White Blood Cell Disease Prediction Using Neural Network Classifier

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Abstract
White blood cells (WBCs) are an important part of the immune system and help our body to fight infections and other disease. As medical technology advances, the need for faster and more accurate diagnostic tools will become more important. In this study the image recognition problem of blood cells was investigated. Classification of five types of white blood cell (leukocytes) using a feed forward back propagation neural network. In this study, a neural network was used as a good decision maker to make microscopic images of blood cells to accurately identify white blood cells. Neural networks are powerful at analyzing complex data, and the wide and diverse applications of neural networks include analysis andcontrol, image recognition and decision making.

Keywords
Neural Network, Image recognition, Leukocytes

I. Introduction

In haematology and infectious diseases, the classification of various blood cells is used as adiagnostic device. Blood deficiency can be determined by find out the relative numbers ofapproximately cells and compare them with ordinary cells. Blood contains leucocytes, erythrocytes, platelets and plasma. The number of white blood cells plays an important role in person healthcare. Human blood contains five types of leukocytes. The purpose of blood cell count is to determine that the total leukocytes count is within a healthy range. This test is often done in conjunction with other blood tests such as CBC, which also measureother blood components such as erythrocytes and platelets. Leukocytes make up only 1% of the blood, but their effect is enormous. They protect us from diseases. Think of white blood cell as your immune system. Blood cell analysis demonstrates the need for fast, efficient methods to identify different blood cells. Although it requires a lot of testing, and the results are unique. But when there are too many leukocytes, it usually means there is a disease or disorder in your body. Less commonly, a high leukocytes count may indicate certain types of cancer or bone disease. We present the application of a multi layer perceptron back propagation neural network for classification of the five most important leukocytes segmented using the most important features.

II. Literature Survey

The normal number of white blood cells in the body is 4500 to 11000 per microliter. To count the blood cells different method are used.

In 2018, Acharya and Kumar proposed a standard operating procedure for red blood cell count and analysis. They used Kmedoids algorithm and particle size analysis to separate erythrocytes by removing leukocytes, and then count erythrocytes by labeling and cyclic transform. The comparison results show that the Hough transform loop performs well in computation and registration algorithms and can confirm whether the red blood cells are normal or not.

Ongun provides a comprehensive method for classifying blood and bone marrow smears using avariety of methods. It includes neural network-based classifiers and support vector machines (SVMs), as well as features used in classification. A combination of segmentation, feature extraction, and classification is required for automatic blood cell counting. Segmentation is done with morphological preprocessing and snake balloon algorithm. Various attributes such as density, color, quality and texture are used to represent the product. For classification, SVM performed best with a score of 91% accuracy.

In 2010, Madhloom published a leucocyte detection and classification method that usesimageprocessing techniques to isolate the nuclei of the target. First, they convert the image to gray scale and remove the dark part of the white blood cells as nuclei. They then used contrast, equalization and image algorithms to identify nuclei and segments using global automaticthresholding. Thepresentedprogrameventuallyachievedanaccuracyof 85 to 90%.

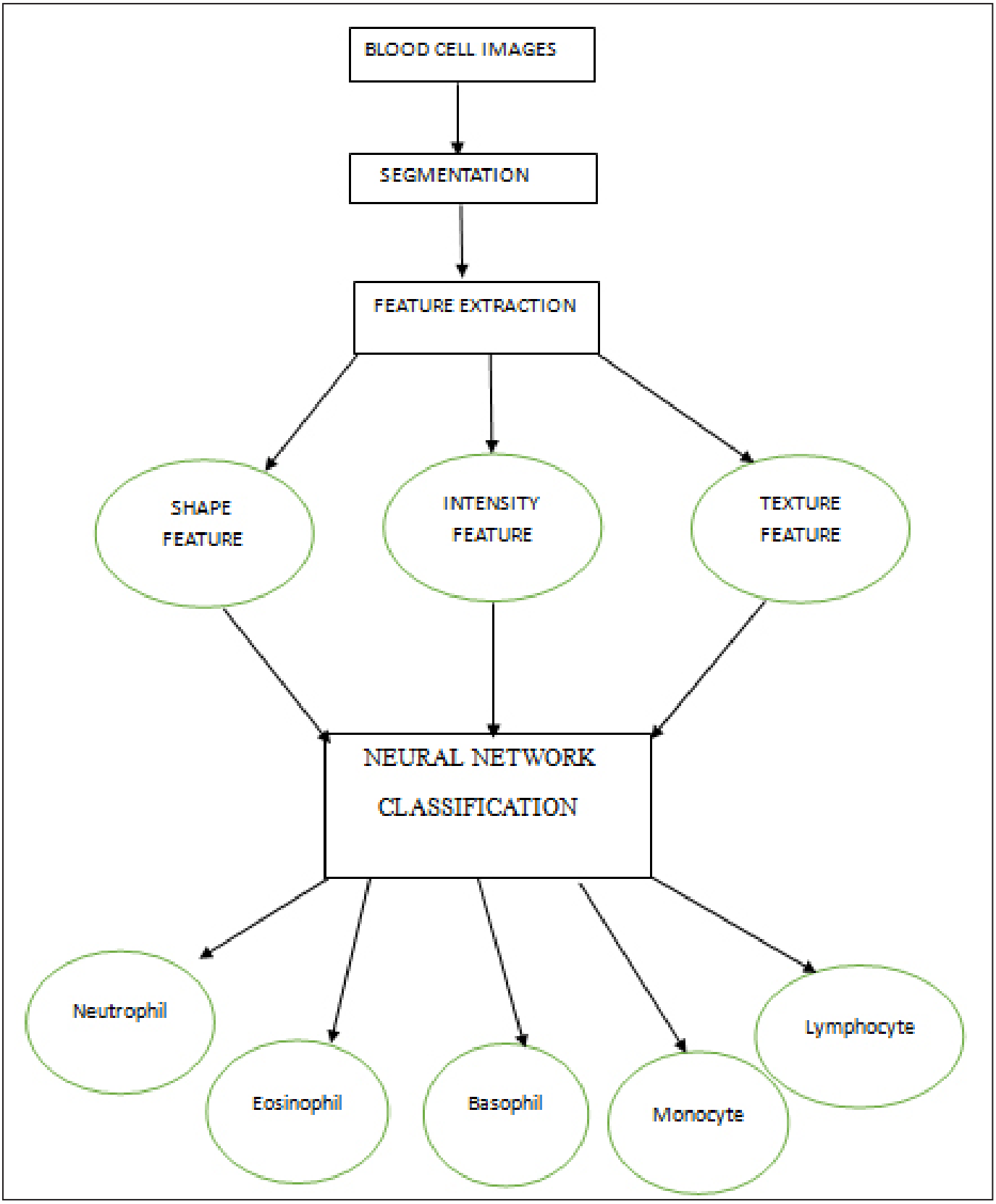
Suhail Odeh and Manal Khalil proposed a method used to verify offline authentication byextracting unique signature features. The process first scans the image to the, then improves quality of image and reduce noise, then performs the subtraction and neural network training, and finally checks whether the signature is genuine or fake. There are 3 main steps to implementing signature authentication and verification, and each step has different methods that can help improve results.

III. Proposed System

We present the application of a multi layer perceptron back propagation neural network for classification of the five most important leucocytes segmented using the most important features from blood smear microscopy images. The working algorithm has three phases. Image segmentation and pre-processing, recording, returning the number and location of the each leukocytesand reveal the clarity of the analysed cell measurement. Image preprocessing is quite useful to improve quality of images and thus boost them for analysis and further processing.

Steps for segmentation are as follows:

1. Read color blood slide image to the system
2. Convert color image into a grayscale image.
3. Enhance contrast of the grayscale image by Histogram equalization.
4. Sub image separation of the image
5. Obtain the image to brighten all other image components except cell nucleus
6. Remove nucleus and other components from the image
7. Reduce noise, preserve edges of the images
8. Using threshold value, convert the images in binary image
9. Use morphological opening for the images
10. Deduct the size of all objects of the images



A. Neural Network Classification

The features that are considered significant to represent an image of WBC are extracted and accumulated in the vector, which we refer to as the features vector. The features vector is then converted into a set of classes using neural networks as a technique to solve a WBC classification problem.Convolutional neural network (CNN) is a deep learning method that uses multiple levels of inputs and input string to produce output.CNN has five layers. These layers are used to recognizeimages and perform various operations, especially on pixel data. Also, CNN features includeconvolution andlink layers, and custom maps are created with CNN layers. Different filters are used in the convolution process to process the communication. Finally, during the merging process,images are classified according to their visual characteristics. In this study, a fully connected CNN algorithm is proposed to classify leukocytes images.

Automatic tuning of hyper parameters for CNN techniques. In this fully connected CNN, Leukocytes cells were divided into five types such as neutrophils, monocyte, basophils, eosinophils and lymphocytes.

Neutrophils are granulocytes that contain enzymes that help in the digestion of bacteria.

Monocytes are a type of leukocytes that differentiate into macrophages which specialize in clearing theblood of foreign invaders and red blood cells or damaged blood cells.

Eosinophils are responsible for tissue damageand inflammation in many diseases. They also play an important role in warfare.

Lymphocytes play an important role in the host's defense against tumor and pathogenic bacteria.

Doctor:

The doctor examines the patient's blood test and follows the blood report with all the details about the blood.

Patient:

Patient checks doctor's report and can turn to a doctor for advice or medical attention, such as medication for their condition.

IV. Algorithm

A. Background Propagation

Features important to represent the image of leucocytes are extracted andstoredin vectors called feature vectors.To solve the white blood cells classification problem, a neural network is used to transform feature vectors into algorithm-based classes. The system uses learning methods to determine the best model for the data entry process and relationship between lecture notes. Therefore, the main purpose of learning algorithms is to create a model that predict with previously unknown text.

Use feed forward back propagation neural networks; this is an important model in medicine and healthcare. This type of neural network configuration does not have a feedback loop however uses least square error to propagate the error backwards during the learning process.

A back propagation neural network is a multilayer feedback learning algorithm that requiresinputs pairs. A feed forward network has three layers:

1. Input layer,
2. Multiple hidden layers and output layer. Input and output processes are linked by synaptic connections called weights,
3. And, input and output processes are also attached by weights.

B. Naive Bayes Classifier

Naive Bayes is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set. There is not a single technique for training such classifiers, but a family of algorithms based on a common principle: all naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable.Naive Bayes classifiers assume that the proximity of a class is independent of theproximityofcertainobjects.Forex ample,anaturalproductcanbeconsideredanappleifit is red, round, and about 3 inches wide. Whether these bright areas are affected or due to thepresence of different light sources, these products are free to liquefy these organics, hence thename"Guileless".

V. Conclusion

Analysis of the patient's white blood cell composition can affect the patient's health. Different products are often available in different quantities and have different effects on the patient health. However, laboratory preparation and manual analysis of leukocytes microscopic images can be unnecessary and error prone. Then an incorrect assessment of the patient's condition occurs. In sufficient data to cover the morphological changes of different leukocytes is a major challenge when using learning models for classification.

Therefore, this article explores information augmentation techniques and deep neural networks to classify leukocytes into five types such as neutron phils, eosinophils, lymphocytes, mono cytes or basophiles. Compared to traditional methods based on predesigned drawings and construction manuals, the plan does not require preliminary design and manual labor for distribution. Most importantly, the plan achieved the results of the state.

We hope that this classification of blood can be used in the future to develop diagnostic blood tests for diseases.

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