RET Site: Research Experience in Cybersecurity for Nevada Teachers (RECNT)
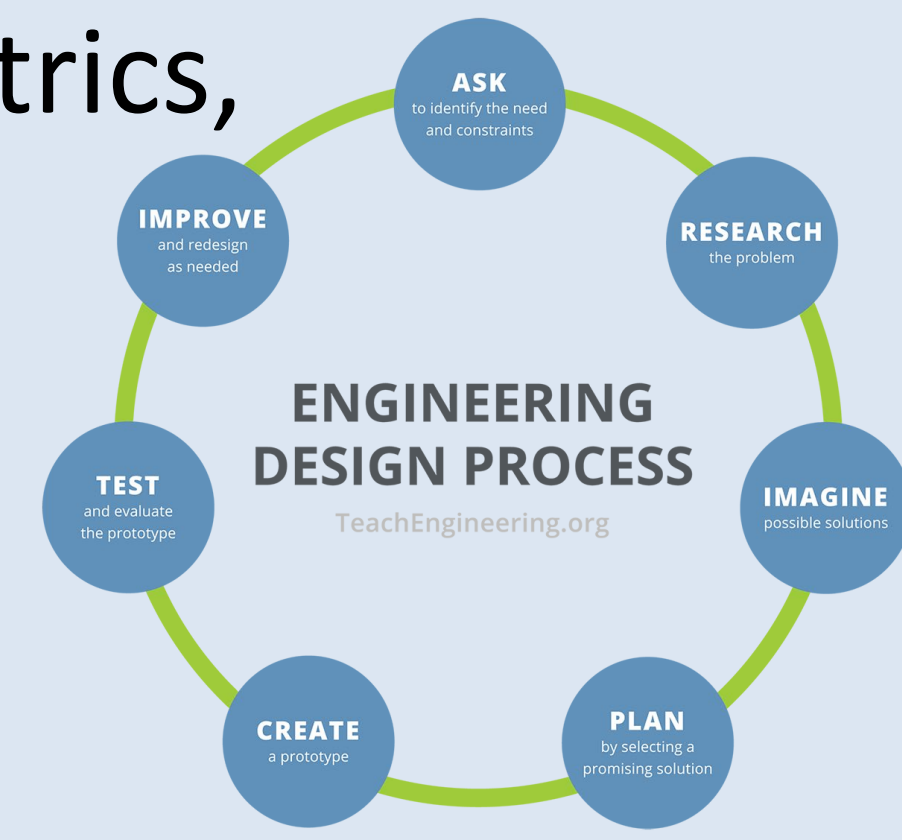## Biometrics

PI: Shamik Sengupta Ph.D., Co-PI: David Feil-Seifer Ph.D., Nate Thom M.S. &
Rob Riley M.A.

Introduction

Northern Nevada teachers are participating in a research experience provided by the University of Nevada, Reno--a premier research university. Our 2022 Cohort consisted of three groups: biometrics, smart city (IOT) and digital forensics.
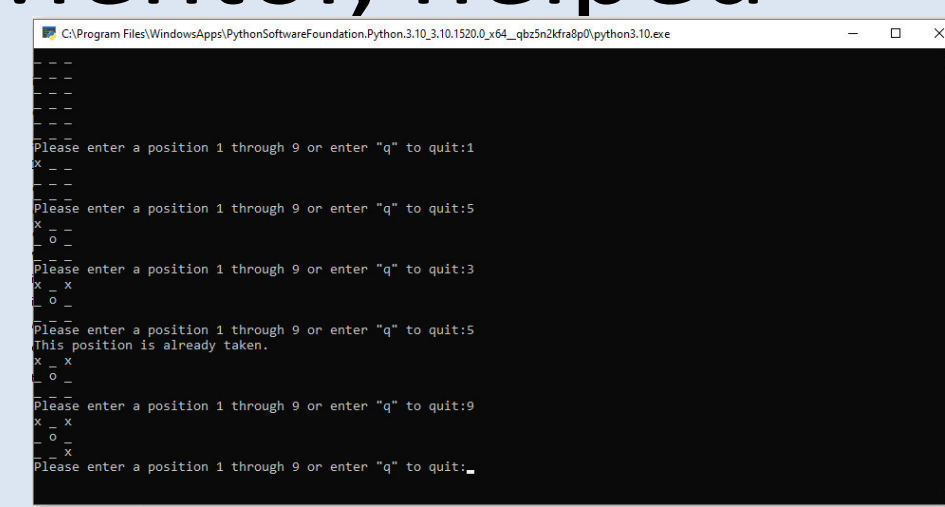
I was in the biometrics group. This research poster is laid out using the engineering design process.

Ask

Every research task requires a question—identify a need and constraints. For our research, we wanted to see if an image that receives a certain level of augmentation can still be recognized by a facial recognition machine learning model. We needed a way to display and augment images so a biometric machine learning model could process the images and determine how much distortion the model could interpret before not being able to recognize the image.
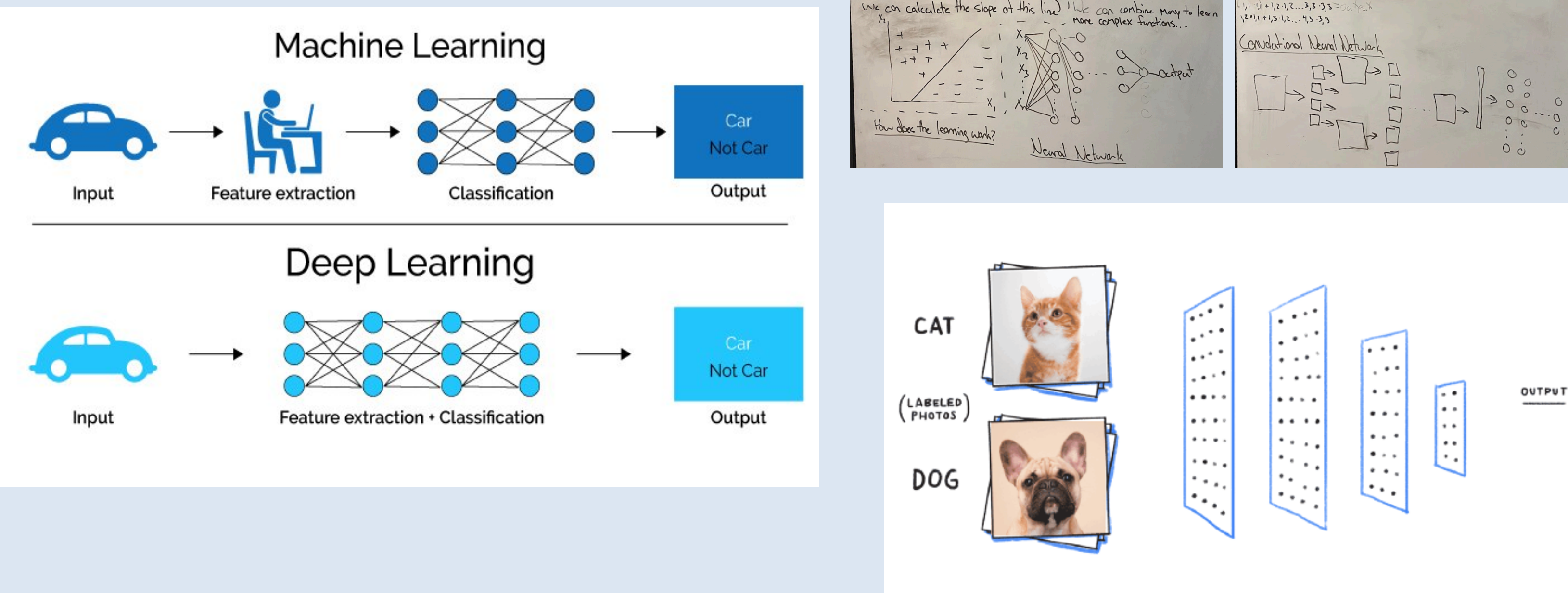
Research

In order to address this problem, we all needed to brush up on our programming skills using the Python general-purpose high-level programming language. I had taken a Python mini course when I was in my K-8 Computer Science endorsement cohort back in 2019. Unfortunately, I had forgotten most of it, so my RET experience here has been instrumental in re-learning Python and going beyond what I had initially learned. In a nutshell, the bulk of our research time was used in learning Python and using it to develop the front end of an application. We chose to build an image viewer. Our Lab Mentor, helped when we got stuck on a problem.
Print("Hello, World!")

Imagine

We had to imagine solutions to resolve our need to develop an image viewer application. Part of our learning Python was to build a tic tac toe game. With the skills gleaned from that experience, we researched and working together, we built an image viewer to display images to later be processed with the machine learning model using the convolution Neural Network program.

Plan

For our biometrics group, we had our mentor, his supervising professor, his two undergrad research students and three teachers. We all come from different backgrounds and came together to plan out our summer project. We researched and found a rudimentary image viewer and worked together as a team to figure out our objective for what we wanted to accomplish. Two items needed to be accomplished: front end application to view and augment images and a backend application to process the images through a facial recognition program. Our Ph.D. candidate mentor developed a visual recognition model in Python. We finished planning out what we wanted our image viewer to feature and then began the create portion of our project.
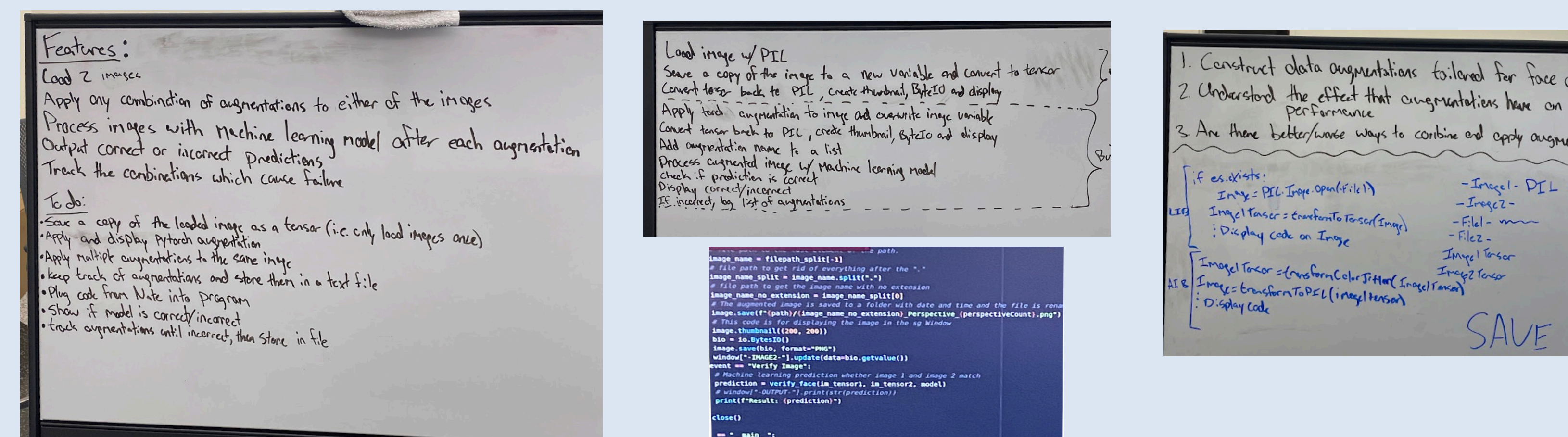
Create

We each prototyped a separate image viewer. We shared code so that each of our viewers possessed the same functionality. The viewer was completely programmed in Python as well as the machine learning model. Once we got our viewers the way we wanted, we then added the biometric function to test it. And programmed a way for it to save the processed image.
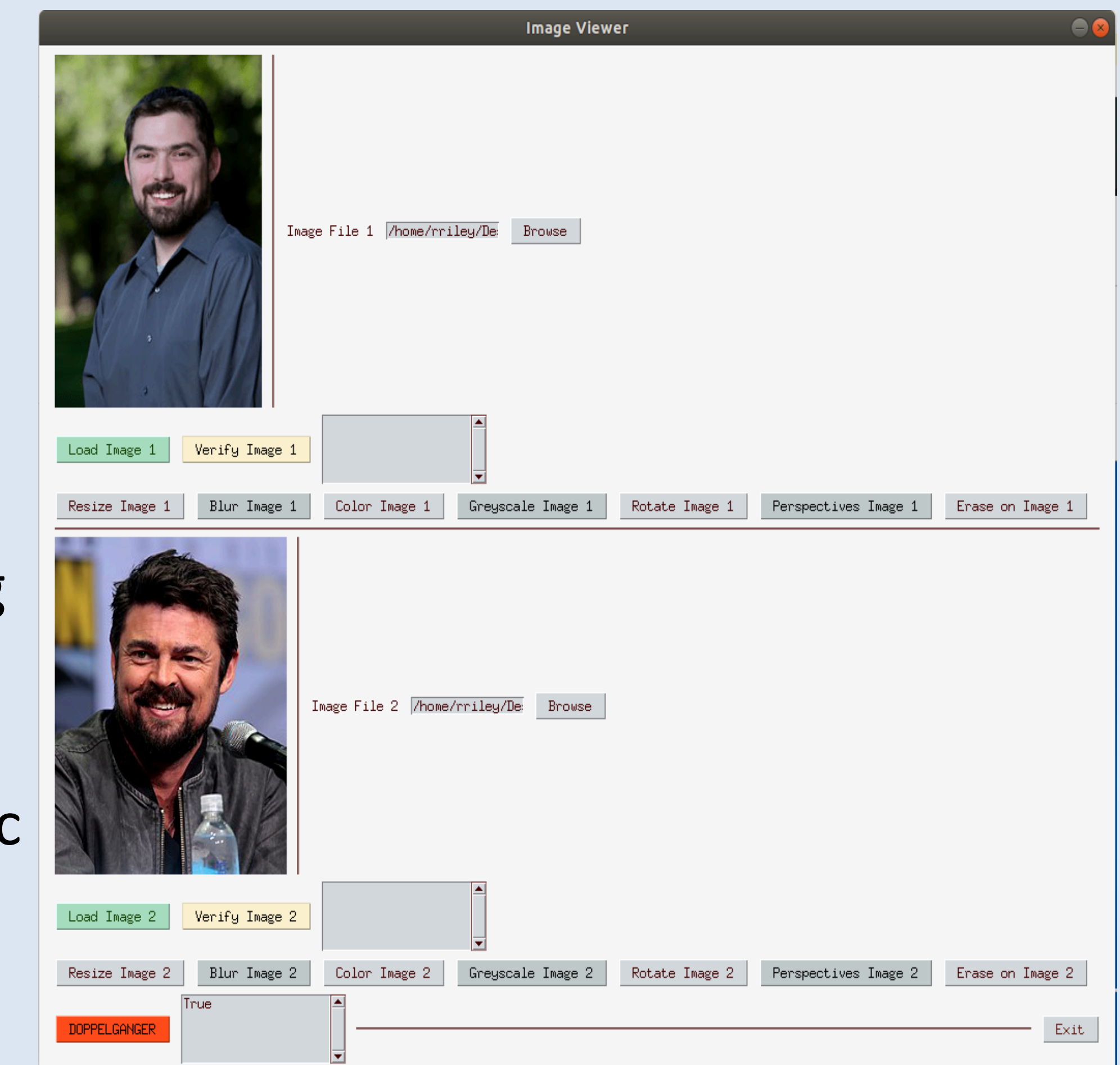
Test

Once we added the biometric model to the image viewer, we tested its parameters. We ran the program and used the augmentation functions to test the machine learning model's threshold for facial recognition. My image viewer displays two separate images with currently 7 augmentation functions. They are as follows: resizing image, blur image, color image, grayscale image, random rotate image, random perspective change image and erase partial image. The model worked well and still recognized images after several augmentations were performed. My image viewer had the added function of comparing two separate images to determine doppelganger images.

Improve

As we prototyped our image viewer, we went through many iterations until we found one that works well with the biometric processor. An improvement would be to have the visualization model process the images to the same resolution for determining doppelgangers. Also, we want the application to work in Microsoft Windows. It currently only works in Linux for saving files to the computer.