CELLnet: Automated White Blood Cell Differential Counting as a Diagnostic Method for Leukemia Using Artificial Intelligence

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Approximately every 3 minutes one person in the United States is diagnosed with a blood cancer. Leukemia is the most common cancer in children and teens, accounting for more than 3,500 cases per year. In order to evaluate the symptoms and health condition of the patient, an examination of peripheral blood is performed. Abnormal numbers and types of leukocytes may indicate an underlying condition such as leukemia. Thus, highly qualified technicians are required to manually differentiate and count hundreds of white blood cells on each blood smear. However, this method proves to be very time-consuming, labor-intensive and expensive. Automation of white blood cell differential counting is therefore necessary to increase the throughput of diagnosis. I apply image processing and deep learning algorithms to detect white blood cells using microscopic images of the blood smear. I developed a deep convolutional neural network, CELLnet, that overcomes the classification problem of leukocytes in a desirable accuracy and speed. After collecting samples of the five sub-types of white blood cells (lymphocytes, monocytes, basophils, neutrophils and eosinophils), the proposed neural network was trained on 1,200 images and validated on 300 images. On this dataset, CELLnet has performed with an accuracy of 98% on the test images. In conclusion, CELLnet is able to assist pathologists by providing a cost-efficient, fast system for automated white blood cell differential counts.