LEGOLAS Lab Notebook – 2/10/24 – 5/26/24

<https://studentsloyola-my.sharepoint.com/:w:/r/personal/arversteegen_loyola_edu/_layouts/15/Doc.aspx?sourcedoc=%7B24793729-B4A2-4409-BFB4-DF8515D8571A%7D&file=LEGOLAS%20Lab%20Notebook.docx&fromShare=true&action=default&mobileredirect=true>

2/10/24

An operating system for the independent Raspberry Pi was established. This operating system, Bullseye, allows for camera recognition and integration. Much of the documentation for camera integration with Raspberry Pi’s is more or less obsolete, as in recent years the company has switched methods and libraries.

2/20/24

Meeting between Brendan and Dr. Lowe.

2/21/24

A small cardboard tower was constructed with the purpose of being a prop to take pictures with. The tower has three levels, one level to mimic position A, one level to mimic position D, and another level at the top to provide stability and a location to house the Raspberry Pi as the pictures are taken. This was done to mimic the infrastructure of the LEGOLAS machine to assess the locations and start gathering images for the training set.

Dr. Lowe provided two longer 15-22 cables, which allow for much more freedom in positioning the camera and Pi.

3/12/24

The Arducam Camera has some warp around the edges of the pictures. This phenomenon is called radial distortion. This is to be expected of any camera, but when it comes to using these images in machine learning models, it is important for the warp to be addressed. To quantify the amount and spread of the distortion, some calibration is needed. Research was done into techniques for addressing this problem, and a method was selected. This process will include a checkerboard printed out onto a hard surface, collecting a series of images, and then finding and running a program to assess the difference between the straight lines that are expected, and the curved ones in the picture.

3/18/24

The checkerboard mentioned previously was assembled, some issue arose in the program found. This is unsurprising as it seems much of Raspberry Pi’s camera related software has depreciated. Libcamera is relatively new. Work can be done to adapt the program to current software.

3/23/24

Machine learning requires three sets of data, which can be drawn from the same database. The database will need to be split into three categories, a training set, a validation set, and a testing set at a 70/20/10 ratio. Familiarity with the camera and the commands to take pictures was reestablished. A script to take images in a series was started.

3/25/24

The previously mentioned picture taking script was finished. Pictures were taken by the Arducam camera in position D. 117 images were taken from this position with varying lighting and position of the tray well. Another script was then made to crop these pictures. Minimizing the size of an image is important for image pre-processing as it simplifies the amount of datapoints the machine learning model needs to train and learn on for an individual picture.

3/26/24

The data set of images has been established. The initial images manipulated by rotation and hue and were cropped down to only the portion necessary for our purposes. There is a total of 1,404 images that have been processed. This should allow us to properly train a model once each has been labeled. This data now needs to be labeled.

3/27/24 (Dr. Lowe)

Brendan said that he tried to update Pi 7A from Debian 10 to Debian 11 via a hotspot on his phone but the update was interrupted. Now 7A is missing UI elements and is not fully working.

7A and new Pi are both Raspberry Pi 4 Model B.

On 7A: buildhat 0.7.0 and rpyc 6.0.0

On 7B: buildhat 0.5.12 and rpyc 5.3.1

Python manual.py > Connect via IP > 192.168.1.11 (7A)

* Get error “Cannot connect to pi1, try again. Expected 3, got 0.”
* Def connect\_pis in manual.py. def connect\_pi1 in core.py
* \*\*\*\*\*I normally don’t use Connect via IP\*\*\*\*\*

New Pi (Debian 11)

* client name raspberry pi 3
* ip address 192.168.1.13
* MAC D8…
* Auto\_rpyc\_server.sh works
* Configuration: SSH, VNC, serial port enabled. Same as in handout.

When 7A’s Buildhat hardware was inserted onto new Pi:

* Python manual.py on PC
* Connect via IP
* Error: “Not enough values to unpack (expected 3 got 0)
* \*\*\*\*\*I’m not sure if Arduino was hooked up\*\*\*\*\*
* Buildhat 0.7.0 and rpyc 6.0.0
* Cloned directory was done.
* Autoscript works: auto\_rpyc\_server.sh

Copy 7B SD card onto 7A SD card to try to restore 7A to Debian 10 and old software

* Insert 7A SD card into reader. Push in as far as possible.
* Reader/SD – insert into 7B USB2.0 port. Seemed to slide in OK.
* Follow instructions to copy 7B SD card onto 7A card
* After copying finished, insert 7A SD card into 7A.
* Power 7A using USB-C 3A/5V cable.
* Configure and assign a hostname to R-Pi
  + System tab: hostname raspberrypi 7A
  + Reboot
* Fix IP address in router
  + Ifconfig
  + Wlan0: 192.168.1.11 This is correct already!
  + Ether: e4:5f:01:ef:9c:46 No change was done. Same as previous numbers.
* Laptop can ping 7A and ssh to it.

Put together restored 7A and Buildhat hardware. Attach Arduino to USB 2.0.

* Python manual.py
* Reset…
* Connect via Config
  + Error: “There is not a Force Sensor connected to port D (Found Motor).”
  + Never got “Expected 3, got 0” error.

George Hall said to use Ethernet. Switch was put into KH210.

3/28/24

Cables for port D and port C are reversed on 7A.

Now 7A seems to work. Manual.py runs. Home runs.

Check if Arduino connection is causing Expected 3, got 0 error.

Disconnect Arduino. When power was initially turned on, got tty… error.

Insert Arduino USB into 7A USB 2.0. No more error.

cat /etc/os-release see OS

getconf LONG\_BIT tells us that pi’s are 32-bit Linux

Brendan updated packages on 7A. Takes a long time.

Meeting with Gilad, Haotong (hliang16@umd.edu), Corey, etc (UMD and JHU). Haotong (and Sam) helped Brendan solve the errors with new Pi with Debian 11 and old BuildHat hardware.

* Nohup python /home/pi/git/rpyc/bin/rpyc\_classic.py -- host 0.0.0.0&
* There is no “3” after python. Above command is different from what is in packet on Setting Up An Automatic RPyC Server.
* Rpyc server was downgraded from 6.0.0 to 5.3.1. The lower version is present on 7A, 7B. Not sure how important this change is.
* Camera with new Pi, Debian 11, old Buildhat hardware works.

Gilad will:

* email circle code for well ID. Ryan did something with color.
* Send link for wifi camera from Adafruit #4959

Part sourcing:

<https://www.amazon.com/dp/B0CLNSTV39/ref=pe_386300_440135490_TE_simp_item_image>

Arducam for Raspberry Pi Camera Module 3 Wide, 120°(D) IMX708 Autofocus Pi Camera V3 with Case, Comes with15cm 15-22 Pin and 22-22 Pin FFC Cable

<https://www.arducam.com/product/arducam-for-raspberry-pi-zero-camera-cable-set-2-pack-11-8-30cm-ribbon-flex-extension-cables-for-pi-zerow-b0244/>

(I think this is what was ordered) Arducam for Raspberry Pi Zero Camera Cable Set, 2 Pack 11.8″ (30cm) Ribbon Flex Extension Cables for Pi Zero&W

<https://www.amazon.com/dp/B08B6G2RFG?ref_=pe_386300_442618370_TE_sc_as_ri_0&th=1>

Raspberry Pi 4 Model B, Cana kit

Raspberry Pi 4 Extreme Kit - 128GB Edition (4GB RAM)

5/26/24

Installed Git for windows 2.45.1 64-bit on Dell at home. Pick all default settings.