

Chapter 14

Identification of Subtype Blood Cells Using Deep Learning Techniques

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ABSTRACT

The deep learning mechanism has indicated power in numerous applications and is recognized as a superior technique by an ever growing number of people than the conventional models of machine learning. In particular, the use of deep learning algorithms, particularly convolutional neural networks (CNN), brings immense benefits to the clinical sector, where an immense amount of images must be prepared and analyzed. A CNN-based framework is generated to automatically classify the images of blood cells into subtypes of cells. This chapter suggested the deep learning models, which are the convolutional neural network, the deep convolutional neural network, and a CNN-based model built in combination with the recurrent neural network (RNN), which is called RCNN, to identify the monocytes, lymphocytes, and types of WBCs. These are monocytes, eosinophils, lymphocytes, basophils, and neutrophils.

INTRODUCTION

A significant part of the immune system is white blood cells (WBC), also known as leukocytes. By destroying bacteria, viruses, and germs invading our bodies, these cell battle infections. In the bone marrow, white blood cells formed, yet flow through the bloodstreams. It travels from blood to tissue and provides protection against the capture, absorption, demolition of infectious agents or antibody formation of foreign microorganisms, such as germs, viruses and bacteria.

There are five types of leukocytes(WBC):

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1. Neutrophils,
2. Eosinophils,
3. Lymphocytes,
4. Monocytes and
5. Basophils.
 - **Neutrophils** - in general, Neutrophils are numerous and are responsible for hiding tiny organisms or infectious contaminants from reaching the surface of the cell membrane.
 - **Eosinophils** have very little WBC and function on the basis of sensitivities and parasite diseases.
 - **Lymphocytes** are subject to special identification by distant specialists and eventual expulsion from the host. In the direct annihilation of pathogens and the cleaning of waste from polluted areas.
 - **Monocytes** This counter of various white platelets plays an important role in clinical identification and examination because it represents the secret contamination within the body, which is something that haematologists are aware of and treat as a warning. The abnormal disease in white blood cells is known as leukocytosis, and it is an indicator of this secret contamination. Also possible is the observation of the effectiveness of chemotherapy or radiation therapy, which is referred to as cancer, in persons who have malignant growth by physicians.
 - **Basophils** are bone marrow cells that play a role in preventing the immune system from functioning correctly. It helps to diagnose any health concerns.

The proportion of blood cells is as follows:

- Neutrophils (50-70%)
- Lymphocytes (25-30%)
- Monocytes (3-9%)
- Eosinophils (0-5%)
- Basophils (0-1%)

Identifying and distinguishing the complex WBC from other WBC, as well as quantifying the matching proportions, is critical due to the quantity of clinical significance that it carries. In order for the automated categorization based on WBC images to emerge, it is necessary to manually differentiate leukocytes under magnifying tools, which is time-consuming and of inferior quality.

For the most part, with a few simple steps, automated classification approaches are available: **pre-processing, segmentation, extraction of features, and classification.**

Preprocessing The term “preprocessing” refers to the practice of attempting to reduce noise from images or other objects in order to produce high-contrast images.

Segmentation Alternatively, segmentation may be seen as as the process of separating the WBC from the background of smear photographs or eliminating the Region of Interest (ROI) from the images again. The next step is to create an agent highlight vector for each of the WBC forms that have been identified.

Feature Extraction is the option of images that monstrously affects the execution of the classifier. For a good grouping, each WBC subtype must be identified by the highlights and must be independent of each other for better judgment and correlation.

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