 This note is a GSOC phase 3 summary and provides a complete set of links related to the project.

Google Summer of Code proposal available at: <https://publiclab.org/notes/MaggPi/03-20-2018/gsoc-proposal-computer-vision-enhancements-for-raspberry-pi-based-public-lab-science-projects>

Code descriptions can be seen at <https://publiclab.org/profile/MaggPi>.

Video demos at: <https://www.youtube.com/channel/UCbyyYOlNo87CXJ39h3wqXZA>

Github readme file contains a list of all programs with a short description:

<https://github.com/MargaretAN9/Peggy/blob/master/readme.md%20(1).docx>

Phase 3 activities involved several areas:

HDR imaging and manual camera controls were described to look at different ways to extend image dynamic range.

NDVI was explored in NDVI microscopy and NGB-NDVI video optimization. In addition, a NDVI LED Simulator was proposed as a potential method to calibrate NDVI data.

Software also was developed to display real time spectral data output. Work to separate orders and conduct calibration by colormaps were frustrated by signal crossover between RGB channels.

In general, the programs demonstrate a transition from ‘snapshot’ imaging to processing data at video rates with manual control of camera settings. The ability to adjust image properties in real time provides a quick way to control image quality and optimize for different computer vision tasks. While resolution is limited in real time processing, the same settings can be used for higher resolution images which can then be processed by image sequencer.

My only regret is that I didn’t have the time to look at problems discovered along the way. Issues like real time flat field correction and keeping focus from visible to near infrared are two frustrating problem areas that deserve a second look. It may be worthwhile to look at how computer vision could compensate for optical limitations as well as provide different lens options.

My last comment is I would like to thank all my mentors [@amirberAgain](https://publiclab.org/profile/amirberAgain), [@warren](https://publiclab.org/profile/warren), [@icarito](https://publiclab.org/profile/icarito) as well as those who provided help , comments and encouragement. I learned so much but I also know I have much more to learn. While the programs developed provide a way to get started with real time computer vision techniques for Public Lab kits, possible future applications are unlimited.

<https://publiclab.org/notes/MaggPi/07-18-2018/ndvi-micrsocopy>

<https://publiclab.org/questions/MaggPi/07-24-2018/ndvi-led-simulator>

<https://publiclab.org/notes/MaggPi/07-17-2018/high-dynamic-range-hdr-imaging-revisited>

<https://publiclab.org/notes/MaggPi/08-03-2018/ngb-ndvi-video-optimization-red-blue-manual-gain-control>

<https://publiclab.org/notes/MaggPi/08-09-2018/raspberry-pi-manual-camera-control>

In addition to the research notes, additional ‘test’; code was tested on Fourier masks, real time measurement, histogram equalization and region of interest selection.

On setback is that I have been unable to use 10bit RAW Raspberry Pi camera data. I have tried different processing options but they all need color and lens corrections. I have started work on HDR techniques as an alternative. My initial review is that HDR may operate over a larger dynamic range than a 10-bit RAW image.

Phase 3 Code deliverables: Spectroscopy and Microscope Applications (July 14 to Aug 14) Goals were outlined in prior posts but are summarized below for convenience: ‘The last phase will concentrate on applying some of the general processing options developed earlier to specific applications. Applications to be considered are NIR/G/B microscopy and spectral calibration. The general approach for spectral calibration is to see if multiple exposure settings and analyzing data from the higher spectral orders could be used for spectral analysis’.

Week 9 –Real time spectrographs

Week 10 -Spectroscopic calibration for (near) real time spectroscopy

Week 11 -Transmission spectroscopy experiment – objective is to extend the free spectral range Week 12 -Prepare documentation/final evaluation