

Exploring Nvidia's Jetson Xavier NX

RMS 2020 Summer Studentship Report: Jennifer Bertonesi, University of Strathclyde

This research was carried out to demonstrate the ability of a tiny computer (a Jetson Xavier NX) to view and then capture images seen using a 3D printed microscope and a Raspberry Pi camera. The 3D printed microscope was previously printed in the lab using the OpenFlexure project, and all the materials were sent to me so that I was able to construct the microscope myself and safely work from home. I hoped that clear images were able to be viewed using the microscope and thought that trying to view onion cells would be a good demonstration of this because they are transparent and generally easy to view. If the Jetson was going to be suitable for capturing such images, I thought that I would use it for my fourth-year project as

an undergraduate student. The code that would tell the Jetson to take a picture of what could be seen through the microscope was written using Python – a high-level general-purpose programming language.

The basis of the project was to use and become familiar with the Jetson Xavier NX and to test microscopy-based applications using this small AI supercomputer.

The aim was to view and capture images using a 3D printed microscope, that was paired with a Raspberry Pi camera, all powered by the Jetson.

The microscopy was performed using a 3D printed OpenFlexure microscope which I had previous



Fig. 1. Image of the experimental setup. The Jetson Xavier NX paired to the 3D printed microscope. The OpenFlexure (left) is 3D printed and can allow for full 3D imaging since it has a moving stage.

experience with and knew to be reliable. No one in the group was familiar with the Jetson, so a key aim was to become familiar with the software used to code and instruct the Jetson to perform simple commands. Python was selected to be the primary programming language due to it being incredibly user-friendly. This again built upon my previous experience. My first tasks were writing routines for taking and saving simple images using a raspberry pi camera connected to the Jetson. I was then able to use the Jetson, OpenFlexure and Raspberry Pi camera to image microscope slides containing thin slices of onion.

Whilst working on this project, I learned how powerful the Jetson is – I was able to compare this experience to my last summer internship where I was working with Raspberry Pi driven systems. The power-efficient and compact Jetson was much faster processing code and this gave me confidence it would be suited for handling larger sets of data.

It was my first time constructing a 3D printed microscope myself too, so it was rewarding to physically build it after having the experience of working with the design software previously – I learned that one needs a good amount of patience for putting together finicky parts.

Key findings

The Jetson can take and store images. These images can then be subject to more in-depth analysis and the Jetson is powerful and fast enough to do this easily.

This was the first image of cells to be taken and the colour gradient is a bit off due to the camera not having any calibrated illumination.

The final imaging was limited due to the fact I was working from home. With better preparation, I could have taken sharper, clearer images. While the images are not as clear as we'd like, this is likely due to the limitations of home sample preparation and not the hardware.



Fig. 2. An image of cells in an onion slice.

This was my first time working from home and I found that it pushed me to explore and troubleshoot more things before resorting to asking for help from my supervisor. My coding skills were enhanced with more 'on-the-job' real life examples of coding – rather than repeating coding exercises from labs – so that was incredibly useful and beneficial for my own studies.

I learned that it would be beneficial for me to now learn about how to enhance the image taken by the microscope after it was captured. This would have allowed for a clearer image to be viewed with less noise in the picture.

The skills I've forementioned will definitely aid me in my current fourth-year studies. Having this experience will back me well for continuing on with building a holographic microscope as my undergraduate project. Long-term goal-wise, I could be persuaded to embark on a PhD! I enjoy the different challenges I faced daily whilst working towards an end goal. I found completing this project incredibly rewarding in the sense that you're producing your own work that's contributing towards my university's Nanobiophotonics group's work. I think I'd like to continue down the research route and I'll be aiming to continue getting tastes of the different careers out there. With it being such a rapidly advancing and diverse area of physics, I am sure microscopy will feature heavily in my career as a physicist.

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Place of Project: Student's home