federal opportunities (**EDA Tech Hubs**) that look to us to engage in regional economic development. Led federal proposals of \$100M for NSF Engines and Build Back Better.

- Defining new scope and vision for UB research and economic development enterprise in accordance with recent flagship status designation by Governor and the aspirational goal of **doubling research expenditures**.
- Chaired university-wide steering committee on the **storage, security, and accessibility of research data** supported through federal and state funding.
- Chaired committee to inform University Provost on STEM departments primed for large, one-time investments under a **disciplinary excellence initiative** (2020-21).
- Chaired university-wide task force on **safeguarding university and faculty assets and interests** to advise faculty and staff on mitigation of undue foreign influence in the research enterprise (2018-20).
- Reorganized Sponsored Projects Services by adding new FTEs in liaison roles to improve support to faculty by implementing a hybrid of central and decanal staffing mechanism to **stem attrition triggered by the pandemic**, and improve work-life balance, workflow efficiencies, and staff morale.
- Implemented a **salary review of research administration staff** to address disparities in compensation when compared to national averages at AAU public universities (2021).
- Created a Faculty Research Hub for **one-stop faculty support** of pre- and post-award operations, team proposal preparation, industry contracts, compliance, and computing.
- **Redefined VPRED roles**, making units more efficient, fiscally self-sufficient, and to stay current with the needs of faculty and students in the ever-changing research landscape.
- Reorganized Technology Transfer to **maximize the constructive collaboration between units** focused on external community and industry-facing partnerships and internal-facing support services for faculty and staff (staff reorganized: 40).
- Reorganized Clinical and Research Institute on Addictions to **integrate research, education and clinical services** to best counter the rising addiction crisis by taking a holistic approach and consider the opportunities afforded by the **new laws governing medicinal use of previously – and exclusively considered – controlled substances** (staff reorganized: 59).
- Addressed **diversity, equity, and inclusion (DEI)** in the research enterprise with cognizance of post-pandemic hybrid workplaces; informed by campus-wide surveys, focus groups, and a dedicated, diverse standing committee charged with recommending systemic changes.
- Implemented **Shared Governance** model in the research enterprise by hosting annual retreats with participation from all research center directors and unit heads, enabling the free exchange of ideas and transparency on all initiatives, and established monthly meetings with Associate Deans for Research to vet new policies and address faculty challenges.
- Established the **Clinical Research Office** in partnership with the Vice President for Health Sciences to spur clinical trials and industry engagement; implemented new policies around budgeting, revenue sharing, and human subjects' compensation in clinical trials (2015).

- **FACULTY DEVELOPMENT**

- Leadership in the **creation of a new department**, AI Science, Systems, and Society, saddled in two decanal units: School of Engineering and College of Arts and Sciences (on behalf of the UB Provost).
- Identify departments and focus areas annually that align with UB's strategic vision to facilitate **high profile hires** under SUNY's Empire Innovation Program (on behalf of the UB Provost).
- Advocated on behalf of entrepreneurial faculty to the UB Provost to consider community engagement and **commercialization activities in faculty promotion dossiers** on par with scholarship in the university's efforts to evaluate impact.

- Recruited and **appointed six Associate Vice Presidents** and more than a dozen research center directors.
- Oversaw **recruitment of 19 interdisciplinary faculty** members under the RENEW (Research and Education in eNergy, Environment and Water) initiative in the areas of environment, water, energy, and sustainability.
- Chaired search committee to **hire 25 interdisciplinary faculty** members across decanal units (Engineering, Arts and Sciences, Management) to build strength in Information Technologies (prior Director role, 2008-13).
- Established best practices guidelines for the VPRED unit to **ensure diversity and inclusion** in the recruiting process, employing consistent messaging and ensuring diversity in pools.
- Collaborated with the Provost's office in **retaining several high-profile faculty** members on campus with retention packages that constituted funding for labs, instruments, postdocs, and more.
- Launched a Grand Rounds forum, **highlighting the research of distinguished faculty** as well as recognizing NSF CAREER awardees and other accolade winners from both STEM and non-STEM areas.
- Establishing a Scientific Fellows program to **recruit "Distinguished Research Faculty"** (non-ladder) that will be self-sustaining and enhance the research profile of highly ranked departments.

  

- **STUDENT FOCUS**
  - Partnered with Dean of Undergraduate Education to develop **experiential learning network** portal so students can obtain credit-hours as well as participate in non-credit experiential projects.
  - Launched the **e-Law clinic** in partnership with UB's School of Law to ensure substantive experiential learning opportunities to students with real businesses and high-growth ventures.
  - Established undergraduate research **abroad** summer program featuring a personalized matching process between students and international research mentors; provides experiential opportunities and visits to the host country's iconic academic and cultural institutions.
  - Partnered with UB Student Life office and the Office of Undergraduate Education to establish a "mixer social day" that allows for **undergraduate students to be recruited and mentored** solely by graduate students and postdoctoral students; promotes easy exposure to research, getting questions answered without hesitation, and the welcoming of underrepresented populations.
  - Oversight of **interdisciplinary programs**: i) Revamping existing bioinformatics undergraduate major (jointly between Biological Sciences and Computer Science and Engineering Departments); ii) Launching of PhD program in Computational Data Science, coupled with partner MS departments; and iii) Development of new graduate certificates in genomic literacy, advanced manufacturing, and robotics.
  - Partner local life sciences and materials informatics companies with undergraduate students for **internships (for pay or credit), leading to employment** upon graduation; class projects informed by real industry challenges/data; sponsorship of graduate student thesis (partnered with UB Career Services).
  - Supported campus-based program designed to introduce **entrepreneurship as a viable career path** to students via Blackstone Launchpad, which organizes hands-on training, business plan competitions, supports startups, networking events, etc.
  - Established a **shadow alumni** program – in partnership with UB Career Services – that pairs undergraduate students with alumni; students shadow alumni (in partnership for days or weeks) to gain an understanding of what an industry job in their field entails; opens avenues for networking, internships, and job prospects.

- Organized **company visits** to campus to expose students to various industries, enabling informed career choices.
- Organized innovative **Sprints & Hackathons** by posing a challenge to student teams to consider innovative solutions that companies can use as part of experiential student learning.
- **RESEARCH**
  - Exceeded \$475M annual research expenditures on NSF Higher Education Research and Development (HERD) Survey (2021); achieved **65% rise in sponsored research**; the submission of large team-science proposals doubled over the last five years.
  - Selected the best team proposals on campus under UB's **Bold Ideas Initiative** to promote ideas and position faculty to win philanthropic awards.
  - Established a \$3M annual fund to support the Buffalo Blue Sky program that provides **just-in-time seed funding** for investigator-led, multidisciplinary research, addressing large and complex societal problems.
  - Established more than a dozen **new research centers** to support star researchers and faculty clusters; recent examples include the Institute for Artificial Intelligence and Data Science (IAD) and the Center for Information Integrity with balanced leadership, representing both STEM and non-STEM expertise.
  - **Achieved accreditations renewals** from AAHRPP (Association for the Accreditation of Human Research Protection Programs, Inc.) and AAALAC (Association for Assessment and Accreditation of Laboratory Animal Care).
  - Provided leadership on **\$30M university investment** in the Communities of Excellence to address societal challenges on renewable energy, advanced manufacturing, global health, and precision medicine; supported core faculty strengths and new faculty hires to fill gaps and strengthen areas.
  - Implemented a plan for creating a sustainable fund for purchase of **high-end instrumentation (\$2M+)** for shared use by PIs so they can conduct innovative research and prepare competitive team proposals.
  - Enabled wins of **large federally funded competitive research centers** (selected):
    - (i) Center for Early Literacy and Responsible AI (CELaRAI) - \$10M
    - (ii) NSF & IES National AI Institute for Exceptional Education - \$20M
    - (iii) MURI on Assessment of Nano/Microelectronics Devices - \$7.5M
    - (iv) AFRL Space University Research Institute on Space Domain Awareness - \$5M
    - (v) EPA Machine Learning prediction tools for neurodevelopment - \$5M
    - (vi) NNSA Center for Exa scale Simulation of Hybrid Rocket Motors - \$8.5M
    - (vii) NSF Science and Technology Center on Biology with X-Ray Free Electron Lasers - \$23M
    - (viii) NIH Clinical and Translational Science Award (CTSA) - \$15M; \$23M renewal awarded.
    - (ix) PCORI (Patient-Centered Outcomes Research Institute) awards - \$10.0M
  - Enabled wins of **large New York State-sponsored projects** through intensive engagement of NYS Economic State Development (ESD) through its Division of Science, Technology, and Innovation (selected):
    - (i) NYS New Drug Discovery Center to move PI's targets to commercialization - \$35M
    - (ii) NYSTAR Centers of Excellence in Bioinformatics and Life Sciences and Materials and Informatics
    - (iii) NY State Innovation Hub for technology commercialization and incubation space - \$32M
    - (iv) NYS Buffalo Institute for Genomics & Data Analytics (BIG) - \$49.5M
    - (v) Center for Advanced Technology in Big Data and Health Sciences (CAT) - \$10.0M

- Enabled wins of **competitive foundation grants** (selected):
  - (i) JPB Foundation in support of environmental justice - \$9M (2017-26)
  - (ii) Mellon Foundation in support of indigenous studies - \$3M (2020); \$2.7M (2023)
  - (iii) Community Foundation for Greater Buffalo, East Side Corridor Development -\$3.2M (2022)
- **INNOVATION AND PARTNERSHIPS**
  - Launched the **Innovation Hub** to accelerate the growth of startups from UB and its partners across technology sectors in Western New York through a New York State initiative (2019).
  - Connected dozens of **incubator companies** with UB talent via internships, competitions, consulting opportunities, speaking engagements, and enhanced career fair opportunities; new wave of startups (more than 60) co-located on university campus and incubators.
  - Created the UB SWIFT program to reduce transaction time with industry by **eliminating lengthy, costly negotiations**; both parties encouraged to set licensing terms at the project planning stage.
  - Created an incentive plan to stimulate industry engagement by **simplifying the licensing process with pre-packaged templates and expedited agreements** to avoid long and arduous negotiations.
  - **Quadrupled SBIR/STTR projects** by incentivizing partnerships of faculty PI with companies to win large multi-phase federally funded projects.
  - Established the Empire Discovery Institute to convert scientific **breakthroughs into viable pharmaceuticals** by overcoming key challenges faced in drug discovery.
- **GOVERNMENT RELATIONS**
  - Played a crucial role in **advocating for the university's interests and building relationships** with policymakers at local, state, and federal levels of government. Recently met New York State delegation of senators and representatives in Washington, DC (July 26, 2023).
  - Developed strategies, prepared grant applications, and negotiated with agencies to **secure funding from government sources** by analyzing policy trends, identifying key decision-makers and engaging them. A current application (Fall 2023) can result in a potential investment of several hundred million dollars in UB's research infrastructure.
  - Panelist on "Current Developments in **Artificial Intelligence Regulation**: European Union, Canada, and the United States" at the Association of Research Libraries meeting, Washington, DC (October 17, 2023).
  - **Presented an "AI Primer" to the New York Governor's office staff** (October 5, 2023).
  - Took part in Capitol Hill Day to raise federal staff members' understanding of AI, proactively **shaping the conversation around AI academic research** in this rapidly moving field (September 19, 2023).
  - Develop targeted strategies for **annual federal earmarks and appropriations**, and state funding opportunities to help ensure competitive requests. In FY23, submitted requests totaled \$18.9M.
- **ADVANCEMENT AND ALUMNI RELATIONS**
  - Engaged with successful Computer Science alumni to **invite endowed professorships** and support of AI infrastructure at UB to support AI integrated curriculum to enable wide access of GPUs for classes.
  - Supported UB's Medical School advancement officers in **making the case for significant solicitation** of targeted alumni.
  - Developed a plan, in **collaboration with the UB Vice President of Advancement**, for a substantial (\$100M) ask of an engineering alumnus/CEO of billion-dollar+ global company (2018).
  - Joined the Dean of the UB School of Engineering and Applied Sciences and advancement officers in **cultivating successful school alumni** in the San Francisco Bay area during a series of events (June 2023).

- Strategized with University Advancement for alumni gathering of my former students, with goal of **establishing endowment** (August 2023).
- Received **gifts from high tech companies** (Adobe, eBay, Fujitsu, Google, IBM) as director of university research center (CUBS) for student and project support.

- **ECONOMIC DEVELOPMENT**

- Enabled partner companies to create nearly 2,000 jobs in Western NY over four years; UB economic impact for the WNY region is more than \$3B annually.
- Lead team responsible for 150 technologies ready to commercialize, **50 active startups**, and two incubators offering co-working space to connect with a diverse network of entrepreneurs.
- Participated in **Rochester-Buffalo metro corridor** tours to showcase economic development and innovation assets to enable a single Western New York team for proposal development (2021-22).
- Worked as a team to submit and win the **EDA Tech Hub designation** for the Buffalo-Rochester-Syracuse Semiconductor Corridor (SMART I-Corridor) (October 2023).
- Garnered more than \$100M of **state funding to leverage university infrastructure** and laboratories, faculty expertise, and student talent pools.

- **COMMUNITY ENGAGEMENT**

- Organize annual Genome Day, bringing about 400 **Buffalo Public School** 8<sup>th</sup>-graders to the medical campus to learn about genetics/genomics.
- Sponsor annual **Health Sciences Symposium**, organized by VPRED, bringing 120 high school juniors from the Hamburg, Lancaster and West Seneca Health and Life Sciences Academies.
- Promoted **Responsible AI in K-12 education** at UB AI discussion series at Grand Island High School (October 2023).

- **INCLUSIVE EXCELLENCE**

- Supported establishment of UB's Community Health Equity Research Institute, putting the university's research and innovation strength at the forefront of **eliminating health disparities** in the City of Buffalo.
- Modified all marketing communications and Web sites in Business and Entrepreneur Partnerships unit to **reflect values of inclusion** with transparent, related goals on recruitment to diversify the workforce – thus being representative of the community we serve.
- Established specific goals to increase number of female and minority startup founders and the number of minorities hired by the startups as they grow; this entails **supporting “pipeline” programs to** reach out to historically underrepresented minorities; including Blackstone Launchpad and new partnerships with Buffalo-based *The Exchange at Beverly Grey* and the national organization *Efor All*, both of which are focused on supporting underrepresented entrepreneurs.
- Partnered with UB's Dean of Engineering and Applied Sciences to **recruit underrepresented faculty** in the Department of Computer Science and Engineering as part of a SUNY-wide initiative.
- Charged cross-decanal committee to address **social equity in research**, promote awareness, and bring systemic changes to the research enterprise; included training, recruiting, infrastructure support, mentoring, and excellence.
- Leadership on several research grant applications to create a **safe and inclusive research and academic environment**; enabled the T32-Initiative for **Maximizing Student Diversity**; five-year training grant from the National Institute of General Medical Sciences to support 12 underrepresented PhD candidates in Biomedical, Behavioral and STEM disciplines.

## **ADMINISTRATIVE EXPERIENCE VICE PRESIDENT, RESEARCH & ECONOMIC DEVELOPMENT (VPRED)**

VPRED is key to UB's strategic plan for becoming a model 21st-century institution and among the nation's highly ranked public research universities. The mission is to:

- *Advance* Research & Scholarly Excellence through the cultivation of a world-class research support infrastructure.
- *Contribute* to Job Growth and a Diversified Economy through innovation, economic development, and commercialization.
- *Ensure* Compliance in a Regulatory Environment that operates through ethical compliance and a lens of diversity, equity, and inclusion.

### **A. Management**

The VPRED supervises the following units, centers, and communities. While the enterprise employs nearly 150 staff, the total number of members – when considering research centers – nears 300 staff members. VPRED's operating budget is approximately \$150M. Supervision of these units includes all administrative decision-making such as budget allocation, discretionary salary increases, hiring, appointment of new leadership, space management, and other operational matters.

#### Office Units

- **Business and Entrepreneur Partnerships** (BEP, staff: 25)  
Bridge research and economic development on campus.
- **Clinical Research Office** (CRO, staff: 20)  
Office charged with administrative oversight for all clinical research activities at the university (2015-22).
- **Comparative Medicine Laboratory Animal Facilities** (CM-LAF, staff: 13)  
Centralized service responsible for the animal care-and-use program campus wide.
- **Office of Research Advancement** (ORA, staff: 10)  
Help faculty create highly competitive proposals to support research and advance UB initiatives.
- **Office of Research Compliance** (ORC, staff: 17)  
Oversight of Institutional Review Board, Institutional Animal Care and Use, financial conflicts of interest, responsible conduct of research and export controls.
- **Research Information Systems** (RIS, staff: 8)  
Provide integrated information services, resources, and technologies to the UB community.
- **Social and Behavior Research Support Office** (BRO, staff: 1)  
Supports investigators who conduct studies in non-clinical areas.
- **Sponsored Projects Services** (SPS, staff: 60)  
Submit proposals for funding, provide stewardship of awarded funds, and ensure compliance.
- **Technology Transfer** (staff: 10)  
Guide researchers as their discoveries and inventions become new products and services.

#### Interdisciplinary STEM Centers

- **Center for Post-Acute COVID Sequelae** (PASC)  
Recovery by multidisciplinary approach to caring for those suffering from long COVID.
- **Center for Cannabis and Cannabinoid Research** (CeCaR)  
Improve the scientific understanding of the components of cannabis, patterns of use by various populations, health and medical benefits, adverse reactions, including addiction.

- **Center for Information Integrity (CI)**  
Combating online disinformation to improve user awareness and resilience.
- **Institute for Artificial Intelligence and Data Science (IAD)**  
Innovative human-machine partnerships in health and autonomous systems.
- **Center for Computational Research (CCR)**  
Provide faculty with access to high-performance computing, data, and visualization resources.
- **Center for Hearing and Deafness**  
Focus on clinical and research approaches to solve the problems of hearing loss.
- **Center for Integrated Global Biomedical Sciences**  
Hub for non-traditional approaches to address regional and global health challenges.
- **Clinical Research Institute on Addictions (CRIA)**  
Advance the knowledge of the causes, consequences, prevention, and treatment of substance use disorders.
- **Institute for Lasers, Photonics, and Biophotonics (ILPB)**  
Multidisciplinary research in Medicine, Dental Biology, Engineering, Physics, and Chemistry.
- **NYS Center of Excellence in Bioinformatics and Life Sciences (CBLS)**  
Hub for life sciences innovation and technology-based economic development.
- **NYS Center of Excellence in Materials Informatics (CMI)**  
Leverage UB's materials science, big data analytics, and advanced manufacturing expertise to impact private sector growth.
- **UB RENEW: Research and Education in eNergy, Environment and Water Institute**  
Inter-disciplinary focus on energy and environmental issues and their social and economic ramifications.
- **UB Microbiome Center**  
Conduct research to improve health care, boost food production and restore the environment.

#### Non-STEM Centers

- **Creative Arts Institute (CAI)**  
Dedicated to the creation and production of new work, upholding the highest artistic standards of excellence and fostering a complementary atmosphere of creative investigation and engagement among students, faculty, visiting artists, and the community.
- **Humanities Institute (HI)**  
Provides a forum for conversations among humanists of all disciplines to question, comprehend, and transform an increasingly complex world.

#### Collaborative Research Centers

- **Biology with X-ray Free Electron Lasers (BioXFEL)**  
A NSF Science and Technology Center to enhance understanding of molecular machines.
- **Buffalo Institute for Genomics & Data Analytics (BIG)**  
Transforms genomic medicine nationally while building the healthcare economy regionally.
- **Clinical Translational Research Center**  
Improves health and reduces health disparities in our community.
- **START-UP NY**  
Gives companies the opportunity to operate state and local tax-free on/near a UB campus.
- **UB CAT: Center for Advanced Biomedical & Bioengineering Technology**  
Focuses on the intersection of big data and health sciences, particularly as it relates to drug development, medical devices, diagnostic tools, and healthcare IT.
- **UB Incubators**

- Support the creation of new companies by providing affordable business services to entrepreneurs.
- **WNY Innovation Hot Spot**  
Help incubator ventures grow quickly, achieve greater profitability, and become more attractive to investors.
- **Women's Health Initiative (WHI)**  
Focus on strategies for preventing heart disease, breast and colorectal cancer, and osteoporosis in postmenopausal women.

#### Communities of Excellence

Analogous to the concept of *Convergence* in NSF, the idea of “Communities” differs from “Centers” as the pivoting is not necessarily on research but a seamless integration of research, education, and community engagement dedicated to solving a societal challenge. Given that real life problems are not cast in silos, the solutions must necessarily be not so either, but rather should be interdisciplinary in their multi-dimensional approach.

- **Genome, Environment and Microbiome (GEM)**  
GEM community is advancing genomic science and increasing genomic literacy through research, education and community outreach. This collaboration among the sciences, social sciences, arts, and humanities will empower all people in society's shift to more personalized medicine.
- **Sustainable Manufacturing and Advanced Robotic Technologies (SMART)**  
Collaborate with area companies in advanced manufacturing and design to help shape education and national policy. The SMART Community focuses on next generation technologies and processes for customizable production.
- **Community for Global Health Equity (GHE)**  
GHE focuses on the social, economic, political, and environmental factors that contribute to global health inequities. Its aim is to influence policymakers, funders, and practitioners in addressing problems ranging from child survival, growth and development to refugee health and wellbeing.

## **B. Responsibilities**

#### Scholarly Excellence

Advance research and creative activities in response to the challenging societal problems of our times.

- Identify promising new projects to seed and stay ahead of the curve.
- Conduct internal competitions for limited submission calls.
- Pursue suitable funding opportunities in industry, government, and philanthropy.
- Provide comprehensive administrative and technical assistance to develop proposals.
- Support proposal development, review, and submission
- Manage research awards for the life of the project.
- Forge strategic partnerships with institutions and investigators.
- Provide shared equipment and facilities to the research community.
- Enhance and maintain a rich IT infrastructure in support of faculty grants activity.
- Communicate results, expertise and stories to multiple audiences and stakeholders.

### *Economic Development*

Transform the economies of Buffalo-Niagara, New York State, and beyond by helping UB achieve its full impact as a major economic engine.

- Bridge research and economic development by leveraging the knowledge, resources and expertise necessary for an innovation economy.
- Create regional attraction for the US workforce to locate in Western New York.
- Connect businesses with university resources and facilities.
- Engage entrepreneurs and facilitate entrepreneurial ecosystems.
- Disseminate information for economic development agencies.
- Advocate for technology that can be licensed by entrepreneurs and companies.
- Encourage and reward invention, collaboration, and community.
- Assist with technology transfer, licensing, and commercialization.
- Protect UB intellectual property (IP).
- Manage royalty distributions.
- Handle transfer disclosure and non-disclosure agreements.
- Take UB research from lab to market and assist with all the opportunities in between.
- Support startups that locate in Western New York.
- Innovate for business growth - particularly in the Western New York region.
- Develop a workforce that connects industry with student interns and talented graduates.
- Conduct employee training workshops to enable industry workforce to stay current.
- Develop consultation and support programs for businesses.

### *Compliance in a Regulatory Environment*

- Provide administrative oversight for all research activities of the university's faculty members.
- Facilitate compliant, meaningful research within the institution.
- Unify policies governing research conducted across all university schools and departments.
- Be cognizant of all policies from sponsoring agencies.
- Implement federal regulations and university guidelines.
- Provide tools, systems, and processes for maintaining research compliance.
- Negotiate contracts to establish the legal parameters of an agreement.
- Develop budgets to schedule and identify the charges to be assessed to a funding entity.
- Assist protocol development for submission to the Institutional Review Board (IRB).
- Review clinical research studies for operational feasibility.
- Offer wide range of pharmacy-related services for investigators and staff.
- Protect human subjects in clinical, social, and behavioral research and clinical trials.

### *University's Research Centers and Institutes*

Academic, discipline-based research is key to the university's mission. Interdisciplinary research centers expand on that mission by addressing societal issues and new learning from multiple perspectives.

- Formulate policies for creating interdisciplinary centers.
- Conduct annual internal review and periodic external review of center.
- Appoint leadership for certain centers based on strategic considerations.
- Conduct external searches and hiring at all levels.
- Make the case for annual allocations to the Central Financial Planning.

### Annual Resource Planning Process (ARPP)

ARPP is a framework to review UB's financial capacity, evaluate current activities, identify, and assess potential areas for new investment that continue to elevate the university.

- *Provide* inputs to the Senior Leadership annually to enable a predictable and transparent planning process.
- *Propose* and justify resources to support research administration infrastructure including investments to advance university and unit strategic goals.
- *Make the case* for additional recurring and non-recurring funds, based on emerging needs.

### Fundraising

The "Campaign for UB" (Boldly Buffalo, 2018-24) seeks to raise \$1B to deliver transformative changes for the public research university, Western New York, and the world."

- *Support* the University Advancement Office in its philanthropic and development efforts.
- *Cultivate* high profile alumni to partner in the vision of UB.
- *Spread* the word about the campaign, encourage participation, and thank those who contribute.

### Capital Planning

Member of the capital planning committee, which works as an internal team and together with external partners as necessary to achieve effective capital plan implementation.

- *Guide* long-range campus development, including buildings, land use, and capital infrastructure.
- *Initiate* strategic efforts required to implement the comprehensive physical master plan.
- *Make* recommendations regarding the university's capital plans and priorities.

### Student Experience

Provide experiential learning outside the classroom under the undergraduate scholar's program.

- Program supports students during Summer to conduct research at Cambridge University and Oxford University at labs with UB faculty partnership.
- Encourages students' postgraduate pursuit, cultural mixing, and international experience.
- The Entrepreneurship Law Center engages students to provide quality legal services for early-stage entrepreneurs and startups who are not yet ready or able to engage outside legal counsel.
- Enable business' means to recruit interns, post a job, search and message students, interview on-campus, or consult with talent experts to develop a long-term recruitment strategy.
- Enable businesses to sponsor an event, speak in a class, host students for a half day to highlight their company, or visit the campus to gain access to future graduates.
- Enable businesses to tap into groups of students to gain innovative solutions or find a student to conduct a research project on a company initiative.

### Transparency and Shared Governance

The authority for major changes and new initiatives in the university's research enterprise rests with the OVPRED strategic group chaired by the VPRED. The group includes the associate vice presidents, the unit chief of staff, and the unit financial officer.

- Annual retreat camps held with participation from all the center directors and unit heads reporting to the VPRED to allow free exchange of ideas and transparency on all initiatives.
- Monthly meetings of all Associate/Assistant Deans for Research of the decanal units (12) to vet new policies, respond to faculty needs, and keep the channel of communications with the academic mission of the university open and effective.

## C. Accomplishments

### Large Scale Awards

#### **FEDERAL**

- Center for Early Literacy and Responsible AI (CELaRAI): Innovating Beginning Reading Instruction for Culturally and Linguistically Diverse Learners -\$10M (2024-29)
- Buffalo-Rochester-Syracuse Tech Hub for semiconductor manufacturing and innovation - \$9.5M (of \$40M) (2024-28)
- Institute of Educational Sciences (IES), National Center for Early Literacy and Responsible AI - \$10M (2024-28)
- National Science Foundation (NSF), National AI Institute for Exceptional Education - \$20M (2023-27)
- Air Force Research Labs (AFRL), Space University Research Institute on Space Domain Awareness - \$5M (2022-27)
- National Nuclear Security Administration (NNSA), Center for Exascale Simulation of Hybrid Rocket Motors - \$8.5M (2020-25)
- National Institute of Health (NIH), Clinical and Translational Science Award (CTSA) - \$23M (2019-23)
- National Science Foundation (NSF) Science and Technology Center (STC) on Biology with X-Ray Free Electron Lasers (BioXFEL) - \$23M (2018-22)
- National Institutes of Health (NIH), Clinical and Translational Science Award (CTSA) - \$38M (2014-23)

#### **NY STATE**

- Empire Discovery Institute (EDI) to support moving PI-developed drug targets to proof of concept in animals and then to commercialize - \$35M (2018-24)
- Awarded NYSTAR matching funds to support industry R&D with faculty in area of big data and health - \$10M over 10 years (2018)
- Innovation Hub Commercialization for technology commercialization fund, programs, and experts in commercialization and incubation space - \$32M (2018-22)
- Awarded NSF I-Corps grants to PI's to support customer discovery - \$500,000 (2017)

#### **FOUNDATIONS**

- JPB Foundation in support of environmental justice - \$9M (2017-26)
- Mellon Foundation in support of community-engaged study of healthcare that centers on historically marginalized voices - \$2.7M (2023)
- Mellon Foundation in support of Indigenous Studies - \$3M (2020)
- Community Foundation for Greater Buffalo, East Side Corridor Economic Development -\$3.2M (2022)

### Faculty Recruiting

Empire Innovation Program (EIP) is a SUNY-funded grant program dedicated to recruiting and retaining excellent faculty to the SUNY system. On behalf of the UB Provost's office, the VPRED annually identifies the departments and areas that match the strategic vision of growth and sustainability at UB. Too, led a systematic analysis of STEM departments to inform university investments primarily for faculty recruiting.

- \$1M to add faculty in Neurogenetics and Next Generation Therapeutic Proteins in Pharmacy (2017-18).
- \$1M shared with Stony Brook University for recruiting to meet New York State's clean energy goals (2017-18).

- \$3M to add faculty researchers who will build upon the university's existing expertise in artificial intelligence and robotics (2016-17).
- \$1M to add faculty researchers in the field of systems pharmacology (2016-17).
- \$500,000 to add faculty researchers to the National Science Foundation-funded BioXFEL – a research consortium led by UB that focuses on cutting-edge X-ray laser science (2016-17).
- \$1M to add faculty in the newly formed Biomedical Engineering Department (2015-16).
- \$1.3M to recruit faculty to the newly launched RENEW Institute (2015-16)

#### *Hiring Upper Management Staff*

Responsible for filling five Associate Vice President (Research and Economic Development) positions, and more than a dozen center director and office lead positions. Formed the appropriate search committees and charged the chairs of these committees with making recommendations for appointment with full cognizance of the university's unstinted commitment to diversity and inclusion.

- Created the following positions and made inaugural appointments:
  - Associate Vice President for Strategic Research Initiatives
  - Associate Vice President for Regulatory Support
  - Associate Vice President for Research Advancement
  - Associate Vice President for Economic Development
  - Assistant Vice President for Communications, Marketing, and Digital Operations
  - Assistant Vice President for Strategic Growth
  - Chief Compliance Officer
- Appointed the directors of the following centers in 2014-23:
  - Institute for Artificial Intelligence and Data Science (IAD)
  - Institute for Research in Energy, Environment and Water (RENEW)
  - NYS Center of Excellence in Materials Informatics (CMI)
  - NYS Center of Excellence in Bioinformatics and Life Sciences (CBLS)
  - Center for Computational Research (CCR)
  - Office of Research Compliance (ORC)
  - Lab Animal Facilities (LAF)
  - Business Entrepreneur and Partnerships (BEP)

#### *New Initiatives*

- Established programs to facilitate the purchase and maintenance of high-end equipment, distributing up to \$1M/year in matching funds, at a 1:1 ratio with funds provided by faculty, departments, or units. Up to \$100,000 is provided for qualifying purchases and up to \$500,000 for maintenance. Equipment must be available to all researchers for at least two years from the date of the award (2023).
- Launched the Buffalo Blue Sky program to provide just-in-time seed funding for investigator-led, multidisciplinary research that pushes the boundaries to solve large and complex problems in any domain (2018).
- Created a faculty research hub for one-stop faculty support for pre- and post-award management, grant writing, financial reporting, and technology transfer (2016).
- Created UB SWIFT program to reduce transaction time with industry (and eliminate lengthy, costly negotiations) by empowering both parties to set research and licensing terms at the project planning stage (2016).
- Launched the faculty consulting program to stimulate industry engagement (2016).

- Launched the university's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs to stimulate industry engagement (2016).
- Developed dashboards featuring searchable information on proposals, awards, and research expenditures to anticipate research trends and measure research faculty productivity.

#### *Creation of New Centers*

- Center for Post-Acute COVID Sequelae to study long-COVID.
- Center for Information Integrity to combat false news and propaganda by social platforms.
- Center for Cannabis and Cannabinoid Research to advance the understanding of all aspects of cannabis, its medicinal benefits, and addiction (2021).
- Institute for Artificial Intelligence and Data Science to tackle some of the world's biggest problems through groundbreaking research in the following areas: Media Forensics, Big Data, Mobile Computing, Machine Learning, Robotics, Autonomous Vehicles, Natural Language Processing, Human Machine Partnerships, and Law and Ethics (2021).
- Center for Ingestive Behavior Research to study the physiological, nutritional, developmental, genetic, sensory, and socio-economic determinants of food and fluid intake (2018).
- UB Microbiome Center to conduct research on the human microbiome - the collective microorganisms that live on and in the human body. The goal of research conducted at the center is to develop a base of knowledge about the human microbiome and its role in health (2016).
- UB Center for Integrated Global Biomedical Sciences uses education, training and research to promote novel discovery, maximize technology and foster translation. It works with international partners in addressing global health challenges and in recognizing the important connections between health and sustainable economic development (2016).
- Formalized the Office of Research Advancement (ORA) to support the university's research and scholarly community in the pursuit of external grants and research funding. Comprehensive administrative and technical support are available to researchers as they form their research teams, identify collaborators, refine their projects and develop their proposals. (2016).
- Communities of Excellence - \$10M (2015-19).
  - Global Health Equity, which reflects an interdisciplinary approach to better promote the health and well-being of under-sourced populations.
  - Sustainable Manufacturing and Advanced Robotic Technologies, which leverage UB and regional strength in manufacturing, partner with regional companies.
  - Genome, Environment, and Microbiome to advance genomic science and increase genomic literacy through research, education, and community outreach.
- Research and Education in Environment, Energy and Water (RENEW) Institute - \$3M/year.
- Launched the Creative Arts Institute for creation production of highest artistic standards -\$1M (2015-19).

#### *Accreditation*

UB follows rigorous standards for ethics, quality, and protections for human research and promotes humane and responsible research animal care.

- AAHRPP: Association for the Accreditation of Human Research Protection Program (2018; 2023)
- AAALAC: Association for Assessment and Accreditation of Laboratory Animal Care (2017; 2022; 2023)

### Entrepreneurial Programming

- Connected dozens of incubator companies with UB talent via internships, competitions, consulting opportunities, speaking engagements, and enhanced career fair opportunities.
- Certified 22 incubator clients to leverage NYS Innovation Hot Spot tax incentives, adding money back to their balance sheets to fuel added growth.
- Paired 27 incubator clients with outside experts to lead them past milestones in their scalable development through UB's Embedded Consultants program.
- Buffalo Student Sandbox – WNY's first accelerator program – to help more than 40 teams of disruptive student entrepreneurs take giant leaps forward.
- *Piloted* and expanded “Inclusive Launch” - a first-of-its-kind diversity outreach program that provides crucial learning opportunities for underrepresented populations.
- **Last 3 years (2021-2024)**
  - 1,701 new jobs created
  - 285 startups supported
  - \$788M in non-job economic impact
  - UB was ranked No. 41 overall in the 2025 Entrepreneur magazine/Princeton Review annual ranking, up three spots from last year. UB also ranked No. 22 among public universities and No. 7 in the Northeast.

## ACADEMIC CREDENTIALS SUMMARY

**Area:** Artificial Intelligence; Document Analysis and Recognition; Biometrics

**Publications:**

- 475 reviewed technical papers
- 8 books
- 6 patents
- ~18,000 citations; h-index 72

;

**Major Adviser:**

- 6 postdocs (including from MIT and RIT)
- 50 doctoral students (46 graduated)
- 17 master's degree students graduated (thesis option)

**Mentorship of Students:**

- 18 academic institution placements, including tenure track faculty positions (in Cornell University and University of Washington)
- 4 placements in university research labs: Dartmouth, USC, UB, and University of Michigan
- 2 MS students went on to receive doctorate from MIT and University of Chicago
- Global placement of students in USA, Brazil, India, Japan, China, and S. Korea.

**Research Grants:** Total grants: \$96M; Principal Investigator on \$42M

Selected grants (from over 100)

- \$160M NSF Engines, AI in Health Innovations (selected for final submission, 2024)
- \$20M NSF AI Institute (2023-27)
- \$2.9M NSF Data Laboratory in Materials Engineering (2016-22)
- \$1.3M IARPA Janus Face Recognition (2014-17)
- \$1.2M NSF Long term Biometric Authentication (2012-16)
- \$3.2M DARPA Multilingual Document Classification (2007-13)
- \$1.5M DoD Advanced Biometrics (2005- )

**Teaching:**

- Undergraduate classes: Introduction to Programming (Freshman), Data Structures (Junior)
- Graduate classes: AI, Pattern Recognition, Operating Systems, Biometrics
- Mentorship of the McNair Scholars

**Service:** Selected board memberships (of total 10)

- IEEE Biometrics Compendium (Editor-in-Chief, 2012-16)
- IEEE Transactions on Pattern Analysis and Machine Intelligence (2001-05)
- IAPR International Journal of Document Analysis and Recognition (2003 – on)

Selected conference and society leadership roles (of total ~50)

- President of the IEEE Biometric Council (2014-15)
- General Chair of International Conference on Document Analysis and Recognition (2023)

- General Chair of International Conference on Biometrics (2018)
- General Chair of International Conference on Document Analysis Recognition (2023)

**Talks:** Selected plenary talks (of total 150 seminars worldwide)

- IAPR International Conference on Document Analysis and Recognition (2024)
- G20 Conference on Digital Education form (2023)
- NRC Intelligence Committee on Science & Technology Investments (2013)

**AWARDS & HONORS:**

- **118<sup>th</sup> US Congressional Recognition**, Honorable Timothy M. Kennedy of New York (December 14, 2024)
- **New York State Assembly Citation**, Karen M. McMahon (December 14, 2024)
- **Office of the Erie County Executive Proclamation**, Honorable Mark C. Poloncarz (December 14, 2024)
- **Proclamation by Town Supervisor**, Amherst, NY, Brian. J. Kulpa (December 14, 2024)
- **Person of the Year** – Council of Heritage and Arts of India (2024)
- **President's Medal** – University at Buffalo (2024)
- **Fellow of the AAIA** - Asia-Pacific Artificial Intelligence Association (2022)
- **Fellow of the AP Academy of Sciences** (2016)
- **Excellence in Graduate Student Mentoring Award**, University at Buffalo, SUNY (2016)
- **Fellow of National Academy of Inventors** (2015)
- **ICDAR Outstanding Achievements** (2015), “For pioneering contributions to pattern recognition”
- **Distinguished Alumnus Award** (2014), Indian Institute of Technology Kharagpur
- **Fellow of SPIE** – Society for Optics and Photonics (2013), “For contributions to Biometrics”
- **Fellow of AAAS** – American Association for the Advancement of Science (2010), “For outstanding contributions in biometrics and document retrieval”
- **IEEE Technical Achievement Award** (2010), “For pioneering contributions to handwriting systems”
- **Fellow of ACM** – Association of Computing Machinery (2009), “For contributions to handwritten document image analysis, recognition, and retrieval”
- **SUNY Chancellor's Award** (2007), “In recognition of outstanding scholarship and creative productivity”
- **Fellow of IEEE** – Institute of Electrical and Electronics Engineers (2006), “For contributions to handwriting recognition”
- **Fellow of IAPR** – International Association of Pattern Recognition (2004), “For contributions to advances in handwriting recognition”
- **MIT Global Indus Technovator Award** (2004), “For pioneering endeavors at the frontiers of technological innovation,” MIT Indian Business Club, Cambridge, MA
- **Fellow of IETE – Institution of Electronics and Telecommunication Engineers** (2002)
- **IAPR/ICDAR Outstanding Young Investigator Award** (2001), “For visibly demonstrating the utility of pattern recognition algorithms and for outstanding scientific productivity”

**IMPACT:**

- Designed an early AI success story by making postal address recognition and deployment of engineered systems a reality, saving the postal services of US, UK, and Australia, hundreds of millions of dollars.
- Computing Research that Changed the World: “...Using a learning-based system developed at UB by Venu Govindaraju and colleagues, 25 billion letters a year are processed automatically by the US postal service - bar-coded for precise delivery- saving hundreds of millions of dollars...” Computing Consortium 2009.

## APPENDIX

## A. Publications

h-index 72; total citations: 17,500

### BEST PAPER AWARDS (8)

1. IJCB Best Paper Award (Bhavin, Mohan, Fedorishin, Setlur), Ljubljana, Slovenia, 2023.
2. FG 2nd Best Student Paper Award, (Mohan and Sankaran), Jodhpur, India, 2020.
3. ICDAR Best Student Paper Award, (Fei Xu), Sydney, Australia, 2019.
4. CBDAR Best Paper Award, Sydney, Australia, 2019.
5. Data for Development Challenge, National Statistics Prize (Neeti Pokhriyal), Boston, 2015.
6. ICFHR, ITESOFT Best Paper Award, Kolkata, India, 2010.
7. ICPR, IBM Best Student Paper Award, (X. Peng), Istanbul, Turkey, 2010.
8. ICDAR Best Paper Award, ICDAR 1st Place in Line segmentation competition, Barcelona, 2009.

### BOOKS (7)

1. Handbook of Statistics Vol 48: Deep Learning, A. S. Rao, V. Govindaraju, and C. R. Rao (eds.), Elsevier 2023.
2. Handbook of Statistics Vol 35: Cognitive Computing: Theory and Applications, V. V. Raghavan, V. Gudivada, V. Govindaraju, and C. R. Rao (eds.), Elsevier 2017.
3. Handbook of Statistics Vol 33: Big Data, V. Govindaraju, V. V. Raghavan, and C. R. Rao (eds.), Elsevier 2016.
4. Handbook of Statistics Vol 31: Machine Learning Theory and Applications, C. R. Rao & V. Govindaraju (eds.), Elsevier 2013.
5. Multibiometrics for Human Identification. B. Bhanu & V. Govindaraju (eds.), Cambridge University Press 2011.
6. Indic OCR- Document Recognition & Retrieval. V. Govindaraju & S. Setlur (eds.), Springer 2009.
7. Biometrics: Sensors, Systems, and Algorithms. N. Ratha & V. Govindaraju (eds.), Springer 2007.

### JOURNAL PAPERS (89)

#### 2024

1. S. Suresh, V. Menon, and V. Govindaraju, "Adaptive Coverage Optimization for Energy-Constrained Multi-Camera Surveillance Networks", *IEEE Sensors* (2024).
2. P. Nedungadi, M. V. Ramesh, V. Govindaraju, Bhavani Rao, P. Berbeglia, R. Raman: Emerging leaders or persistent gaps? Generative AI research may foster women in STEM. *International Journal of Information Management*, 77 (2024).

#### 2023

3. M. Singh, B. M. Mehtre, S. Sangeetha, and V. Govindaraju, "User Behavior based Insider Threat Detection using a Hybrid Learning Approach", *Journal of Ambient Intelligence and Humanized Computing*, Springer, 14(4): 4573-4593 (2023).

#### 2021

4. K. Davila, F. Xu, S. Setlur, and V. Govindaraju, "FCN-LectureNet: Extractive Summarization of Whiteboard and Chalkboard Lecture Videos", *IEEE Access*.
5. K. Davila, S. Setlur, D. Doermann, B. U. Kota and V. Govindaraju, "Chart Mining: A Survey of Methods for Automated Chart Analysis," in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 43, no. 11, pp. 3799-3819, 2021. doi: 10.1109/TPAMI.2020.2992028.

#### 2020

6. N. Pokhriyal and V. Govindaraju, "Learning Discriminative Factorized Subspaces with Application to Touchscreen Biometrics", *IEEE Access*, vol. 8, pp. 152500-152511, 2020.

7. Z. Yan, V. Govindaraju, Q. Zheng and Y. Wang, "IEEE Access Special Section Editorial: Trusted Computing," in *IEEE Access*, vol. 8, pp. 25722-25726, 2020.
8. N. Sankaran, D.D. Mohan, N. N. Lakshminarayana, S. Setlur, V. Govindaraju, Domain adaptive representation learning for facial action unit recognition, *Pattern Recognition*, Volume 102, 2020.
9. N. Narayan, N. Sankaran, S. Setlur, V. Govindaraju, "Learning Deep Features for Online Person Tracking Using Non-Overlapping Cameras: A survey, *Image Vision and Computing*, pp. 222-235, 2019.
10. B. Urala Kota, K. Davila, A. Stone, S. Setlur, V. Govindaraju, "Generalized Framework for Summarization of Fixed-Camera Lecture Videos by Detecting and Binarizing Handwritten Content", *International Journal of Document Analysis and Recognition - ICDAR Special Issue* 2019.

**2019**

11. C. Liu, G. Fink, V. Govindaraju, and L. Jin, "Special Issue on Deep Learning for Document Analysis and Recognition", *International Journal for Document Analysis and Recognition*.

**2018**

12. N. Pokhriyal, K. Tayal, I. Nwogu and V. Govindaraju, "Cognitive-biometric recognition from language usage: A feasibility study", *Transactions on Information Forensics and Security*, Vol. 12, No. 1, 2017.
13. Gaurav Kumar, Venu Govindaraju, "Bayesian background models for keyword spotting in handwritten documents", *Pattern Recognition* 64: 84-91, 2017.

**2017**

14. S. Wshah, G. Kumar, and V. Govindaraju, "Statistical script independent word spotting in offline handwritten documents", *Journal of Pattern Recognition*, Vol. 47, No. 3, pp. 1039-1050, 2014.
15. V. Menon, B. Jayaraman, and V. Govindaraju, "Probabilistic spatio-temporal retrieval in smart spaces" *Special issue of Journal of Ambient Intelligence and Humanized Computing*, Vol. 5, No. 3, pp. 383-392, 2014.

**2014**

16. X. Peng, S. Setlur, V. Govindaraju and R. Sitaram, "Handwritten text separation from annotated machine printed documents using Markov random fields", *International Journal on Document Analysis and Recognition*, Vol. 16, No. 1, pp. 1-16 , 2013.
17. U. Porwal, and V. Govindaraju, "Semi supervised framework for writer identification using structural learning", *IET Biometrics*, Vol. 2, No. 4, pp. 208-215, 2013.
18. M. Malgireddy, I. Nwogu, and V. Govindaraju, "Language motivated approach to action recognition", *Journal of Machine Learning Research*, Vol. 14, No. 1, pp. 2189-2212, 2013.
19. A. Shivram, C. Ramaiah, and V. Govindaraju, "A hierarchical Bayesian approach to online writer identification", *IET Biometrics, Special Issue on Handwriting Recognition*, Vol. 2, No. 4, pp. 191-198, 2013.
20. Y. Zhou, I. Nwogu, and V. Govindaraju, "Labeling Spain with Stanford", *IEEE Transactions on Image Processing*, Vol. 22, No. 12, pp. 5362-5371, 2013.
21. V. Menon, B. Jayaraman, and V. Govindaraju, "Enhancing biometric recognition with spatio-temporal reasoning in smart environments", *Journal of Personal and Ubiquitous Computing, Springer*, Vol. 17, No. 5, pp. 987-998, 2013.

**2013**

22. X. Peng, S. Setlur, V. Govindaraju, and R. Sitaram, "Using a boosted tree-classifier for text segmentation in hand-annotated documents", *Pattern Recognition Letters, Special Issue of Award-Winning Papers*, Vol. 33, No. 7, pp. 943-950, 2012.

**2012**

23. V. Menon, B. Jayaraman, and V. Govindaraju, "The 3 R's of cyber-physical spaces", *IEEE Computer*, Vol. 44, No. 9, pp. 73-79, 2011.
24. V. Menon, B. Jayaraman and V. Govindaraju, "Spatio-temporal querying in smart spaces",

*Procedia Computer Science*, Elsevier Press, Vol. 10, pp. 366-373, 2011.

25. H. Cao, A. Bharadwaj, and V. Govindaraju, "Unconstrained handwritten document retrieval", *International Journal for Document Analysis and Recognition, Special Issue on Noisy Text Analytics*, Springer, Vol. 14, No. 2, pp. 145-157, 2011.

#### 2010

26. P. Mansukhani, S. Tulyakov, and V. Govindaraju, "A framework for efficient fingerprint identification using a minutiae tree", *IEEE Systems Journal- Special Issue on Biometrics*, Vol. 4, No. 2, pp. 126-137, 2010.

27. V. Menon, B. Jayaraman, and V. Govindaraju, "Multimodal identification and tracking in smart environments", *Special Issue on Multimodal Systems, Services and Interfaces for Ubiquitous Computing in the Journal of Personal and Ubiquitous Computing*, Springer, Vol. 14, No. 8, pp. 685-694, 2010.

28. R. Chandrasekhar, J. C. Miecznikowski, D. P. Gaile, V. Govindaraju, F. V. Bright, and K. F. Sellers, "Xerogel package", *Chemometrics and Intelligent Laboratory Systems*, Elsevier Press, Vol. 96, No. 1, pp. 70-74, 2010.

29. A. Rusu, A. Thomas, and V. Govindaraju, "Generation and use of handwritten CAPTCHAs", *International Journal of Document Analysis and Recognition*, Springer, Vol. 13, No. 1, pp. 49-64, 2010.

30. S. Tulyakov, C. Wu, and V. Govindaraju, "On the difference between optimal combination functions for verification and identification systems", *International Journal Pattern Recognition and Artificial Intelligence*, Vol. 24, No. 2, pp. 173-191, 2010.

#### 2009

31. F. Farooq, A. Bharadwaj, and V. Govindaraju, "Using topic models for OCR correction", *International Journal of Document Analysis and Recognition*, Springer, Vol. 12, No. 3, pp. 153- 164, 2009.

32. A. Thomas, A. Rusu, and V. Govindaraju, "Synthetic handwritten CAPTCHAs", *The Journal of Pattern Recognition, Special Issue on Handwriting Recognition*, Elsevier Press, Vol. 42, No. 12, pp. 3365-3373, 2009.

33. F. Farooq, D. Jose, and V. Govindaraju, "Phrase based direct model for improving handwriting recognition accuracies", *The Journal of Pattern Recognition, Special Issue on Handwriting Recognition*, Elsevier Press, Vol. 42, No. 12, pp. 3271-3277, 2009.

34. H. Cao, A. Bharadwaj, and V. Govindaraju, "A probabilistic method for keyword retrieval in handwritten document images", *The Journal of Pattern Recognition, Special Issue on Handwriting Recognition*, Elsevier Press, Vol. 42, No. 12, pp. 3374-3382, 2009.

35. S. Kompalli, S. Setlur, and V. Govindaraju, "Devanagari OCR using a recognition driven segmentation framework and stochastic language models", *International Journal on Document Analysis and Recognition*, Springer, Vol. 12, No. 2, pp. 123-138, 2009.

36. R. N. Rodrigues, L. L. Ling, and V. Govindaraju, "Robustness of multimodal biometric fusion methods against spoof attacks", *Journal of Visual Languages and Computing, Special Issue on Advances in Multimodal Biometric Systems*, Elsevier Press, Vol. 20, No. 3, pp. 169-179, 2009.

37. R. Milewski, A. Bharadwaj, and V. Govindaraju, "Automatic recognition of handwritten medical forms for search engines", *International Journal of Document Analysis and Recognition*, Springer, Vol. 11, No. 4, pp. 203-218, 2009.

38. H. Cao and V. Govindaraju, "Preprocessing of low quality handwritten carbon forms using Markov Random Fields", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 31, No. 7, pp. 1184-1194, 2009.

39. R. V. Yampolskiy and V. Govindaraju, "Strategy-based behavioral biometrics: A novel approach to automated identification", *International Journal of Computer Applications in Technology, Special Issue on: Automated Identification Technology*, Vol. 35, No. 1, pp. 29-41, 2009.

**2008**

40. S. Tulyakov and V. Govindaraju, "Use of identification trial statistics for the combination of biometric matchers", *IEEE Transactions on Information Forensics and Security*, IEEE Signal Processing Society Press, Vol. 3, No. 4, pp. 719-733, 2008.
41. R. Milewski and V. Govindaraju, "Binarization and cleanup of handwritten text from carbon copy medical form images", *The Journal of Pattern Recognition*, Elsevier Publishers, Vol. 41, No. 4, pp. 1308-1315, 2008.
42. R. V. Yampolskiy and V. Govindaraju, "Behavioral biometrics: A survey and classification", *International Journal of Biometrics*, Inderscience Publishers, Vol. 1, No. 1, pp. 81-113, 2008.

**2007**

43. S. Tulyakov, F. Farooq, P. Mansukhani, and V. Govindaraju, "Symmetric hash functions for secure fingerprint biometric systems", *Pattern Recognition Letters*, Elsevier Publishers, Vol. 28, No. 16, pp. 2427-2436, 2007.
44. R. V. Yampolskiy and V. Govindaraju, "Embedded noninteractive continuous bot detection", *ACM Computers in Entertainment (CIE)*, Vol. 5, No. 4, 2007.
45. S. Chikkerur, A. Cartwright, and V. Govindaraju, "Fingerprint image enhancement using STFT analysis", *The Journal of Pattern Recognition*, Elsevier Publishers, Vol. 40, No. 1, pp. 198-211, 2007.
46. R. N. Rodrigues, L. L. Ling, and V. Govindaraju, "Robustness of multimodal biometric fusion methods against spoof attacks", *Journal of Visual Languages and Computing. Special Issue on Advances in Multimodal Biometric Systems*, Elsevier Press, Vol. 20, No. 3, pp. 169-179, 2009.
47. R. Milewski, A. Bharadwaj, and V. Govindaraju, "Automatic recognition of handwritten medical forms for search engines", *International Journal of Document Analysis and Recognition*, Springer, Vol. 11, No. 4, pp. 203-218, 2009
48. R. V. Yampolskiy and V. Govindaraju, "Computer security: A survey of methods and systems", *Journal of Computer Science*, Vol. 3, No. 7, pp. 478-486, 2007.
49. R. V. Yampolskiy and V. Govindaraju, "Direct and indirect human computer interaction-based biometrics", *Journal of Computers*, Vol. 2, No. 10, pp. 76-88, 2007.
50. K. Bowyer, V. Govindaraju, and N. Ratha, "Guest editorial: Introduction to the special issue on recent advances in biometric systems", *IEEE Transactions on Systems, Man, and Cybernetics – Part B*, Vol. 37, No. 5, pp. 1091-1093, 2007.

**2006**

51. Z. Shi and V. Govindaraju, "A chaincode based scheme for fingerprint feature extraction", *Pattern Recognition Letters*, Elsevier Press, Vol. 27, pp. 462-468, 2006.
52. L. Lorigo and V. Govindaraju, "Offline Arabic handwritten recognition: A survey", *IEEE Transaction on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 28, No. 5, pp. 712-724, 2006.
53. S. Kompalli, S. Setlur, and V. Govindaraju, "Multi-font Devanagari OCR using recognition driven segmentation", *Vivek – A Quarterly Journal of Artificial Intelligence*, National Centre for Software Technology, Vol. 16, No. 3, pp. 18-25, 2006.
54. H. Xue and V. Govindaraju, "Hidden Markov models combining discrete symbols and continuous attributes in handwriting recognition", *IEEE Transaction on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 28, No. 3, pp. 458-462, 2006.

**2005**

55. H. Lei and V. Govindaraju, "Matching and retrieving sequential patterns under regression", *International Journal on Web Intelligence and Agent Systems*, IOS Press, Vol. 3, No. 4, pp. 261-270, 2005.
56. T. Jea and V. Govindaraju, "A minutia-based partial fingerprint recognition system", *The Journal of Pattern Recognition*, Elsevier Publishers, Vol. 38, No. 10, pp. 1672-1684, 2005.
57. H. Lei and V. Govindaraju, "A comparative study on the consistency of features in on-line signature verification", *Pattern Recognition Letters*, Elsevier Press, Vol. 26, No. 15, pp. 2483-2489, 2005.

58. A. Teredesai and V. Govindaraju, "GP-based secondary classifiers", *The Journal of Pattern Recognition*, Pergamon Publishers, Vol. 38, No. 4, pp. 505-512, 2005.

**2002**

59. H. Xue and V. Govindaraju, "On the dependence of handwritten word recognizers on lexicons", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 24, No. 12, pp. 1553-1564, 2002.

60. V. Govindaraju, P. Slavik, and H. Xue, "Lexicon density as a measure for performance evaluation of handwritten recognizers", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 24, No. 6, pp. 789-800, 2002.

61. S. Setlur, V. Govindaraju, A. Lawson, and S. Srihari, "Large scale address recognition systems- truthing and tools", *International Journal of Document Analysis and Recognition*, Springer-Verlag, Vol. 4, No. 3, pp. 154-169, 2002.

62. J. Park and V. Govindaraju, "Use of adaptive segmentation in phrase recognition", *The Journal of Pattern Recognition*, Pergamon Publishers, Vol. 35, No. 1, pp. 245-252, 2002.

63. Y. Wu, K. Ianakiev, and V. Govindaraju, "Improved to k-nearest neighbor classification", *The Journal of Pattern Recognition*, Pergamon Press, Vol. 35, No. 10, pp. 2311-2318, 2002.

64. R. Kasturi, L. O. Gorman, and V. Govindaraju, "Document image analysis: A primer", *Saadhana*, Vol. 27, No. 1, pp. 3-22, 2002.

**2001**

65. P. Slavik and V. Govindaraju, "Equivalence of methods for slant and skew correction in word recognition applications", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 23, No. 3, pp. 323-325, 2001.

66. S. Madhvanath and V. Govindaraju, "The role of holistic paradigms in handwritten word recognition", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 23, No. 2, pp. 149-164, 2001.

67. S. Madhvanath, K. Sunder, and V. Govindaraju, "Syntactic methodology of pruning large lexicons in cursive script recognition", *Journal of Pattern Recognition*, Pergamon Publishers, Vol. 34, No. 1, pp. 37-46, 2001.

**2000**

68. V. Govindaraju and K. Ianakiev, "Potential improvement of classifier accuracy by using fuzzy measures", *IEEE Transactions on Fuzzy Systems*, IEEE Neural Networks Council, Vol. 8, No. 6, pp. 679-690, 2000.

69. X. Wang, V. Govindaraju, and S. Srihari, "Holistic recognition of handwritten character pairs", *Journal of Pattern Recognition*, Pergamon Publishers, Vol. 33, No. 12, pp. 1967-1974, 2000.

70. J. Park, V. Govindaraju, and S. Srihari, "OCR in a hierarchical feature space", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 22, No. 4, pp. 400-406, 2000.

**1999**

71. S. Madhvanath, E. Kleinberg, and V. Govindaraju, "Holistic verification of handwritten phrases", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 21, No. 12, pp. 1344-1356, 1999.

72. S. Madhvanath, G. Kim, and V. Govindaraju, "Chain code processing for handwritten word recognition", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 21, No. 9, pp. 928-932, 1999.

73. D. Bouchaffra, V. Govindaraju, and S. Srihari, "Recognition of strings using non-stationary Markovian models: An application in ZIP code recognition", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 21, No. 10, pp. 990-999, 1999.

74. D. Bouchaffra, V. Govindaraju, and S. Srihari, "A methodology for mapping scores to probabilities", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 21, No. 9, pp. 923-927, 1999.

75. S. Madhvanath and V. Govindaraju, "Reference lines for holistic recognition of handwritten words", *Journal of Pattern Recognition*, Pergamon Press, Vol. 32, No.12, pp. 2021-2028, 1999.
76. G. Kim, V. Govindaraju, and S. Srihari, "Architecture for handwritten text recognition systems", *International Journal of Document Analysis and Recognition*, Springer Verlag, Vol. 2, No. 1, pp. 37-44, 1999.

**1998**

77. G. Kim and V. Govindaraju, "Handwritten phrase recognition as applied to street name images", *Journal of Pattern Recognition*, Pergamon Press, Vol. 31, No. 1, pp. 41-51, 1998.
78. G. Sheikoaslami, S. Srihari, V. Govindaraju, "Computer-aided graphology and Persian handwriting", *Computer Magazine*, Vol. 9, No. 61, pp. 43-46, 1998. (in Arabic).

**1997**

79. Z. Shi and V. Govindaraju, "Segmentation and recognition of connected handwritten numeral strings", *Journal of Pattern Recognition*, Pergamon Press, Vol. 30, No. 9, pp. 1501-1504, 1997.
80. G. Kim and V. Govindaraju, "A lexicon driven approach to handwritten word recognition for real-time applications", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, IEEE Computer Society Press, Vol. 19, No. 4, pp. 366-379, 1997.
81. G. Kim and V. Govindaraju, "Bank check recognition using cross validation between legal and courtesy amounts", *International Journal on Pattern Recognition and Artificial Intelligence*, World Scientific Publishing Company, Vol. 11, No. 4, pp. 657-674, 1997.
82. S. Madhvanath, E. Kleinberg, and V. Govindaraju, "Empirical design of a multi-classifier thresholding control strategy for recognition of handwritten street names", *International Journal of Pattern Recognition and Artificial Intelligence*, World Scientific Publishing Company, Vol. 11, No. 6, pp. 933-946, 1997.

**1996**

83. V. Govindaraju, "Locating human faces in photographs", *The International Journal of Computer Vision*, Kluwer Academic Publishers, Vol. 19, No. 2, pp. 129-146, 1996.
84. Z. Shi and V. Govindaraju, "Character image enhancement using selective region growing", *Pattern Recognition Letters*, Elsevier Science Publishers, Vol. 17, pp. 523-527, 1996.
85. V. Govindaraju and R. Krishnamurthy, "Holistic handwritten word recognition using temporal features derived from off-line images", *Pattern Recognition Letters*, Elsevier Science Publishers, Vol. 17, pp. 537-540, 1996
86. S. Madhvanath, V. Govindaraju, and S. N. Srihari, "Recognition of handwritten US Census forms", *International Journal of Imaging Systems & Technology*, John Wiley & Sons, Inc., Vol. 7, pp. 312-319, 1996.

**1995**

87. S. Setlur and V. Govindaraju, "Generating manifold samples from handwritten words", *Pattern Recognition Letters*, Elsevier Science Publishers, Vol. 15, pp. 901-905, 1995.

**1991**

88. V. Govindaraju and R.K. Srihari, "Automatic face recognition in news photo database", *Advanced Imaging*, Miller Freeman, Inc., Vol. 5, No. 11, pp. 22-26, 1991.

**1989**

89. S. Srihari and V. Govindaraju, "Textual image analysis using the Hough transform", *International Journal of Machine Vision and Applications*, Kluwer Academic Publishers, Vol. 2, No. 3, pp. 141- 153, 1989.

**BOOK CHAPTERS (30)**

**2023**

1. D. Mohan, B. Javade, S. Setlur, and V. Govindaraju, "Deep metric learning for computer vision: A brief overview", Govindaraju and Rao (editors), Springer.

**2021**

2. N. Sankaran, D. Mohan, S. Tulyakov, S. Setlur, and V. Govindaraju "Deep Feature Fusion for Face Analytics", *Deep-Learning Based Face Analytics*, N. Ratha, V. Patel, and R. Chellappa (editors), Springer. 2019
3. S. Tulyakov, and V. Govindaraju, "Fusion of Recognition Systems", *Handbook on Computer Vision*, Ikeuchi (editors), Springer.

**2018**

4. Urala Kota B. et al, "Automated Extraction of Data from Binary Phase Diagrams for Discovery of Metallic Glasses. In: Fornés A., Lamiroy B. (editors) Graphics Recognition. Current Trends and Evolutions. *Lecture Notes in Computer Science*, vol 11009. Springer.

**2017**

5. R. Pandey, Y. Zhou, and V. Govindaraju, "Learning representations for cryptographic hash-based face template protection", *Deep Learning for Biometrics, Advances in Computer Vision and Pattern Recognition*, B. Bhanu and A. Kumar (editors), Springer.
6. M. R. Malgireddy, I. Nwogu, and V. Govindaraju: "Language-Motivated Approaches to Action Recognition", *Gesture Recognition*, Escalera, Guyon, Athitsos (editors), Springer, 155-181, 2017.

**2015**

7. V. Govindaraju, I. Nwogu, and S. Setlur, "Document informatics for scientific learning and accelerated discovery", *Handbook of Statistics, Big Data Analytics*, V. Govindaraju and C. R. Rao (editors), Elsevier, Vol. 33, pp. 3-28, 2015.
8. N. Pokhriyal, I. Nwogu, and V. Govindaraju, "A large-scale study of language usage as a cognitive biometric trait", *Handbook of Statistics, Big Data Analytics*, V. Govindaraju, V. Raghavan, and CR Rao (editors), Elsevier, Vol. 33, pp. 69-88, 2015.

**2013**

9. S. Tulyakov, and V. Govindaraju, "Matching score fusion methods", *Handbook of Statistics, Machine Learning*, V. Govindaraju and C. R. Rao (editors), Elsevier, Vol. 31, pp. 151-175, 2013.
10. I. Nwogu and V. Govindaraju, "Conditional random fields for scene labeling", *Handbook of Statistics, Machine Learning*, V. Govindaraju and C. R. Rao (editors), Elsevier, Vol. 31, pp. 227-247, 2013.

**2012**

11. Z. Shi, S. Setlur, and V. Govindaraju, "Pre-processing issues in Arabic OCR", *Guide to OCR for Arabic Scripts*, V. Margner and H. E. Abed (editors), Springer, pp. 79-102, 2012.

**2011**

12. M. G. Frank, C. J. Maccario, and V. Govindaraju, "Behavior and security", *Protecting Airline Passengers in the Age of Terrorism*, P. Seidenstat and F. X. Splane (editors), pp. 86-106, 2011.
13. S. Tulyakov and V. Govindaraju, "Predicting performance in large-scale identification systems by score resampling", *Multibiometrics for Human Identification*, Bhanu and V. Govindaraju (editors), pp. 363-378, 2011.

**2010**

14. A. O. Thomas and V. Govindaraju, "Biometrics in security", *Encyclopedia of Cryptography and Security*, H. C. A. van Tilborg and S. Jajodia (editors), Springer, Vol. 2, 2010.

**2009**

15. M. G. Frank, M. O' Sullivan, C. Hurley, V. Govindaraju, and I. Pavlidis, "Deception, behavior, and technology", *Handbook of Science and Technology for Homeland Security*, J. Voeller (editor), John Wiley & Sons, 2009.
16. R. V. Yampolskiy and V. Govindaraju, "Game playing tactic as a behavioral biometric for human identification", *Behavioral Biometrics for Human Identification: Intelligent Applications*, L. Wang and X. Geng (editors), IGI Global, 2009.

17. R. V. Yampolskiy V. Govindaraju, "Taxonomy of behavioral biometrics", *Behavioral Biometrics for Human Identification: Intelligent Applications*, L. Wang and X. Geng (editors), IGI Global 2009.
18. O. Mukhtar, S. Setlur, and V. Govindaraju, "Experiments with Urdu text recognition", *Guide to OCR for Indic Scripts*, V. Govindaraju and S. Setlur (editors), Springer, pp. 163-171, 2009.
19. Z. Shi, S. Setlur, and V. Govindaraju, "Digital image enhancements of Indic historical manuscripts", *Guide to OCR for Indic Scripts*, V. Govindaraju and S. Setlur (editors), Springer, pp. 249-267, 2009.
20. A. Bharadwaj, S. Setlur, and V. Govindaraju, "Keyword spotting and retrieval in Indic documents", *Guide to OCR for Indic Scripts*, V. Govindaraju and S. Setlur (editors), Springer, pp. 285-299, 2009.
21. V. Govindaraju, S. Setlur, "Indic OCR landscape", *Guide to OCR for Indic Scripts*, (Preface), V. Govindaraju and S. Setlur (editors), Springer 2009.
22. A. Bharadwaj, S. Setlur, and V. Govindaraju, "Keyword spotting and indexing in Sanskrit documents", *Topics in Sanskrit Computational Linguistics*, P. Scharf and G. Huet (editors), Springer, pp. 403-416, 2009.
23. S. Tulyakov and V. Govindaraju, "Issues and advances in biometrics", *Annals of Emerging Research in Information Assurance, Security and Privacy Services*, H. Rao and S. Upadhyaya (editors), Elsevier, pp. 41-60, 2009.

#### 2008

24. H. Cao and V. Govindaraju, "Indexing and retrieval of handwritten documents", *Document Image Processing*, B. B. Chowdhury (editor), World Scientific Publishers, 2008.
25. S. Tulyakov, Stefan Jaegar, V. Govindaraju, and D. Doermann, "Classifier combination survey", *Machine Learning in Document Analysis and Recognition*, S. Marinai (editor), Springer, pp. 361-386, 2008. (Invited).
26. S. Tulyakov and V. Govindaraju, "Learning matching score dependencies for classifier combination", *Machine Learning in Document Analysis and Recognition*, S. Marinai (editor), Springer, pp. 305-332, 2008. (Invited).

#### 2003

27. R. Manmatha and V. Govindaraju, "Handwriting recognition", *Encyclopedia on Human Computer Interaction*, W. Bainbridge (editor), Berkshire Publications, 2003. (Invited).

#### 2002

28. K. Ianakiev and V. Govindaraju, "Deriving pseudo-probabilities of correctness given scores", *Pattern Recognition and String Matching*, D. Chen and X. Cheng, (editors), Kluwer Publishers, pp. 281, 2002.

#### 1997

29. D. Niyogi, S. N. Srihari, and V. Govindaraju, "Analysis of printed forms", *Handbook of Character Recognition and Document Image Analysis*, H. Bunke and S. P. Wang (editors), pp. 485-502, 1997.

#### 1991

30. S. Srihari and V. Govindaraju, "Pattern recognition: a survey", *Encyclopedia of Computer Science*, A. Ralston (editor), Van Nostrand Reinhold, New York, NY, pp. 1034-1041, 1991.

### CONFERENCE, WORKSHOP, AND SYMPOSIUM PAPERS (353)

Full paper reviewed for acceptance.

#### 2024

1. M. S. Suresh, V. Menon, S. Setlur, V. Govindaraju, "Maximizing Coverage over a Surveillance Region Using a Specific Number of Cameras", ICPR (22): 303-320, 2024.
2. B. Jawade, S. Subramanya, A. Dabhade, S. Setlur, V. Govindaraju: GestSpoof: Gesture Based Spatio-Temporal Representation Learning for Robust Fingerprint Presentation Attack Detection. FG 2024: 1-9.
3. F. Xu, L. Chaudhary, L. Dong, S. Setlur, V. Govindaraju, I. Nwogu: A Comparative Study of Video-Based Human Representations for American Sign Language Alphabet Generation. FG 2024: 1-6.
4. D. Fedorishin, L. Forte, P. Schneider, S. Setlur, V. Govindaraju: Fine-Grained Engine Fault Sound Event Detection Using Multimodal Signals. ICASSP 2024: 1186-1190.

5. D. Fedorishin, L. Lu, S. Setlur, V. Govindaraju: Audio Match Cutting: Finding and Creating Matching Audio Transitions in Movies and Videos. ICASSP 2024: 6200-6204.
6. K. Davila, R. Lazarus, F. Xu, Nicole R. Alcántara, S. Setlur, V. Govindaraju, A. Mondal, C. V. Jawahar: CHART-Info 2024: A Dataset for Chart Analysis and Recognition. ICPR (19) 2024: 297-315.
7. S. Tulyakov, M. Yakimov, G. Biswal, V. Tokranov, S. Oktyabrsky, V. Mitin, V. Govindaraju, Workshop on Infrared Computer Vision, ICPR, 2024.

### 2023

8. J. Bhavin, D. Mohan, D. Fedorishin, S. Setlur, and V. Govindaraju, "Conditional Neural Aggregation Network for Unconstrained Face Feature Fusion", International Joint Conference on Biometrics, Ljubljana, Slovenia, 2023.
9. S. Ahmed, B. Jawade, S. Pandey, S. Setlur, and V. Govindaraju, "Scientific Chart Question Answering as a Test-Bed for First-Order Logic", International Conference on Document Analysis and Recognition, San Jose, CA, pp. 66-83, 2023.
10. S. Ahmed, P. Yan, D.S. Doermann, S. Setlur, and V. Govindaraju, "Sparse and Dense Keypoint Estimation for Real-World Chart Understanding", International Conference on Document Analysis and Recognition, San Jose, CA, pp. 77-93, 2023.
11. D. Fedorishin, D.D. Mohan, S. Setlur, and V. Govindaraju, "Hear the Flow: Optical Flow-Based Self-Supervised Visual Sound Source Localization", in Proceedings of the Winter Conference on Applications of Computer Vision, Waikoloa, HI, 2023.
12. B. Jawade, D.D. Mohan, S. Setlur, and V. Govindaraju, "NAPReg: Nouns as Proxies Regularization for Semantically Aware Cross-Modal Embeddings", in Proceedings of the Winter Conference on Applications of Computer Vision, Waikoloa, HI, 2023.

### 2022

13. F. Xu, K. Davila, S. Setlur, and V. Govindaraju, "Synthetic Data Generation for Semantic Segmentation of Lecture Videos", in Proceedings of the International Conference on the Frontiers of Handwriting Recognition, Hyderabad, India, 2022.
14. D. Fedorishin, J. Birgiolas, D.D. Mohan, L. Forte III, P. Schneider, S. Setlur, and V. Govindaraju, "Large-Scale Acoustic Automobile Fault Detection: Diagnosing Engines Through Sound", in Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD '22). Association for Computing Machinery, New York, NY, USA, 2022.
15. K. Davila, F. Xu, S. Ahmed, D.A. Mendoza, S. Setlur, and V. Govindaraju, "ICPR 2022: Challenge on Harvesting Raw Tables from Infographics (CHART-Infographics)" in 2022 26th International Conference on Pattern Recognition (ICPR), 2022.

### 2021

16. K. W. Lee, N. Sankaran, DD. Mohan, K. Davila, D. Fedorishin, S. Setlur, V. Govindaraju, "Bayesian Personalized-Wardrobe Model (BP-WM) for Long-Term Person Re-Identification," 2021 17th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS), 2021, pp. 1-8.
17. S. Tulyakov, N. Sankaran, D. Mohan, S. Setlur and V. Govindaraju, "Multistage Fusion of Face Matchers," 2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 2021, pp. 1444-1452.
18. N. Sankaran, D. D. Mohan, S. Tulyakov, S. Setlur and V. Govindaraju, "TADPool: Target Adaptive Pooling for Set Based Face Recognition," 2021 16th IEEE International Conference on Automatic Face and Gesture Recognition (FG 2021), 2021, pp. 1-8.
19. B. Jawade, A. Agarwal, S. Setlur and N. Ratha, "Multi Loss Fusion for Matching Smartphone Captured Contactless Finger Images," 2021 IEEE International Workshop on Information Forensics and Security (WIFS), 2021, pp. 1-6.

20. Fedorishin, D., Sankaran, N., Mohan, D. D., Birgiolas, J., Schneider, P., Setlur, S., & Govindaraju, V. (2021). Waveforms and Spectrograms: Enhancing Acoustic Scene Classification Using Multimodal Feature Fusion. In DCASE (pp. 216-220).

**2020**

21. S. Ahmed, K. Davila, S. Setlur, and V. Govindaraju, "Equation Attention Relationship Network (EARN): A Geometric Deep Metric Framework for Learning Similar Math Expression Embedding" ICPR 2020.

22. B.U. Kota, A. Stone, K. Davila, S. Setlur, and V. Govindaraju, "Automated Whiteboard Lecture Video Summarization by Content Region Detection and Representation" ICPR 2020.

23. F. Xu, K. Davila, S. Setlur, and V. Govindaraju, "Skeleton-based Methods for Speaker Action Classification on Lecture Videos", HCAU 2020 – The First International Workshop on Deep Learning for Human-Centric Activity Understanding, ICPR 2020.

24. K. Davila, C. Tensmeyer, S. Shekhar, H. Singh, S. Setlur, and V. Govindaraju, "CHART-Infographics ICPR 2020 Competition on Harvesting Raw Tables from Infographics" ICPR 2020.

25. N. Sankaran, D. D. Mohan, S. Setlur, and V. Govindaraju, "Moving in the Right Direction: A Regularization for Deep Metric Learning", IEEE Conference on Computer Vision and Pattern Recognition, Seattle, WA, 2020.

26. N. N. Lakshminarayana, S. Setlur and V. Govindaraju "Learning Guided Attention Masks for Facial Action Unit Recognition", International Conference on Face and Gesture Recognition, Buenos Aires, Argentina, 2020.

**2019**

27. F. Xu, K. Davila, S. Setlur and V. Govindaraju "Content Extraction from Lecture Video via Speaker Action Classification based on Pose Information", International Conference on Document Analysis and Recognition (ICDAR), Sydney, Australia, 2019.

28. S. Tulyakov, D. D. Mohan, S. Setlur, and V. Govindaraju, "Significant Feature Based Representation for Template Protection", IEEE CVPR Workshop on Biometrics, Long Beach, CA, 2019.

29. S. Tulyakov, N. Sankaran, S. Setlur, and V. Govindaraju, "Utilizing Template Diversity for Fusion of Face Recognizers", International Conference of Identity, Security, and Behavior Analysis, Hyderabad, India, 2019.

30. K. Davila, R. Joshi, S. Setlur, V. Govindaraju and R. Zanibbi, "Visual Search using Line-of-Sight Graphs: Application to Math Formula Images", European Conference on Information retrieval, Cologne, Germany, 2019.

31. N. N. Lakshminarayana, N. Sankaran, S. Setlur, V. Govindaraju, "Multimodal Deep Feature Aggregation for Facial Action Unit Recognition Using Visible Images and Physiological Signals", IEEE International Conference on Automatic Face and Gesture Recognition, Lille, France, 2019.

32. N. Sankaran, D. D. Mohan, S. Setlur, V. Govindaraju, "Representation Learning Through Cross-Modality Supervision ", IEEE International Conference on Automatic Face and Gesture Recognition, Lille, France, 2019.

**2018**

33. K. W. Lee, N. Sankaran, S. Setlur, N. Napp, V. Govindaraju, IEEE International Conference on Advanced Video and Signal-based Surveillance, "Wardrobe Model for Long Term Re-identification and Appearance Prediction ", 2018.

34. N. N. Lakshminarayana, D. D. Mohan, N. Sankaran, S. Setlur, and V. Govindaraju, "Multi-modal Conditional Feature Enhancement for Facial Action Unit Recognition", ICML Workshop on Domain Adaptation for Visual Understanding, Sweden 2018.

35. B. U. Kota, K. Davila, A. Stone, S. Setlur and V. Govindaraju, "Automated Detection of Handwritten Whiteboard Content on Lecture Videos for Summarization", International Conference on Handwriting Recognition, Niagara Falls, NY, 2018.

36. K. Ravi, V. Ravi, S. Setlur and V. Govindaraju, "Article citation sentiment analysis using deep learning", IEEE International Conference Series on Cognitive Informatics and Cognitive Computing, Berkeley, CA, 2018.
37. N. Narayanan, S. Setlur, and V. Govindaraju, "Re-identification for Online Person Tracking by Modeling Space-Time Continuum", IEEE Computer Society Workshop on Biometrics - Computer Vision and Pattern Recognition, Salt Lake City, UT 2018.
38. R. Radhakrishnan Nair, N. Sankaran, B. Urala, S. Tulyakov, S. Setlur and V. Govindaraju, "Knowledge Transfer using Neural network-based approach for Handwritten Text Recognition", International Workshop on Document Analysis and Systems, Vienna, Austria (DAS 2018).
39. N. Sankaran, S. Setlur, and V. Govindaraju, "Metadata-based Feature Aggregation Network for Face Recognition", 11<sup>th</sup> IAPR International Conference on Biometrics, Gold Coast, Australia (ICB 2018).

**2017**

40. B.U. Kota, S. Setlur, A. Dasgupta, S. Broderick, V. Govindaraju, and K. Rajan, "Automated analysis of phase diagrams", 12<sup>th</sup> IAPR International Workshop on Graphics Recognition, GREC, 2017.
41. R. R. Nair, N. Sankaran, B. U. Kota, S. Tulyakov, S. Setlur, and V. Govindaraju, "Using transfer learning for handwritten text transcription in historical documents", 4<sup>th</sup> IAPR International Workshop on Historical Document Imaging and Processing, 2017.
42. S. Tulyakov, N. Sankaran, S. Setlur, and V. Govindaraju, "Score Normalization in Stratified Biometrics Systems", IEEE International Joint Conference in Biometrics (IJCB 2017), Denver, CO, 2017.
43. N. Narayan, N. Sankaran, D. Arpit, K. Dantu, S. Setlur, and V. Govindaraju, "Person Re-identification for Improved Multi-Person Multi-Camera Tracking by Continuous Entity Association, CVPRW, HI, 2017.
44. N. Lakshminarayana, N. Narayan, N. Napp, and V. Govindaraju, "A Discriminative Spatio-temporal Mapping of Face for Liveness Detection", IEEE International Conference on Identity, Security and Behavioral Analysis, Delhi, India, 2017.

**2016**

45. R. Rathin, B. Urala, I. Nwogu, and V. Govindaraju, "Segmentation of highly unstructured handwritten documents using a neural network technique", 23<sup>rd</sup> International Conference on Pattern Recognition (ICPR 2016), Cancun, Mexico, 2016.
46. D. Arpit, Y. Zhou, H. Ngo, and V. Govindaraju, "Why regularized auto-encoders learn sparse representation? 33<sup>rd</sup> International Conference on Machine Learning (ICML 2016), New York, NY, 2016.
47. D. Arpit, Y. Zhou, B. Kota, and V. Govindaraju "Normalization propagation: A parametric technique for removing internal covariate shift in deep networks", 33rd International Conference on Machine Learning (ICML 2016), New York, NY, 2016.
48. R. R. Nair, N. Sankaran, I. Nwogu, and V. Govindaraju "Understanding line plots using Bayesian network", 12th IAPR International Workshop on Document Analysis Systems, Santorini, Greece, pp. 108-113, 2016.
49. R. Pandey and V. Govindaraju "Deep secure encoding for face template protection", CVPR Biometrics Workshop, Las Vegas, NV, pp. 9-15, 2016.
50. D. Arpit, C. Ramaiah, and V. Govindaraju, "Subspace learning via low rank projections for dimensionality reduction", 8<sup>th</sup> IEEE International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2016), Niagara Falls, NY, 2016.

**2015**

51. N. Narayan and V. Govindaraju, "Deep learning for key points detection in unconstrained face imagery", IEEE Western New York Image Processing Workshop, Rochester, NY, 2015. (Best student paper).
52. B. Zhu, A. Shivram. M. Nakagawa, and V. Govindaraju, "Online handwritten cursive word recognition using segmentation-free and segmentation-based methods", ACPR 2015, Kuala Lumpur, Malaysia, pp. 161-165, 2015.
53. N. Pokhriyal, W. Dong, and V. Govindaraju, "Virtual networks and poverty analysis in Senegal", NetMob, MIT Media Lab, Boston, MA, 2015.

54. R. Radhakrishnan, N. Sankaran, I. Nwogu, and V. Govindaraju, "Automated analysis of line plots in documents", International Conference and Document Analysis and Recognition (ICDAR), France, pp. 796-800, 2015.

55. C. Ramaiah, R. Plamondon, and V. Govindaraju, "A sigma-lognormal model for character level handwritten CAPTCHA generation", International Conference and Document Analysis and Recognition (ICDAR), France, pp. 966-970, 2015.

56. J. Hartloff, M. Morse, B. Zhang, T. Effland, J. Cordaro, J. Schuler, S. Tulyakov, A. Rudra and V. Govindaraju, "A multiple server scheme for fingerprint fuzzy vaults", IEEE Computer Vision and Pattern Recognition, Biometrics Workshop (CVPRW), Boston, MA, pp. 119-127, 2015.

57. R. K. Pandey and V. Govindaraju, "Secure face template generation via local region hashing", International Conference on Biometrics, Phuket, Thailand, pp. 299-304, 2015.

**2014**

58. A. Shivram, T. Khit, S. Natarajan, and V. Govindaraju, "Statistical relational training for handwriting recognition", International Conference on Inductive Logic Programming, Nancy, France, 2014.

59. D. Arpit, I. Nwogu, V. Govindaraju, "Dimensionality reduction with subspace structure preservation", Neural Information Processing Systems (NIPS), Montreal, Canada, 2014.

60. Y. Zhou, U. Porwal, H. Ngo, C. Zhang, C. Re, L. Nguyen, and V. Govindaraju, "Parallel feature selection inspired by group testing", Neural Information Processing Systems (NIPS), Montreal, Canada, 2014.

61. N. Pokhriyal, I. Nwogu, and V. Govindaraju, "Use of language as a cognitive biometric trait", International Journal of Biometrics, Clearwater, FL, 2014.

62. J. Hartloff, A. Rudra, S. Tulyakov, and V. Govindaraju, "Secure fingerprint with generic local structures", CVPR Biometrics Workshop, Columbus, OH, pp. 84-89, 2014.

63. D. Arpit, I. Nwogu, G. Srivastava and V. Govindaraju, "An analysis of random projections in cancelable biometrics", ICML Workshop on Learning, Security and Privacy, Beijing, China, 2014.

64. C. Ramaiah, R. Plamondon, and V. Govindaraju, "A sigma-lognormal model for handwritten text CAPTCHA generation", 22nd International Conference on Pattern Recognition (ICPR), Stockholm, Sweden, pp. 250-255, 2014.

65. G. Kumar, and V. Govindaraju, "Bayesian active learning for keyword spotting in handwritten documents", 22nd International Conference on Pattern Recognition (ICPR), Stockholm, Sweden, pp. 2041-2046, 2014.

66. A. Shivram, C. Ramaiah, and V. Govindaraju, "Data sufficiency for online writer identification: A comparative study of writer-style space vs. feature space models", 22nd International Conference on Pattern Recognition (ICPR), Stockholm, Sweden, pp. 3121-3125, 2014.

67. G. Kumar, and V. Govindaraju, "A Bayesian approach to script independent multilingual keyword spotting", International Conference on Handwriting Recognition, Greece, pp. 357-362, 2014.

68. D. Arpit, G. Srivastava, and V. Govindaraju, "Randomized subspace learning algorithms with subspace structure preservation guarantees", CoRR, 1401.4489, 2014.

69. G. Kumar, S. Wshah, and V. Govindaraju, "Variational dynamic background model for keyword spotting in handwritten documents", Document Recognition and Retrieval XXI, San Jose, CA, 2014.

70. C. Ramaiah, and V. Govindaraju, "A hierarchical framework for accent-based writer identification", Document Analysis Systems (DAS), Tours- Loire Valley, France, pp. 21-25, 2014.

71. U. Porwal, C. Ramaiah, A. Kumar, and V. Govindaraju, "Multiclass learning for writer identification using error-correcting codes", Document Analysis Systems (DAS), Tours- Loire Valley, France, pp. 16-20, 2014.

**2013**

72. S. P. Satheesan, S. Tulyakov, and V. Govindaraju, "A feature information-based approach for enhancing score-level fusion in multi-sample biometric systems", National Conference on Computer Vision, Pattern Recognition, Image Processing, and Graphics, Jodhpur, India, 2013.

---

73. X. Peng, H. Cao, S. Setlur, V. Govindaraju, and P. Natarajan, "Multilingual OCR research and applications: An Overview", 4<sup>th</sup> ICDAR Workshop on Multilingual OCR", Washington, D. C., 2013.

74. X. Cheng, S. Tulyakov, and V. Govindaraju, "Minutiae-based matching and state model for combination in fingerprint matching system", IEEE CVPR Workshop on Biometrics, Portland, OR, pp. 92-97, 2013.

75. C. Ramaiah, A. Shivram, and V. Govindaraju, "A Bayesian framework for modeling accents in handwriting", International Conference on Document Analysis and Recognition (ICDAR 2013), Washington, D.C., pp. 917-921, 2013.

76. A. Shivram, C. Ramaiah, S. Setlur, and V. Govindaraju, "IBM\_UB\_1: A dual mode unconstrained English handwriting dataset", International Conference on Document Analysis and Recognition (ICDAR 2013), Washington, D.C., pp. 13-17, 2013.

77. A. Shivram, B. Zhu, S. Setlur, M. Nakagawa, and V. Govindaraju, "Segmentation based online word recognition: A conditional random field driven beam search strategy", International Conference on Document Analysis and Recognition (ICDAR 2013), Washington, D.C., pp. 852-856, 2013.

78. B. Zhu, A. Shivram, S. Setlur, V. Govindaraju, and M. Nakagawa, "Online handwritten cursive word recognition using segmentation-free MRF in combination with P2DBMN-MQDF", International Conference on Document Analysis and Recognition (ICDAR 2013), Washington, D.C., pp. 349- 353, 2013.

79. Z. Shi, S. Setlur, and V. Govindaraju, "Table cell detection and content extraction from degraded document images", International Conference on Document Analysis and Recognition (ICDAR 2013), Washington, D.C., 2013.

80. C. Ramaiah, R. Plamondon, and V. Govindaraju, "Handwritten CAPTCHA generation based on the Sigma-Lognormal model", International Graphonics Society, Nara, Japan, 2013.

81. K. Hong, M. Voelz, V. Govindaraju, B. Jayaraman and U. Ramachandran, "A distributed framework for spatio-temporal analysis on large-scale camera networks", 3<sup>rd</sup> International Workshop on Cyber-Physical Networking Systems (CPNS 2013), Philadelphia, PA, 2013.

82. J. Hartloff, M. Bileshi, S. Tulyakov, J. Dobler, A. Rudra, and V. Govindaraju, "Towards fingerprints as strings: Secure indexing for fingerprint matching", International Conference on Biometrics, Spain, pp. 1-6, 2013.

83. J. Hartloff, M. Bileshi, S. Tulyakov, J. Dobler, A. Rudra, and V. Govindaraju, "Security analysis for fingerprint fuzzy vaults", SPIE Biometrics and Surveillance Technology for Human and Activity Identification, Baltimore, MD, 2013.

84. G. Kumar, S. Wshah, and V. Govindaraju, "Segmentation free keyword spotting framework using dynamic background model", SPIE Symposium on Document Recognition and Retrieval XX", San Jose, CA 2013.

## 2012

85. Z. Shi, S. Setlur, and V. Govindaraju, "Model based table cell detection and content extraction from degraded document images", Workshop on Document Analysis and Recognition, Mumbai, India, pp. 62-67, 2012.

86. V. Menon, B. Jayaraman, and V. Govindaraju, "Spatio-temporal querying in smart spaces", 3rd International Conference on Ambient Systems, Networks and Technologies, (ANT-2012), Niagara Falls, Ontario, Vol. 10, pp. 366-373, 2012.

87. X. Cheng, S. Tulyakov, and V. Govindaraju, "Utilization of matching score vector similarity measures in biometric systems", 7th IEEE Computer Vision and Pattern Recognition (CVPR), Workshop on Biometrics, Providence, RI, pp. 111-116, 2012.

88. S. Wshah, G. Kumar, and V. Govindaraju, "Multilingual word spotting in offline handwritten documents", International Conference on Pattern Recognition (ICPR), Tsukuba City, Japan, 2012.

89. U. Porwal, Y. Zhou, and V. Govindaraju, "Handwritten Arabic text recognition using Deep Belief Networks", International Conference on Pattern Recognition (ICPR), Tsukuba City, Japan, 2012.

90. A. Shivaram, C. Ramaiah, U. Porwal, and V. Govindaraju, "Modeling writing styles for online writer identification: A hierarchical Bayesian approach", 13th International Conference on Frontiers of Handwriting Recognition (ICFHR), Bari, Italy, 2012.
91. U. Porwal, C. Ramaiah, A. Shivaram, and V. Govindaraju, "Structural learning for writer identification in offline handwriting", 13th International Conference on Frontiers of Handwriting Recognition (ICFHR), Bari, Italy, 2012.
92. S. Wshah, G. Kumar, and V. Govindaraju, "Script independent word spotting in offline handwritten documents based on Hidden Markov Models", 13th International Conference on Frontiers of Handwriting Recognition (ICFHR), Bari, Italy, 2012.
93. G. Kumar, Z. Shi, S. Setlur, V. Govindaraju, and S. Ramachandrula, "Keyword spotting framework using dynamic background model", 13th International Conference on Frontiers of Handwriting Recognition (ICFHR), Bari, Italy, pp. 582-587, 2012.
94. U. Porwal, A. Shivaram, C. Ramaiah, and V. Govindaraju, "Ensemble of biased learners for offline Arabic handwriting recognition", 10th IAPR International Workshop on Document Analysis and Systems (DAS), Gold Coast, Australia, pp. 322-326, 2012.
95. C. Ramaiah, U. Porwal, and V. Govindaraju, "Accent detection in handwriting based on writing styles", 10th IAPR International Workshop on Document Analysis and Systems (DAS), Gold Coast, Australia, pp. 312-316, 2012.
96. A. Kashyap, S. Tulyakov, and V. Govindaraju, "Facial Behavior as a soft biometric", 5th IAPR International Conference on Biometrics (ICB), New Delhi, India, pp. 147-151, 2012.
97. U. Porwal, S. Rajan, and V. Govindaraju, "An oracle-based co-training framework for writer identification in offline handwriting", SPIE Symposium on Document Recognition and Retrieval XIX, San Jose, CA, 2012.
98. C. Ramaiah and V. Govindaraju, "Handwritten document age classification based on handwriting styles", SPIE Symposium on Document Recognition and Retrieval XIX, San Jose, CA, 2012.
99. M. R. Malgireddy, I. Nwogu, and V. Govindaraju, "A temporal Bayesian model for classifying, detecting, and localizing activities in video sequences", IEEE Computer Vision and Pattern Recognition Workshop (CVPR), Providence, RI, pp. 43-48, 2012.

## 2011

100. M. R. Malgireddy, I. Nwogu, S. Ghosh, and V. Govindaraju, "A generative framework to investigate the underlying patterns in human activities", International Conference on Computer Vision (ICCV), Combinatorial Image Analysis Workshop, Spain, pp. 1472-1479, 2011.
101. X. Cheng, S. Tulyakov, and V. Govindaraju, "Combination of multiple samples utilizing identification model in biometric systems", 4<sup>th</sup> International Joint Conference on Biometrics (IJCB), Washington, D.C., 2011. (31 oral papers out of 324 submissions)
102. U. Porwal and V. Govindaraju, "A co-training based framework for writer identification in offline handwriting", 1st International Workshop on Automatic Forensic Handwriting Analysis, Beijing, China, pp. 36-40, 2011.
103. V. Menon, B. Jayaraman, and V. Govindaraju, "Spatio-temporal reasoning in biometrics based smart environments", 2nd International Conference on Ambient Systems, Networks and Technologies (ANT), Niagara Falls, Canada, Procedia Computer Science 5, pp. 378-385, 2011.
104. X. Cheng, S. Tulyakov, and V. Govindaraju, "Multiple-sample fusion of matching scores in biometric systems", 6th IEEE Computer Vision and Pattern Recognition (CVPRW) Biometrics Workshop, Colorado Springs, CO, pp. 120-125, 2011.
105. X. Cheng, S. Tulyakov, and V. Govindaraju, "Combination of user- and enrollee-specific statistical information in verification systems", 6th IEEE Computer Vision and Pattern Recognition Biometrics Workshop (CVPRW), Colorado Springs, CO, pp. 126-131, 2011.

106. N. Bhaskaran, I. Nwogu, M. Frank, and V. Govindaraju, "Lie to me: Deceit detection via online behavioral learning", 9th IEEE Conference on Face and Gesture Recognition, Santa Barbara, CA, pp. 24-29, 2011.
107. M. R. Malgireddy, I. Nwogu, S. Ghosh, and V. Govindaraju, "A shared parameter model for gesture and sub-gesture analysis", 14th International Workshop on Combinatorial Image Analysis, Madrid, Spain, pp. 483-493, 2011.
108. N. Bhaskaran, I. Nwogu, M. G. Frank and V. Govindaraju, "Deceit detection via online behavioral learning", ACM Symposium on Applied Computing, Tachung, Taiwan, pp. 29-30, 2011.
109. D. You, S. Antani, and V. Govindaraju, "Automatic identification of ROI in figure images toward improving hybrid (text and image) biomedical document retrieval", 18th Annual SPIE Symposium on Document Recognition and Retrieval, San Jose, CA, 2011.
110. X. Peng, S. Setlur, V. Govindaraju and R. Sitaram, "Binarization of camera-captured document using A MAP approach", 18th Annual SPIE Symposium on Document Recognition and Retrieval, San Jose, CA, 2011.
111. Z. Shi, and V. Govindaraju, "Image enhancement for degraded binary document images", IEEE International Conference of Document Analysis and Recognition, Beijing, China, pp. 895-899, 2011.
112. D. You, S. Antani, D. Deemer-Fushman, V. Govindaraju, and G. Thoma "Detecting figure-panel labels in medical journal articles using MRF", IEEE International Conference of Document Analysis and Recognition, Beijing, China, pp. 967-971, 2011.

## 2010

113. X. Peng, S. Setlur, V. Govindaraju, and R. Sitaram, "Markov random fields based segmentation for hand-held devices captured document image", 7th Indian Conference on Computer Vision and Image Processing, Chennai, India, pp. 71-76, 2010.
114. R. Rodrigues, K. Kamat, and V. Govindaraju, "Evaluation of biometric spoofing in multimodal systems", 4<sup>th</sup> IEEE International Conference on Biometrics: Theory Applications and Systems (BTAS), Washington, D.C., 2010.
115. I. Nwogu, V. Govindaraju and C. Brown, "Syntactic image parsing using ontology and semantic descriptions", 5th IEEE Conference on Computer Vision and Pattern Recognition Biometrics Workshop (CVPRW), San Francisco, CA, pp. 41-48, 2010.
116. A. Chowirappa, R. Rodrigues, and V. Govindaraju, "Generation of handwriting by active shape modeling and global local approximation (GLA) adaptation", 12th IAPR International Conference on Handwriting Recognition, Kolkata, India, pp. 206-211, 2010.
117. A. Bhardwaj, A. O. Thomas, Y. Fu and V. Govindaraju, "Retrieving handwriting styles: A content based approach to handwritten document retrieval", 12th IAPR International Conference on Handwriting Recognition, Kolkata, India, pp. 265-270, 2010.
118. A. O. Thomas, S. Chaudhury, and V. Govindaraju, "Leveraging the mixed-text segmentation problem to design secure handwritten CAPTCHAs", 12th IAPR International Conference on Handwriting Recognition, Kolkata, India, pp. 13-18, 2010.
119. A. Bhardwaj, Y. Fu and V. Govindaraju, "Document age estimation using hierarchical subspace learning techniques", 24th Annual Conference on Neural Information Processing Systems, Workshop on Topic Models: Text and Beyond, Vancouver, Canada, 2010.
120. Z. Shi, S. Setlur, and V. Govindaraju, "Removing rule-lines from binary handwritten Arabic document images using directional local profile", 20th International Conference of Pattern Recognition, Istanbul, Turkey, pp. 1916-1919, 2010.

121. X. Peng, S. Setlur, V. Govindaraju, and R. Sitaram, "Text separation from mixed documents using a tree-structured classifier", 20th International Conference of Pattern Recognition, Istanbul, Turkey, pp. 241-244, 2010.
122. M. Malgireddy, J. Corso, S. Setlur, V. Govindaraju, and D. Mandalapu, "A framework for hand gesture recognition and spotting using sub-gesture modeling", 20th International Conference of Pattern Recognition (ICPR), Istanbul, Turkey, pp. 3780-3783, 2010.
123. S. Weshah, V. Govindaraju, H. Li, and Y. Cheng, "A novel lexicon reduction method for Arabic handwriting recognition", 20th International Conference of Pattern Recognition (ICPR), Istanbul, Turkey, pp. 2865-2868, 2010.
124. G. Kumar, S. Tulyakov, and V. Govindaraju, "Combination of hash functions for secure fingerprint matching", 20th International Conference of Pattern Recognition (ICPR), Istanbul, Turkey, pp. 890-893, 2010.
125. J. Koh, V. Govindaraju, and V. Chaudhury, "A robust iris localization method using an active contour model and Hough transform", 20th International Conference of Pattern Recognition (ICPR), Istanbul, Turkey, pp. 2852-2856, 2010.
126. S. Tulyakov and V. Govindaraju, "Predicting performance in large-scale identification systems by score resampling", International Biometrics Performance Conference, NIST, Gaithersburg, MD, 2010.
127. R. Rodrigues and V. Govindaraju, "Assessment of biometrics robustness against spoof attacks," International Biometrics Performance Conference, NIST, Gaithersburg, MD, 2010.
128. X. Peng, S. Setlur, V. Govindaraju and R. Sitaram, "Overlapped text segmentation using Markov random field and aggregation", 9th International Workshop on Document Analysis and Systems, Boston, MA, pp. 129-134, 2010.
129. A. Bhardwaj, M. Malgireddy, S. Setlur, V. Govindaraju and S. Ramachandrula, "Latent Dirichlet allocation based writer identification in offline handwriting", 9th International Workshop on Document Analysis and Systems, Boston, MA, pp. 357-362, 2010.
130. I. Nwogu, M. Frank, and V. Govindaraju, "An automated process for deceit detection", 7th SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2010.
131. D. You, S. Antani, D. Demner-Fushman, V. Govindaraju, and G. R. Thoma, "Biomedical article retrieval using multimodal features and image annotations in region-based CBIR", 17th SPIE Symposium on Document Recognition and Retrieval, San Jose, CA, 2010.

**2009**

132. A. Bhardwaj, M. Malgireddy, S. Setlur, V. Govindaraju and R. Sitaram, "Writer identification in offline handwriting using topic models", NIPS Workshop on Topic Models: Text and Beyond, Vancouver, BC, 2009.
133. R. Rodriguez, J. Corso, and V. Govindaraju, "Unconstrained face recognition using MRF Priors and Manifold Traversing", 3rd IEEE Conference on Biometrics, Theory, Algorithms, and Systems, Washington, D.C., pp. 86-91, 2009.
134. J. Xu, V. Singh, V. Govindaraju and D. Neogi, "A hierarchical classification model for document categorization", 11th International Conference on Document Analysis and Recognition, Barcelona, Spain, pp. 486- 490, 2009.
135. Z. Shi, S. Setlur, and V. Govindaraju, "A steerable directional local profile technique for extraction of handwritten Arabic text lines", 11th International Conference on Document Analysis and Recognition, Barcelona, Spain, pp. 176-180, 2009.
136. X. Peng, S. Setlur, V. Govindaraju, and S. Ramachandrula, "Markov random field based text identification from annotated machine printed documents" 11th International Conference on Document Analysis and Recognition, Barcelona, Spain, pp. 431-435, 2009.

137. S. Wshah, Z. Shi, and V. Govindaraju, "Segmentation of Arabic handwriting based on both contour and skeleton segmentation", 11th International Conference on Document Analysis and Recognition, Barcelona, Spain, pp. 793-797, 2009.
138. Z. Shi and V. Govindaraju, "Robust fingerprint matching using spiral partitioning scheme", International Conference on Biometrics, Sassari, Italy, pp. 647-655, 2009.
139. S. Tulyakov and V. Govindaraju, "Neural network optimization for combinations in identification systems", 8th International Workshop on Multiple Classifier Systems, Reykjavik, Iceland, pp. 418- 427, 2009.
140. J. Xu, V. Singh, V. Govindaraju, and D. Neogi, "A cascade multiple classifier system for document categorization", 8th International Workshop on Multiple Classifier Systems, Reykjavik, Iceland, pp. 458- 467, 2009.
141. X. Peng, S. Setlur, V. Govindaraju, and S. Ramachandrula, "Text identification from mixed documents using weighted features", 14th Conference of the International Graphonomics Society, Dijon, France, 2009.
142. Z Shi, S. Setlur, and V. Govindaraju, "Writer identification of Arabic documents by multi-scale modeling", 14th Conference of the International Graphonomics Society, Dijon, France, 2009.
143. D. You, Z. Shi, V. Govindaraju and A. Blatt "Line removal and handwritten word recognition of police accident report forms", 10th International Conference on Digital Government Research, Pueblo, Mexico, pp. 317-318, 2009.
144. A. Bharadwaj, and V. Govindaraju, "Script identification of handwritten word images", 16th SPIE Symposium on Document Recognition and Retrieval, San Jose, CA, 2009.

**2008**

145. Z. Zhang, S. Tulyakov, and V. Govindaraju, "Combining facial skin mark and eigenfaces for face recognition", 2<sup>nd</sup> International Conference on Biometrics, Alghero, Italy, pp. 424-433, 2009.
146. H. Cao, R. Prasad, P. Natarajan, and V. Govindaraju, "Nested state indexing in pairwise Markov networks for fast handwritten document image rule-line removal", 16<sup>th</sup> IEEE International Conference on Image Processing, Cairo, Egypt, pp. 2009-2012, 2009.
147. S. Tulyakov and V. Govindaraju, "Enrolled template specific decisions and combinations in verification systems", 2<sup>nd</sup> IEEE Conference on Biometrics: Theory, Applications, and Systems (BTAS 08), Washington, D.C., 2008.
148. J. Li, S. Tulyakov, and V. Govindaraju, "Fingerprint matching using correlation and thin-plate spline deformation model", 2<sup>nd</sup> IEEE Conference on Biometrics: Theory, Applications, and Systems (BTAS 08), Washington, D.C., 2008.
149. J. Li, S. Tulyakov, F. Farooq, J. Corso, and V. Govindaraju, "Integrating minutiae-based fingerprint matching with local mutual information", 19th International Conference on Pattern Recognition, Tampa, FL, 2008.
150. A. Bharadwaj, F. Farooq, H. Cao, and V. Govindaraju, "Topic based language models for OCR correction", 2nd ACM Workshop on Analytics of Unstructured Noisy Data, SIGIR, Singapore, pp. 107-112, 2008.
151. F. Farooq, G. Chandalia, and V. Govindaraju, "Lexicon reduction in handwriting recognition using topic categorization", 8<sup>th</sup> International Workshop on Document Analysis Systems, Nara, Japan, 2008.
152. S. Tulyakov, and V. Govindaraju, "Comparison of combination methods utilizing T- normalization and second best score model", IEEE Computer Vision and Pattern Recognition, Biometrics Workshop, Anchorage, AL, 2008.
153. F. Farooq, D. Jose, and V. Govindaraju, "Phrase based direct model for improving handwriting recognition accuracies", 11th International Conference on Frontiers of Handwriting Recognition (ICFHR 08), Montreal, Canada, pp. 3271-3277, 2008.

154. A. Thomas and V. Govindaraju, "Generation and performance evaluation of synthetic handwritten CAPTCHAs", 11th International Conference on Frontiers of Handwriting Recognition (ICFHR 08), Montreal, Canada, 2008.
155. H. Cao, A. Bharadwaj, and V. Govindaraju, "A probabilistic method for keyword retrieval in handwritten document images", 11th International Conference on Frontiers of Handwriting Recognition (ICFHR 08), Montreal, Canada, pp. 3374-3382, 2008.
156. H. Lei and V. Govindaraju, "Relative pattern recognition for noisy handwritten numeral recognition", 11th International Conference on Frontiers of Handwriting Recognition (ICFHR 08), Montreal, Canada, 2008.
157. V. Menon, B. Jayaraman, and V. Govindaraju, "Integrating recognition and reasoning in smart environments", 4th IET Conference on Intelligent Environments, Seattle, WA, p. 35, 2008.
158. V. Menon, B. Jayaraman, and V. Govindaraju, "Biometrics driven smart environments: Abstract framework and evaluation", 5<sup>th</sup> International Conference on Ubiquitous Intelligence and Computing (UIC-08), Oslo, Norway, pp. 75-89, 2008.
159. H. Cao and V. Govindaraju, "Processing and retrieving handwritten medical forms", ACM Digital Government Research Conference, Montreal, Canada, pp. 371-372, 2008.
160. R. V. Yampolskiy and V. Govindaraju, "Behavioral biometrics for verification and recognition of malicious software agents", 5<sup>th</sup> SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
161. R. V. Yampolskiy and V. Govindaraju, "Generation of artificial biometric data enhanced with spatio-temporal and environmental information", 5<sup>th</sup> SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
162. Z. Shi, and V. Govindaraju, "Modeling biometric systems using the general pareto distribution (GPD)", 5<sup>th</sup> SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
163. P. Mansukhani and V. Govindaraju, "Selecting optimal classification features for SVM based elimination of incorrectly matched minutiae", 5<sup>th</sup> SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
164. R. V. Yampolskiy and V. Govindaraju, "Behavioral biometrics for recognition and verification of game bots", 8<sup>th</sup> Annual European Game-On Conference on simulation and AI in Computer Games, Bologna, Italy, 2008.
165. A. Bharadwaj, D. Jose, and V. Govindaraju, "Script independent word spotting in multilingual documents", 2nd International Workshop on Cross Lingual Information Access, Hyderabad, India, pp. 48-54, 2008.
166. A. Bharadwaj, S. Kompalli, S. Setlur, and V. Govindaraju, "An OCR based approach for word spotting in Devanagari documents", 15th SPIE Symposium on Document Recognition and Retrieval XV, San Jose, CA, 2008.
167. K. V. U. Reddy and V. Govindaraju, "Form classification", 15th SPIE Symposium on Document Recognition and Retrieval XV, San Jose, CA, 2008.
168. D. Jose, A. Bhardwaj, and V. Govindaraju, "Transcript mapping for handwritten English documents", 15th SPIE Conference on Document Recognition and Retrieval, San Jose, CA, 2008.

**2007**

169. A. Thomas, A. Rusu, S. Mukund, and V. Govindaraju, "Non-writer specific synthetic handwriting generation for the CAPTCHA application", IEEE WNY Image Processing Workshop, Rochester, NY, 2007.
170. F. Farooq and V. Govindaraju, "Language identification in historical Afghan manuscripts", 9<sup>th</sup> International Symposium on Signal Processing and Its Applications (ISSPA), Sharjah, United Arab Emirates, 2007.

171. J. Li, S. Tulyakov, and V. Govindaraju, "Verifying fingerprint match by local correlation methods", 1<sup>st</sup> IEEE Conference on Biometrics: Theory, Algorithms, and Systems, Washington, D.C., pp. 1-5, 2007. (Oral presentation acceptance rate = 25%).
172. S. Tulyakov, C. Wu, and V. Govindaraju, "Iterative methods for searching optimal classifier combination function", IEEE Conference on Biometrics: Theory, Applications, and Systems, Washington, D.C., 2007. (Short oral presentation acceptance rate = 60%).
173. A. Rusu and V. Govindaraju, "Synthetic handwriting generator for cyber security", 13th Conference of the International Graphonomics Society, Melbourne, Australia, 2007.
174. C. Wu, S. Tulyakov, and V. Govindaraju, "Robust point-based feature fingerprint segmentation algorithm", 1st International Conference on Biometrics, Seoul, S. Korea, pp. 1095-1103, 2007.
175. I. Nwogu, Z. Shi, and V. Govindaraju, "PDE-based enhancement of low quality documents", 9<sup>th</sup> International Conference on Document Analysis and Recognition, Curitiba, Brazil, 2007.
176. H. Cao, and V. Govindaraju, "Vector model based indexing and retrieval of handwritten medical forms", 9<sup>th</sup> International Conference on Document Analysis and Recognition, Curitiba, Brazil, 2007.
177. S. Tulyakov, T. Slowe, Z. Zhang, and V. Govindaraju, "Facial expression biometrics using tracker displacement features", 2nd IEEE CVPR Workshop on Biometrics (CVPRW), Minneapolis, MN, 2007.
178. A. Cartwright, A. Titus, F. Bright, and V. Govindaraju, "CMOS chemical and biochemical sensors using nanostructured materials", 2007 IEEE/LEOS Summer Topical Meetings, Portland, OR, pp. 84-85, 2007.
179. Z. Zhang, V. Singh, T. Slowe, S. Tulyakov, and V. Govindaraju, "Real-time automatic deceit detection from involuntary facial expressions", 2nd IEEE CVPR Workshop on Biometrics (CVPRW), Minneapolis, MN, pp. 1-6, 2007.
180. V. Govindaraju and H. Cao, "Indexing and retrieval of handwritten medical forms", 8th Annual International Conference on Digital Government Research, Philadelphia, PA, pp. 280-281, 2007.
181. H. Cao and V. Govindaraju, "Handwritten carbon form preprocessing based on Markov random field", IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR), Minneapolis, MN, 2007.
182. T. Slowe and V. Govindaraju, "Automatic deceit indication through reliable facial expressions", 5<sup>th</sup> IEEE Workshop on Automatic Identification Advanced Technologies, Alghero, Italy, pp. 87-92, 2007.
183. R. Yampolskiy and V. Govindaraju "Similarity measure functions for strategy-based biometrics", 4th SPIE Symposium on Biometric Technology for Human Identification, Orlando, FL, pp. 4254-4259, 2007.
184. P. Mansukhani, S. Tulyakov, and V. Govindaraju, "Using support vector machines to eliminate false minutiae matches during fingerprint verification", SPIE Defense and Security Symposium, Orlando, FL, 2007.
185. L. Lorigo and V. Govindaraju, "Transcript mapping for handwritten Arabic documents", 14th SPIE Symposium on Document Recognition and Retrieval XIV, San Jose, CA, 2007.
186. H. Cao, F. Farooq, and V. Govindaraju, "Indexing and retrieval of degraded handwritten medical forms", IJCAI Workshop on Multimodal Information Retrieval, Hyderabad, India, 2007.
187. H. Cao and V. Govindaraju, "Template-free word spotting in low quality grayscale manuscripts", International Conference on Advances in Pattern Recognition, Kolkata, India, 2007.

**2006**

188. S. Tulyakov and V. Govindaraju, "Utilizing independence of multimodal biometric matchers", International Workshop on Multimedia Content Representation, Classification, and Security, Istanbul, Turkey, pp. 34-41, 2006.
189. A. Tulyakov and V. Govindaraju, "Identification model for classifier combinations", IEEE Biometric Consortium Conference, Special Session on Research, Washington, D.C., pp. 1-6, 2006.

190. C. Wu, S. Tulyakov and V. Govindaraju, "Image quality measures for fingerprint image enhancement", International Workshop on Multimedia Content Representation, Classification, and Security, Istanbul, Turkey, pp. 215-222, 2006.
191. A. Rusu and V. Govindaraju, "The influence of image complexity on handwriting recognition", 10th International Workshop on the Frontiers of Handwriting Recognition, La Baule, France, 2006.
192. R. Milewski and V. Govindaraju, "Automatic indexing of handwritten medical forms for search engines", 10th International Workshop on the Frontiers of Handwriting Recognition, La Baule, France, 2006.
193. F. Farooq, L. Lorigo and V. Govindaraju, "On the accent in handwriting of individuals", 10th International Workshop on the Frontiers of Handwriting Recognition, La Baule, France, 2006.
194. K. Sridharan, M. Beal, and V. Govindaraju, "Competitive mixtures of simple neurons", 18th International Conference on Pattern Recognition, Hong Kong, China, pp. 494-497, 2006.
195. F. Farooq, K. Sridharan, and V. Govindaraju, "Identifying handwritten text in mixed documents", 18th International Conference on Pattern Recognition, Hong Kong, China, pp. 1142-1145, 2006.
196. S. Kompally, and V. Govindaraju, "Devanagari OCR", 13th World Sanskrit Conference, Edinburgh, UK, 2006.
197. C. Wu and V. Govindaraju, "Singularity preserving fingerprint image adaptive filtering", 13th International Conference on Image Processing, Atlanta, GA, pp. 313-316, 2006.
198. S. Kompalli, S. Setlur, and V. Govindaraju, "Design and comparison of segmentation driven and recognition driven Devanagari OCR", 2<sup>nd</sup> International Workshop on Document Image Analysis for Libraries, Lyon, France, pp. 96-102, 2006.
199. R. Yampolsky and V. Govindaraju, "Use of behavioral biometrics in intrusion detection and online gaming", 3rd SPIE Symposium on Biometric Technology for Human Identification, Orlando, FL, pp. 249-258, 2006.
200. R. Milewski and V. Govindaraju, "Extraction of handwritten text from carbon copy medical form images", International Workshop on Document Analysis Systems, Nelson, New Zealand, pp. 106-116, 2006.
201. S. Chikkerur and V. Govindaraju, "K-plet and coupled BFS: A graph based fingerprint representation and matching algorithm", 1st International Conference on Biometrics, Hong Kong, China, pp. 309- 315, 2006.
202. V. Govindaraju, "Indexing and searching handwritten medical forms", International Conference on Digital Government Research, San Diego, CA, 2006.

## 2005

203. K. Sridharan and V. Govindaraju, "A sampling-based approach to facial feature extraction", 4<sup>th</sup> IEEE Workshop on Automatic Identification Advanced Technologies (AutoID), Buffalo, NY, pp. 51-56, 2005. (Won 2<sup>nd</sup> prize for Best Student Paper).
204. S. Deshpande, S. Chikkerur, and V. Govindaraju, "Accent classification in speech", 4th IEEE Workshop on Automatic Identification Advanced Technologies (AutoID), Buffalo, NY, pp. 139-143, 2005.
205. K. Sridharan, F. Farooq, and V. Govindaraju, "Classification of machine print and handwriting in mixed Arabic documents", Symposium on Document Image Understanding Technology", College Park, MD, pp. 89-94, 2005.
206. T. Jea and V. Govindaraju, "Partial fingerprint recognition based on localized features and matching", Biometrics Consortium Conference, Crystal City, VA, 2005.
207. S. Tulyakov and V. Govindaraju, "Identification model with independent matching scores", Biometrics Consortium Conference, Crystal City, VA, 2005.
208. S. Chikkerur, A. Cartwright, and V. Govindaraju, "Fingerprint image enhancement using STFT analysis", International Conference on Pattern Recognition and Image Analysis, Bath, UK, 2005.

209. S. Tulyakov, F. Farooq, and V. Govindaraju, "Symmetric hash functions for fingerprint minutiae", International Conference on Pattern Recognition and Image Analysis, Bath, UK, pp. 30-38, 2005.
210. F. Farooq, V. Govindaraju, and M. Perrone, "Processing of handwritten Arabic document images", Proceedings of the 12th Biennial Conference of the International Graphonics Society, Salerno, Italy, pp. 183-186, 2005.
211. A. Rusu and V. Govindaraju, "Visual CAPTCHA with handwritten image analysis", 2nd International Workshop on Human Interactive Proofs, Bethlehem, PA, pp. 42-52, 2005.
212. S. Tulyakov and V. Govindaraju, "Using independence assumption to improve multimodal biometric fusion", 6<sup>th</sup> IAPR International Workshop on Multiple Classifier Systems, Monterrey, CA, pp. 147- 155, 2005.
213. S. Tulyakov and V. Govindaraju, "Identification model with independent matching scores", Biometric Consortium Conference, Washington, D.C., 2005.
214. H. Lei and V. Govindaraju, "Half-against-half multi-class support vector machines", 6<sup>th</sup> IAPR International Workshop on Multiple Classifier Systems, Monterrey, CA, pp. 156-164, 2005.
215. H. Lei and V. Govindaraju, "Speeding up multi-class SVM evaluation by PCA and feature selection", International Workshop on Feature Selection for Data Mining: Interfacing Machine Learning with Statistics, Newport Beach, CA, 2005.
216. S. Chikkerur, S. Pankanti, N. Ratha, R. Bolle, and V. Govindaraju, "Minutiae verification in fingerprint images using steerable wedge filters", IEEE Workshop on Applications of Computer Vision, Breckenridge, CO, pp. 111-116, 2005.
217. Z. Shi and V. Govindaraju, "Historical document image segmentation using light intensity normalization", 12th SPIE Symposium on Document Recognition and Retrieval, SPIE Proceedings Series, San Jose, CA, 2005.
218. H. Lei and V. Govindaraju, "Mouse based signature verification for internet-based transactions", 12th SPIE Symposium on Document Recognition and Retrieval, SPIE Proceedings Series, San Jose, CA, pp. 153-160, 2005.
219. A. Rusu and V. Govindaraju, "Challenges that handwritten text pose to computers and new practical applications", 12th SPIE Symposium on Document Recognition and Retrieval, SPIE Proceedings Series, San Jose, CA, pp. 84-91, 2005.
220. H. Lei, and V. Govindaraju, "Similarity-driven sequence classification based on support vector machines and its application in adaptive on-line handwriting recognition", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 252-256, 2005.
221. S. Kompalli, S. Setlur, and V. Govindaraju, "Challenges in OCR of Devanagari documents", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 327-331, 2005.
222. L. Lorigo, and V. Govindaraju, "Segmentation and pre-recognition of Arabic handwriting", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 605-609, 2005.
223. S. Kang, and V. Govindaraju, "A new feature ranking method in a HMM-Based handwriting recognition system", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 779-783, 2005.
224. Z. Shi, S. Setlur, and V. Govindaraju, "Text extraction from gray scale historical document images using adaptive local connectivity map", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 794-798, 2005.
225. A. Rusu, and V. Govindaraju, "A human interactive proof algorithm using handwriting recognition", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 967-971, 2005.

---

226. Z. Shi, and V. Govindaraju, "Multi-scale techniques for document page segmentation", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 1020-1024, 2005.

227. R. Milewski, S. Setlur, and V. Govindaraju, "A lexicon reduction strategy in the context of handwritten medical forms", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 1146-1150, 2005.

228. S. Tulyakov, and V. Govindaraju, "Combining matching scores in identification model", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 1151-1155, 2005.

229. F. Farooq and V. Govindaraju, and M. Perrone, "Pre-processing methods for handwritten Arabic documents", Proceedings of the 8th IAPR International Conference on Document Analysis and Recognition, Seoul, S. Korea, pp. 267-271, 2005.

230. V. Govindaraju, "Emergency medicine, disease surveillance, and informatics", Proceedings of the ACM 6th National Conference on Digital Government Research, Atlanta, GA, pp. 167-168, 2005.

231. V. Govindaraju, "Advances in fingerprint recognition at CUBS", Proceedings of the International Workshop on Document Analysis, Kolkata, India, pp. 149-174, 2005. (Invited).

232. P. Mansukhani and V. Govindaraju, "Exploring similarity measures for biometric databases," International Conference on Audio and Video Based Biometric Person Authentication, Tarrytown, NY, pp. 832-840, 2005.

233. K. Sridharan, S. Nayak, S. Chikkerur and V. Govindaraju, "A probabilistic approach to semantic face retrieval system", International Conference on Audio and Video Based Biometric Person Authentication, Tarrytown, NY, pp. 977-986, 2005.

234. A. Mhatre, S. Chikkerur, and V. Govindaraju, "Indexing biometric databases using pyramid technique", International Conference on Audio and Video Based Biometric Person Authentication, Tarrytown, NY, pp. 841-849, 2005.

235. A. Mhatre, S. Palla, S. Chikkerur, and V. Govindaraju, "Efficient search and retrieval in biometric databases", SPIE Conference on Defense and Security, Orlando, FL, pp. 265-273, 2005.

#### 2004

236. J. Pei, F. Farooq, S. Upadhyaya, and V. Govindaraju, "Data mining for intrusion detection: Techniques, applications, and systems", 20th International Conference on Data Engineering, Boston, MA, 2004.

237. Z. Shi and V. Govindaraju, "Dynamic local connectivity and its application to page segmentation", ACM Hardcopy Document Processing Workshop Washington, D.C., pp. 47-51, 2004.

238. S. Palla, H. Lei, and V. Govindaraju, "Signature and lexicon pruning techniques", 9th IAPR International Workshop on Frontiers of Handwriting Recognition, Tokyo, Japan, pp. 474-478, 2004.

239. A. Rusu and V. Govindaraju, "Handwritten CAPTCHA: using the difference in the abilities of humans and machines in reading handwritten words", 9th IAPR International Workshop on Frontiers of Handwriting Recognition, Tokyo, Japan, pp. 226-231, 2004.

240. H. Lei, S. Palla, and V. Govindaraju, "ER<sup>2</sup>: An intuitive similarity measure for on-line signature verification", 9th IAPR International Workshop on Frontiers of Handwriting Recognition, Tokyo, Japan, pp. 191-195, 2004.

241. H. Baird, V. Govindaraju, and D. Lopresti, "Document analysis systems architectures for digital libraries: Challenges and opportunities", IAPR Workshop on Document Analysis Systems, Florence, Italy, pp. 1-16, 2004.

242. S. Kompalli, R. Setlur, and V. Govindaraju, "Architectures for Devanagari digital libraries" IAPR Workshop on Document Analysis Systems, Florence, Italy, pp. 28-37, 2004.

243. H. Lei and V. Govindaraju, "Direct image matching by dynamic warping", 1<sup>st</sup> IEEE Workshop on Face Processing in Video, Washington, D.C., 2004.

244. H. Lei and V. Govindaraju, "A comparative study on the consistency of features in on-line signature verification", Joint IAPR International Workshops on Syntactical and Structural Pattern Recognition and Statistical Pattern Recognition, Portugal, Lisbon, pp. 444-449, 2004.
245. V. Govindaraju and H. Xue, "Fast handwriting recognition for indexing historical documents", 1st Workshop on Document Image Analysis and Libraries, Palo Alto, CA, pp. 314-320, 2004.
246. Z. Shi and V. Govindaraju, "Line separation for complex document images using fuzzy run length", 1st Workshop on Document Image Analysis and Libraries, Palo Alto, CA, pp. 306-313, 2004.
247. B. Zhang, C. Tomai, S. Srihari, and V. Govindaraju, "Construction of handwritten databases using transcript-based mapping", 1st International Workshop on Document Image Analysis and Libraries, Palo Alto, CA, pp. 288-298, 2004.
248. V. Govindaraju, S. Kompalli, F. Farooq, S. Khedekar, V. Ramanaprasad, and S. Setlur, "Tools for enabling digital access to multi-lingual Indic documents", 1st Workshop on Document Image Analysis for Libraries, Palo Alto, CA, pp. 122-133, 2004.
249. Z. Shi, S. Setlur, and V. Govindaraju, "Digital enhancement of palm leaf manuscript images using normalization techniques", 5th International Conference on Knowledge Based Computer Systems, Hyderabad, India, pp. 69-78, 2004.
250. A. Rusu and V. Govindaraju, "Handwriting word recognition: A new CAPTCHA challenge", 5th International Conference on Knowledge Based Computer Systems, Hyderabad, India, pp. 357-367, 2004.
251. S. Chikkerur, S. Pankanthini, N. Ratha, R. Bolle, and V. Govindaraju, "Novel approaches for minutiae verification in fingerprint images", Indian Conference on Computer Vision and Image Processing, 2004.
252. H. Lei and V. Govindaraju, "Matching and retrieving sequential patterns under regression", IEEE/WIC/ACM International Joint Conference on Web Intelligence, Beijing, China, pp. 84-90, 2004.
253. H. Lei and V. Govindaraju, "Regression time warping for similarity measure of sequence", International Conference on Computer and Information Technology, Wuhan, China, pp. 826-830, 2004.
254. Z. Shi and V. Govindaraju, "Historical document image enhancement using background light intensity normalization", 17th IAPR International Conference on Pattern Recognition, Cambridge, UK, pp. 473- 476, 2004.
255. H. Lei and V. Govindaraju, "GRM: A new model for clustering linear sequences", SIAM Conference on Data Mining, Orlando, FL, pp. 23-32, 2004.
256. S. Chikkerur, C. Wu, and V. Govindaraju, "A systematic approach for feature extraction in fingerprint images", 1st International Conference on Biometric Authentication, Hong Kong, China, pp. 344-350, 2004.
257. A. Teredesai and V. Govindaraju, "Issues in evolving GP based classifiers for a pattern recognition task", IEEE Congress on Evolutionary Computation, pp. 509-515, Portland, OR, 2004.
258. C. Wu, Z. Shi, and V. Govindaraju, "Fingerprint image enhancement method using directional median filters", SPIE Symposium on Biometric Technology for Human Identification, Orlando, FL, 2004.
259. T. Jea, V. Chavan, and V. Govindaraju, "Security and matching of partial fingerprint recognition systems", SPIE Symposium on Biometric Technology for Human Identification, Orlando, FL, pp. 39-50, 2004.
260. R. Milewski and V. Govindaraju, "Automatic reading and mining of pre-hospital care reports", 17th IEEE Symposium on Computer-Based Medical Systems, Bethesda, MD, pp. 428-433, 2004.
261. V. Chavan, S. Chikkerur, S. Tulyakov, and V. Govindaraju, "Securing pervasive networks using biometrics", 1<sup>st</sup> NSF / NSA / AFR Workshop on Secure Knowledge Management, Buffalo, NY, 2004.
262. S. Chikkerur, V. Chavan, and V. Govindaraju, "A study on the convergence of biometrics and cryptographic security", 1<sup>st</sup> NSF / NSA / AFR Workshop on Secure Knowledge Management, Buffalo, NY, 2004.
263. S. Palla, S. Chikkerur, and V. Govindaraju, "Classification and indexing in large biometric databases", Biometrics Consortium Conference, Crystal City, VA, 2004.

264. S. Tulyakov, V. Chavan and V. Govindaraju, "Symmetric hash functions for fingerprint minutiae", Biometrics Consortium Conference, Crystal City, VA, 2004.

**2003**

265. V. Govindaraju, Z. Shi, and J. Schneider, "Feature extraction using chaincoded contour representation of fingerprint images", International Conference on Audio and Video Based Biometric Person Authentication, Surrey, UK, pp. 268-275, 2003.

266. J. Schneider, C. Richardson, F. Kiefer, L. Pratt, and V. Govindaraju, "On the correlation of image size to system accuracy in automatic fingerprint identification systems", International Conference on Audio and Video Based Biometric Person Authentication, Surrey, UK, pp. 895-902, 2003.

267. Z. Shi and V. Govindaraju, "Skew detection for complex document images using fuzzy runlength", IEEE International Conference on Document Analysis and Recognition, Edinburgh, UK, pp. 715-719, 2003.

268. S. Tulyakov and V. Govindaraju, "Postal address block location by contour clustering", IEEE International Conference on Document Analysis and Recognition, Edinburgh, UK, pp. 421-432, 2003.

269. S. Khedekar, V. Ramanaprasad, S. Setlur, and V. Govindaraju, "Text - image separation in Devanagari documents", 7th IAPR International Conference on Document Analysis and Recognition, Edinburgh, UK, pp. 1265-1269, 2003.

270. S. Setlur, V. Ramanaprasad, S. Kompalli, and V. Govindaraju, "A multi-lingual truthing platform for South Asian languages", 7th IAPR International Conference on Data Engineering - Multilingual Information Management, Hyderabad, India, 2003.

271. S. Kompalli, S. Setlur, V. Govindaraju, and V. Ramanaprasad, "Creation of data resources and evaluation tool for multi-lingual OCR", Symposium on Document Image Understanding Technology, MD, pp. 189-196, 2003.

**2002**

272. H. Xue and V. Govindaraju, "A stochastic model combining discrete symbols and continuous attributes and its application to handwriting recognition" 5th IAPR Workshop on Document Analysis Systems, Princeton, NJ, pp. 70-81, 2002.

273. H. Xue and V. Govindaraju, "Incorporating contextual character geometry in word recognition", 8th International Workshop on Frontiers of Handwriting Recognition, IEEE Computer Society Press, Niagara-on-the-Lake, Canada, pp. 123-127, 2002.

274. G. Leedham, S. Varma, A. Patankar, and V. Govindaraju, "Separating text and background in degraded document images - A comparison of global thresholding techniques for multi-stage thresholding", 8th International Workshop on Frontiers of Handwriting Recognition, IEEE Computer Society Press, Niagara-on-the-Lake, Canada, pp. 244-249, 2002.

275. R. Milewski and V. Govindaraju, "Medical word recognition using a computational semantic lexicon", 8th International Workshop on Frontiers of Handwriting Recognition, IEEE Computer Society Press, Niagara-on-the-Lake, Canada, pp. 401-406, 2002.

276. C. Tomai, B. Zhang, and V. Govindaraju, "Transcript mapping for historic handwritten document images", 8th International Workshop on Frontiers of Handwriting Recognition, IEEE Computer Society Press, Niagara-on-the-Lake, Canada, pp. 413-418, 2002.

277. A. Teredesai and V. Govindaraju, "On-line digit recognition using off-line features", Indian Conference on Computer Vision, Graphics, and Image Processing, Ahmedabad, India, 2002.

278. A. Teredesai and V. Govindaraju, "Recurrent genetic programming", IEEE International Conference on Systems, Man, and Cybernetics, IEEE Computer Society Press, Hammamet, Tunisia, 2002.

279. H. Xue and V. Govindaraju, "On the dependence of handwritten word recognizers on lexicons" 16th IAPR International Conference on Pattern Recognition, Quebec City, Canada, pp. 1553-1564, 2002.

## 2001

280. V. Govindaraju, "Automatic reading and mining of pre-hospital care reports", 14th IEEE Symposium on Computer-Based Medical Systems, Bethesda, MD, pp. 152-157, 2001.
281. V. Govindaraju, Z. Shi, and A. Teredesai, "Secondary classification using key features", SPIE Symposium on Document Recognition and Retrieval, Internet Imaging, SPIE Proceedings Series, San Jose, CA, pp. 272-278, 2001.
282. S. Setlur, V. Govindaraju, S. Srihari, and A. Lawson, "Large scale address recognition systems trothing, testing, tools and other evaluation issues", Symposium on Document Image Understanding Technology, College Park, MD, 2001.
283. H. Xue and V. Govindaraju, "Building skeletal graphs for structural feature extraction on handwriting images", 6th IAPR International Conference on Document Analysis and Recognition, Seattle, WA, pp. 96-105, 2001.
284. S. Tulyakov and V. Govindaraju, "Probabilistic models for segmentation based word recognizers with lexicon", 6th IAPR International Conference on Document Analysis and Recognition, Seattle, WA, pp. 164-167, 2001.
285. A. Teredesai, and V. Govindaraju, "Active digit classifiers: A separability optimization approach to emulate cognition", 6<sup>th</sup> IAPR International Conference on Document Analysis and Recognition, Seattle, WA, pp. 401-405, 2001.
286. S. Setlur, A. Lawson, V. Govindaraju, and S. Srihari, "A truthing and evaluation system for measuring address recognition performance", 6th IAPR International Conference on Document Analysis and Recognition, Seattle, WA, pp. 1205-1214, 2001.
287. A. Teredesai, J. Park, and V. Govindaraju, "Active handwritten character recognition using genetic programming", 4th European Conference, EuroGP, Lake Como, Italy, pp. 371-379, 2001.
288. W. Yang, V. Govindaraju, and S. Srihari, "Discovering redundant address components for automatic address interpretation", International Conference on Artificial Intelligence, Las Vegas, NV, pp. 308-312, 2001.
289. Y. Wu, K. Ianakiev and V. Govindaraju, "Improving K-NN classification", International Conference on Advances in Pattern Recognition, Rio De Janerio, Brazil, pp. 222-229, 2001. (Invited paper).

## 2000

290. Y. Wu, K. Ianakiev, and V. Govindaraju, "Confidence combination methods in multi-expert systems", IAPR International Workshop on Structural and Syntactic Pattern Recognition, Alicante, Spain, pp. 641-649, 2000.
291. K. Ianakiev and V. Govindaraju, "Improvement of recognition accuracy using 2-stage classification", 7th International Workshop on Frontiers of Handwriting Recognition, Amsterdam, The Netherlands, pp. 153-165, 2000.
292. J. Park and V. Govindaraju, "Active handwritten word recognition", 7th International Workshop on Frontiers of Handwriting Recognition, Amsterdam, The Netherlands, pp. 403-412, 2000.
293. H. Xue and V. Govindaraju, "Character recognition by matching sequences of pseudo-stroke positions and directions", 7th International Workshop on Frontiers of Handwriting Recognition, Amsterdam, The Netherlands, pp. 589-594, 2000.
294. K. Ianakiev and V. Govindaraju, "Architecture for classifier combination using entropy measures", 3rd IAPR International Workshop on Multiple Classifier Systems, Cagliari, Italy, pp. 340-350, 2000.
295. P. Slavik, H. Xue, and V. Govindaraju, "Use of lexicon density in evaluating word recognizers", 3rd IAPR International Workshop on Multiple Classifier Systems, Cagliari, Italy, pp. 310-319, 2000.
296. S. Madhvanath and V. Govindaraju, "Score aggregation from multiple sources and training in the context of lexicon reduction using holistic features", 2nd Indian Conference on Computer Vision, Graphics, and Image Processing, Allied Publishers Limited, Bangalore, India, pp. 180-187, 2000.

297. J. Park and V. Govindaraju, "Active character recognition using "A\*-like" algorithm", 6th IEEE International Conference on Computer Vision and Pattern Recognition, IEEE Computer Society Press, Hilton Head, S.C., pp. 82-87, 2000.

298. J. Park and V. Govindaraju, "Using lexical similarity in handwritten word recognition", 6th IEEE International Conference on Computer Vision and Pattern Recognition, IEEE Computer Society Press, Hilton Head, S.C., pp. 290-295, 2000.

**1999**

299. S. Setlur and V. Govindaraju, "Translingual OCR by template correlations", 7th SPIE Symposium on Document Recognition and Retrieval, SPIE Proceedings Series, San Jose, CA, 1999.

300. D. Bouchaffra, V. Govindaraju, and S. Srihari, "Recognition of strings using non-stationary Markovian Models: An application in ZIP Code recognition", 5th IEEE Conference on Computer Vision and Pattern Recognition, IEEE Computer Society Press, Fort Collins, CO, pp. 174-179, 1999.

301. V. Govindaraju, S. Srihari, and Y.C. Shin, "Use of handwriting recognition features in handwriting identification", International Graphonomics Society Conference, Singapore, pp. 73- 78, 1999.

302. K. Ianakiev and V. Govindaraju, "Fuzzy control structures in multiple parameter systems: An application in a handwritten address interpretation system", 18<sup>th</sup> International Conference of the North American Fuzzy Information Processing Society, IEEE Computer Society Press, Manhattan, NY, pp. 918-922, 1999.

303. X. Wang, V. Govindaraju, and S. Srihari, "Multi-experts for touching digit string recognition", 5th IAPR Conference on Document Analysis and Recognition, IEEE Computer Society Press, Bangalore, India, pp. 800-803, 1999.

304. J. Park, V. Govindaraju, and S. Srihari, "Efficient word segmentation driven by unconstrained handwritten phrase recognition", 5th IAPR Conference on Document Analysis and Recognition, IEEE Computer Society Press, Bangalore, India, pp. 605-608, 1999.

305. S. Srihari, W. Yang, and V. Govindaraju, "Information theoretic analysis of postal address fields for automatic address interpretation", 5th IAPR Conference on Document Analysis and Recognition, IEEE Computer Society Press, Bangalore, India, pp. 309-312, 1999.

306. S. Srihari, W. Yang, and V. Govindaraju, "Address interpretation", 5th International Conference on Mail Technology in Tomorrow's World, Stakis Brighton Metropole, Brighton, UK, 1999.

307. S. Srihari, W. Yang, and V. Govindaraju, "Graph-theoretic modeling and entropy analysis of postal address fields", HKK Conference and Symposium, Waterloo, ON, 1999.

**1998**

308. S. Madhvanath and V. Govindaraju, "Perceptual features for off-line handwritten word recognition: A framework for heuristic prediction, matching and representation", IAPR Workshop on Syntactic and Statistical Pattern Recognition, Sydney, Australia, pp. 524-531, 1998.

309. G. Kim, V. Govindaraju, and S. Srihari, "Architecture for handwritten text recognition systems", 6th International Workshop on Frontiers of Handwriting Recognition, Taejon, S. Korea, pp. 113-122, 1998.

310. X. Wang, V. Govindaraju, and S. Srihari, "Holistic recognition of handwritten character pairs", 6th International Workshop on Handwriting Recognition, Taejon, S. Korea, pp. 295-303, 1998.

311. D. Bouchaffra, V. Govindaraju, and S. Srihari, "A methodology for deriving probabilistic correctness measures from recognizers", 4th IEEE Conference on Computer Vision and Pattern Recognition, IEEE Computer Society Press, Santa Barbara, CA, pp. 930-935, 1998.

312. D. Bartnik, V. Govindaraju, S. Srihari, and B. Phan, "Reply card mail processing", 12th International Conference on Pattern Recognition, IEEE Computer Society Press, Brisbane, Australia, pp. 633-636, 1998.

313. J. Park, V. Govindaraju, and S. Srihari, "OCR in hierarchical feature space", IEEE International Conference on Systems, Man, and Cybernetics, IEEE Computer Society Press, San Diego, pp. 324-329, 1998. (Invited paper).

314. V. Govindaraju, K. Ianakiev, and S. Srihari, "Improving classifier accuracy by simulating fuzzy boundaries between classes", North American Fuzzy Logic and Image Processing Conference, Pensacola, FL, pp. 161-164, 1998. (Invited paper).

315. S. Srihari, W. Yang, V. Govindaraju, X. Wang, and X. Song, "Information content in united states postal address fields", International Conference on Combinatorics, Statistics, Pattern Recognition, and Related Areas, Mysore, India, pp. 71-72, 1998.

**1997**

316. V. Govindaraju and M. Rajapakse, "Precise location of human faces in cluttered photographs", IEEE International Conference on Systems, Man and Cybernetics, IEEE Computer Society Press, Orlando, FL, pp. 28-33, October 1997. (Invited paper).

317. V. Govindaraju, G. Kim, and S. Srihari, "Paradigms in handwriting recognition", IEEE International Conference on Systems, Man and Cybernetics, IEEE Computer Society Press, Orlando, FL, pp. 1498-1503, 1997. (Invited paper).

318. S. Madhvanath, E. Kleinberg, and V. Govindaraju, "The HOVER system for rapid holistic verification of off-line handwritten phrases", 4th IAPR International Conference of Document Analysis and Recognition, IEEE Computer Society Press, Ulm, Germany, pp. 855-859, 1997.

319. S. Madhvanath and V. Govindaraju, "Contour-based image preprocessing for holistic handwritten word recognition", 4th International Conference of Document Analysis and Recognition, IEEE Computer Society Press, Ulm, Germany, pp. 536-539, 1997.

**1996**

320. G. Kim, V. Govindaraju and S. N. Srihari, "A segmentation and recognition approach of handwritten phrases as applied to street name images", 2nd IEEE Conference on Pattern Recognition, IEEE Computer Society Press, Vienna, Austria, pp. 510-513, 1996.

321. G. Kim and V. Govindaraju, "Recognition of handwritten phrases as applied to street name images", 2nd IEEE Conference on Computer Vision and Pattern Recognition, IEEE Computer Society Press, San Francisco, CA, pp. 459-464, 1996.

322. G. Kim, V. Govindaraju, and S. Srihari, "Handwritten word recognition using dynamic matching with variable duration", IEEE Conference on Acoustics, Speech, and Signal Processing, IEEE Signal Processing Society Press, Atlanta, GA, pp. 454-457, 1996.

323. J. Favata, V. Govindaraju, and S. Srihari, "Off-line handwritten sentence recognition" 5th International Workshop on Frontiers in Handwriting Recognition, Essex, UK, pp. 171-176, 1996.

324. G. Sheikholeslami, V. Govindaraju, and S. Srihari, "Computer aided graphology", 5th International Workshop on Frontiers in Handwriting Recognition, Essex, UK, pp. 457-460, 1996.

325. G. Kim, V. Govindaraju, and S. Srihari, "Extension of handwritten word recognition to street name recognition", 5th International Workshop on Frontiers in Handwriting Recognition, Essex, UK, pp. 221-226, 1996.

326. Z. Shi and V. Govindaraju, "Segmentation and recognition of connected handwritten numeral strings", 5th International Workshop on Frontiers in Handwriting Recognition, Essex, UK, pp. 305-308, 1996.

327. G. Kim and V. Govindaraju, "Efficient chain code based image manipulation for handwritten word recognition", SPIE Symposium on Document Recognition and Retrieval, SPIE Proceedings Series, San Jose, CA, pp. 262-272, 1996.

328. S. Madhvanath and V. Govindaraju, "Holistic lexicon reduction for handwritten word recognition", SPIE Symposium on Document Recognition and Retrieval, SPIE Proceedings Series, San Jose, CA, pp. 224-234, 1996.

**1995**

329. M. Venkatraman and V. Govindaraju, "Zero crossings of a non-orthogonal wavelet transform for object location", IEEE Conference on Image Processing, IEEE Signal Processing Society Press, Washington, D.C., Vol. 3, pp. 57-60, 1995.
330. V. Govindaraju and S. Srihari, "Image quality and human readability", IEEE Conference on Image Processing, IEEE Signal Processing Society Press, Washington, D.C., Vol. 3, pp. 324-327, 1995.
331. G. Kim and V. Govindaraju, "Handwritten word recognition for real-time applications", International Conference on Document Analysis and Recognition, IEEE Computer Society Press, Montreal, Canada, pp. 24-27, 1995.
332. S. Madhvanath, V. Govindaraju, V. Ramanaprasad, D. Lee, and S. Srihari, "Reading handwritten US census forms", International Conference on Document Analysis and Recognition, IEEE Computer Society Press, Montreal, Canada, pp. 82-85, 1995.
333. S. Madhvanath and V. Govindaraju, "Serial classifier combination for handwritten word recognition", International Conference on Document Analysis and Recognition, IEEE Computer Society Press, Montreal, Canada, pp. 911-914, 1995.
334. V. Govindaraju and S. Srihari, "System for reading handwritten documents", IEEE International Conference on Systems, Man and Cybernetics, IEEE Computer Society Press, Vancouver, BC, pp. 347-352, 1995. (Invited paper).
335. J. Favata, V. Govindaraju, and S. Srihari, "Unconstrained handwritten text recognition", Symposium on Document Image Understanding Technology, Bowie, MD, pp. 226-236, 1995.

**1994**

336. V. Govindaraju, R. Srihari, and S. Srihari, "Handwritten text recognition", 4th International Workshop on Frontiers of Handwriting Recognition, Taipei, Taiwan, pp. 265-274, 1994.
337. R. Srihari, M. Venkatraman, R. Chopra, D. Burhans, and V. Govindaraju, "Use of collateral text in image interpretation", ARPA Image Understanding Workshop, Monterey, CA, pp. 897-907, 1994.
338. V. Govindaraju, R. Srihari, and S. Srihari, "Handwritten text recognition", IAPR Workshop on Document Analysis Systems, Kaiserlautern, Germany, pp. 157-171, 1994.
339. S. Lam, V. Govindaraju, R. Srihari, J. Hull, and S. Srihari, "Intelligent data retrieval from raster images of documents", The First Annual Conference on the Theory and Practice of Digital Libraries, College Station, TX, pp. 34-40, 1994.

**1993**

340. J. Zhou, V. Govindaraju, R. Acharya, and S. Srihari, "State name abbreviation recognition", 3rd International Workshop on Frontiers in Handwriting Recognition, pp. 423-430, Buffalo, NY, 1993.
341. S. Madhvanath and V. Govindaraju, "Holistic word recognition", 3rd International Workshop on Frontiers in Handwriting Recognition, Buffalo, NY, pp. 71-81, 1993.
342. V. Govindaraju, A. Shekhawat, and S. Srihari, "Interpretation of handwritten addresses in US mail stream", 2nd IAPR International Conference on Document Analysis and Recognition, IEEE Computer Society Press, Tsukuba Science City, Japan, pp. 291-294, 1993.
343. V. Govindaraju, A. Shekhawat, and S. Srihari, "Interpretation of handwritten addresses in US mail stream", 1st European Conference Dedicated to Postal Technologies, Nantes, France, pp. 421-428, 1993.

**1992**

344. V. Govindaraju, E. Cohen, A. Shekhawat, and S. Srihari, "Determining the delivery point Code on handwritten addresses", 5th Advanced Technology USPS Conference, Washington D.C., pp. 321-336, 1992.
345. V. Govindaraju, D. Wang, and S. Srihari, "Holistic approach to handwritten word recognition using temporal information extracted from static images", 5<sup>th</sup> Advanced Technology USPS Conference, Washington D.C., pp. 529-546, 1992.

346. S. Madhavanath, V. Govindaraju, and S. Srihari, "Using holistic features in handwritten word recognition", 5th Advanced Technology USPS Conference, Washington D.C., pp. 183-198, 1992.
347. V. Govindaraju, D. Sher, and S. Srihari, "A computational model for face location based on cognitive principles", 10th National Conference of the American Association of Artificial Intelligence, AAAI Press / The MIT Press, San Jose, CA, pp. 350-355, 1992.
348. V. Govindaraju, D. Sher, and S. Srihari, "Caption-aided face location in newspaper photographs", IAPR International Conference on Pattern Recognition, IEEE Computer Society Press, The Hague, Netherlands, pp. 474-477, 1992.

#### 1991

349. V. Govindaraju, S. Lam, D. Niyogi, D. Sher, R. Srihari, S. Srihari, and D. Wang, "Newspaper image understanding", International Conference on Knowledge Based Systems, Narosa Publishing House, Bombay, India, pp. 375-386, 1991.
350. V. Govindaraju and S. Srihari, "Separating handwritten text from overlapping non-textual contours", International Workshop on Frontiers in Handwriting Recognition, Bonas, France, pp. 229-240, 1991.
351. J. Hull, T. Ho, V. Govindaraju, J. Favata, and S. Srihari, "Combination of segmentation based and holistic handwritten word recognition algorithms", International Workshop on Frontiers in Handwriting Recognition, Chateau de Bonas, France, pp. 229-240, 1991.

#### 1990

352. V. Govindaraju, D. Sher, and S. Srihari, "A computational model for face location", 3rd International Conference on Computer Vision", IEEE Computer Society Press, Osaka, Japan, pp. 718-721, 1990.

#### 1989

353. V. Govindaraju, R. Srihari, D. Sher, and S. Srihari, "Locating human faces in newspaper photographs", IEEE Conference on Computer Vision and Pattern Recognition, IEEE Computer Society Press, San Diego, CA, pp. 278-281, 1989.

## PATENTS (6)

1. US 8,005,277: "Secure fingerprint matching by hashing localized information", S. Tulyakov; F. Farooq; S. Chikkerur; and V. Govindaraju, 2011.
2. US 7,689,006: "Biometric convolution using multiple biometrics", V. Govindaraju; V. Chavan; and S. Chikkerur, 2010.
3. US 7,580,551. "Method and apparatus for analyzing and/or comparing handwritten and/or biometric samples", S. Srihari; V. Govindaraju; et. al. 2009.
4. US 20080260212. "System for indicating deceit and verity", V. Govindaraju; J. Holsopple; M. Moskal; P. Kilinskas; and T. Slowe, 2008.
5. US 20080220984. "Method for diagnosis of physiological states by detecting patterns of volatile analytes", F. Bright; A. Cartwright; V. Govindaraju; W. Hicks; and A. Titus, 2008.
6. US 5,515,455: "System for recognizing handwritten words of cursive script", V. Govindaraju; D. Wang; and S. Srihari, 1996.

**B. Grants & Research Projects Support**

**Total Sponsored Funding: \$95.2M**

Projects	Government	PI: V. Govindaraju Co-Is	Awards	Period
NY SMART I-Corridor Commercialization & Collaboration Center (C3)".	Economic Development Administration	Stromhaug	\$935,000	2024-28
NSF & IES AI Institute for Transforming Education for Children with Speech and Language Processing Challenges	National Science Foundation (NSF)	Xiong Setlur (MD)	\$20,000,000	2023-27
Autonomous Target Recognition System for Thermal Infrared Spectrum	US Air Force Research Laboratory (AFRL)	Mitin	\$100,000	2022-23
Biometric Recognition and Identification at Altitude and Range (BRIAR)	Intelligence Advanced Project Activity (IARPA)	Setlur	\$682,367	2021-24
Center for Identification Technology Research (CITeR) Phase II	NSF	Setlur	\$400,000	2018-24
CITeR Government (MIPR via NSF) Phase II	Dept of Homeland Security (DHS)	Setlur	\$368,871	2018-24
CITeR Program Income (via WVU/Clarkson) Phase II	DFBA, DHS-Cyber	Setlur	\$799,000	2018-24
CIF21 DIBBs: EI: Data Laboratory for Materials Engineering	NSF	Setlur, Rajan, Furlani	\$2,909,772	2016-22
Janus - Face Recognition	IARPA	Setlur	\$1,300,000	2014-18
Long term active authentication using multi- modal user profiles	NSF	Setlur, Upadhyaya, Nwogu	\$1,200,000	2013-16
Center for Identification Technology Research (CITeR) Phase I	NSF	Setlur, Nwogu	\$300,000	2013-18
CITeR (Government via MIPR) Phase I	DHS	Setlur, Nwogu	\$175,744	2013-18
CITeR (Government via WVU) Phase I	National Security Agency (NSA)	Setlur, Nwogu	\$77,480	2013-18
Planning I/UCRC Grant	NSF	Setlur	\$12,997	2012

Privacy Preserving Biometric Templates & Efficient Indexing	NSF	Rudra	\$514,788	2011-14
Identifying Accents in Handwritten Scripts	NSF		\$150,000	2010-12
Transcript Mapping in Indic Scripts	NSF		\$94,234	2008-10
Health Card Biometrics	NY Science & Technology Advanced Research (NYSTAR)		\$25,000	2008
Multilingual Document Classification	Defense Advanced Project Agency (DARPA)	Setlur	\$3,277,393	2007-13
Person Specific Behavioral Dynamics	NSF	Frank	\$852,649	2007-10
Sanskrit Digital Library	NSF		\$202,888	2005-08
Advanced Biometrics	Dept. of Defense (DoD)	Moskal	\$1,585,884	2005-07
Multimodal Biometric Systems	Army Research Labs (ARL)		\$265,714	2004-06
Disease Surveillance Informatics	NSF	Setlur	\$450,000	2004-08
Arabic Handwritten OCR	Directorate of Central Intelligence (DCI)		\$240,000	2004-06
Smart Card Biometrics	NYSTAR		\$100,000	2004-05
Automation of Medical Forms	NSF		\$50,000	2003-04
Cognitive Recognition Models	NSF		\$99,731	2002-03
Devanagari OCR	NSF		\$487,319	2002-04
<b>Total Federal/State Funding as PI</b>				<b>\$37,656,831</b>

CITeR Industry Phase II	Qualcomm, ACV, Zoloz	Setlur	\$520,000	2018-24
Preparation of Data Sets	Lockheed	Setlur	\$130,000	2014-15
Automated Package Processing System (APPS) Support	Lockheed	Setlur	\$54,571	2013-14
CITeR Industry Phase I	Raytheon, CUBRC, Qualcomm, Zoloz	Setlur, Nwogu	\$350,000	2013-18
ML in NLP	Diligiant		\$30,000	2012-13
Scene Text OCR	eBay		\$50,000	2012-13
Handwriting Datasets	Google		\$50,000	2012-13

Soft Biometrics	CUBRC		\$200,000	2011-12
Machine Learning	Fujitsu		\$55,000	2011
Pen, Touch, and Hand Gestures	HP Labs	Corso	\$150,000	2008-10
Processing Hand-Annotated Documents	HP Labs	Setlur	\$185,000	2008-11
Smart Card Biometrics	Health Networks		\$75,000	2008
GUI for DAQ	ACIS	Setlur	\$40,000	2008
Barcodes project	Matrix	Setlur	\$161,663	2008-10
Arabic OCR	Applied Media Analysis		\$150,000	2008-10
Document Classification	Copanion		\$20,000	2007-08
Student Doctoral Fellowship	IBM		\$55,314	2007-09
RCR Truthing	Lockheed	Setlur	\$1,094,900	2007-14
Behavioral Dynamics	CUBRC		\$31,000	2007
NY State Medical Forms	Buffalo Graphics		\$60,000	2005-07
Information Retrieval for HW Documents	Google		\$50,000	2005-06
Biometric Fusion	CUBRC		\$25,000	2005
Friction Ridge Analysis	CUBRC		\$25,000	2005-06
Face Recognition	CUBRC		\$25,000	2005
Multimodal Biometrics	CUBRC		\$25,000	2005
CAPTCHAS for Web Security	CUBRC		\$25,000	2004-05
Smart Card Biometrics	U-Scan		\$50,000	2004
Biometric Access Control System	International Graphics Inc.		\$235,000	2003-04
Automatic Fingerprint Identification Systems	Ultra-Scan	Bartnik, Setlur	\$1,246,333	2002-05
Medical Forms Reading	CUBRC		\$25,000	2003-04
Forms Reading	CUBRC		\$25,000	2003-04
Biometrics	CUBRC		\$5,000	2003-04
HWAI Plus	Siemens	Srihari	\$317,000	2002-03
Parcel Recognition (PARS)	Siemens	Srihari	\$90,000	2002
Student Support Fellowship	IBM		\$21,000	2001-02
Canadian Postcode Interpretation	Siemens	Srihari	\$50,000	2000-01
Handwritten Address Interpretation	Siemens	Srihari	\$300,000	2000-01
Canadian Postcode Recognition	Systems House Ltd.	Srihari	\$10,000	1994
Recognition of Hand Printed Forms	Readers Digest	Srihari	\$10,000	1994

Document Analysis and Recognition	Xerox	Srihari	\$70,000	1993-00
<b>Total Industry Funding</b>			<b>\$6,091,781</b>	
<b>Total Funding as PI</b>			<b>\$42,813,612</b>	
<b>Non-Postal Funding as Co-PI</b>				
OCR Solutions	FBI (via WVURC)	Setlur	\$298,786	2022-24
AI Driven Adaptive Sensors for Object Recognition	Army Research Labs	Mitin, Oktyabrsky	\$500,000	2021-23
Odor Typing for Disease Detection	Oishei Foundation	Bright, Cartwright, Titus	\$400,000	2006-07
The LitGloss Project	National Endowments for Humanities (NEH)	Jameson	\$196,938	2003-05
Unobtrusive Biometrics Systems	NYSTAR	Bright, Titus, Cartwright	\$153,360	2003-04
Handwritten Text Recognition	NSA	Chin, Srihari	\$532,939	1994-96
Handwriting Individuality	National Institute of Justice (NIJ)	Shin, Srihari	\$428,328	1999-00
<b>Total Funding as Co-PI (Non- Postal)</b>			<b>\$2,510,351</b>	
<b>Govindaraju Co-PI</b>				
<b>Postal</b>				
IES Enhancements, Test Decks, Truthing for PARS V	USPS	Setlur	\$398,000	2016-20
Image Scoring Perf Eval APBS Program	USPS	Setlur	\$26,983	2015
Flats RECO 2	USPS	Setlur	\$38,548	2014
Prep of TD14 Test Deck for Comp Eval DQI Recognition Program	USPS	Setlur	\$224,016	2014-15
Perf Eval for DQI Recognition Program	USPS	Setlur	\$575,462	2013-15
DQI TD13 Test Deck Creation Support	USPS	Setlur	\$249,127	2013-14
Evaluation of Flat Mail Recognition Improvements	USPS	Setlur	\$256,165	2013-14
Image Scoring and Evaluation Support (APPS)	USPS	Setlur	\$77,897	2012-13

DQI Evaluation	USPS	Setlur	\$359,921	2012-13
Cancellation Mark Readability	USPS	Setlur	\$26,974	2012
Test Deck, RCR Development Support	USPS	Setlur, Srihari	\$690,009	2011-12
APBS Parcel Project	USPS	Setlur	\$95,489	2010-11
OCR Assist	USPS	Setlur	\$46,051	2009-10
DQI Evaluation Support	USPS	Setlur, Srihari	\$2,253,975	2008-11
PRIP, FRIP and FSS Evaluation	USPS	Setlur, Srihari	\$786,069	2008-10
Intelligent Mail Technologies	USPS	Setlur, Srihari	\$30,918	2009
Flats Image Collection and Truthing	USPS	Setlur, Srihari	\$1,950,533	2003-08
Digital Camera use in Barcode Imaging	USPS	Setlur, Srihari	\$409,867	2003-07
Image Collection and Truthing	USPS	Setlur, Srihari	\$4,368,541	2003-08
Alternate Keying Strategies	USPS	Srihari	\$165,000	2004-05
Reply Card Scanning	USPS	Srihari	\$210,000	2003-04
Personal Name Lookups	USPS	Setlur, Srihari	\$166,000	2003
Comparison Study of Barcodes	USPS	Setlur, Srihari	\$470,000	2003-05
UK Address Interpretation Project	Lockheed	Setlur, Srihari	\$15,000	2003
Image Evaluation System- Flats	USPS	Setlur, Srihari	\$340,000	2002-03
Micropayment Processing	USPS	Srihari	\$1,204,000	2001-03
Mailpiece Library	USPS	Setlur, Srihari	\$190,000	2002
Evaluation of ID Codes	USPS	Srihari	\$133,000	2001
Return Merchandise System	USPS	Bartnik, Srihari	\$300,000	2001-02
Image Evaluation System	USPS	Setlur, Srihari	\$1,850,583	1999-03
Information Based Indicia	USPS	Srihari	\$300,000	1999-01
UK Address Interpretation Project	Lockheed	Setlur, Srihari	\$1,245,000	2000-02
RCR/HWAI	Lockheed	Srihari	\$660,000	2000-01
Directory Generation	Lockheed	Setlur, Srihari	\$44,235	2000-01
Image Truthing	USPS	Setlur, Srihari	\$1,102,000	2000-02
Address Interpretation for UK	Lockheed	Setlur, Srihari	\$1,224,367	2000
HWAI Control Strategy	Lockheed	Srihari	\$129,190	1999-00
PROZE Character Recognition	Lockheed	Srihari	\$128,395	1999-00
VRR Word Recognizer	Lockheed	Srihari	\$42,590	1999-00
Foreign Address Processing	Lockheed	Setlur, Srihari	\$101,417	1999-00

RCR/HWAI Improvements	Lockheed	Srihari	\$503,480	1999-00
UKAI Parsing and Resolution	Lockheed	Setlur, Srihari	\$152,442	1999-00
HWAI Australian, Release 4	Lockheed	Srihari	\$240,000	1999-00
Truthing for RIP	USPS	Setlur, Srihari	\$75,000	1999-00
Truthing and Analysis	USPS	Setlur, Srihari	\$290,636	1999-00
New Image Evaluation System	USPS	Setlur, Srihari	\$395,257	1999-00
Semi-automated Encoding	USPS	Setlur, Srihari	\$185,261	1999-00
Sender Information Processing	USPS	Setlur, Srihari	\$134,167	1999-00
Equipment Grant	USPS	Srihari	\$46,200	1999-00
Travel Grant	USPS	Srihari	\$34,103	1999-00
HWAI of Australia, Release 3	Lockheed	Srihari	\$218,333	1999
Last Line, Foreign Processing	Lockheed	Srihari	\$100,412	1999
Image Processing Functions	Lockheed	Srihari	\$69,156	1999
Control Strategy	Lockheed	Srihari	\$101,468	1999
Word Recognizer	Lockheed	Srihari	\$46,541	1999
New Character Recognition	Lockheed	Srihari	\$45,019	1999
HWAI of Australia, PIP -1	Lockheed	Srihari	\$230,000	1999
HWAI of Australia, PIP	Lockheed	Srihari	\$89,959	1999
Gray Scale Investigation	USPS	Srihari	\$790,000	1998-00
Address Truthing Analysis	USPS	Srihari	\$1,424,641	1998-00
HWAI Control Structures	Lockheed	Srihari	\$79,200	1998-99
Database Enhancement	Lockheed	Srihari	\$52,500	1998-99
New Parsing Technique	Lockheed	Srihari	\$77,500	1998-99
New Word Recognition	Lockheed	Srihari	\$132,000	1998-99
New Character Recognition	Lockheed	Srihari	\$88,000	1998-99
RCR/HWAI Improvements	Lockheed	Srihari	\$400,000	1998-99
Firm name Recognition	Lockheed	Srihari	\$70,738	1998-99
RCR/ HWAI Improvements	Lockheed	Srihari	\$568,538	1998-99
Port HWAI to NT	Lockheed	Srihari	\$28,586	1998-99
HWAI Recognition Co- processor	USPS	Srihari	\$650,000	1998
HWAI of Australia	Lockheed	Srihari	\$1,144,418	1997-98
RCR/ HWAI Integration	Lockheed	Srihari	\$1,500,000	1997-98
HWAI PC Integration	USPS	Srihari	\$494,924	1997-98
HWAI/RCR Research	Lockheed	Srihari	\$550,860	1997
HWAI/RCR	Lockheed	Srihari	\$407,686	1997
Directory Compression	USPS	Srihari	\$37,959	1997
Image Analysis	USPS	Srihari	\$40,722	1997
Evolutionary Computing	USPS	Srihari	\$57,410	1997
HWAI PC Porting	USPS	Srihari	\$215,497	1997
HWAI/RCR Research	Lockheed	Srihari	\$585,924	1996-97
HWAI/RCR Integration	Lockheed	Srihari	\$596,474	1996-97

HWAI PC Integration, Task 1	USPS	Srihari	\$255,076	1996-97
HWAI Integration Testing	USPS	Srihari	\$99,750	1996-97
Improvements in HWAI	USPS	Srihari	\$2,510,680	1993-96
Reply Card Processing - Phase III	USPS	Srihari	\$1,388,534	1995-96
Reply Card Processing PIMS	USPS	Srihari	\$1,435,416	1993-95
Interactive Service Research	USPS	Srihari	\$1,299,519	1993-96
Supplemental Activities	USPS	Srihari	\$750,000	1991-95
HWAI Research	USPS	Srihari	\$3,256,837	1991-94
<b>Total Postal Funding Co-PI</b>			<b>\$46,832,145</b>	
<b>TOTAL FUNDING (PI /Co-PI)</b>			<b>\$93,091,108</b>	
SCC-PG: Sustainable & Connected Community-Scale Food System	NSF	Kennedy (PI), Setlur (Co-PI)	\$150,000	2021-23
AFSM100-TR2-FPARS	USPS	Setlur	\$95,440	2023-25
Package Reco R2P2	USPS	Setlur	\$55,325	2022-24
Dangerous goods label detection pilot	USPS	Setlur	\$150,184	2022-23
Informed Address	USPS	Setlur	\$65,000	2021-22
Package Reco R2	USPS	Setlur	\$83,460	2021-22
AMP Audio ML	ACV Auctions	Setlur	\$14,000	2020
EPPS OCR	USPS	Setlur	\$80,000	2019-20
RCR TD19 Evaluation	USPS	Setlur	\$289,121	2019-20
COA Forms Processing	USPS	Setlur	\$123,456	2019-20
Letter Mail Forward Intercept System	USPS	Setlur	\$64,470	2018-19
AFSM100-TR1	USPS	Setlur	\$91,536	2018-19
Interactive Document Processing	W. Interactive	Setlur	\$25,815	2018-19
APPS-SSIU Performance Evaluation	USPS	Setlur	\$82,847	2017-18
RAPTIR	USPS	Setlur	\$169,003	2017
DSS OCR	USPS	Setlur	\$42,315	2016-17
DSS/PASS	USPS	Setlur	\$19,365	2016
Package Reco	USPS	Setlur	\$28,670	2016
RCR, APPS and SSIU Evaluation	USPS	Setlur	\$279,675	2016-17
Flats Recognition	USPS	Setlur	\$48,660	2015-16
DSS	USPS	Setlur	\$50,360	2015
PRES	USPS	Setlur	\$20,011	2015
SSIU-PRES	USPS	Setlur	\$71,226	2014
<b>Other funding at CUBS</b>			<b>\$2,099,939</b>	
<b>TOTAL FUNDING (PI /Co-PI + Other CUBS Funding)</b>			<b>\$95,191,047</b>	

## C. Mentorship

### Post-Doctoral Fellows (6)

2023-24	S. Suresh (Amrita PhD)	
2017-20	K. Davila (RIT PhD)	
2017-18	R. Subramanian (UB PhD)	
2015-16	Y. Zhou (UB PhD)	
2006-07	S. Tulyakov (UB PhD)	
2004-06	L. Lorigo (MIT PhD)	

- Handwriting Recognition and Dyslexia
- Equations OCR and Understanding
- Materials Discovery and Machine Learning
- Deep Learning
- Fusion of Classifiers
- Arabic Handwriting Recognition

### Major Adviser of Doctoral Students (46)

2025	Bhavin Jawade <i>Netflix, CA</i>	Multimodal Contrastive Models through Zero-short Training
2024	Dennis Fedorishin <i>ACV Auctions, NY</i>	<ul style="list-style-type: none"><li>• Listen and Learn: From Supervised to Contrastive Multi-Modal Audio Deep Learning</li></ul>
2023	Deen Dayal Mohan <i>Verizon, NY</i>	<ul style="list-style-type: none"><li>• Improving Representation Learning for Diverse Modalities and Distributions with Metric Learning</li></ul>
2023	Kyung Won Lee <i>Icahn School of Medicine, Mount Sinai, NY</i>	<ul style="list-style-type: none"><li>• Learning Appearance Features Using Soft-Biometrics for Long-term Person Re-identification</li></ul>
2021	Nagashri N. Lakshminarayana <i>Amazon, CA</i>	<ul style="list-style-type: none"><li>• Modeling Local Attention and Relations for Automated Facial Action Unit Recognition</li></ul>
2021	Nishant Sankaran <i>Amazon, CA</i>	<ul style="list-style-type: none"><li>• Feature Fusion for Deep Representations</li></ul>
2020	Bhargav Urala Kota <i>ACV Auctions, NY</i>	<ul style="list-style-type: none"><li>• Lecture Video Summarization by detection and representation of content</li></ul>
2019	Neeti Pokhriyal <i>NSF</i>	<ul style="list-style-type: none"><li>• Multiview learning via Gaussian processes with applications in biometrics and sustainability</li></ul>
2018	Neeti Narayan <i>Amazon, MN</i>	<ul style="list-style-type: none"><li>• Re-identification for online person tracking using spatio-temporal discrimination</li></ul>
2017	Rathin Radhakrishnan <i>Qualcomm, NY</i>	<ul style="list-style-type: none"><li>• An adaptive framework for metadata extraction and analysis from documents</li></ul>
2016	Rohit Pandey <i>Google, CA</i>	<ul style="list-style-type: none"><li>• Learning privacy preserving representations using deep neural networks</li></ul>
2016	Devansh Arpit <i>SalesForce, CA</i>	<ul style="list-style-type: none"><li>• Methodologies for learning data manifolds and robust feature representation</li></ul>
2015	Shounak Gore <i>Qualcomm, NY</i>	<ul style="list-style-type: none"><li>• Social networks analysis using game theory</li></ul>
2015	Yingbo Zhou <i>SalesForce, CA</i>	<ul style="list-style-type: none"><li>• Towards a globally optimal approach for learning deep unsupervised models</li></ul>

2015	Aarti Shivram <i>CUBRC, NY</i>	<ul style="list-style-type: none"> <li>Dynamic hierarchical relational models for handwriting recognition on mobile devices</li> </ul>
2015	Gaurav Kumar <i>Amazon, CA</i>	<ul style="list-style-type: none"> <li>Bayesian approaches for word spotting</li> </ul>
2014	Chetan Ramaiah <i>Google, CA</i>	<ul style="list-style-type: none"> <li>Accents in handwriting: A hierarchical Bayesian approach to handwriting analysis</li> </ul>
2014	Utkarsh Porwal <i>Walmart, CA</i>	<ul style="list-style-type: none"> <li>A semi-supervised framework for handwriting analysis</li> </ul>
2013	Manavender Malgireddy <i>Amazon, WA</i>	<ul style="list-style-type: none"> <li>Language motivated approaches for human action recognition and spotting</li> </ul>
2012	Xi Cheng <i>Google, CA</i>	<ul style="list-style-type: none"> <li>A novel multi-sample fusion methodology for improving biometric verification</li> </ul>
2012	Safwan Wshah <i>University of Vermont, VT</i>	<ul style="list-style-type: none"> <li>Word spotting in multilingual handwritten documents using character recognition HMM models</li> </ul>
2011	Ricardo Rodriguez <i>Universidade Federal do Rio Grande, Brazil</i>	<ul style="list-style-type: none"> <li>Transfer Learning for probability density estimation</li> </ul>
2011	D. You <i>University of Michigan, MI</i>	<ul style="list-style-type: none"> <li>Methods for content extraction towards improved biomedical multimodal retrieval</li> </ul>
2010	Xijun Peng <i>ISI, University of Southern California, CA</i>	<ul style="list-style-type: none"> <li>Probabilistic Random Field based text identification</li> </ul>
2010	Anurag Bhardwaj <i>Apple, CA</i>	<ul style="list-style-type: none"> <li>Statistical techniques for efficient indexing and retrieval of document images</li> </ul>
2010	Achint O. Thomas <i>Deep Science and Trusted Datasets, Canada</i>	<ul style="list-style-type: none"> <li>Enhancing cyber security through synthetic handwritten CAPTCHAs</li> </ul>
2009	Jiang Li <i>Quincy University, IL</i>	<ul style="list-style-type: none"> <li>Integrating minutiae based fingerprint matching with local correlation methods</li> </ul>
2009	Ifeoma Nwogu <i>University at Buffalo, NY</i>	<ul style="list-style-type: none"> <li>Statistical modeling and inferencing techniques for medical image segmentation</li> </ul>
2008	Zhi Zhang <i>J. P. Morgan Chase, NY</i>	<ul style="list-style-type: none"> <li>Integrating facial expressions and skin texture in face recognition</li> </ul>
2008	Huaigu Cao <i>ISI, University of Southern California, CA</i>	<ul style="list-style-type: none"> <li>Enhancement and retrieval of low quality handwritten documents</li> </ul>
2008	Faisal Farooq <i>LinkedIn, NY</i>	<ul style="list-style-type: none"> <li>Use of language models and automatic topic categorization for indexing and retrieval of handwritten document images</li> </ul>
2008	Praveer Mansukhani <i>Machinomatic Engineers, India</i>	<ul style="list-style-type: none"> <li>A framework for efficient fingerprint identification using a minutiae tree</li> </ul>
2008	Roman Yampolisky <i>University of Louisville, KY</i>	<ul style="list-style-type: none"> <li>Intrusion detection using spatial information and behavioral biometrics</li> </ul>

2008	Amalia Rusu <i>Fairfield University, CT</i>	<ul style="list-style-type: none"> <li>Exploiting gap between human and machine in handwriting recognition</li> </ul>
2007	Chaohong Wu <i>KLA-Tencor, CA</i>	<ul style="list-style-type: none"> <li>Framework for fingerprint enhancement and feature detection</li> </ul>
2007	Suryaprakash Kompalli <i>INSOFE, India</i>	<ul style="list-style-type: none"> <li>Stochastic framework for font-independent Devanagari OCR</li> </ul>
2007	Robert Milewski <i>@Hidden, Japan</i>	<ul style="list-style-type: none"> <li>Automatic search engines for handwritten medical forms</li> </ul>
2006	Sergey Tulyakov <i>University at Buffalo, NY</i>	<ul style="list-style-type: none"> <li>A complexity framework for combining classifiers in biometric systems</li> </ul>
2005	Tsai Yang Jea <i>Bloomberg, NY</i>	<ul style="list-style-type: none"> <li>Minutiae-based partial fingerprint recognition</li> </ul>
2005	Hansheng Lei <i>University of Texas, Rio Grande Valley, TX</i>	<ul style="list-style-type: none"> <li>Sequential pattern classification without explicit feature extraction</li> </ul>
2003	Ankur Teredesai <i>University of Washington, Tacoma, WA</i>	<ul style="list-style-type: none"> <li>Use of genetic programming for advanced pattern recognition</li> </ul>
2002	Hanhong Xue <i>Google, NY</i>	<ul style="list-style-type: none"> <li>Stochastic models for handwritten word recognition</li> </ul>
2000	Ianiev Krassimir <i>Fair Isaac, Inc., CA</i>	<ul style="list-style-type: none"> <li>Organizing multiple experts for efficient pattern recognition</li> </ul>
2000	Jaehwa Park <i>(Co-advised)</i> <i>Chung-Ang University, S. Korea</i>	<ul style="list-style-type: none"> <li>Hierarchical character recognition in handwritten phrase recognition</li> </ul>
1997	Srikanth Madhvanath <i>(Co-advised)</i> <i>eBay, NY</i>	<ul style="list-style-type: none"> <li>The holistic paradigm in handwritten word recognition and its applications</li> </ul>
1996	Gyeonghwan Kim <i>(Co-advised)</i> <i>Sogang University, S. Korea</i>	<ul style="list-style-type: none"> <li>Handwritten word recognition for real-time applications</li> </ul>

#### Major Adviser of graduated Masters students (17) with thesis option

2013	Nisha Bhaskaran <i>Time Inc., CA</i>	<ul style="list-style-type: none"> <li>Facial Expressions and Deception</li> </ul>
2009	Omar Mukhtar <i>Amazon, WA</i>	<ul style="list-style-type: none"> <li>Language Modeling</li> </ul>
2009	Bhaskar Purkayastha <i>Hughes Systems, MD</i>	<ul style="list-style-type: none"> <li>Gesture Recognition</li> </ul>
2008	Daemien Jose <i>Microsoft, WA</i>	<ul style="list-style-type: none"> <li>Transcript Mapping</li> </ul>
2006	Kartik Sridharan <i>Cornell University, NY</i>	<ul style="list-style-type: none"> <li>Sematic Face Recognition</li> </ul>
2006	Sankalp Nayak <i>Morgan Stanley, NY</i>	<ul style="list-style-type: none"> <li>Devanagari OCR</li> </ul>
2006	Shamalee Deshpande <i>Veritas Technologies, CA</i>	<ul style="list-style-type: none"> <li>Accent in Speech</li> </ul>

2005	Amit Mahtre <i>Amazon, WA</i>	• Hand Geometry Biometrics
2005	Sharat Chikkerur <i>Microsoft, MA</i>	• Fingerprint Verification
2004	Pawan Rudravaram <i>Qualcom, CA</i>	• Palmprint Recognition
2004	Sumeet Manocha <i>Patni Computers, India</i>	• Security of Biometrics Systems
2004	Viraj Chavan <i>Nividea, CA</i>	• Biometrics and Barcode Representation
2004	Srinivas Palla <i>Amazon, CA</i>	• Multimodal Biometrics
2003	Swapnil Khadekar <i>Bloomberg, NY</i>	• Devanagari OCR
2000	David Bartnik <i>Qualcom, NY</i>	• Video Surveillance
2000	Gaurav Pal <i>BMC Software India</i>	• Music Index on the Web
2000	F. Zhou <i>Panasonic, NJ</i>	• Thinning Algorithms

#### 2000-14 McNair Scholars program (post baccalaureate)

##### **HON 101: Presidential Scholars Development Seminar (undergraduates)**

11/3/2016	Experiential Learning Activities	16 students
11/5/2015	Experiential Learning Activities	19 students

- 18 academic institution placements including tenure track faculty positions in Cornell University and University of Washington.
- 4 placements in top university research labs: Dartmouth, USC, UB, and University of Michigan.
- 2 MS students went to graduate with doctorate from MIT and University of Chicago.
- Students placed in USA, Brazil, India, Japan, China, and S. Korea.

## D. Teaching

<b>Undergraduate Lower Division</b>		<b>Class size</b>
Fall 94	Introduction to Programming	90
Spring 95	Introduction to Programming	90
<b>Undergraduate Upper Division</b>		
Summer 89	Introduction to Artificial Intelligence	30
Fall 96	Computer Architecture and Organization	98
Spring 97	Algorithms and Data Structures	40
Spring 98	Computer Architecture and Organization	100
Fall 98	Computer Architecture and Organization	94
Spring 99	Computer Architecture and Organization	67
<b>Graduate core classes</b>		
Spring 00	Operating Systems	59
Fall 00	Operating Systems	76
<b>Advanced graduate classes</b>		
Fall 00	Topics in Artificial Intelligence	8
Fall 03	Document Analysis and Recognition	6
Spring 03	Topics in Artificial Intelligence	13
Spring 04	Topics in Artificial Intelligence	13
Fall 04	Image Analysis	12
Spring 05	Topics in Artificial Intelligence	11
Fall 05	Topics in Artificial Intelligence	7
Spring 06	Biometrics	6
Spring 07	Topics in Artificial Intelligence	8
Fall 07	Biometrics	10
Spring 08	Topics in Artificial Intelligence	6
Fall 08	Biometrics	7
Spring 09	Markov Models	7
Fall 09	Biometrics	11
Spring 10	Machine Learning	9
Fall 10	Biometrics	10
Spring 11	Machine Learning	13
Fall 11	Machine Learning	17
Spring 12	Biometrics	9
Fall 13	Biometrics	13
Spring 14	Topics in Artificial Intelligence	16
Fall 15	Topics in Artificial Intelligence	7
Fall 16	Topics in Artificial Intelligence	7
Fall 17	Deep Learning	10
Fall 19	Biometrics and Machine Learning	13
Fall 21	Computational Vision	26

## **E. Professional Service**

<b>Professional Societies Activities</b>		
• IEEE Biometrics Council	President	2015 - 16
• IEEE Biometrics Council Nominations Committee	Chair	2009 - 11, 17-19
• IEEE Biometrics Council (Education)	Member	2007 - 08
• IEEE Education Activities Board	SME	2007 - 08
• International Graphonomics Society (IGS)	Secretary	2007 - 09

<b>Editorial Boards</b>		
• IEEE Access		2015 - 2020
• IDRBT Journal of Banking Technologies		2017 - on
• IEEE Transactions on Information Security and Forensics		2014 - 2016
• IEEE Biometrics Compendium (Editor-in-Chief)		2012 - 2016
• IET Biometrics Identification		2011 - on
• Journal of Technology Management for Growing Economies		2010 - on
• International Journal on Document Analysis and Recognition		2003 - on
• International Journal of Pattern Analysis and Applications		2004 - 2008
• IEEE Transactions on Systems, Man, and Cybernetics (B)		2000 - 2008
• IEEE Transactions on Pattern Analysis and Machine Intelligence		2001 - 2005
• The Journal of Pattern Recognition		1997 - 2005

<b>Conference Leadership</b>		
• Executive Chair	IEEE International Conference on Document Analysis and Recognition, San Jose, CA	Aug. 2023
• General Chair	IEEE International Conference on Identity, Security, and Behavioral Analysis (ISBA), Hyderabad, India	Jan. 2019
• General Chair	IAPR International Conference on Frontiers of Handwriting Recognition, Niagara Falls, NY	Aug. 2018
• Honorary Chair	IEEE International Conference on Identity, Security, and Behavioral Analysis (ISBA), Singapore	Jan. 2018
• General Chair	IEEE International Conference on Identity, Security, and Behavioral Analysis (ISBA), New Delhi, India	Feb. 2017
• General Chair	IAPR Summer School on Document Analysis: Document Informatics, Jaipur, India	Jan. 2017
• General Chair	IEEE Biometrics, Theory, Algorithms, and Systems (BTAS), Niagara Falls, NY	Sept. 2016
• General Co-Chair	International Conference on Information and Systems Security (ICISS), Hyderabad, India	Dec. 2014
• Sponsorship Chair	International Joint Conference on Biometrics, Tampa, FL	Sept. 2014
• Area Co-Chair	International Conference on Pattern Recognition (ICPR), Stockholm, Sweden	Aug. 2014
• General Co-Chair	Int. Conf. on Document Analysis and Recognition, Washington, D.C.	Sept. 2013
• General Co-Chair	ICDAR Multilingual OCR Workshop, Washington D.C.	Aug. 2013

• General Co-Chair	Int. Conf. on Information Assurance and Management, Buffalo, NY	Aug. 2013
• Industry Chair	IAPR International Conference on Biometrics (ICB), Madrid, Spain	Jun. 2013
• Program Co-Chair	CVPR Biometrics Workshop, Portland, OR	Jun. 2013
• Tutorials Co-chair	IAPR International Conference on Biometrics (ICB), Spain	Jun. 2013
• Track Chair	Int. Conf. on Pattern Recognition, Tsukuba City, Japan	Nov. 2012
• Program Chair	CVPR Biometrics Workshop, Providence, RI	Jun. 2012
• Advisory Board	International Conference on Information Systems for Indian Languages, Patiala, India	Dec. 2011
• Area Chair	Indian Conference on Computer Vision and Image Processing, Chennai, India	Dec. 2011
• General Co-chair	Multilingual OCR Workshop, Beijing, China	Sept. 2011
• Program Chair	CVPR Workshop, Colorado Springs, CO	Jun. 2011
• Advisory Board	Multimedia Signal Processing	Apr. 2011
• Tutorials Chair	Int. Conf. on Handwriting Recognition, Kolkata, India	Oct. 2010
• General Co-Chair	1st International Workshop on Emerging Techniques and Challenges for Hand-based Biometrics , Istanbul, Turkey	Aug. 2010
• General Co-Chair	International Workshop. Document Analysis Systems, Boston, MA	Jun. 2010
• Program Chair	CVPR Biometrics Workshop., San Francisco, CA	Jun. 2010
• Steering Committee	Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications, NY	May. 2010
• General Co-Chair	Multilingual OCR Workshop., Barcelona, Spain	Jul. 2009
• Program Chair	CVPR Biometrics Workshop., Miami, FL	Jun. 2009
• Program Co-Chair	Document Analysis Track (ICPR) Tampa, FL	Dec. 2008
• Awards Committee	IEEE Biometrics Symposium, Tampa FL	Sept. 2008
• Program Co-Chair	2nd IEEE Conf. on Biometrics: (BTAS), DC	Sept. 2008
• Program Chair	CVPR Biometrics Workshop., Anchorage, AL	Jun. 2008
• Program Co-Chair	International Conference on Cognition and Recognition, India	Apr. 2008
• Steering Committee	Indo-US Symposium on Data Info Knowledge Spectrum	Dec. 2007
• Program Co-Chair	1st IEEE Conf. on Biometrics (BTAS), DC	Sept. 2007
• Program Chair	CVPR Biometrics Workshop., Minneapolis, MN	Jun. 2007
• Program Chair	CVPR Multi-biometric Workshop., NY, NY	Jun. 2006
• General Co-Chair	Int. Conf. on Cognition and Recognition, India	Dec. 2005
• General Chair	4th IEEE Int. Workshop. on AutoID, NY	Oct. 2005
• Program Co-Chair	Int. Conf. Document Analysis and Recognition, Korea	Oct. 2005
• General Co-Chair	Int. Workshop. on DIAL, Palo Alto, CA	Jan. 2004
• General Co-Chair	Int. Workshop. on Document Analysis and Retrieval, WI	Jun. 2003
• Publicity Chair	New York State Cyber-Security Symposium, Utica	Feb. 2003
• Program Co-Chair	International Workshop. on Handwriting Recognition	Sept. 2002
• Technical Committee	IEEE SMC (B) for Pattern Recognition	1998-02

## **F. Invited Talks**

### **Keynotes, Plenary Talks, and Distinguished Lectures (52)**

03/04/25	Innovation and Responsibility in AI-supported Education (iRAISE), American Association of Artificial Intelligence, Philadelphia, PA
12/04/24	International Conference on Pattern Recognition, Kolkata, India
12/22/23	AI in Education, International Conference on Computational Intelligence, Networks, and Society (ICCINS), Mylavaram, India
11/02/23	Transforming UB into an Engine for Entrepreneurial Growth and Commercialization, MedTech, New York's Life Sciences Conference, Buffalo NY
10/12/23	AI in Education, Michigan State University, East Lansing, MI
05/21/23	AI for Exceptional Education, G20 Conference on Digital Education, Trivandrum, India
10/19/22	Inaugural Address, Amrita University, Amaravati, India
10/11/22	IEEE Biometrics Council, Biometrics and Systems Week, Houston, TX
04/29/22	Indian Institute of Technology, Jodhpur, India
12/04/21	International Conference on Computer Vision and Image Processing (CVIP), Ropar, India
07/03/21	International Conference on AI for Social Good (AISG), Amrita University, India
09/29/18	International Conference on Computer Vision and Image Processing, Jabalpur, India
07/14/17	International Conference on Computational Intelligence & Data Engineering, Amaravati, India
03/28/17	Open Cloud Institute, University of Texas, San Antonio, TX
06/23/17	International Conference on Biometric and Forensic Engineering, Singapore
02/22/17	International Symposium on Biometric Authentication, Delhi, India
12/19/15	National Conf. on Computer Vision, Pattern Recognition, and Image Processing, Patna, India
08/24/15	IAPR/ ICDAR Outstanding Achievements Award Keynote, Nancy, France
12/14/14	ICVGIP Document Analysis and Recognition Workshop, Bengaluru, India
12/14/14	ICVGIP Workshop on Applications of Computer Vision, Graphics, and Image Processing, Bengaluru, India
12/30/13	Statistics 2013, Advanced Inst. of Mathematical, Statistics, and Comp. Sciences, Hyderabad, India
12/20/13	National Conf. on Computer Vision, Pattern Recognition, and Image Processing, Jodhpur, India
12/07/13	Large Scale Visual Commerce Workshop, at Int. Conf. Computer Vision, Sydney, Australia
02/22/13	International Conclave on Innovations in Engineering and Management, Patna, India
07/27/12	International Joint Conference on e-Business and Telecommunications, Rome, Italy
12/16/12	Distinguished Lecture Series, Adobe Inc., Bengaluru, India
02/03/12	TACTIC Smart Facilities, Hyderabad, India
12/17/11	IEEE India Conference (INDICON), Hyderabad, India
04/07/11	TACTIC Conference, Trivandrum, India
03/09/11	International Conference on Information Systems for Indian Languages, India
12/15/10	TACTIC Security Conference, Hyderabad, India
05/06/10	Computational Modeling of Objects Presented in Images, Niagara Falls, NY
02/01/10	Government of Jamaica Seminar on National Identification System, Jamaica.
12/21/09	International Conference on Recent Advances on Mathematical Sciences and Applications, Visakhapatnam, India
12/19/09	Workshop on Image and Speech Processing (WISP), Hyderabad, India

12/18/09	International Conference on Pattern Recognition and Machine Intelligence, Kolkata, India
12/14/09	5th International Conference on Information Systems Security, Kolkata, India
09/11/09	HP Technology Summit, Bangalore, India
07/24/09	3rd Workshop on Analytics for Noisy Unstructured Text Data, Barcelona, Spain
03/15/09	11th International Conference on Technology, Policy, and Innovation, Delhi, India
12/30/08	International Conference on Business Data Mining, Hyderabad, India
12/16/08	Indian Conference on Vision and Image Processing, Bhubaneswar, India
07/21/08	Intensive Workshop on Indic Document Recognition, Delhi, India
07/09/08	Lockheed BEACON Center, Rockville, MD (broadcast to 8 remote centers)
02/12/08	IDGA's Military Biometrics Summit 2008, Washington, DC
01/02/08	Platinum Jubilee Conference, Indian Statistical Institute, Kolkata, India
09/29/06	IEEE Western New York Image Processing Workshop, Rochester, NY
12/23/05	International Conference on Cognition and Recognition, Mysore, India
12/15/05	13th International Conference on Advanced Computing and Comm., Coimbatore, India
01/03/05	Amrita University, Coimbatore, India
09/11/04	World Hindi Conference, Amherst, NY
05/09/03	Rochester Institute of Technology, Rochester, NY

#### Colloquium Talks (33)

12/15/23	IIT Ropar, India
08/09/23	University of Minnesota, Minneapolis, MN
10/20/22	University of Central Florida, Center for Computer Vision, Orlando, FL
10/25/17	National Cancer Institute, Biomedical Informatics and Info Technology, Washington DC
12/22/14	Jawaharlal Nehru Technological University, Hyderabad, India
01/16/13	Accelerated Discovery Lab, IBM Almaden, CA
03/29/13	IBM Almaden, CA
03/01/13	SRC, Syracuse, NY
03/07/12	Syracuse University, Syracuse, NY*
12/23/11	HP, Bangalore, India
10/08/10	Fujitsu Inc, Sunnyvale, CA
10/04/10	Department of Computer Science and Engineering, Lehigh University, PA
07/10/09	Machine Learning Lab, Stanford University, Palo Alto, CA
12/15/08	IEEE Bangalore Chapter, India
05/20/08	École de Technologie Supérieure, Montréal, Québec (IEEE Chapter on CI)
01/28/08	University of California, Riverside, CA
11/09/07	University of New South Wales, Sydney, Australia
02/22/07	Carnegie Mellon University, Pittsburgh, PA
12/01/06	University of Maryland, College Park, MD
04/28/05	Korea Advanced Institute of Science and Technology, Seoul, S. Korea
01/16/05	Brown University, RI
10/10/03	Concordia University, Montreal, Canada
08/14/03	IBM TJ Watson Research Center, Yorktown Heights, NY
05/09/03	Rochester Institute of Technology, Rochester, NY
04/16/03	Wayne State University, Detroit, MI
10/13/02	University of Massachusetts, Amherst
10/09/00	IBM TJ Watson Research Center, Yorktown Heights, NY
06/15/00	Xerox Palo Alto Research Center (PARC)
12/03/99	Xerox, Webster Research Center, Rochester, NY

11/23/99	University of Maryland, College Park, MD
06/28/99	Kent Research Digital Labs, Singapore
03/27/97	Wayne State University, Detroit, MI
12/16/94	University of Michigan, Dearborn, MI

### Invited Conferences Talks (22)

12/19/16	International Workshop on Pattern Recognition Applications, Kolkata, India
12/17/15	BB Chaudhuri Conference, Indian Statistical Institute, Kolkata, India
10/29/13	NRC Intelligence Committee Workshop on Science & Tech Investments, Washington DC
06/19/13	International Program on Information Assurance and Management, Buffalo, NY
08/22/12	CAPTCHAs for Remote Cyber Security in Banks, IPIAM, Buffalo, NY
12/20/12	Tutorial Lecture on Machine Learning, Amrita University, India
11/03/08	ROBUST Biometrics Conference, Hawaii
05/16/08	International Sanskrit Digital Library Workshop, Brown University
02/07/07	NYSTAR University Technology Showcase, Rochester, NY
11/17/06	NSF Workshop on International Sanskrit Digital Library Integration, Providence, RI
09/28/06	Summit on Arabic and Chinese Handwriting Recognition, College Park, MD
05/07/05	Workshop on Tools for Indian Digital Libraries, IIIT Hyderabad, India
11/14/03	Griffis Institute Cyber Security Conference, New Paltz, NY
02/25/03	New York State Cyber-Security Symposium, Utica, NY
01/24/03	International Workshop on Technology Development in Indian Languages, Kolkata, India
04/24/01	Symposium for Document Image Understanding Technology (SDIUT), Annapolis, MD
03/29/01	International Workshop. on Technology Development in Indian Languages, Kolkata, India
06/22/00	International Workshop on Multiple Classifier Systems, Cagliari, Italy
05/19/99	National Postal Forum, San Antonio, TX.
11/09/94	Digital Post Modernism, Nice, France
05/10/94	Digital Road Show, UK & France
02/15/94	2nd Census OCR Conference, National Institute of Standards, Bethesda, MD

### Invited Talks at UB (26)

03/02/23	UB Foundation Board of Directors (presentation: National AI Institute for Exceptional Edu)
05/23/22	Health Equity Dimensions of a Changing Climate Workshop
12/04/17	UB Council (presentation: AI for Social Good; Vision for UB)
10/12/17	Honors College, Honors 101: Presidential Scholar Development Seminar
04/12/17	Department Chairs (presentation: Mentoring Faculty for Research Success)
11/09/16	College of Arts & Sciences* Deans and Directors Meeting (Building Research Capacity) *largest academic unit
08/26/16	School of Engineering and Applied Sciences, New Graduate Student Engagement, Professionalism and Ethics Orientation (Presentation: Beyond the lab and coursework: Your role and responsibilities as a UB SEAS graduate student)
03/22/16	UB Department Chair Leadership Program workshop: Enhancing Research Productivity in Your Department

10/23/15	UB Business Engagement Committee (Topic: New paradigm in economic development and higher education)
07/22/14	UB This Summer
07/22/14	UB This Summer
03/14/13	Pi Day: Biometrics and Privacy
10/08/13	UB Insights (Biometrics: Is Privacy a Bygone Concept in the 21 <sup>st</sup> century)
06/07/11	UB Postdoc Forum
03/31/11	UB Management School (Amrita)
07/25/09	UB Catholic Ministry, Newman Center
04/13/07	Guest Speaker, Information Assurance Class, School of Management
12/02/05	UB Friday Forum
09/30/05	IGERT Colloquium Series
07/21/05	UB This Summer
03/12/05	Engineering Seminar & Exhibition, University at Buffalo
07/23/03	UB This Summer
10/29/04	Guest Speaker, Information Assurance Class, School of Management
04/24/03	University at Buffalo, School of Engineering, Dean's Council, Buffalo, NY
11/19/99	Department of Computer Science & Engineering, University at Buffalo, NY
10/16/92	Department of Computer Science, University at Buffalo, NY

### Other Seminars (47)

01/23/24	Convergence of AI, Buffalo Niagara Partnership
05/24/23	IDRBT, Hyderabad, India
04/22/22	IDRBT, Hyderabad, India
11/08/19	Barrett Women's Club, Buffalo, NY
03/25/19	Aditya Institute of Technology and Management, Tekkali, India
09/01/17	Microsoft Research, Redmond, WA
01/25/17	Manipal Institute of Technology, Jaipur, India
01/27/17	Birla Institute of Technology Mesra Campus, Jaipur, India
01/19/17	Indian Statistical Institute, Kolkata, India
12/18/13	Prime Minister's Office Complex, Delhi, India
02/20/13	IDRBT, Hyderabad, India
01/02/13	IDRBT, Hyderabad, India
04/02/12	IDRBT, Hyderabad, India
04/12/11	IIT Hyderabad, India
06/08/10	Jawaharlal Nehru Technological University, Hyderabad, India
06/06/10	College of Engineering, Andhra University, Visakhapatnam, India
12/31/09	Int. Conference on Interface Between Statistics and Sciences, Hyderabad, India
03/16/09	Windows to the World Series, Tata Indicom, Delhi, India
01/05/09	Indian Institute of Technology Madras, Chennai, India
12/29/08	Computer Maintenance Corporation, Tata Group, Hyderabad, India
12/15/08	Hewlett Packard Research, Bengaluru, India
12/04/08	University of Hyderabad, India
08/07/08	Satyam Computers, Hyderabad, India
08/05/08	Siddhartha Engineering College, Vijayawada, India
07/22/08	TIFAC, Dept. of Science and Technology, Delhi, India
01/30/08	Google, Inc, Mountain View, CA

01/04/08	HP Research Laboratories, India
01/03/08	Google Research, Bangalore, India
06/04/07	Motorola Labs, Hyderabad, India
05/26/07	IEEE Chapter of Hyderabad and University of Hyderabad, India
01/04/07	Gayatri Vidya Parishad, Visakhapatnam, India
12/30/06	PES College of Engineering, Bangalore, India
11/07/06	Indian Institute of Technology, Delhi, India
11/04/06	IEEE Chapter of Birla Institute of Technology, Ranchi, India
11/04/06	Birla Institute of Technology, Ranchi, India
07/04/06	International Institute of Technology, Hyderabad, India
06/23/06	HP Research, Bangalore, India
05/06/05	Center for Development of Advanced Computing, Hyderabad, India
01/04/05	HP Research Labs, Bangalore, India
12/30/04	Indian Institute of Technology, Chennai, India
07/24/04	AP State Education Council, Hyderabad India
12/30/03	Jawaharlal Nehru Technological University, Hyderabad, India
06/02/03	Tata Consulting Services, Hyderabad, India
07/08/02	International Institute of Information Technology, Hyderabad, India
08/09/01	Institution of Electronics and Telecommunication Engineers, Hyderabad, India
12/24/99	Indian Statistical Institute, Calcutta, India

**Podcasts (3)**

12/27/24	Evolution of AI in Language Communication
08/08/23	Tech Talk podcast with UB Chief Information Officer (topic: AI research at UB and in education)
06/02/23	Achieving Joy and Mastery in Public Schools podcast series, Erie-Niagara Schools Superintendents Association (topic: National AI Institute for Exceptional Education)