Title: Portable Schistosomiasis Egg Counting and Diagnosis

By: Daniel Fernandes (dfern@stanford.edu)

Project:

Schistosomiasis is a parasitic disease caused by worms that generally occurs in tropical countries. The disease is diagnosed by passing the urine of a patient through a polycarbonate filter and counting the number of oval-shaped eggs. Currently, an aid-worker or technician would take this circular (13 mm diameter) filter, place it under a microscope, and pan around to count the number of eggs. While this would be fine for only a few patients, since schistosomiasis is a water-borne disease, generally it is entire villages that are infected—the time-crunch is panning around to count the eggs. These eggs are small, on the order of 100 to 60 microns, but can be imaged with a macro lens. I am currently a rotational student in Prof. Audrey Bowden's lab, and she has approved my use of this project as a proposal in this class. We currently have a fiberglass holder for the glass slides and LED illumination, along with an Olympus AIR micro-four-thirds camera with a macro lens. This camera comes with WiFi capabilities and an open API for connecting to an Android device. I hope to be able to use template matching to locate the filter in the field of view and count the number of eggs using binary connected component labeling. Below, I show an example photo that I have taken already using the Olympus AIR camera of 40 micron glass beads, illuminated from the sides with an LED array. It would also be interesting to compare template matching effectiveness to convolutional neural net effectiveness [2]. There has already been some work in automated diagnosis using image moments [1,3], which is reportedly successful.
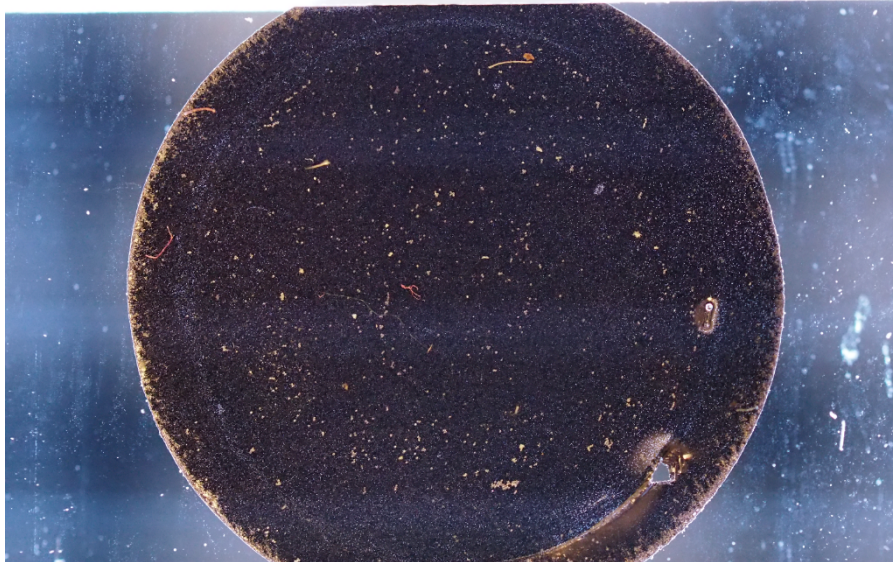
Figure 1: 13 mm filter with 40 micron glass beads [4]

References:

[1] Hassan, M. O. K., & Al-Hity, K. M. (2012). Computer-Aided Diagnosis of Schistosomiasis. *Journal of Clinical Engineering*, *37*(1), 29–34. https://doi.org/10.1097/JCE.0b013e31823fda36

[2] Ronneberger, O., Fischer, P., & Brox, T. (2015). U-Net: Convolutional Networks for Biomedical Image Segmentation. Retrieved from http://arxiv.org/abs/1505.04597

[3] Dogantekin, E., Yilmaz, M., Dogantekin, A., Avci, E., & Sengur, A. (2008). A robust technique based on invariant moments – ANFIS for recognition of human parasite eggs in microscopic images. *Expert Systems with Applications*, *35*(3), 728–738. https://doi.org/10.1016/j.eswa.2007.07.020

[4] SCAN: The Schistosomiasis Collection at the NHM. The Natural History Museum. http://scan.myspecies.info/gallery?f[0]=im_field_smg_galleries%3A4117