

## ABSTRACT

The work reported in this thesis deals with 'fingerprint pattern classification. A fingerprint can be classified based on its ridge flow directions and various minutiae found in the pattern. Fuzzy set theoretic approach has been used for developing a suitable technique for preprocessing and binary conversion of a digitized fingerprint pattern. Suitable procedures developed for edge detection and minutiae extraction has been used after thinning the binary image, and the fingerprint is transformed into a directional image suitable for classification. Regular grammars and finite state automata have been constructed for description and classification of fingerprint patterns. In quadrant method, features are extracted from the directional image divided into 4 quadrants and a fingerprint is described by 4 quadrant strings. Classification is achieved when more than 2 quadrant strings are accepted by corresponding finite automaton. In ridge following method, dominant ridge direction codes have been used as the features. The fingerprint pattern strings and their angle of curvature are extracted for classification by a recognizer. For sub-classification of fingerprints, stochastic regular grammars have been constructed. For partial fingerprint, quadrant method is used for classification and sub-classification. Finally an object-oriented fuzzy knowledge based expert system FINPREX built around a general purpose expert system building shell FORT, has been presented for classification of a fingerprint. The declarative knowledge of knowledge base is stored in the rule base in the form of production rules and data is stored in the data base. The different phases of activity of the FINPREX system are binary conversion, thinning, edge detection, feature extraction and classification. During each phase of activity suitable rules are used to select appropriate procedures for carrying out the tasks involved. An inference engine controls the entire process of decision making. The proposed expert system based approach is not only efficient but also supports good number of interfaces and ready expandability.