A basic outline of our setup is:

- We have a sensing mat that comes with its own documentation and software (The supporting documents for the mat can be found here: https://www.dropbox.com/sh/hnse9kir58f8mzb/AAAANw48DGWq9jmSfiGLMqS4a/114_Fitness%20Mat%20Development%20Kit?dl=0). Since we are not meeting in-person and not all of us have access to the mat, we will be using videos that I will share from the mat, so there is no need to download the mat software, the links can just give an understanding of how the system works.
- We connect the mat via Bluetooth to our laptop, through which a live video of the foot movement on the mat can be seen.
- We have a python 3 script (Anaconda Setup) where we take screenshots of the monitor screen where the mat output video is running. We have to do a screen capture because the mat does not currently have robust APIs that can help us stream the output into our code. These screenshotted images are then converted to grayscale, and we run template matching on it to detect the left and right foot.

Now, to set up anaconda and opencv (computer vision library):

1. Install anaconda3 https://docs.anaconda.com/anaconda/install/windows/
2. conda update anaconda
3. conda update conda
4. Use anaconda prompt (Type in Anaconda Prompt on Start Menu) to install:
    a. https://anaconda.org/anaconda/pillow
    b. https://anaconda.org/conda-forge/opencv - this can take a long time
    c. https://anaconda.org/conda-forge/pyautogui

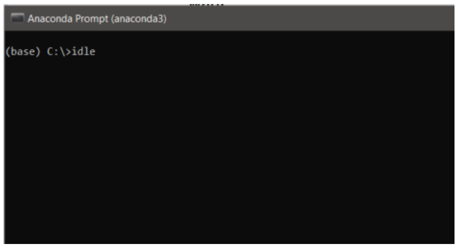
Code:

- We are using gitLab for our code sharing. Here is the link to our repository: https://research-git.uiowa.edu/krector/blindsmartmat
- You can initially download the code to see the scripts working (Though it would be useful to install git and clone the repository early on).
- I use VS-code for code editing, running and source control, but feel free to do it however you want.

Test Run:

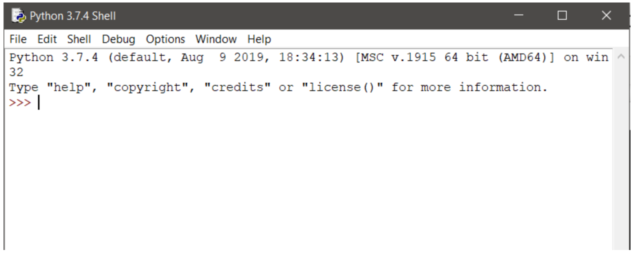
Once the installations for anaconda and opencv are done and the code is downloaded, it would be helpful to go through “basic_foot_detect_script.py” to see how things are working. Below is a description of a quick way to run the script using anaconda.

- Open the anaconda prompt (should be in the anaconda folder as the Anaconda Powershell Prompt)
- Type in “idle” (shown in picture). Or go to the anaconda3 folder on your computer (under users or appdata) : anaconda3 > Scripts > idle.exe



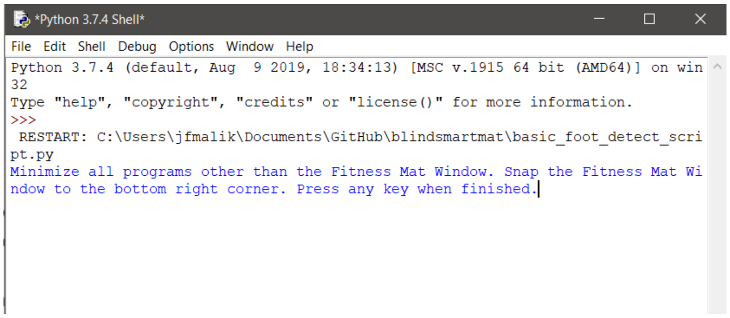
```
(base) C:\>idle
```

- This should open up the python default IDE (shown in picture)



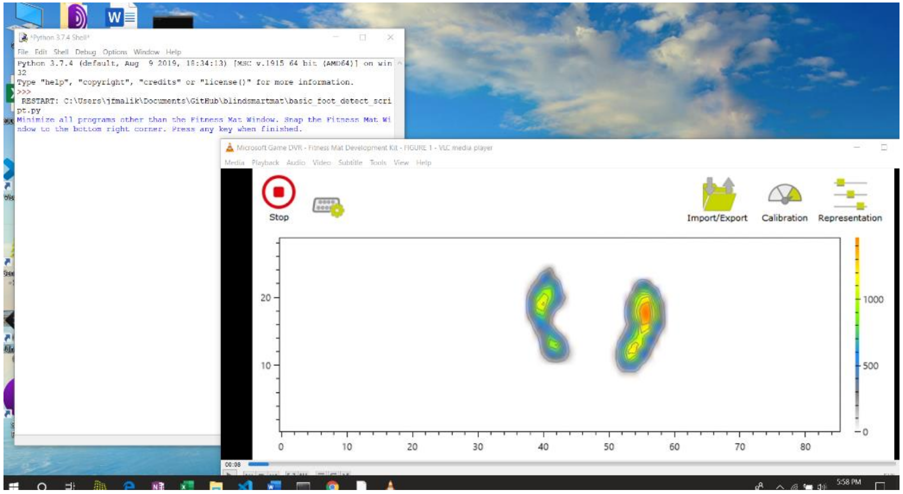
```
Python 3.7.4 (default, Aug  9 2019, 18:34:13) [MSC v.1915 64 bit (AMD64)] on win
32
Type "help", "copyright", "credits" or "license()" for more information.
>>> 
```

- Now go to file> open and browse to the file “basic_foot_detect_script.py”
- Go to run > run module or press F5
- Something like this will be seen:



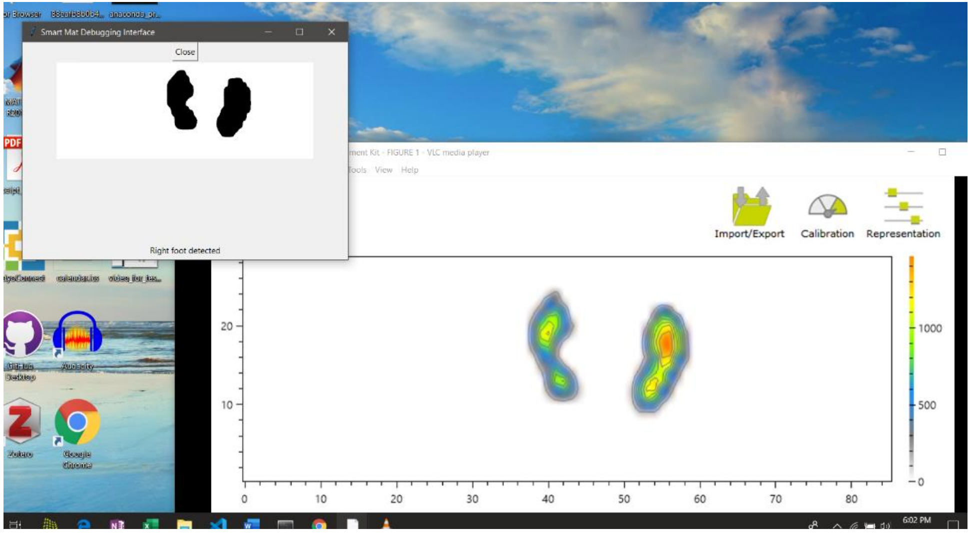
```
Python 3.7.4 (default, Aug  9 2019, 18:34:13) [MSC v.1915 64 bit (AMD64)] on win
32
Type "help", "copyright", "credits" or "license()" for more information.
>>> 
 RESTART: C:\Users\jfmalik\Documents\GitHub\blindsmartmat\basic_foot_detect_scri
pt.py
Minimize all programs other than the Fitness Mat Window. Snap the Fitness Mat Wi
ndow to the bottom right corner. Press any key when finished.
```

- At this point, make sure the video_for_testing.mp4 is open (not maximized, with the screen on the bottom right corner of your desktop, picture below):


Python 3.7.4 Shell
File Edit Shell Debug Options Window Help
Microsoft Game DVR - Fitness Mat Development Kit - FIGURE 1 - VLC media player
Media Playback Audio Video Subtitle Tools View Help
Stop
Import/Export
Calibration
Representation
20
10
0
10
20
30
40
50
60
70
80
1000
500
0
00:08
5:58 PM

```
Python 3.7.4 (default, Aug  9 2019, 18:34:13) [MSC v.1915 64 bit (AMD64)] on win
32
Type "help", "copyright", "credits" or "license()" for more information.
>>> 
 RESTART: C:\Users\jfmalik\Documents\GitHub\blindsmartmat\basic_foot_detect_scri
pt.py
Minimize all programs other than the Fitness Mat Window. Snap the Fitness Mat Wi
ndow to the bottom right corner. Press any key when finished.
```

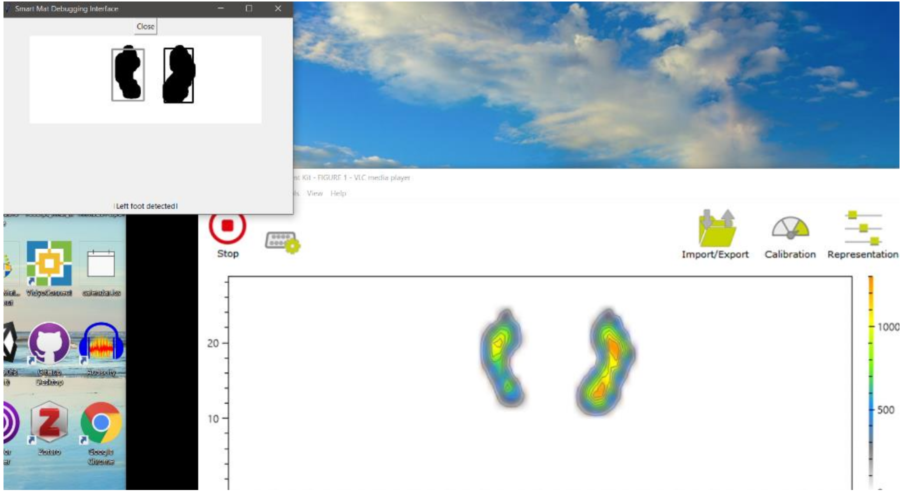
- Press any key and then minimize the idle terminal as well. Something like this will be seen:



Right foot detected

- The video window can be adjusted (move it back and forth) until both the feet are visible on the Python GUI. Keep playing the video.

- Black and gray bounding boxes will be seen as the feet move. These indicate foot detection. The template matching for the right foot can be seen by the black box and for the left foot can be seen by the gray box. The setup works! 😊



Left foot detected!

Some background Reading and Additional Resources:

- https://www.udacity.com/course/introduction-to-computer-vision--ud810: This is a free Computer Vision course that can be skimmed for a basic understanding of images and template matching.
- https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_template_matching/py_template_matching.html : Template Matching tutorial using opencv and python
- https://www.youtube.com/watch?v=YRhxdVk_sIs : A short video explaining CNNs
- https://machinelearningmastery.com/how-to-develop-a-convolutional-neural-network-from-scratch-for-mnist-handwritten-digit-classification/ : A basic CNN tutorial (No need to go into too much detail)

Feel free to reach out with any questions or confusions, we can work together to solve them!