Automated Searching of Illicit Drug Logos and Imprints

by

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Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Abstract

This thesis describes solutions for the automation of illicit tablet image searching based on tablet logos, colour and edge profiles. An original aim was to develop or exploit algorithms for searching images in an existing Australian Federal Police (AFP) drug tablet database. However, the pre-existing images were found to be inadequate for use with accepted logo extraction methods, due to poor illumination and insufficient contrast between the tablet surface and the logos. Extracting a complete logo from them was difficult. New “high contrast” images were taken in a way such that the contrast between the tablet surface and the logo was maximised. This was achieved by lowering the ring light that was attached to the macroscope very close to the tablet, resulting in a very shallow angle of illumination.

An in-house algorithm was designed to select the most appropriate threshold for each of these “high contrast” images to be converted to black-and-white (BW) images. Morphological and logical operations were used to segment the logos from the tablets. The final images contained only the silhouettes of the logos.

The logo silhouettes were encoded by calculating the Zernike moment invariants with the Kintner method, followed by the normalisation approach. The best chance of finding matching logos in the database was by ranking these invariants using the Euclidean distance.

Matching illicit tablets by colour was also investigated. The best method found involved changing the RGB colour values of the tablet photos to the CIE L*a*b* coordinates and then comparing these coordinates using the Normalised Inner Product.

The side profiles of tablets were suggested as an extra feature for comparison. Although there were limitations that remained to be solved (namely the symmetry problems for the positioning of tablets with asymmetric side profiles), results were promising when comparing the derivatives of symmetric side profiles using the Euclidean distance.

All of the algorithms developed or used in this project have been compiled into executable files such that any tablet database computer can run the scripts for searching

logos and side profiles. In addition, the scripts can provide measurements of a tablet's diameter and thickness in millimetres.