Handwritten Signature Verification Using Complementary Statistical Models

Thesis submitted by
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November, 2003

for the Degree of Doctor of Philosophy
in the School of Information Technology at
James Cook University of North Queensland.

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Doctor Bruce Litow

Declaration

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text, and a list of references is given.

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Acknowledgements

I would like to thank a number of people who have made it possible for me to complete this project. Firstly I would like to thank the School of Information Technology and in particular my supervisor Dr Bruce Litow. I appreciate Dr Litow's time, constructive advice and his words of wisdom, many of which I remain unable to comprehend.

I also need to thank a number of friends and work colleagues for providing an outlet for the many frustrations over the past few years, as well as always being a willing source of distraction, whether it was required or not. I would especially like to thank Gerry O'Reilly who has continually remained patient, supportive and understanding, regardless of the pressures or the situation. She has always managed to put a smile on my face.

Finally and most significantly, I would like to thank both of my parents, Frank and Vicky, whose generosity quite simply knows no bounds. None of this would have been possible without the unlimited support, in all its forms, offered by them both.

Abstract

There is considerable interest in computerised personal identification and in particular in *biometrics*, a branch of identification that deals with verifying physical or behavioural characteristics of human beings. This thesis is concerned with the development of the particular biometric of handwritten signature verification, which is superior in many ways to other biometric authentication techniques that may be reliable but are much more intrusive.

Specifically, this project involves the use of two complementary artificially intelligent systems in the form of neural networks and hidden Markov models. Five sample signatures are used to build a reference in each of the independent models and experimentation and testing is done using an extensive database of almost 4,000 genuine signatures and forgeries. The confidence levels from each model are then combined and tested on unseen signatures resulting in an equal error rate of 1.1%. Further experimentation is performed and includes analysis of different verification scenarios, error contribution and the importance of visual feedback when signing. Finally, experiments are conducted exploring the possibility of "signing" handwritten passwords, with the developed system resulting in an equal error rate of 0.7% in the worst case.

Major Contributions

- A new method of signature segmentation, detailed in Appendix A, which dramatically reduces "false" segments;
- The development of successful methods for selecting effective training forgeries from a body of other users' reference signatures;
- A method for comparing signatures via string edit distance, outlined in Appendix B;
- Examination and development of methods for combining the output of neural networks and hidden Markov models;
- The introduction of several new features not previously used in on-line handwritten signature verification;
- A study on the need for a signer to have visual feedback when performing their signature.

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