Reading the Handwriting on the Letter

UB research that gave new life to the US Postal Service

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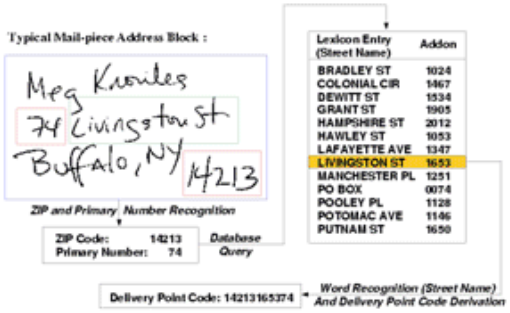
A Machine Learning Success Story

Pioneering work on Postal Automation at UB

- Handwriting recognition for postal automation
- Saving hundreds of millions of dollars in labor costs for the US Postal Service
- Over 95% of US letter mail sorted without manual intervention
- Technology licensed to Australia Post and UK's Royal Mail

Mail Transport Hardware
(Processing/Sorting)



Automated Handwritten
Address Interpretation

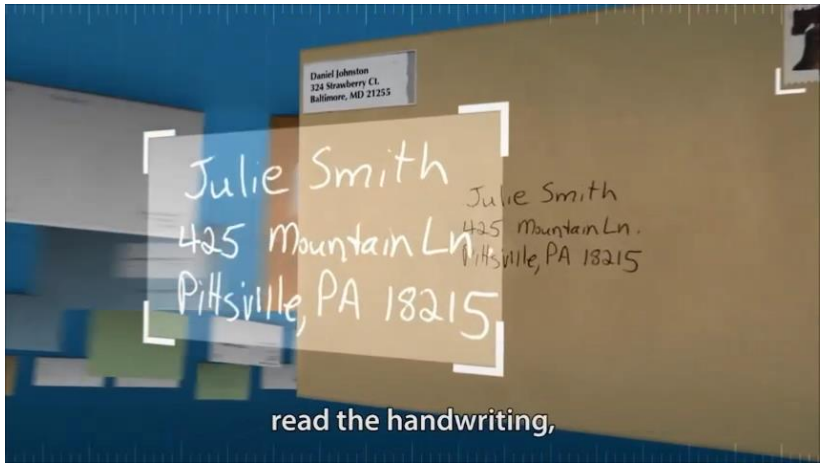
Remote Computer
Reader (RCR) Software

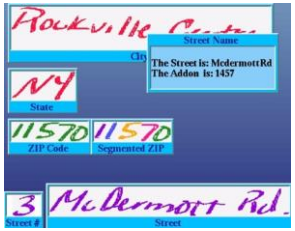
"*A lexicon driven approach to handwritten word recognition for real-time applications*",
IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 19, No. 4, pp. 366-379, 1997

SIEMENS · AUSTRALIA POST · UNITED STATES POSTAL SERVICE · Royal Mail · LOCKHEED MARTIN

Highlighted in the CCC Symposium on "Computing Research That Changed the World" (2009)

Making Handwriting Recognition a Reality





Handwriting recognition for postal automation
(click image for video)
Source: Systems at Work: a USPS TV Production
https://www.youtube.com/watch?v=WX16-52bHvg

Jan. 24, 1997:
"This project represents a major step forward, not only for the Postal Service, but for technology in general," said Edward Kuebert, manager of image and telecommunications technology at USPS. "**It will do the seemingly impossible - help postal machines read handwritten mail.**"

Computing Community Consortium - March 25, 2009:
"Using a learning-based system developed at **SUNY Buffalo 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…**"

Postal automation – A timeline

1753 Benjamin Franklin (1st Postmaster General) began sorting mail

1950s First American-built sorters

1965 Machines could barely read print

1982 First computer-driven, single-line OCR installed in LA

1994 Siemens and Lockheed Martin tasked "to teach machines to decipher scribbling"

1996 UB research helps USPS start machine-reading handwritten addresses, boosting efficiency and saving millions of dollars each year

Developing Smarter Human/Machine Systems

The crux of the UB solution (Kim, Govindaraju 1997) : "A lexicon driven approach to handwritten word recognition for real-time applications." IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 19, No. 4, pp. 366-379, 1997

Remote Encoding Centers (REC): Manual keying of mail not read by machines.
(click image for video)

1997:
- 32,000 employees, 55 centers
- 19 billion letters manually keyed

2014:
- 1,600 employees , 1 center
- 2 billion letters manually keyed

Real-time processing
(click image for video)

- 15 mailpieces/ second
- UB system ported to multiple platforms
- Modular pipeline
- Licensed to Australia Post, Royal Mail

Automated processing

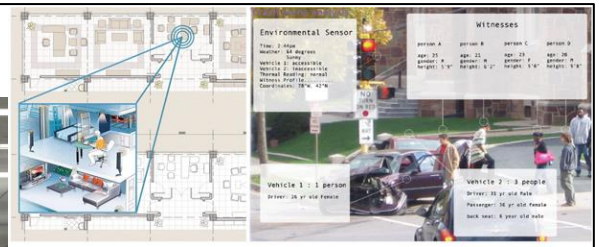
2014:
- Over 99% of all letter pieces (98% handwritten) sorted without any manual intervention

Videos Source: Discovery/Science Channel's "How It's Made" Mail episode
https://www.youtube.com/watch?v=xqoUn4g4elU

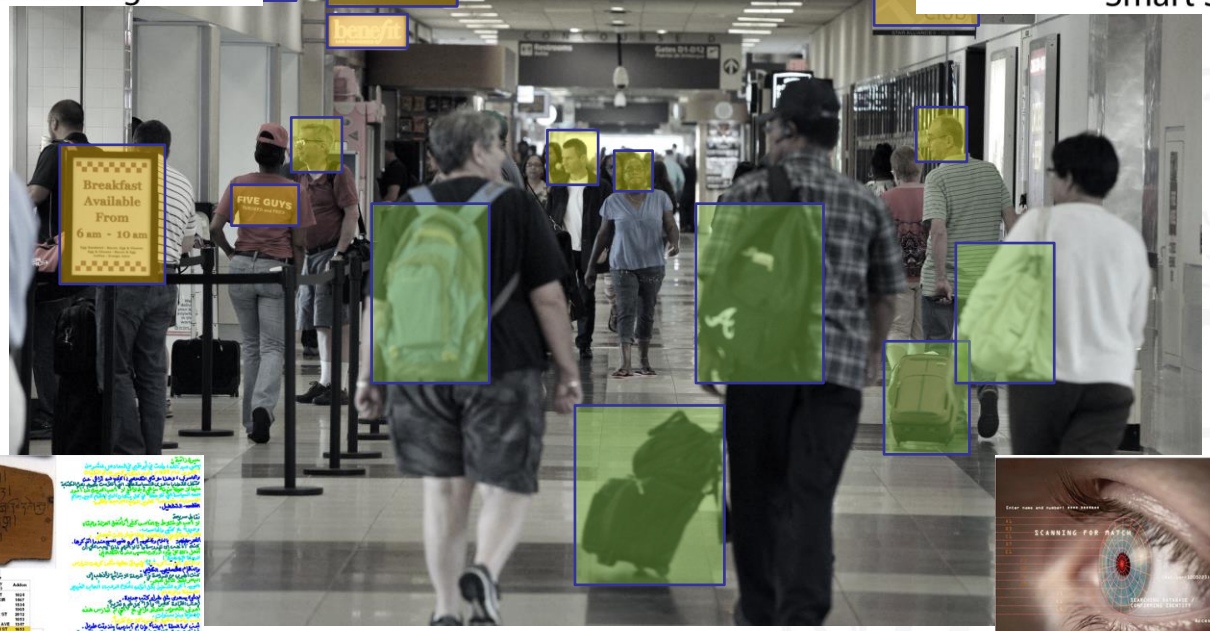
Research at the crossroads: Focus of Govindaraju lab at UB

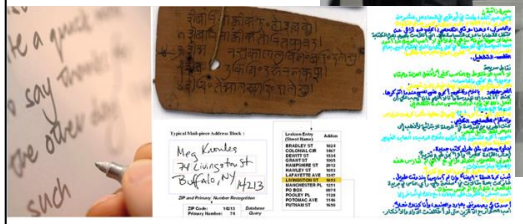
Holistic understanding of visual scene to realize (personalized) smart spaces for societal benefit – making sense of multilingual text, objects, and people (in the wild).

Scene Understanding

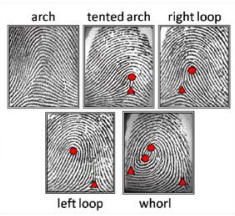


Smart Spaces





Language Technologies



Biometrics

Innovative approaches must cross the traditional boundaries of pre processing/segmentation, recognition, and contextual understanding to develop integrated solutions.