Venu Govindaraju

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Personal	*US Citizen (naturalized in 2000); Married to Padma*	*Born: June 17, 1964 Daughter (Swati); Son (Krishna)*

Education		
PhD	University at Buffalo, State University of New York *Major*: Computer Science (Artificial Intelligence)	1992
MS	University at Buffalo, State University of New York *Major*: Computer Science	1988
BTech	Indian Institute of Technology (IIT), Kharagpur *Major*: Computer Science and Engineering	1986

Employment History	University at Buffalo, State University of New York (SUNY)
Vice President, Research and Economic Development (VPR)	**9/14 - current**
SUNY Distinguished Professor *Highest rank in the SUNY system ; Less than 0.1% all SUNY faculty have this rank*	11/10 - current
Furnas Chair Professor, School of Engineering and Applied Sciences	6/14 – 8/15
UB Distinguished Professor *Less than 0.25% of engineering school faculty have this designation*	9/08 – 11/10
Professor, Department of Computer Science & Engineering	8/02 – 11/10
Associate Professor, Department of Computer Science & Engineering	8/00 – 8/02
Research Scientist, Center for Document Analysis and Recognition (CEDAR)	6/92 – 8/00

Administrative Positions	University at Buffalo, State University of New York (SUNY)	
Vice President, Research and Economic Development (VPR)		**9/14 - current**
Director	Center for Unified Biometrics and Sensors (CUBS)	1/04 - current
Director	Computational Data Science & Engineering (central initiative)	7/13 – 8/15
Director	UB Strategic Strength in Information Technology (central initiative)	1/07 – 8/15
Assoc. Director	Center for Document Analysis and Recognition (CEDAR)	1/94 – 9/14

Leadership Positions		
Hauptman Woodward Institute, NY	Board of Directors	2015- current
IEEE Biometrics Council	President	2015 - 2016
Buffalo Niagara Enterprise, NY	Board of Directors	2014 - 2016
Inst. for Development and Research in Banking Technology	Distinguished Fellow	2013 - current
Engage Click Inc., CA	Advisory Board	2012 - 2016
Int. Graphonomics Society	Advisory Council	2012 - 2015
Copanion Inc., MA	Advisory Board	2005 - 2009
Asian Indian Community Foundation of WNY	Vice President	2008 - 2012
Girl Scouts of Buffalo, NY	Board of Directors	2004 - 2006

Short Biography:

Venu Govindaraju, **VP for Research and Economic Development and SUNY Distinguished Professor**, is also the founding director of the Center for Unified Biometrics and Sensors of Computer Science and Engineering at the State University of New York (SUNY) at Buffalo. He received his Bachelor's degree with honors from the Indian Institute of Technology, Kharagpur in 1986, and his Ph.D. from SUNY Buffalo in 1992.

A recognized authority in the field of Pattern Recognition, Govindaraju has received peer honors such as the IAPR/ICDAR Outstanding Achievements (2015), Distinguished Alumnus Award from IIT Kharagpur (2014), the IEEE Technical Achievement Award (2010), MIT Global Indus Technovator Award (2004), and fellowships from the major professional societies such as AAAS, ACM, IAPR, IEEE, and the SPIE. He is a **member of the National Academy of Inventors** (2015).

Govindaraju is credited with major conceptual and practical advances in this area with six books and over **425 refereed publications**. He has served on the editorial boards of several premier journals including the most prestigious IEEE Transactions on Pattern Analysis and Machine Intelligence and has been the **Editor-in-Chief of IEEE Biometrics** Council Compendium. Recently he served as the president of the IEEE Biometrics Council positioning it for consideration of a full-fledged IEEE Technical Society.

Govindaraju has graduated **37 doctoral students as their major advisor** and was recently awarded the University at Buffalo's "Excellence in Graduate Student Mentoring Award (2017)". He has given over a hundred invited talks, keynotes, plenaries and seminars, at prestigious venues including influential think tanks such as the Science and Technology Investment committee of the National Academy of Sciences.

Govindaraju has had active and continuous sponsorship from the National Science Foundation for the past 15 years (2002-17) and a career total of nearly **$70M of sponsored funding** as a Principal or Co-Principal Investigator from several federal and state agencies and industry. His annual research expenditures are consistently over $1.5M, making him a top performer at UB.

Govindaraju is the **Chief Research Officer at UB** with an annual operating budget of $35M and over 100 staff members reporting to the Office of the Vice President of Research and Economic Development. He sits on the President's cabinet as well as the Provost's cabinet and is responsible for managing UB's research enterprise, including supporting scholarly excellence, creating collaborations, ensuring compliance in a regulatory environment, and oversees programs that contribute to regional job growth and a diversified economy in the Western New York region.

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I. Awards and Honors

- *Excellence in Graduate Student Mentoring Award*, University at Buffalo, SUNY (2016).
- ***Fellow of the AP Academy of Sciences***, India (2016).
- ***Fellow of NAI*** – *National Academy of Inventors* (2015).
- *IAPR /ICDAR Outstanding Achievements Award* (2015), "For pioneering contributions to pattern recognition and its application to the fields of handwriting recognition, multilingual document analysis, and biometrics; and for the development of real-time engineered systems.
- *Distinguished Alumnus Award* (2014), Indian Institute Technology Kharagpur, India.
- ***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" for sustained achievement over last 10-15 years.
- *UB Visionary Innovator* (2009, 08, 04).
- ***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 and significant contribution to institutional quality".
- ***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.
- *Business First 40 Under 40 Honoree (2002*), "For success in profession heavy involvement in community activities", Buffalo, NY.
- *SUNY Research Foundation Scholarship Award* (2002).
- ***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 in complex applications of postal document handling and for outstanding scientific productivity".

II. Administration Experience

- ***Vice President for Research and Economic Development*** **(VPRED)**

(August 2014 – current)

Annual operating budget:
(approx.) $50M including university allocation and sponsored funds in support of OVPRED mission.

The Office of the Vice President for Research and Economic Development provides a supportive environment for scholarship and creative activities in advancing the university's vision as an AAU public research institution. The Vice President develops effective and innovative strategies to best achieve UB's research goals, while ensuring that resources are aligned with the university's education and service missions. The mission is to manage UB's research enterprise, including supporting scholarly excellence, creating collaborations, ensuring compliance in a regulatory environment, and contributing to job growth and a diversified economy.

Supporting Scholarly Excellence

- New project identification
- Funding opportunities
- Proposal development, review and submission
- Partnership with investigators and agencies to present fundable research
- Management of research awards for the life of the project

Creating Collaborations

- Shared equipment and facilities
- Strategic partnerships with institutions and investigators
- Results, expertise and stories communicated to multiple audiences

Ensuring Compliance in a Regulatory Environment

- Up-to-date policies from sponsoring agencies
- Federal regulations and university guidelines
- Tools, systems and processes for maintaining research compliance

Contributing to Job Growth and a Diversified Economy

- Protection of UB intellectual property
- Assistance with technology transfer
- Launch of start-ups
- Innovation for business growth
- Regional attraction of knowledge / creative workers

Leading the University's research centers and institutes

UB has over 100 active research centers on topics ranging from the environment to evolving materials and technologies, and from big data analytics to addictive behaviors. Following 12 centers with total sponsored expenditures of over $25M (FY17), cut across several decanal units and report directly to the VPRED.

- Buffalo Institute for Genomics and Data Analytics (BIG) - $3.2M
- Center for Computational Research - $2.8M
- NYS Centers of Excellence - $8.4M
    - Bioinformatics and Life Sciences – $2.2M

    - Materials Informatics - $6.2M
- Center for Hearing and Deafness - $1.3M
- Center for Unified Biometrics and Sensors - $1.1M
- Institute for Lasers Photonics, and Biophotonics - $530K
- Research Institute on Addictions - $5.5M

Major VPRED Accomplishments

RESEARCH

2017:

- All-time highest recovery of indirect costs from sponsored activities (~$38M)
- Increased Clinical Trials Expenditures by 25% over 2014
- Awarded the National Science Foundation Science and Technology Center (NSF STC) on Biology with X-Ray Free Electron Lasers (BioXFEL), $25M award for 5 years
- Awarded the SUNY Empire Innovation Program, for recruiting and retaining world-class scholars:
    - $3M to add faculty researchers who will build upon the university's existing expertise in artificial intelligence and robotics
    - $1M to add faculty researchers in the field of systems pharmacology
    - $0.5M 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:

- All-time highest sponsored activities expenditures (~$167M)
- Created a Faculty Research Hub for one-stop faculty support for pre- and post-award accounting, grant writing, and technology transfer
- Launched the *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 and disease.
- Launched the *UB Center for Integrated Global Biomedical* Sciences that 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.
- Formalized the *Office of Research Advancement (ORA)* to support the university's research and scholarly community in the pursuit of external grant 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. Working with UB faculty, our goal is to help create highly competitive proposals to support promising research and advance university initiatives.

2015:

- Launched the university-wide clinical research office
- Launched and oversee Communities of Excellence - ~$3M (per year over 5 years)
    - Global Health Equity: interdisciplinary approach to better promote the health and well-being of under-resourced populations by helping reduce the sources and effects of inequity.
    - Sustainable Manufacturing and Advanced Robotic Technologies: leverage university and regional strength in manufacturing, partner with regional companies, and capitalize on state and private investments to develop intelligent, interconnected systems that support design and production processes and to educate future

manufacturing leaders.
    - Genome, Environment, and Microbiome: advance genomic science and increase genomic literacy through research, education and community outreach.
- National Institute of Health, Clinical and Translational Science Award, $15M over 4 years
- Launched and oversee Research and Education in Environment, Energy and Water (RENEW) Institute - $3M per year

OUTREACH

2017-15

- Active participation in AAU Research Officers and APLU Council on Research
- Active participation in Congressional visits to Senators and Representatives
- Senior Leadership Representative at the National Cyber Security Summit, Huntsville, AL
- Senior Leadership Representative at the Universities Research Association (URA) Council of Presidents, Washington DC
- Representation in both the UB president's and provost's cabinets as part of UB senior leadership team

2016:

- Reorganized the University Technology Transfer Office
- 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.
- Launched the Faculty Consulting program to stimulate industry engagement
- Launched the university SBIR/STTR support to stimulate industry engagement

- ***Chair of the School of Engineering Dean Search Committee (2012)***
    - Successfully recruited the current Dean of the UB School of Engineering and Applied Sciences

- ***Director, Computational Data Science and Engineering***
  (August 2013 – July 2015)

    - Engaged 24 interdisciplinary faculty from 7 departments
    - Hired 9 new faculty in School of Engineering, College of Arts and Sciences, and Management.
    - Launched a fully functional PhD program in Computational Data Science
        - Designed for students who already hold a Masters' degree
        - Admitted 7 PhD students in 2016
        - Three core areas; Numerical analysis, Data Sciences, and High Performance Computing
    - Framed a MS program to be launched in 2018

- ***Director, Information and Computing Technology (Strategic Strength)***
  (August 2007 – July 2015)

    - Engaged actively with 25 interdisciplinary faculty from 10 different departments
    - Hired 13 new faculty in School of Engineering, College of Arts and Sciences, and School of Management
    - Resulted in over a dozen multi-disciplinary, multi-investigator research projects

III. Technical Impact

- *Seminal Accomplishments*

  - **Architected an early AI success story** by making postal address recognition and deployment of engineered systems (via Lockheed, 1997-2001) a reality, saving the postal services of US, UK, and Australia, hundreds of millions of dollars[1] [2].
    - Govindaraju's seminal work in handwriting recognition[3] was at the core of the first handwritten address interpretation system used by the U.S. Postal Service. It uses an innovative dynamic matching algorithm to assign automatically segmented pieces of words to lexical entities. This simple but powerful idea enabled real-time handwriting recognition by overcoming the challenge of dealing with large lexicons.
    - Govindaraju developed the approach of "active recognition" which is modeled along the lines of the A* algorithm. It provides a multi-resolution framework for adapting to factors such as the quality of the input pattern, its intrinsic similarities with patterns of other classes, and the processing time available. This provides the knobs to engineered real-time systems to tradeoff accuracy and speed in a cost-benefit framework, which enabled postal services to gradually trim down the need for human data entry operators and thereby increase efficiencies and grow savings.

  - **Pioneered automation of (multilingual) handwritten documents processing** by (i) improving efficiencies of document work-flow in large organizations using innovative handwriting recognition solutions (Emergency Medical Response 2004, NYS Department of Health 2007, Medical Management Research Network 2009); (ii) developing script and language-independent techniques for data-driven re-targetable recognition systems (DARPA MADCAT 2009-2013); and (iii) development of digital archives and transcription tools (International Sanskrit Digital Library, 2008; Marian Moore Digital Archive, 2016).
    - Departing from the myriad heuristic approaches, he introduced a principled statistical approach by modeling the degraded document as a Markov Random Field where the prior is learned from a training set of high quality images, and the probabilistic density is estimated on-the-fly. This approach proved to be critical in dealing with poor quality scanned forms and faxed prescriptions, thus contributing to improved health care due to decreased human error in medical transcription.
    - Through his landmark paper on Arabic script recognition, the first comprehensive book on OCR of Indic Scripts, and other publications, he demonstrated novel recognition driven methodologies that steer away from prior approaches that primarily used sequential rules to segment characters and lines. This paved the way for successful deployment of the DARPA Multilingual Automated Document Classification, Analysis, and Translation

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[1] The Government Executive publication reported in 1999 that "USPS issued a contract to researchers at the State University of New York at Buffalo to develop the handwriting recognition technology. It was first launched in 1997 right before the Christmas holiday season. One year later, an estimated 400 million pieces of mail were automatically routed during the Christmas season alone using the handwriting recognition technology. The new technology has saved the Postal Service at least $90 million in its first year in the field."

[2] Computing Community Consortium (http://www.cra.org/ccc/) refers to the seminal work:

- March 25, 2009: **Computing Research that Changed the World: Reflections and Perspectives**, "… Automated handwriting analysis seems easy but there are many ways to write each number or letter. **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**…" (Presentation by Daphne Koller).
- June 7, 2016: AI for public good: "**An early success story in the 90s widely considered the winter of AI**" (Presentation by Eric Horvitz).

[3] US 5,515,455: "System for recognizing handwritten words of cursive script", V. Govindaraju; D. Wang; and S. Srihari, 1996.

(MADCAT) system for generating real-time actionable intelligence using multilingual recognition capabilities. A direct consequence of this effort is the empowerment of people working and collaborating across language barriers.

- **Major impact on the human language interface** to websites and hand-held devices, engaging with users on their terms (i.e., language), contributing to the ease of use and ubiquity of today's technologies.
  - Govindaraju developed a new stochastic framework that combined discrete symbols and continuous attributes and incorporated the theories of reading and perception developed in psychology literature in analyzing handwritten words. This led to the innovative spambot-fighting strategy using simulation of human-like handwriting for designing *captchas* to exploit the differential in handwriting reading proficiency between humans and machines.
  - Govindaraju proposed that, although handwriting is unique to writers, writer style represents a shared component of individual handwriting. He explicitly models this conceptualization via a three-level hierarchical Bayesian framework for the purposes of writer identification and verification. In this text-independent model, each writer's handwriting is modeled as a distribution over a limited set of writing styles that are shared amongst writers. Analogous to speech, accents in writing are treated as distinctive quirks unique to a group of people belonging to a common family of scripts, which have roots in cultural and genetic factors. This paved the way to personalization of handwriting stylus input as a viable alternative to keyboard and speech in mobile devices.

- **Key early consulting role in the world's largest biometric ID system, Aadhar** (over 1 billion enrolled participants in India) used extensively for the delivery of government services, empowering residents of India with a unique identity and digital platform to authenticate anytime, anywhere.
  - Govindaraju's highly innovative work in securing biometric templates using symmetric hash functions and convolving multiple biometric modalities where one biometric provides the encrypting basis for another was proposed for integration to Aadhar. He has also shown theoretically, why random projections are an essential step in cancelable biometrics by defining the notion of an Independent Subspace Structure for datasets, and demonstrating that random projection preserves the subspace structure of data vectors generated from a union of independent linear subspaces.
  - Govindaraju proved that the optimal combination (fusion) algorithm for identification systems is difficult to express analytically because of the difficulty presented by the dependencies between matching scores assigned to different classes by the same classifier. He developed the first taxonomy of the complexity of classification combination methodologies and a guideline for choosing a particular type of fusion technique. Thus, rival vendors reluctant to share the inner workings of individual classifiers are able to join forces on a common platform for improved performance.

- *Scholarship Impact*

  - Research reported in prestigious technical media outlets (Scientific American- March'12; ACM Tech News- October'10, September'07, January'05 ; MIT Tech Review, January'09, October'09.
  - 450 refereed publications; Total citations over11,000; h-index: 52
  - Graduated 38 PhD students as major adviser and 15 MS students with thesis option.

IV. Publications

Books (6)

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

Journal Papers (83)

Under Review

1. R. Radhakrishnan, S. Setlur, N. Sankaran, and V. Govindaraju, "An adaptive framework for metadata analysis in documents", Special Issue on Deep Learning, *International Journal of Document Analysis and Recognition*.
2. A. Shivram, B. Zhu, M. Nakagawa, and V. Govindaraju, "Unconstrained online handwriting recognition using conditional random fields: A multi-expert design", *Journal of Pattern Recognition*.
3. R. Pandey, Y. Zhou, and V. Govindaraju, "Transactions on pattern analysis and machine intelligence", *Special Issue on Learning with Shared Information for Computer Vision and Multimedia Analysis*.
4. Y. Zhou, D. Arpit, I. Nwogu and V. Govindaraju, "Is joint training better for deep auto-encoders?", *Neural Networks,* 2015.
5. D. Arpit, Y. Zhou, H. Ngo and V. Govindaraju, "Why regularized auto-encoders learn sparse representations?", *Journal of Machine Learning Research.*

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6. 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.
7. Gaurav Kumar, Venu Govindaraju, "Bayesian background models for keyword spotting in handwritten documents", *Pattern Recognition* 64: 84-91, 2017.

2014

8. 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.
9. 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.

2013

10. 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.
11. U. Porwal, and V. Govindaraju, "Semi supervised framework for writer identification using structural learning", *IET Biometrics*, Vol. 2, No. 4, pp. 208-215, 2013.
12. 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.

13. 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.
14. Y. Zhou, I. Inwogu, and V. Govindaraju, "Labeling Spain with Stanford", *IEEE Transactions on Image Processing*, Vol. 22, No. 12, pp. 5362-5371, 2013.
15. 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.

2012

16. 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.

2011

17. 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.
18. V. Menon, B. Jayaraman and V. Govindaraju, "Spatio-temporal querying in smart spaces", *Procedia Computer Science*, Elsevier Press, Vol. 10, pp. 366-373, 2011.
19. H. Cao, A. Bhardwaj, 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

20. 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.
21. 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.
22. 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.
23. 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.
24. 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.

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25. 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.
26. 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.
27. 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.
28. 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.

29. 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.
29. 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.
30. 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.
31. 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.
32. R. V. Yampolskiy and V. Govindaraju, "Strategy-based behavioural 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.

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34. 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.
35. R. V. Yampolskiy and V. Govindaraju, "Behavioural biometrics: A survey and classification", *International Journal of Biometrics*, Inderscience Publishers, Vol. 1, No. 1, pp. 81-113, 2008.

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36. 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.
37. R. V. Yampolskiy and V. Govindaraju, "Embedded noninteractive continuous bot detection", *ACM Computers in Entertainment (CIE)*, Vol. 5, No. 4, 2007.
38. 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.
39. 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.
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61. M. R. Malgireddy, I. Inwogu, 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.

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handwriting", 1st International Workshop on Automatic Forensic Handwriting Analysis, Beijing, China, pp. 36-40, 2011.

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74. 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.

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problem to design secure handwritten CAPTCHAs", 12th IAPR International Conference on Handwriting Recognition, Kolkata, India, pp. 13- 18, 2010.

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93. 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.

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Barcelona, Spain, pp. 486- 490, 2009.

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105. 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.
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Japan, 2008.

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117. 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.
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119. 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.
120. V. Menon, B. Jayaraman, and V. Govindaraju, "Biometrics driven smart environments: Abstract framework and evaluation", 5th International Conference on Ubiquitous Intelligence and Computing (UIC-08), Oslo, Norway, pp. 75-89, 2008.
121. H. Cao and V. Govindaraju, "Processing and retrieving handwritten medical forms", ACM Digital Government Research Conference, Montreal, Canada, pp. 371-372, 2008.
122. R. V. Yampolskiy and V. Govindaraju, "Behavioral biometrics for verification and recognition of malicious software agents", 5th SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
123. R. V. Yampolskiy and V. Govindaraju, "Generation of artificial biometric data enhanced with spatio-temporal and environmental information", 5th SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
124. Z. Shi, and V. Govindaraju, "Modeling biometric systems using the general pareto distribution (GPD)", 5th SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
125. P. Mansukhani and V. Govindaraju, "Selecting optimal classification features for SVM based elimination of incorrectly matched minutiae", 5th SPIE Symposium on Biometric technology for Human Identification, Orlando, FL, 2008.
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130. 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.

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133. J. Li, S. Tulyakov, and V. Govindaraju, "Verifying fingerprint match by local correlation methods", 1st IEEE Conference on Biometrics: Theory, Algorithms, and Systems, Washington, D.C., pp. 1-5, 2007. (Oral presentation acceptance rate = 25%).
134. 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%).
135. A. Rusu and V. Govindaraju, "Synthetic handwriting generator for cyber security", 13th Conference of the International Graphonomics Society, Melbourne, Australia, 2007.
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137. I. Nwogu, Z. Shi, and V. Govindaraju, "PDE-based enhancement of low quality documents", 9th International Conference on Document Analysis and Recognition, Curitiba, Brazil, 2007.
138. H. Cao, and V. Govindaraju, "Vector model based indexing and retrieval of handwritten medical forms", 9th International Conference on Document Analysis and Recognition, Curitiba, Brazil, 2007.
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147. L. Lorigo and V. Govindaraju, "Transcript mapping for handwritten Arabic documents", 14th SPIE Symposium on Document Recognition and Retrieval XIV, San Jose, CA, 2007.
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forms", IJCAI Workshop on Multimodal Information Retrieval, Hyderabad, India, 2007.

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154. 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.
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Seoul, S. Korea, pp. 327-331, 2005.

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Patents

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 5,515,455: "System for recognizing handwritten words of cursive script", V. Govindaraju; D. Wang; and S. Srihari, 1996.

V. Grants & Research Projects Support

PI/Co-PI: Total $ 67.3M

Projects	Govt.	PI : V. Govindaraju	Awards	Period
Data Laboratory for Materials Engineering	National Science Foundation (NSF)	V. Govindaraju, S. Setlur, K. Rajan, T. Furlani	$2,909,772	2016-20
Janus - Face Recognition	IARPA (UMD)	V. Govindaraju, S. Setlur	$1,300,000	2014-18
Long term active authentication using multi-modal user profiles	NSF	V. Govindaraju, S. Shambhu, I. Inwogu (UB), S. Shuckers, D. Hou (Clarkson)	$1,200,000	2013-16
Center for Identification Technology Research (CITeR)	NSF	V. Govindaraju, S. Setlur, I. Nwogu	$300,000	2013-18
CITeR	DHS	V. Govindaraju, S. Tulyakov	$80,000	2013-15
CITeR	NSA	V. Govindaraju, A. Rudra	$80,000	2013-15
Planning I/UCRC Workshop Grant	NSF	V. Govindaraju, S. Setlur	$12,997	2012
Privacy Preserving Biometric Templates and Efficient Indexing	NSF	V. Govindaraju, A. Rudra	$514,788	2011-14
Identifying Accents in Handwritten Scripts	NSF	V. Govindaraju	$150,000	2010-12
Transcript Mapping in Indic Scripts	NSF	V. Govindaraju	$94,234	2008-10
Health Card Biometrics	NY Science & Tech. Advanced Research (NYSTAR)	V. Govindaraju	$25,000	2008
Multilingual Document Classification	Defense Advanced Project Agency (DARPA)	V. Govindaraju, S. Setlur	$3,277,393	2007-13
Person Specific Behavioral Dynamics	NSF	V. Govindaraju, M. Frank	$852,649	2007-10
Sanskrit Digital Library	NSF	V. Govindaraju	$202,888	2005-08
Advanced Biometrics	DoD	V. Govindaraju, M. Moskal	$1,585,884	2005-07
Multimodal Biometric Systems	Army Research Labs (ARL)	V. Govindaraju	$265,714	2004-06
Disease Surveillance Informatics	NSF	V. Govindaraju, S. Setlur	$450,000	2004-08
Arabic Handwritten OCR	Directorate of Central Intelligence	V. Govindaraju	$240,000	2004-06
Smart Card Biometrics	NYSTAR	V. Govindaraju	$100,000	2004-05
Automation of Medical Forms	NSF	V. Govindaraju	$50,000	2003-04
Cognitive Models for Recognition	NSF	V. Govindaraju	$99,731	2002-03
Devanagari OCR	NSF	V. Govindaraju	$487,319	2002-04
Total Federal/State Funding			**$14,278,369**	

	Industry			
Preparation of Recognition	Lockheed	V. Govindaraju, S. Setlur	$130,000	2014-15
Data Sets				
Automated Package Processing System (APPS) Support	Lockheed	V. Govindaraju, S. Setlur	$54,571	2013-14
CITeR	Qualcomm	V. Govindaraju, S. Setlur	$70,000	2013-15
CITeR	Raytheon BBN	V. Govindaraju, S. Setlur	$40,000	2013-14
CITeR	CUBRC	V. Govindaraju, S. Setlur	$40,000	2013-14
ML in NLP	Digiliant	V. Govindaraju	$30,000	2012-13
Scene Text OCR	eBay	V. Govindaraju	$50,000	2012-13
Handwriting Datasets	Google	V. Govindaraju	$50,000	2012-13
Soft Biometrics	CUBRC	V. Govindaraju	$200,000	2011-12
Machine Learning	Fujitsu	V. Govindaraju	$55,000	2011
Pen, Touch, and Hand Gestures	HP Labs	V. Govindaraju, J. Corso	$150,000	2008-10
Processing Hand-Annotated Documents	HP Labs	V. Govindaraju, S. Setlur	$185,000	2008-11
Smart Card Biometrics	Health Networks	V. Govindaraju	$75,000	2008
GUI for DAQ	ACIS	V. Govindaraju, S. Setlur	$40,000	2008
Barcodes project	Matrix	V. Govindaraju, S. Setlur	$161,663	2008-10
Arabic OCR	Aplied Media Analysis	V. Govindaraju	$150,000	2008-10
Document Classification	Copanion	V. Govindaraju	$20,000	2007-08
Student Doctoral Fellowship	IBM	V. Govindaraju	$55,314	2007-09
RCR Truthing	Lockheed	V. Govindaraju, S. Setlur	$1,094,900	2007-14
Behavioral Dynamics	CUBRC	V. Govindaraju	$31,000	2007
NY State Medical Survey Forms	Buffako Graphics	V. Govindaraju	$60,000	2005-07
IR for Handwritten Documents	Google	V. Govindaraju	$50,000	2005-06
Biometric Fusion	CUBRC	V. Govindaraju	$25,000	2005
Friction Ridge Analysis	CUBRC	V. Govindaraju	$25,000	2005-06
Face Recognition	CUBRC	V. Govindaraju	$25,000	2005
Multimodal Biometrics	CUBRC	V. Govindaraju	$25,000	2005
CAPTCHAS for Web Security	CUBRC	V. Govindaraju	$25,000	2004-05
Smart Card Biometrics	U-Scan	V. Govindaraju	$50,000	2004
Biometric Access Control System	International Graphics Inc.	V. Govindaraju	$235,000	2003-04
Fingerprint Recognition (AFIS)	Ultra-Scan	V. Govindaraju, D. Bartnik S. Setlur	$1,246,333	2002-05
Medical Forms Reading	CUBRC	V. Govindaraju	$25,000	2003-04
Forms Reading	CUBRC	V. Govindaraju	$25,000	2003-04
Biometrics	CUBRC	V. Govindaraju	$5,000	2003-04

HWAI Plus	Siemens	V. Govindaraju, S. Srihari	$317,000	2002-03
AAPS Parcel Address Recognition	Siemens	V. Govindaraju, S. Srihari	$90,000	2002
Student Support Fellowship	IBM	V. Govindaraju	$21,000	2001-02
Canadian Postcode Interpretation	Siemens	V. Govindaraju, S. Srihari	$50,000	2000-01
Handwritten Address Interpretation	Siemens	V. Govindaraju, S. Srihari	$300,000	2000-01
Canadian Postcode Recognition	Systems House Ltd.	V. Govindaraju	$10,000	1994
Recognition of Hand Printed Forms	Readers Digest	V. Govindaraju, S. Srihari	$10,000	1994
Document Analysis and Recognition	Xerox	V. Govindaraju, S. Srihari	$70,000	1993-00
Total Industry Funding			**$5,371,781**	
Total Funding as PI			**$19,650,150**	

Non-Postal Funding as Co-PI				
Odor Typing for Disease Detection	Oishei Foundation	F. Bright, A. Cartwright, V. Govindaraju, A. Titus	$400,000	2006-07
The LitGloss Project	National Endowments for Humanities (NEH)	V. Govindaraju, M. Jameson	$196,938	2003-05
Unobtrusive Biometrics Systems	NYSTAR	F. Bright, A. Cartwright, V. Govindaraju, A. Titus	$153,360	2003-04
Handwritten Text Recognition	National Security Agency	Y. Chin, V. Govindaraju, S. Srihari	$532,939	1994-96
Handwriting Individuality	National Institute of Justice	V. Govindaraju, Y.C. Shin, S. Srihari	$428,328	1999-00
Total Funding as Co-PI (Non-Postal)			**$1,711,565**	

Postal Funding as Co-PI		**Co-PIs**		
Perf Eval RCR, AOOS, SSIU	US Postal Service (USPS)	V. Govindaraju, S. Setlur	$279,675	2015-16
IES Enhancements, Test Decks, Truthing	USPS	V. Govindaraju, S. Setlur	$398,000	2015-16
Image Scoring Perf Eval APBS Program	USPS	V. Govindaraju, S. Setlur	$31,697	2014-15
Flats RECO 2	USPS	V. Govindaraju, S. Setlur	$40,081	2014-15
Prep of TD14 Test Deck for Comp Eval DQI Recog Prgm	USPS	V. Govindaraju, S. Setlur	$254,368	2014-15
Perf Eval for DQI Recognition Program	USPS	V. Govindaraju, S. Setlur	$309,701	2014-15
Cancellation Mark Readability Support	USPS	V. Govindaraju, S. Setlur	$26,974	2013-14

DQI TD13 Test Deck Creation Support	USPS	V. Govindaraju, S. Setlur	$249,283	2013-14
Evaluation of Flat Mail Recognition Improvements	USPS	V. Govindaraju, S. Setlur	$42,987	2013-14
Image Scoring and Evaluation Support (APPS)	USPS	V. Govindaraju, S. Setlur	$77,897	2012-13
Test Deck Truthing, RCR Support	USPS	V. Govindaraju, S. Setlur	$349,971	2012-13
Performance Evaluation of DQI	USPS	V. Govindaraju, S. Setlur	$1,170,215	2009-11
APBS Parcel Projects	USPS	V. Govindaraju, S. Setlur	$96,373	2010-11
FRIP and FSS Recognition	USPS	V. Govindaraju, S. Setlur	$354,000	2009-10
Comparative Evaluation of DQI	USPS	V. Govindaraju, S. Setlur	$46,051	2009-10
IES and Truthing	USPS	V. Govindaraju, S. Setlur, S. Srihari	$401,511	2008-09
Flats Image Collection and Truthing	USPS	V. Govindaraju, S. Setlur, S. Srihari	$810,664	2008-09
Image Evaluation	USPS	V. Govindaraju, S. Setlur, S. Srihari	$273,116	2008
Flats Image Collection and Truthing	USPS	V. Govindaraju, S. Setlur, S. Srihari	$1,950,533	2003-08
Digital Camera use in Barcode Imaging	USPS	V. Govindaraju, S. Setlur	$409,867	2003-07
Image Collection and Truthing	USPS	V. Govindaraju, S. Setlur, S. Srihari	$4,368,541	2003-08
Alternate Keying Strategies	USPS	V. Govindaraju, S. Srihari	$165,000	2004-05
Reply Card Scanning	USPS	V. Govindaraju, S. Srihari	$210,000	2003-04
Personal Name Lookups	USPS	V. Govindaraju, S. Setlur, S. Srihari	$166,000	2003
Comparison Study of Barcodes	USPS	V. Govindaraju, S. Setlur, S. Srihari	$470,000	2003-05
UK Address Interpretation Project	Lockheed	V. Govindaraju, S. Setlur, S. Srihari	$15,000	2003
Image Evaluation System-Flats	USPS	V. Govindaraju, S. Setlur, S. Srihari	$340,000	2002-03
Micropayment Processing	USPS	V. Govindaraju, S. Srihari	$1,204,000	2001-03
Mailpiece Library	USPS	V. Govindaraju, S. Setlur, S. Srihari	$190,000	2002
Evaluation of Identification Codes	USPS	V. Govindaraju, S. Srihari	$133,000	2001
Return Merchandise System	USPS	D. Bartnik, V. Govindaraju, S. Srihari	$300,000	2001-02
Image Evaluation System	USPS	V. Govindaraju, S. Setlur, S. Srihari	$1,850,583	1999-03
Information Based Indicia	USPS	V. Govindaraju, S. Srihari	$300,000	1999-01

UK Address Interpretation Project	Lockheed	V. Govindaraju, S. Setlur, S. Srihari	$1,245,000	2000-02
RCR/HWAI	Lockheed	V. Govindaraju, S. Srihari	$660,000	2000-01
Directory Generation	Lockheed	V. Govindaraju, S. Setlur, S. Srihari	$44,235	2000-01
Image Truthing	USPS	V. Govindaraju, S. Setlur, S. Srihari	$1,102,000	2000-02
Address Interpretation for UK	Lockheed	V. Govindaraju, S. Setlur, S. Srihari	$1,224,367	2000
HWAI Control Strategy	Lockheed	V. Govindaraju, S. Srihari	$129,190	1999-00
PROZE Character Recognition	Lockheed	V. Govindaraju, S. Srihari	$128,395	1999-00
VRR Word Recognizer	Lockheed	V. Govindaraju, S. Srihari	$42,590	1999-00
Foreign Address Processing	Lockheed	V. Govindaraju, S. Setlur, S. Srihari	$101,417	1999-00
RCR/HWAI Improvements	Lockheed	V. Govindaraju, S. Srihari	$503,480	1999-00
UKAI Parsing and Resolution	Lockheed	V. Govindaraju, S. Setlur, S. Srihari	$152,442	1999-00
HWAI Australian, Release 4	Lockheed	V. Govindaraju, S. Srihari	$240,000	1999-00
Truthing for RIP	USPS	V. Govindaraju, S. Setlur, S. Srihari	$75,000	1999-00
Truthing and Analysis	USPS	V. Govindaraju, S. Setlur, S. Srihari	$290,636	1999-00
New Image Evaluation System	USPS	V. Govindaraju, S. Setlur, S. Srihari	$395,257	1999-00
Semi-automated Encoding	USPS	V. Govindaraju, S. Setlur, S. Srihari*	$185,261	1999-00
Sender Information Processing	USPS	V. Govindaraju, S. Setlur, S. Srihari	$134,167	1999-00
Equipment Grant	USPS	V. Govindaraju, S. Srihari	$46,200	1999-00
Travel Grant	USPS	V. Govindaraju, S. Srihari	$34,103	1999-00
HWAI of Australia, Release 3	Lockheed	V. Govindaraju, S. Srihari	$218,333	1999
Last Line, Foreign Processing	Lockheed	V. Govindaraju, S. Srihari	$100,412	1999
Image Processing Functions	Lockheed	V. Govindaraju, S. Srihari	$69,156	1999
Control Strategy	Lockheed	V. Govindaraju, S. Srihari	$101,468	1999
Word Recognizer	Lockheed	V. Govindaraju, S. Srihari	$46,541	1999
New Character Recognition	Lockheed	V. Govindaraju, S. Srihari	$45,019	1999
HWAI of Australia, PIP -1	Lockheed	V. Govindaraju, S. Srihari	$230,000	1999
HWAI of Australia, PIP	Lockheed	V. Govindaraju, S. Srihari	$89,959	1999
Gray Scale Investigation	USPS	V. Govindaraju, S. Srihari	$790,000	1998-00
Address Truthing Analysis	USPS	V. Govindaraju, S. Setlur, S. Srihari	$1,424,641	1998-00
HWAI Control Structures	Lockheed	V. Govindaraju, S. Srihari	$79,200	1998-99
Database Enhancement	Lockheed	V. Govindaraju, S. Srihari	$52,500	1998-99
New Parsing Technique	Lockheed	V. Govindaraju, S. Srihari	$77,500	1998-99
New Word Recognition	Lockheed	V. Govindaraju, S. Srihari	$132,000	1998-99

New Character Recognition	Lockheed	V. Govindaraju, S. Srihari	$88,000	1998-99
RCR/HWAI Improvements	Lockheed	V. Govindaraju, S. Srihari	$400,000	1998-99
Firm name Recognition	Lockheed	V. Govindaraju, S. Srihari	$70,738	1998-99
RCR/ HWAI Improvements	Lockheed	V. Govindaraju, S. Srihari	$568,538	1998-99
Port HWAI to NT	Lockheed	V. Govindaraju, S. Srihari	$28,586	1998-99
HWAI Recognition Co-processor	USPS	V. Govindaraju, S. Srihari	$650,000	1998
HWAI of Australia	Lockheed	V. Govindaraju, S. Srihari	$1,144,418	1997-98
RCR/ HWAI Integration	Lockheed	V. Govindaraju, S. Srihari	$1,500,000	1997-98
HWAI PC Integration	USPS	V. Govindaraju, S. Srihari	$494,924	1997-98
HWAI/RCR Research	Lockheed	V. Govindaraju, S. Srihari	$550,860	1997
HWAI/RCR	Lockheed	V. Govindaraju, S. Srihari	$407,686	1997
Directory Compression	USPS	V. Govindaraju, S. Srihari	$37,959	1997
Image Analysis	USPS	V. Govindaraju, S. Srihari	$40,722	1997
Evolutionary Computing	USPS	V. Govindaraju, S. Srihari	$57,410	1997
HWAI PC Porting	USPS	V. Govindaraju, S. Srihari	$215,497	1997
HWAI/RCR Research	Lockheed	V. Govindaraju, S. Srihari	$585,924	1996-97
HWAI/RCR Integration	Lockheed	V. Govindaraju, S. Srihari	$596,474	1996-97
HWAI PC Integration, Task 1	USPS	V. Govindaraju, S. Srihari	$255,076	1996-97
HWAI Integration Testing	USPS	V. Govindaraju, S. Srihari	$99,750	1996-97
Improvements in HWAI	USPS	V. Govindaraju, S. Srihari	$2,510,680	1993-96
Reply Card Processing - Phase	USPS	V. Govindaraju, S. Srihari	$1,388,534	1995-96
Reply Card Processing PIMS	USPS	V. Govindaraju, S. Srihari	$1,435,416	1993-95
Interactive Service Research	USPS	V. Govindaraju, S. Srihari	$1,299,519	1993-96
Supplemental Activities	USPS	V. Govindaraju, S. Srihari	$750,000	1991-95
HWAI Research	USPS	V. Govindaraju, S. Srihari	$3,256,83	1991-94
Total Postal Funding Co-PI			**$45,909,105**	
TOTAL FUNDING (PI /Co-PI)			**$67,270,820**	

VI. Mentorship

Post Doctoral Fellows (5)		
2017 -	K. Davila (RIT PhD)	Equations OCR and Understanding
2017-	R. Subramanian (UB PhD)	Materials Discovery and Machine Learning
2015-16	Y. Zhou (UB PhD)	Deep Learning
2006-07	S. Tulyakov (UB PhD)	Fusion of Classifiers
2004-06	L. Lorigo (MIT PhD)	Arabic Handwriting Recognition

Major Adviser of graduated Doctoral Students (40)			
Year	**Doctorates**	**Current Employer**	**Dissertation title**
2018	40. B. Urala	TBD	Scene text OCR
2018	39. N. Narayanan	TBD	Multi-person and multi-camera tracking via spatio-temporal learning approach
2017	38. N. Pokhriyal	TBD	Multiview learning via Gaussian processes with applications in Biometrics and Sustainability
2017	**37.** R. Radhakrishnan	Qualcomm, NY	An adaptive framework for metadata extraction and analysis from documents
2016	**36.** R. Pandey	Google, CA	Learning privacy preserving representations using deep neural networks
2016	**35.** D. Arpit	**Université de Montréal, Canada**	Methodologies for learning data manifolds and robust feature representation
2015	**34.** S. Gore	Qualcomm, NY	Social networks analysis using game theory
2015	**33.** Y. Zhou	SalesForce, CA	Towards a globally optimal approach for learning deep unsupervised models
2015	**32.** A. Shivram	**University at Buffalo, NY**	Dynamic hierarchical relational models for handwriting recognition on mobile devices
2015	**31.** G. Kumar	[24]7, CA	Bayesian approaches for word spotting
2014	**30.** C. Ramaiah	MetroMile, CA	Accents in handwriting: A hierarchical Bayesian approach to handwriting analysis
2014	**29.** U. Porwal	eBay, CA	A semi-supervised framework for handwriting analysis
2013	**28.** M. Malgireddy	Amazon, WA	Language motivated approaches for human action recognition and spotting
2012	**27.** X. Cheng	Google, CA	A novel multi-sample fusion methodology for improving biometric verification
2012	**26.** S. Wshah	**University of Connecticut, Storrs, CT**	Word spotting in multilingual handwritten documents using character recognition HMM models
2011	**25.** R. Rodriguez	**Universidade Federal do Rio Grande, Brazil**	Transfer Learning for probability density estimation

2011	**24.** D You	**University of Michigan Health System, MI**	Methods for content extraction towards improved biomedical multimodal retrieval
2010	**23.** X. Peng	**ISI, University of S. California, CA**	Probabilistic Random Field based text identification
2010	**22.** A. Bhardwaj	eBay, CA	Statistical techniques for efficient indexing and retrieval of document images
2010	**21.** A. O Thomas	Embibe Inc., Bengaluru, India	Enhancing cyber security through synthetic handwritten CAPTCHAs
2009	**20.** J. Li	**Quincy University, IL**	Integrating minutiae based fingerprint matching with local correlation methods
2009	**19.** I. Nwogu	**Rochester Institute of Technology, NY**	Statistical modeling and inferencing techniques for medical image segmentation
2008	**18.** Z. Zhang	J. P. Morgan Chase, NY	Integrating facial expressions and skin texture in face recognition
2008	**17.** H. Cao	**ISI, University of S. California, CA**	Enhancement and retrieval of low quality handwritten documents
2008	**16.** F. Farooq	IBM Watson Research, NY	Use of language models and automatic topic categorization for indexing and retrieval of handwritten document images
2008	**15.** P.Mansukhani	Machinomatic Engineers, India	A framework for efficient fingerprint identification using a minutiae tree
2008	**14.** R. Yampolisky	**University of Louisville, KY**	Intrusion detection using spatial information and behavioral biometrics
2008	**13.** A. Rusu	**Fairfield University, CT**	Exploiting gap between human and machine in handwriting recognition
2007	**12.** C. Wu	KLA-Tencor, CA	Framework for fingerprint enhancement and feature detection
2007	**11.** S. Kompalli	INSOFE, India	Stochastic framework for font-independent Devanagari OCR
2007	**10.** R. Milewski	@Hidden, Japan	Automatic search engines for handwritten medical forms
2006	**9.** S. Tulyakov	**University at Buffalo, NY**	A complexity framework for combining classifiers in biometric systems
2005	**8.** T. Jea	Bloomberg, NY	Minutiae-based partial fingerprint recognition
2005	**7.** H. Lei	**University of Texas, Rio Grande Valley, TX**	Sequential pattern classification without explicit feature extraction
2003	**6.** A. Teredesai	**Univ. of Washington, WA**	Use of genetic programming for advanced pattern recognition
2002	**5.** H. Xue	Google, NY	Stochastic models for handwritten word recognition
2000	**4.** I. Krassimir	Fair Isaac, Inc.	Organizing multiple experts for efficient pattern recognition
2000	**3.** J. Park *	**Chung-Ang University, S. Korea**	Hierarchical character recognition in handwritten phrase recognition
1997	**2.** S.Madhvanath*	Conduent Labs, Rochester, NY	The holistic paradigm in handwritten word recognition and its applications

1996	**1.** G. Kim*	**Sogang University, S. Korea**	Handwritten word recognition for real-time applications
*Co-adviser			

Major Adviser of graduated Masters students (17)			
Year	**Masters**	**Current Employer (known)**	**Thesis**
2013	1. N. Bhaskaran	Time Inc., CA	Facial Expressions and Deception
2009	2. O. Mukhtar	Amazon, WA	Language Modeling
2009	3. B. Purkayastha	Hughes Systems, MD	Gesture Recognition
2008	4. 13. D. Jose	Microsoft, WA	Transcript Mapping
2006	5. 12. K. Sridharan	Cornell University, Ithaca, NY	Sematic Face Recognition
2006	6. 11. S. Nayak	Morgan Stanley, NY	Devanagari OCR
2006	7. 10. S. Deshpande	Veritas Technologies, CA	Accent in Speech
2005	8. 9. A. Mahtre	Amazon, WA	Hand Geometry Biometrics
2005	9. 8. S. Chikkerur	Microsoft, MA	Fingerprint Verification
2004	10. P. Rudravaram	Qualcom, CA	Palmprint Recognition
2004	11. 7. S. Manocha	Patni Computers, India	Security of Biometrics Systems
2004	12. 6. V. Chavan	Yahoo, CA	Biometrics and Barcode representation
2004	13. 5. S. Palla	Amazon, CA	Multimodal Biometrics
2003	14. 4 S. Khadekar	Bloomberg, NY	Devanagari OCR
2000	15. 3. D. Bartnik	Qualcom, NY	Video Surveillance
2000	16. 2. G. Pal	BMC Software India	Music Index on the Web
2000	17. 1. F. Zhou	Panasonic, NJ	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 tenure track faculty position placements including Cornell University and University of Washington.
- 3 placements in top university research labs USC, UB, and
- Michigan.
- 2 MS students went to do doctorate in MIT and University of Chicago.
- Students in USA, Brazil, India, Japan, and S. Korea.

VII. Teaching

Undergraduate Lower Division		Class size
Fall 94	Introduction to Programming	~90
Spring 95	Introduction to Programming	~90
Undergraduate Upper Division		
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
Graduate core classes		
Spring 00	Operating Systems	59
Fall 00	Operating Systems	76
Advanced graduate classes		
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

VIII. Professional Service

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

Editorial Boards	
• IEEE Access	2015 - on
• 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

Conference Leadership		
• 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 (MOCR), 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, OT	Sept. 2002
• Technical Committee	IEEE SMC (B) for Pattern Recognition	1998- 02

IX. Invited Talks

Keynotes, Plenary Talks, and Distinguished Lectures (40)	
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, IIT 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	3rd 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 Communication,

	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 (30)	
10/25/17	National Cancer Institute, Center for Biomedical Informatics and Information Technology, Washington DC
12/22/14	Jawaharlal Nehru Technological University, Hyderabad, India
01/16/13	Acclerated 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

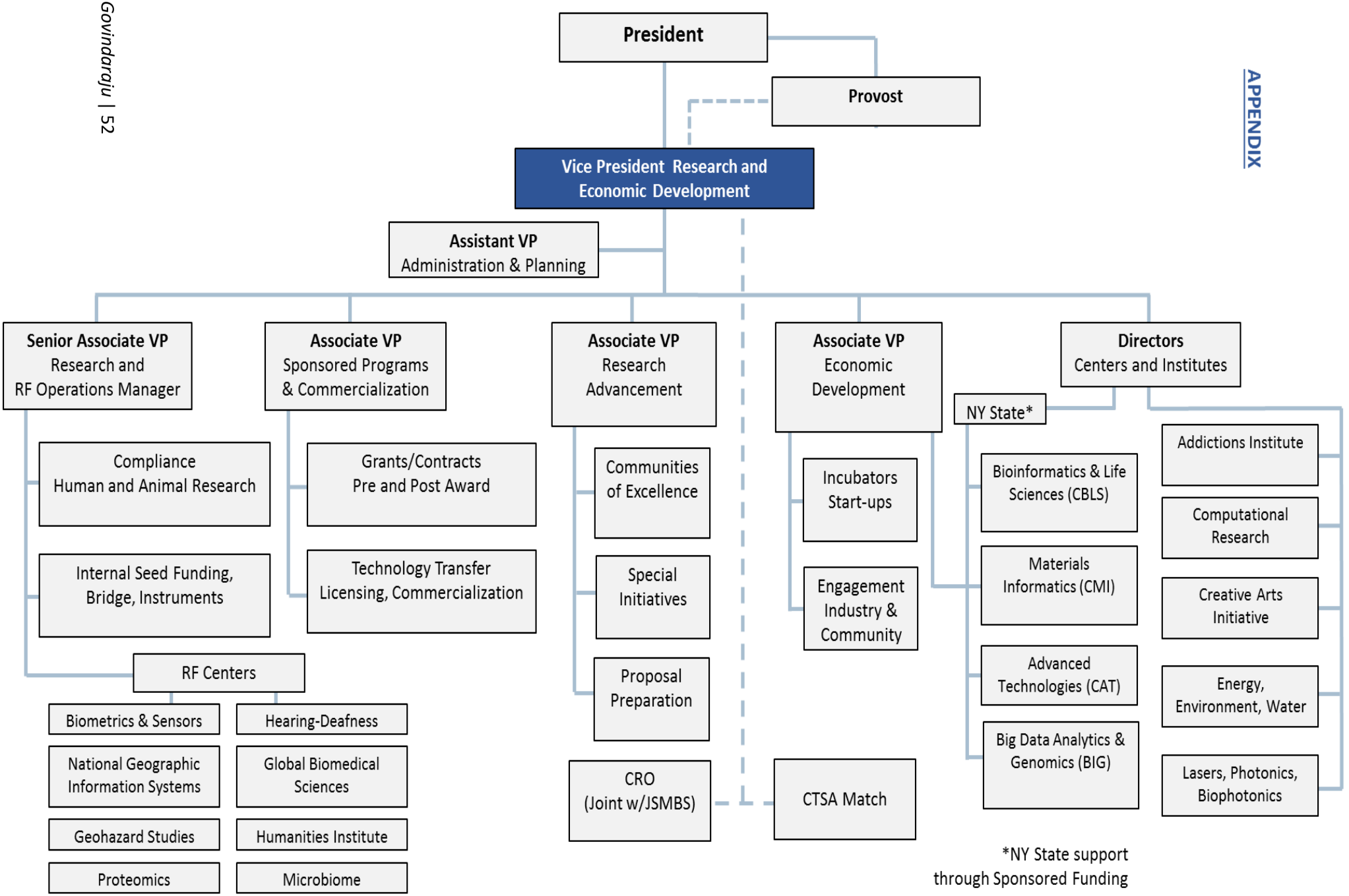
Invited Talks at Conferences (22)	
19/12/16	International Workshop on Pattern Recognition Applications, Kolkata, India
17/12/15	BB Chaudhuri Conference, Indian Statistical Institute, Kolkata, India
10/29/13	NRC Intelligence Committee Workshop on Science & Tech Investments, Washington DC
06/19/13	International 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, Brown University, 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, ISI, 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, ISI 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 SUNY Buffalo (16)	
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 21st 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 (41)	
09/01/17	Microsoft Research, Redmond, WA
01/25/17	Maniphal 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	International Conference on Frontiers of 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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