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An Leukocytes Counting System for Acute Lymphoblastic Leukemia Detection

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Abstract

Background: Today, blood disease is one of the most important causes of human deaths around the world, therefore, early diagnosis of these diseases are very important. Counting and classification of white blood cells (leukocytes) lead to identification of a variety of blood diseases such as leukemia. The aim of this research is producing a computer algorithm to count the leukocytes in order to help the hematologists detect acute lymphoblastic leukemia (ALL) in an accurate and time-efficient way.
Objectives: The purpose of this research is to design and implement an intelligent software system based on image processing algorithms and fuzzy logic to analyze and accurately count blood leukocytes to identify acute lymphoblastic leukemia (ALL).
Methods: The proposed image processing system consists of several sections. The first pre-processing is done to remove noise and improve image contrast. In the second step, the image is segmented using improved fuzzy clustering technique (IFCM) and active contour algorithm. In the third step, the image feature extraction and classification is done. The final step determines whether or not the image is ALL, using ANFIS neural network algorithm where its objective function is optimized by genetic algorithm.
Results: Using samples of blood leukocyte images taken under the same lighting conditions let us introduce a computer aided diagnosis (CAD) system, which is empowered by fuzzy techniques for detection of all types of acute lymphoblastic cancers by 98% accuracy.
Conclusions: A method for the detection and classification of blood leukocytes from the blood microscopic images using image processing techniques and fuzzy logic have been proposed. The results show that the proposed method is able to detect and classify leukocytes in an image with high accuracy.

Keywords: Blood Cell Counting; Classification; Acute Lymphoblastic Leukemia (ALL)