HUMAN EPITHELIAL TYPE 2 CELL CLASSIFICATION BASED ON CONCATENATED FEATURES AND MACHINE LEARNING ALGORITHMS

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A project report submitted in partial fulfilment of the requirements for the award of the degree of Master of Engineering (Electrical - Computer & Microelectronics System)

Faculty of Engineering
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JUNE 2015
Dedicated to my adorable parents Farah and Elyas, beloved husband Shahab and gorgeous daughter Elsa.
ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my supervisor, Prof. Dr. Syed Abdul Rahman bin Syed Abu Bakar, for his excellent guidance, caring, patience, and providing me with an excellent atmosphere for doing research.

I would also like to thank my parents. They were always supporting me and encouraging me with their best wishes.

Finally, I would like to thank my husband, Shahab Ensafi. He was always there cheering me up and stood by me through the good times and bad.

I would also like to thank the developers of the utmthesis \LaTeX{} project for making the thesis writing process a lot easier for me. Thanks to them, I could focus on the content of the thesis, and not waste time with formatting issues. Those guys are awesome.

Mahsa Nasseri
ABSTRACT

Medical researches show that Autoimmune Diseases (AD) are among the top ten leading causes of death among women in all age groups. The detection of AD in human body is performed by testing a type of antinuclear antibody, Human Epithelial Type 2 (HEp-2). The indirect immunofluorescence (IIF) imaging technique is used to capture the HEp-2 images to be used by physicians for detection. However, the detection of AD by IIF technique and analysis of them depends heavily on the experience of the physicians and may consume a long time. An accurate and automatic Computer Aided Diagnosis system will help greatly for the classification of the patterns in HEp-2 test. In this project an automatic HEp-2 cell image classification technique is proposed that exploits different feature types such as Rotation Invariant Co-Occurrence Local Binary Patterns (RICLBP), Scale Invariant Feature Transform and Speeded-Up Robust Feature. Additionally, a three layer of feature concatenation technique is proposed to extract spatial information of the images rather than local features. Finally, for the classification model, variety of classifiers are exploited to evaluate the performance of the system. These classifiers are Support Vector Machines (SVM), Random Forest (RF) and AdaBoost. As the results show, the performance of the system by using the RICLBP features with SVM and RF classifier is improved for ICPR2012 and ICIP2013 datasets, respectively. The performance on ICPR2012 is almost reached to the human expert accuracy and in image level classification it goes beyond the expert physicians’ accuracy and reaches to 86%. In ICIP2013 dataset, specially for intermediate intensity level, almost 8% improvement is achieved by comparing with other methods.
ABSTRAK