Portable Egg/Bead Detection and Counting

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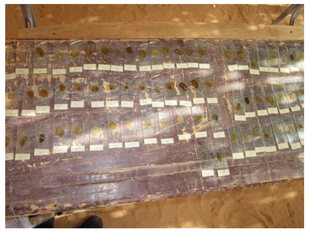
Motivation

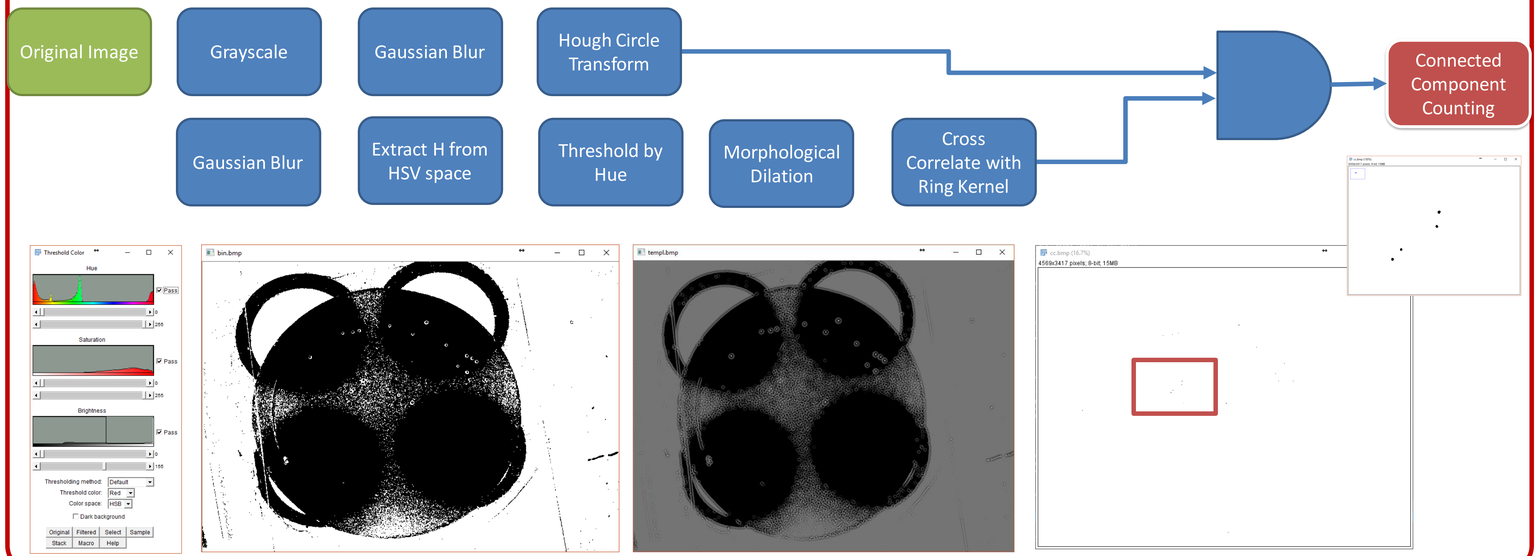
- Schistosomiasis is a parasitic disease caused by waterborne snails
- The snails infect the body and lay eggs in the bloodstream that manifest in the urine
- Urine filters are used to test if the patient is infected
- Counting the eggs with a microscope is time consuming in the case of severe outbreaks

http://www.who.int/mediacentre/factsheets/fs115/en/



http://scan.myspecies.info/file-colorboxed/650

Image Processing Pipeline



Related Work

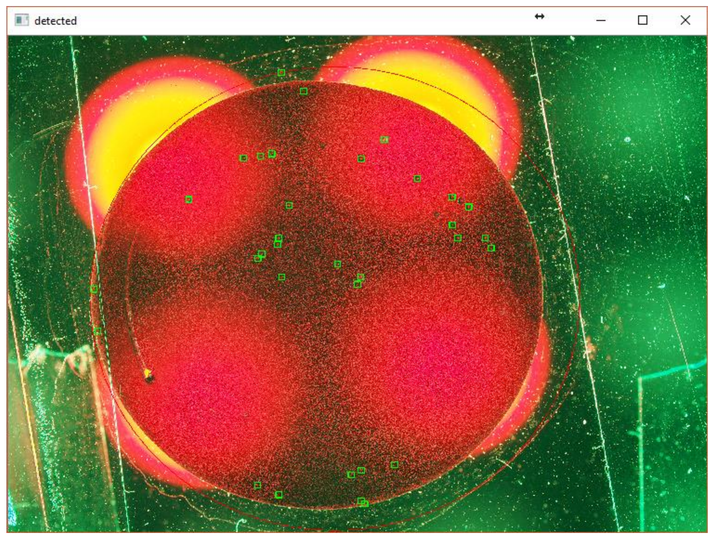
Coulibaly, J. T., Ouattara, M., D'Ambrosio, M. V., Fletcher, D. A., Keiser, J., Utzinger, J., … Bogoch, I. I. (2016). Accuracy of Mobile Phone and Handheld Light Microscopy for the Diagnosis of Schistosomiasis and Intestinal Protozoa Infections in Côte d'Ivoire. PLOS Neglected Tropical Diseases, 10(6), e0004768. https://doi.org/10.1371/journal.pntd.0004768

Linder, E., Grote, A., Varjo, S., Linder, N., Lebbad, M., Lundin, M., … Lundin, J. (2013). On-Chip Imaging of Schistosoma haematobium Eggs in Urine for Diagnosis by Computer Vision. *PLoS Neglected Tropical Diseases*, *7*(12), e2547. https://doi.org/10.1371/journal.pntd.0002547

Li, Z., Gong, H., Zhang, W., Chen, L., Tao, J., Song, L., & Wu, Z. (2015). A robust and automatic method for human parasite egg recognition in microscopic images. *Parasitology Research*, *114*(10), 3807–3813. https://doi.org/10.1007/s00436-015-4611-z

Zhang, J., Lin, Y., Liu, Y., Li, Z., Li, Z., Hu, S., … Wu, Z. (2014). Cascaded-Automatic Segmentation for Schistosoma japonicum eggs in images of fecal samples. *Computers in Biology and Medicine*, *52*, 18–27. https://doi.org/10.1016/j.compbiomed.2014.05.012

Experimental Results



For this example: 33 connected components
True Positive: 20
False Positive: 13
False Negative: 4

Future Directions:

- Choose cross-correlation kernel based on detected filter size
- Use more modern CV methods from simple Cascade classifiers to CNNs.
- Try segmentation in vanilla brightfield without Rheinberg illumination.