Reusable Screening Method for Malaria Infections From Thin Blood Smear Images Using Convolutional Neural Network

George, Aaron (School: Saint Dominic Savio Catholic High School)

Despite advancements in modern medicine, malaria continues to have high morbidity and mortality, particularly in Sub-Saharan Africa where it is most prevalent. With an incidence of over 250 million cases annually, early screening of malaria is crucial for rapid diagnosis, treatment, and prevention of the spread of the disease. While a single-use test kit costs $10, it becomes exponentially more expensive and cost-prohibitive to procure a large enough supply for an entire region. This generated the demand for a reusable, low-cost, and widely accessible test that can effectively screen for malarial infections to reduce the overall costs and serve a larger patient population. A combination of Artificial Intelligence and Deep Learning techniques utilizing a Convolutional Neural Network model is a solution to this global issue. With a public malaria dataset of 27,000 images from the National Institute of Health and a digital microscope connected to a single onboard computer, Raspberry Pi, trained the AI models, until a champion model with the highest prediction accuracy profile was chosen. Malarial infections were identified with a sensitivity and specificity of 91% and 97%, respectively, with an overall prediction accuracy of 94%. The champion AI model developed from this project demonstrated a low-cost, reusable testing system that reduces the cost of individual tests for malaria to under 10 cents each. When implemented on a larger scale, this level of accuracy and cost reduction will significantly benefit all regions with inadequate access to rapid diagnosis, while also promoting the advancement of global health.

Awards Won:
Third Award of $1,000