When I was 14, I fell in love with visual arts. I greedily consumed the great works of cinema, TV series, storytelling video games and VR shorts. I believed visual art was the best way to reach to our insides and bring us together. Then, I entered Pomona College as a film studies major. I am grateful for the freedom I had in exploring my interest. As I delved deeper into the field, I gradually realized the importance of technology on the development of visual art. As I saw the visual effects in movies like *The Curious Case of Benjamin Button* and *Avengers*, I was attracted by how graphics technology could be waived into storytelling. I realized that technology and art are related rather than separated. Thus, I wished to explore new ways to enrich storytelling and interactions with graphic technologies.

My exploration in academics was not smooth. I first looked into computer graphics, but there was not much research opportunity in my college, so I switched my studies to computer vision. I self-taught the contents with Jeff Heaton's Keras lectures, Stanford CS231 Convolutional Neural Networks and CS330 Meta Learning. I also took math courses that were helpful to my understanding of neural networks, such as probability, advanced linear algebra, differential equations and math of big data.

In order to gain a deeper understanding in the subject, I started my first research project in facial recognition with professor Weiqing Gu at Harvey Mudd College. I proposed to use a joint network combining the prediction of face shape recognition and CNN recognition on extracted areas. To accelerate the progress, I registered the project in a college-wise machine learning club and recruited three students through the organization. As the group leader, I led the research direction, held group discussions and distributed research works. Based on what I learned, we implemented the distance recognition with Gaussian model clustering. Although it did not reach to an ideal result, I learned to read the papers, set the research goal, do presentations and write academically. I was determined to go on doing research in computer science after this experience.

Another thing I learned was that researchers must keep track of new academic result in their respective field in order to make most relavant contributions. Earlier this year, in Vincent Sitzmann's twitter, I read about the exciting work of NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis. I was impressed by the high-quality renderings from the trained model, as well as the elegance of this pipeline. Nonetheless, the training on each scene took 1-2 days on a high-end GPU. It would be too long for interactive 3D graphics or training on a full video. I thought of accelerating the training with meta-learning, so I began to look for relevant articles. As I saw MetaSDF, which applied a Model-Agnostic Meta-Learning (MAML) model to a neural rendering function for computer-generated scenes, I confirmed the idea that first-order meta-learning methods could have great effects on accelerating the training of neural rendering tasks. After I implemented MAML-NeRF, it performed only slightly better than a blank model, and became worse as the iteration increased. Rather than giving up, I went on looking for other meta-learning methods. I soon discovered another optimization-based meta-learning algorithm - Reptile. Since this method could have much more inner steps, I was able to make Reptile-NeRF treat each scene as an inner task, and thus shuffle the rays to decrease the variance of inner training data. This approach improved the result of the original training and enabled me to achieve a better result. I experienced the whole process of research alone in this project. It was also the first time for me to write a paper as first author. To learn from the best, I

carefully read through NeRF and MetaSDF quite a few times and learned their writing structures. For details, I received help from my research partner Alex Beatson, a PhD at Princeton University. My writing was also trained in my thesis project – a survey of rendering functions for neural rendering. Inspired by Reptile-NeRF, I surveyed rendering functions in computer graphics that could be used in neural rendering. I wondered if a wiser choice of the rendering function could also improve the training efficiency.

Previous experience gave me a solid understanding on computer vision and computer graphics. In August, I had the opportunity to work with professor Misha Sra at UCSB in augmented reality. It was a great chance to work with an active researcher in the field and further develop my research skills. Apart from learning the AR implementations, I also learned about designing experiments that involved human participants, which I believed to be very helpful for my future research career. Our goal was to investigate the effect of location-based memory in AR language learning. We let our participants walk around an outdoor area holding a smartphone, through which they would see word tags in the foreign language attached to the real objects. Designing the first user study in my life was quite challenging, so I went through every detail in relevant studies and learned the HCI study principles behind them. In this way, I finished experiment setup and testing metrics. I discussed a lot of details with prof Sra on how to display the words in the most comfortable way and how to control time spent on the walking procedure. Eventually, I successfully designed a pipeline that could demonstrate the effectiveness of AR learning in fair comparison, and implemented an Android AR app with cloud anchors to give participants a comfortable user interface. The actual experiment is postponed due to COVID, but we have all the details set at this point. We plan to conduct the user study in spring semester. I had no experience with Android development before this project, but I learned everything in a short time and was able to finish the app for experiment by myself. I am grateful for prof Sra as she guided me through the design of experiments, writing interview questions and analyzing users' reviews.

At this point, my research spans from machine learning to graphical display and then human computer interaction. I am proud of having experience in all these fields. I believe that great pipelines for visual arts should enrich people's mental world while using most up-to-date and robust technologies.

I am thus very fond of the reality lab of Paul Allen School. The richness of subjects in UW enables me to explore various possibilities and needs of visual technologies. I am highly interested in Professor Ira Kemelmacher-Shlizerman's group. Their work of NBA players' animatable figure reconstruction and background matting are exactly the types of technology I wish to build for visual arts. I am also interested in professor Linda Shapiro's group. Her work on 3D face reconstruction renewed the blendshape technology with machine learning and pushed it to a higher level. This technology would soon be able to save a lot of time for 3D animators. Finally, I wish to continue the journey of neural rendering with professor Steven Seitz. His recent nerfies paper smartly applied a deformation model before the NeRF MLP. If possible, I can use this method for efficient video rendering. Visual art technologies would soon be revolutionized, and I wish to be a part of this history. I believe that I will thrive in UW.