Symmetry Filters Applied to Fingerprints. Representation, Feature extraction, and Registration.

by

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Abstract

A common framework for feature extraction in fingerprints is proposed by use of certain symmetries. The proposal includes representation, filters, and filtering techniques for common features including minutiae points, singular points and the ridge and valley patterns.

The filters are complex and are designed to identify certain symmetries called rotational symmetries and they are applied to the squared complex gradient field of an image. The filters are used as extractors for known fingerprint features. The filter response magnitude is a certainty measure for existence of a symmetry and its argument is the spatial orientation of that symmetry. This means that the position and the spatial orientation of the fingerprint feature are estimated in a single filtering step jointly.

In the proposed framework the position and orientation of singular points are extracted using a multi-scale filtering technique. This strategy is taken to increase the signal-to-noise ratio in the extraction and can be done because singular points have a large spatial support from the orientation field. Experiments show that position is extracted by a precision of 5 ± 3 pixels[1] and the orientation by a precision of $0 \pm 4°$ with an EER of approximately 4%. The estimated position and orientation of singular points are used in an alignment experiment which yielded an unbiased alignment error with a standard deviation of 13 pixels.[1]

A one modality multi-expert registration experiment is presented using singular points and orientation images to estimate the registration parameters.

Keywords: Fingerprint recognition, Symmetry filters, Orientation Field, Multi-scale filtering, Singular points, Orientation radiograms, Registration, Multi-expert

[1] A fingerprint wavelength is in average 10 pixels.