An Affordable, Autonomous, AI-Enhanced Microscope to Enable Efficient Diagnosis of Parasitic Infection in Developing Countries

Martynova, Alice (School: Los Gatos High School)

This project targets Schistosomiasis, a parasitic disease second to Malaria in economic effect in developing countries. Doctors diagnose Schistosomiasis by using microscopes to count the number of parasite eggs in urine. However, developing countries lack microscopes and access to medical professionals. This project uses an algorithm called Generative Adversarial Network (GAN), a Foldscope (a paper microscope), and a Raspberry Pi to replace the current expensive diagnostics. The GAN consists of two components: generator and classifier. The generator learns to produce fake images resembling the real ones, while the classifier learns to recognize the real and fake images. This project applies GAN to count the number of eggs in samples. I conducted four tests. In the first test, the device decides whether a sample has eggs or not. The accuracy in this test was 95%. The next test used three classes: 0 eggs, < 50 eggs, ≥ 50 eggs. This test mirrors how the medication is prescribed for Schistosomiasis, and it was 94% accurate. The third test measured the deviation of the predicted egg count from the true count. By the end of training, the neural network was less than one egg off. The fourth test was the same as the third, but the network had no generator. This test resulted in an accuracy of 11.5 eggs which demonstrates that GAN algorithm is essential for premium accuracy. The trained network is downloaded onto Raspberry Pi, so the device is autonomous and does not require Internet to operate. All together the device costs less than $25, compared to $400 for the cheapest microscope, and replaces the need for a trained professional. While the device was trained to combat Schistosomiasis, it can be re-trained on any parasitic disease.

Awards Won:

Second Award of $2,000

Drexel University: Full tuition scholarship $250,000

Association for the Advancement of Artificial Intelligence: Honorable Mention