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An Intelligent Leukemia Detection and Disease Classification System

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***Abstract*— The disease threatens life by blood cancer called leukemia because of clonal expansion of white blood cells, leading to abrogation of normal hematopoiesis as well as immune response. The disease originates in the bone marrow and further accelerates its pace into important organs through the blood vessels. Leukemia accounts for nearly 3% of all cancers on earth, with an estimated annual new incidence of 474,500 cases together with death of 311,500 individuals from the disease. Across all ages, leukemia affects people: Acute Lymphoblastic Leukemia (ALL) occurs more in children; Acute Myeloid Leukemia (AML) is more in adults. Some early features that manifest to give signs of leukemia are fatigue all the time, frequent infections, loss of weight without any reason, bruising without obvious cause, extended bleeding, and swelling in lymph nodes. Early diagnosis and accuracy in diagnosis are thus important to improve the prognosis. This research is an automated Leukemia Classification and Detection System using deep learning to improve diagnosis accuracy. This uses CNNs for feature extraction and VGG-19 for the ultimate classification into subtypes of leukemia from images of blood smears. The organized pipeline involves image preprocessing, feature extraction, and subtype classification for accurate detection. A web application has been created under Flask and Streamlit into which health care providers can upload patient images for diagnosis of leukemia in real time. Experimental results prove that the suggested model greatly enhances accuracy, making it an effective tool for early leukemia detection and clinical decision making.**

***Index Terms*— Leukemia Detection, Deep Learning, Multi-Modal Data, VGG-19, Random Forest, Web Application, Medical Image Processing.**

I. INTRODUCTION

Leukemia refers to a malignancy that affects blood and is produced in the bone marrow, leading to abnormal reproduction of white blood cells. This condition alters the process of production of blood cells as well as the immune function. Leukemia is among the most commonly reported forms of cancer as far as blood is concerned, with thousands of new cases being reported every year. Thus, early diagnosis and accurate identification of subtypes of leukemia greatly improve treatment efficacy and patient survival rates. Traditional diagnosis of leukemia usually includes microscopic viewing of blood smear images and clinical assessment of the patient symptoms done by senior hematologists.

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