

## Introduction

I worked in Professor Mataric's Interaction lab this summer under the mentorship of my PhD mentor, Zhonghao Shi. The lab focuses on enabling socially assistive human-robot interaction (HRI) with the goal of improving user health and wellness, communication, learning, and autonomy. Zhonghao is currently working on developing models that can detect the state of learning for children with Autism Spectrum Disorder (ASD). He is also trying to determine the optimal way to provide user feedback to engage the child: verbal feedback or audio feedback or through the form of a robot.



## Objective & Impact of Professor's Research

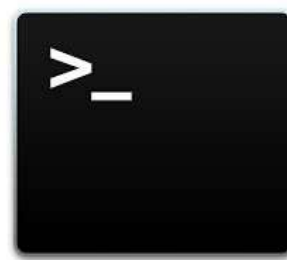
Professor Mataric's research focuses creating socially assistive robotics to improve the quality of human life. The robots are aimed at helping people through social rather than physical interaction. Her work aids special needs populations including the elderly, stroke patients, and children with autism, and has been deployed and evaluated in hospitals, therapy centers, schools, and homes.



## Skills Learned

Technical skills:

- ✓ How to program in Python
- ✓ How to use the Terminal
- ✓ How to use Anaconda and Sublime Text
- ✓ How to use GitHub and Git in the Terminal
- ✓ How to use MATLAB
- ✓ How to use the NumPy, MediaPipe, PyAudio, and PyQt5 libraries
- ✓ Machine learning algorithms
  - ✓ Principal Component Analysis (PCA)
  - ✓ K Nearest Neighbors



Terminal



Sublime Text



GitHub



pyAudio



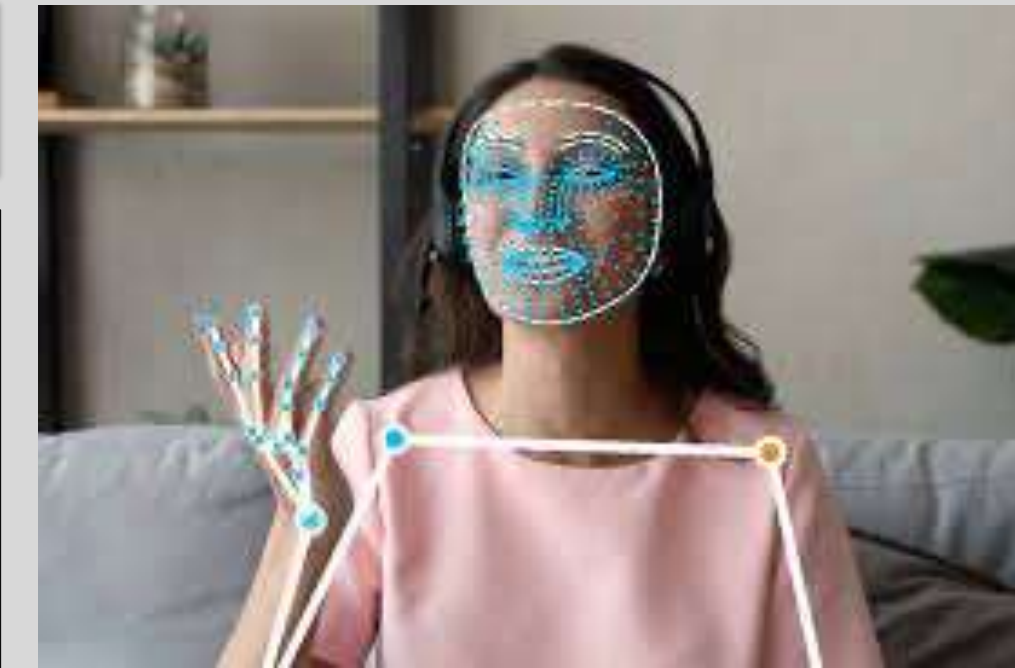
MediaPipe

Other skills:

- ✓ Understanding the research process
- ✓ How to utilize online resources like Stack Overflow and documentation for libraries
- ✓ Debugging compile errors
- ✓ Reading and understanding scholarly literature
- ✓ Ability to self-learn and independence
- ✓ Problem-solving
- ✓ Patience

## My STEM Coursework

Through SHINE, I realized that my STEM coursework in school has several greater applications in the real world. I had previously taken AP CS A, a robotics hardware course, and a computer architecture course in my school. I was able to apply my learning from each of these classes to quickly learn the more advanced concepts needed for my SHINE project. I plan to further my interest in CS and robotics by taking more courses such as robotics software and neural networks in my school next year. In addition, the skills I developed in SHINE relating to independence and self learning will help me through my last year of high school and the rest of college.



Holistic MediaPipe Landmark Extraction  
<https://google.github.io/mediapipe/solutions/holistic.html>

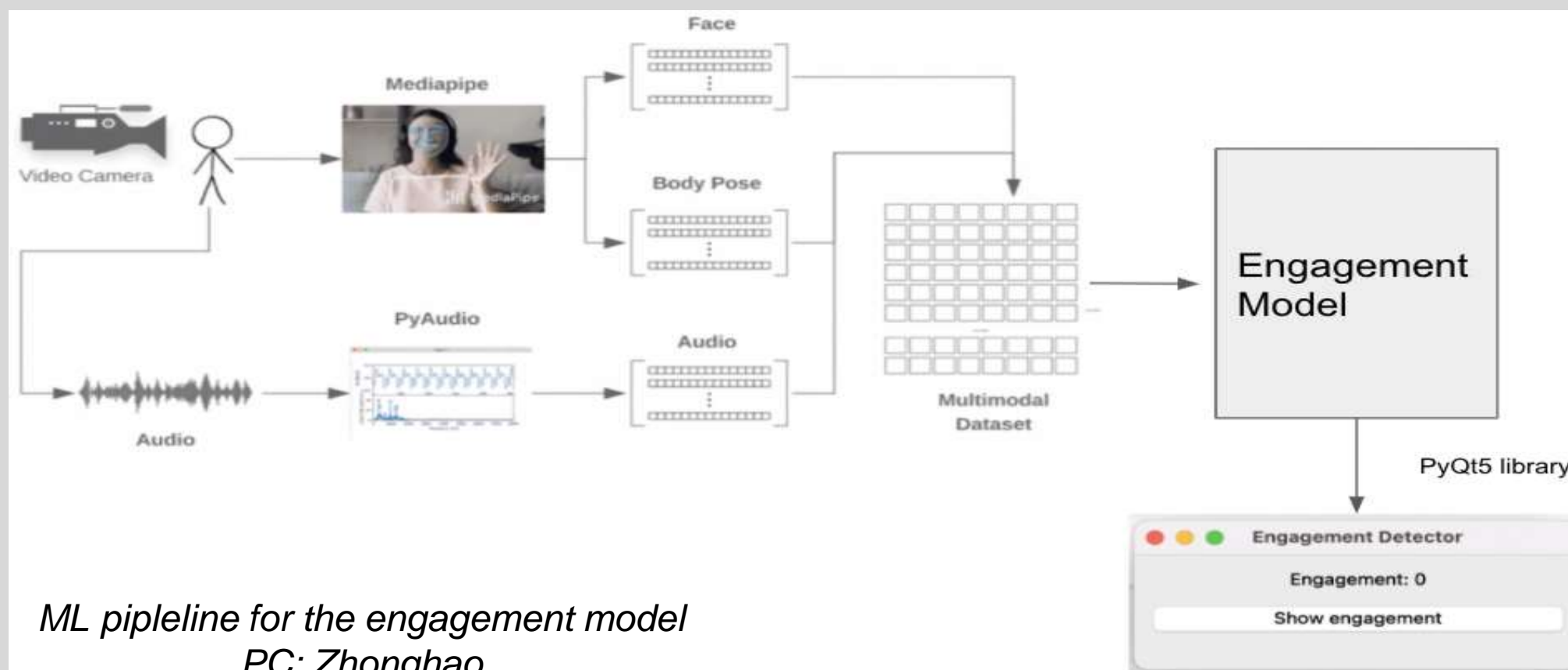
## My Next Steps and Advice

I am interested in continuing my work with the engagement model by pushing it to the front end, either with an app or through the form of a robot. In addition, I would like to train the model on a less noisy dataset to improve the engagement predictions of the model. Through SHINE, I developed a love and appreciation for research and hope to continue doing research related to socially assistive robotics in college. Participating in SHINE has also solidified my views of attending a four-year undergraduate university and majoring in either robotics or computer science. My advice for future SHINE students is to ask lots of questions but also be able to take the time to independently learn material.

## Project Details

My lab partner, Allen, and I worked on building an engagement model this summer. We started with exploring the python libraries MediaPipe and PyAudio. MediaPipe is a framework used for building multimodal ML pipelines. We used the Holistic MediaPipe pipeline which extracts facial and hand features. We also used the PyAudio library which takes in audio inputs to determine engagement. After being trained on our training dataset, our model takes in real time input from the camera and microphone of a computer and updates the terminal with its engagement prediction: (0 for disengaged and 1 for engaged). After we built a functioning decision tree based model, we worked on pushing the code to the front end by creating a GUI interface. We used the PyQt5 library to create a visually pleasing display that shows the engagement level when the user clicks the button.

## How It Works



ML pipeline for the engagement model  
 PC: Zhonghao

## Acknowledgements

I would like to thank Professor Maja Mataric, my lab mentor Zhonghao Shi, center mentor Cassandra Jeon, my lab mate Allen Wang, Katie Mills, Monica Lopez, and the rest of the SHINE team for making my SHINE experience unforgettable!