Using AI To Detect Morphological Abnormalities of Leukocytes To Diagnose Leukemia

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Due to the rapidity of leukemia progression, some patients are not able to obtain a fast diagnosis before safe treatment options become ineffective. In acute myeloid leukemia (AML), myelocytes accumulate in the peripheral blood, while in acute lymphoblastic leukemia (ALL), lymphocytes are overproduced in the bone marrow. These cells differ from normal leukocytes in size, presence of auer rods and granules, and nucleocytoplasmic ratio. Our tool allows patients to perform an efficient test to reduce time between onset of leukemia and diagnosis. To capture a clear image of a blood smear, we designed a 3D-printed microscope phone lens attachment that uses a convex lens to achieve magnification of 400x. These images portrayed no major differences in quality to those taken with a traditional microscope. In Spyder, we segmented each cell using the watershed algorithm to detect the outline, best-fit ellipse, and best-fit rectangle to interpret and compare features with leukemic cells. 200 images were used to train and another 500 to test. The algorithm has 81% accuracy, with more false positives than false negatives. With the application, users upload an image and save prediction outputs to track the history of the disease. A 39 person focus group evaluated our app and gave an average rating of 8.549 on overall user satisfaction. Our project offers an accessible aid for medical professionals to diagnose leukemia using an economical lens to capture microscopic level magnification of blood smears, an AI algorithm to determine patient affliction, and an application that monitors disease advancement.

Awards Won:
Sigma Xi, The Scientific Research Honor Society: Third Life Science Award of $500