

It's magical that how I developed my interest in medical imaging analysis. Before joining JHU, I worked in the VLSI and AI Research Lab at the University of Mississippi under Prof. Azeemuddin Syed. There, I helped implement the Zero Frequency Filtering method to extract epoch locations (Glottal Closure Instants) on VLSI boards and Raspberry Pi for speaker differentiation. This experience led me to consult with the professor about using machine learning methods to differentiate speakers more precisely. I tried to learn methods like GMM and Random Forest to achieve better results. Although I failed to implement the expected methods due to my lack of prior experience in machine learning, reading many papers showed me how powerful these techniques are in extracting specific features to improve system performance. This sparked my interest in machine learning and its benefits in signal processing.

After joining JHU, I chose courses related to machine learning and deep learning and found they are closely related to image processing. I was quickly attracted to this field, even though I hadn't taken relevant courses before, because it involves signal processing in multi-dimensional space—a new concept for me. I was amazed by the benefits that machine learning brings to this field. Hence, I chose machine learning and image processing courses in my first semester. I found that medical image processing is particularly appealing because it connects the knowledge I learned in class with real-world applications. From the Medical Imaging Systems class, I learned about different imaging modalities, the physics behind imaging systems, and image reconstruction. However, lacking a strong background in deep learning and image processing, I didn't get satisfactory grades.

Despite this, my interest in the field didn't diminish. In the second semester, I registered for Deep Learning, Image Processing, and Medical Image Analysis courses and began projects with professors. It was amazing to find intersections between different knowledge from various classes, which inspired me to develop my projects. For example, in research with Dr. Patel on liver cancer segmentation, I implemented U-Net from the Machine Perception course and considered LSTM and attention mechanisms from the deep learning class to improve the model's performance. This project fortified my interest and gave me the passion to push further.

I also conducted a course project with Dr. Prince in the Medical Imaging Analysis course, where we worked on skin lesion classification and MRI brain image analysis. These concepts were novel to me. For the lesion classification project, I used the lesion's mask obtained by segmentation and symmetry information for classification. Notably, in the segmentation process, traditional image processing methods like the OTSU method with mathematical morphology provided better results than some basic deep learning methods, reminding me that it's always necessary to combine traditional methods with new ones.

One of the biggest issues I found in these projects was the scarcity of datasets. It's hard to obtain high-quality datasets in medical imaging due to reasons like patient privacy concerns and the rarity of certain conditions. Initially, I could only think of basic methods like cross-validation or data augmentation. At the end of the second semester, I felt fortunate to join Dr. Eric in sign language processing tasks, focusing on solving the problem of dataset scarcity. I realized that medical imaging analysis and sign language processing share common challenges, such as the need for representative datasets and privacy concerns. To address limited datasets, I came up with using depth information from sign images to obtain 3D representations and applied active learning and semi-supervised learning methods to utilize limited annotated data.

Overall, I want to pursue a Ph.D. degree in the medical imaging field because finding new problems in projects and digging deep to solve them makes me feel extremely fulfilled. I recognize that I have much room for improvement and want to push further to apply the knowledge I've learned and explore new concepts. I believe this will definitely help me reach further in this field.