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Classification of Leucocytes Using Convolutional Neural Network Optimized Through Genetic Algorithm

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Abstract: The microscopic inspection of blood samples provides qualitative and quantitative information about hematic pathologies. More precisely, the inspection of leucocytes (white blood cells) and their proportion of counts of the different types of leucocytes, known as differential counts, can assist hematologists in diagnosing diseases such as AIDS and leukemia. This study applies deep learning's convolutional neural network (CNN) for the image classification of four types of leucocytes, namely, eosinophils, lymphocytes, monocytes, and neutrophils. CNNs work through pattern recognition to detect significant features that help distinguish different classes. The CNN's hyperparameters were optimized through Genetic Algorithm (GA) and applied on a dataset containing 9,957 images and tested on another dataset of 2,478 images. The optimized CNN obtained a classification accuracy of 91% for the validation set and 99% for the training set, it also achieved a sensitivity and specificity of 91% and 97%, respectively. This study is proposed to substitute pathologists manually counting white blood cells in which it is a tiresome and monotonous procedure.

Keywords: Deep Learning, Image Classification, Convolutional Neural Networks, Genetic Algorithm, Leucocytes, White Blood Cells