J5   Computer Vision Methods for Automated Writer Recognition

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After attending this presentation, attendees will understand how current computer vision techniques can be applied to images taken of handwritten text documents, and in particular, how the techniques can automate the recognition of a writer. Several related automated methods, all of which are novel to this application, will be presented with corresponding results discussed for databases of Arabic and Dutch handwritten text.

This presentation will impact the forensic science community by demonstrating how the automated tools developed under this research can facilitate automatically identifying individuals using less time and manpower than can be obtained by expert opinion, and whose expertise may not be readily available.

Unlike most competing automated writer recognition computer vision methods, those presented here based on so-called *Bag-of-Words* models require no human involvement, such as explicit segmentation of linguistic units, manual preprocessing, or supervised training. The statistical *Bag-of-Words* approach name has its origin because of its text documents retrieval roots, and also because in computer vision applications spatial information is discarded, as if one were throwing visual features into a "bag." In this model, signal processing represents images by local feature vectors that are distinctive and also reasonably resistant to moderate sources of image variation like rotations and scale. The local vectors are then quantized using an unsupervised clustering method. Finally, unsupervised training and classification is performed based on a generative technique that originated from text document retrieval, called *Probabilistic Latent Semantic Analysis*.

These methods have been found to provide over 98.0% correct recognition for databases consisting of a total of 153 cursive documents from 51 Arabic writers. Results will also be presented on a Dutch document database with 251 writers. Although the text for each document was the same for the Arabic database, it varies for the Dutch, which can thus help assess the degree of text independence of the approach. Furthermore, the Dutch database includes both printed and cursively written documents.

Significantly, the statistically based *Bag-of-Words* approach does not explicitly incorporate linguistic knowledge. Therefore, this automated approach to writer recognition can work on databases of varying languages and corpuses without extensive and time-consuming re-engineering. In conclusion, an automated approach to writer recognition based on current computer vision methods performs at a high level of reliability across several languages and independently of the text being written.

Computer Vision, Writer Recognition, Handwriting