

Reading the Handwriting on the Letter

*UB research that gave new life to
the US Postal Service*

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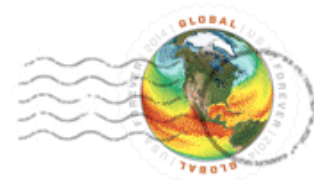
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A Machine Learning Success Story

Pioneering work on Postal Automation at UB



Handwriting recognition for postal automation



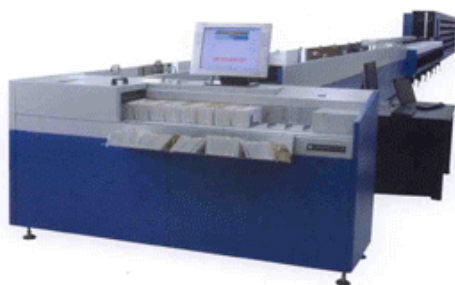
Saving hundreds of millions of dollars in labor costs for the US Postal Service



Over 95% of US letter mail sorted without manual intervention

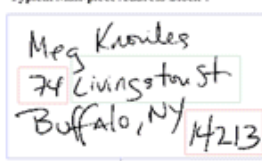


Technology licensed to Australia Post and UK's Royal Mail



Mail Transport Hardware
(Processing/Sorting)

Typical Mail-piece Address Block :



ZIP and Primary Number Recognition

ZIP Code: 14213
Primary Number: 74

Database
Query

Lexicon Entry (Street Name)	Addon
BRADLEY ST	1024
COLONIAL CIR	1467
DEWITT ST	1534
GRANT ST	1905
HAMPSHIRE ST	2012
HAWLEY ST	1053
LAFAYETTE AVE	1347
LIVINGSTON ST	1653
MANCHESTER PL	1251
PO BOX	0074
POOLEY PL	1128
POTOMAC AVE	1186
PUTNAM ST	1650

Word Recognition (Street Name) And Delivery Point Code Derivation

Delivery Point Code: 14213165374

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



Postal automation – A timeline



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



1950s First American-built sorters

1965 Machines could barely read print



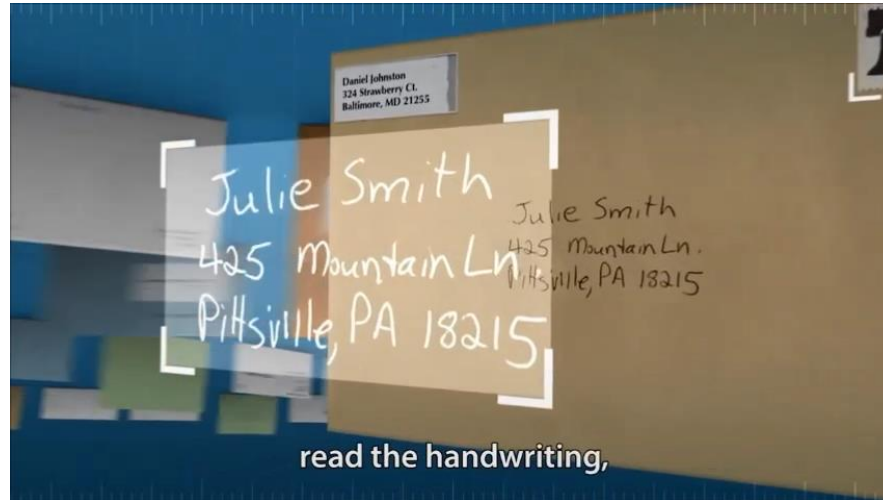
1982 First computer-driven, single-line OCR installed in LA

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

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...**”

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)



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