**University of Washington: Submit a personal statement of ~1000 words (max 500KB) that includes: a) how you became interested in doing research, b) a relevant project or research experience that shows your technical knowledge and skill, and c) your plans for the future in computer science. You may wish to include information about what you feel are the strengths of your application, such as special interests and abilities, or give explanations for what you feel are any weaknesses in your academic record. If you have background that might particularly contribute to the intellectual and social enrichment of the program, please describe it. Examples include unique educational or cultural opportunities (or lack of them), social and economic disadvantages that you may have had to overcome, and interesting or unusual influences on your intellectual development.**

- 字数不重要，但页数重要。

-- Why I chose CS research --

Since I was very little, I have dreamed of changing the world to a better place. This desire has only become stronger as I grew up. 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 that visual art was the best way to reach to each one’s inside and bring us together. In the first summer of high school, I attended a filmmaking course at Emerson College, and I made lot of videos and short films ever since. Then, I entered Pomona College as a film studies major.

I am grateful for the freedom I had in here 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 waive into the storytelling. I realized that technology and art are related rather than separated. Thus, I wished to explore new technologies that could expand the possibilities of storytelling. Around the end of the sophomore year, I decided to become a researcher in technology for visual art.

-- My four periods of research experience --

**Katherine Breeden:**

- 最technical的部分也就是给她写码，但因为CS PhD对代码能力没有太大的要求，从申请PhD角度来说没有太多的东西。所以其实轻描淡写就可以。但学到了如何做presentation或许有点用。

- 这段不太算科研，但可以简单写写实验室里跟别人学了些什么，以及我更喜欢科研了。

The exploration in academics was not smooth for me. I first looked into computer graphics, and yet there was no professor in Claremont colleges who led projects in this field. I joined my first research group in the last summer. It was a group of two students, led by professor Katherine Breeden. We aimed at collecting data of people’s eye movement while watching music videos. I helped her build a C++ pipeline that played music videos while reading the eye tracking data from Gazepoint eye tracker. It was really challenging to understand the code that had over 30 .h files. By the professor’s suggestion, I learned to draw trees that represented the relationship between classes. Eventually, I understood the code and refined the threading process which caused the lag of video playing by about 300ms. I also statistically analyzed the frequency of each kind of eye movement with respect to the speed of editing. Another valuable lesson I learned was presentation – how to make your idea or proposal sound more interesting. As we were in the experiment process, at first, I hardly succeeded in inviting other students to be participants. Nonetheless, my partner almost always did. As I observed, she introduced two of the MVs that she really liked and why she liked them. I thus realized the importance of conveyance. In the future presentations, I made sure to focus on only two most important details and convey with enthusiasm.

**Weiqing Gu:**

- 要写出来为什么我决定用这个想法。我现在只写出来我这么做了然后效果不好。把Motivation写清楚。我当时怎么想的就怎么写就好了。

PS的主要目的是：

1. 为什么我要做research
2. 我经历了什么。整个科研周期。

最好带一些“前人做了什么”，这里就可以加。“我认为人看脸一般是先看contour的”（这里加一个citation）。做survey是很重要的，你要知道别人已经怎么做过。另外，写PS是可以加citation的，用citation来证明你说的是合理的。

1. 为什么你想做这个，对这个领域有什么贡献 / 影响

While I was looking at the data, I wished that I knew machine learning, so I could predict where people would fix their sights on at each frame. This desire thus led to my next project. I self-taught machine learning and computer vision, since the courses in my college were too packed. I started a facial recognition project with professor Weiqing Gu at Harvey Mudd College. After I became comfortable with the basic knowledge of machine learning, such as convolutional neural network, I started working on a joint model that took in the facial shape as a prior for facial recognition. As I found my time insufficient for the work, I registered the project to P-AI, a college-wise machine learning club, and recruited three students through the organization. I led the research direction and held 11 group discussions and distributed research works. The idea I came up was to cluster the 2D face shapes and generate a probability on each cluster for a new face. Then, we multiply this probability with the result of CNN model. Together, we wrote over 3000 lines of code and successful implemented the plan. The result was not ideal, but we learned a lot along the way. We concluded that the plan could have been better if we used 3D shape information instead of 2D shape information.

**Alex Beatson (current PhD):**

- 只要你经历了整个流程而且流程合理，你是受过训练的科研人员，那你就比绝大多数本科生都好一些了。

- Meta learning 并不是by default用来提速的。把想法的发展、Sitzmann的东西写出来。

（代码四个月写不出来不是什么好事……？白师兄没能看出来我想表达tenacity）MAML写出来

- 这个research的感觉就是把A和B结合起来，这不够是一个科研。最好能带一些insight。最好说我研究了哪些方法，以及我为什么选择了MAML和Reptile。不能强调simple！

“我survey了一堆meta learning，我发现里面有一些性质，里面很适合跟MAML结合，但我发现这个效果不好。于是我总结了一下大概有哪些原因不行，但Reptile可以解决这些问题，于是我就用它解决了然后产生好的结果”。最后请记得把具体什么好的结果写一下。

- 扩展一下我怎么写paper的，我怎么学习写paper的，以及有人指导你写作。把东西写好是重要的能力。

- 既然是水会就不要写名字了，直接说under review就算了。

- 千万不要投水会！不是所有非顶会都是水的。学术界不看你有多少篇文章，而是看你最好的那一两个有多好。

Earlier in this year, I read about the exciting work of NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis by Mildenhall et al. I was impressed by the high-quality images that the model could render, as well as the elegance of the method. Nonetheless, training a model on each scene took 300k iterations, which was 1-2 days on a Tesla V100 GPU. It would be too long for interactive 3D graphics or training a full video. I decided to develop a way to increase its speed.

For this project, I did all the work by myself, while receiving advices with Alex Beatson, a PhD student from Princeton University. First, I carefully read through the NeRF paper and looked for meta-learning methods that could be applied to this task. I picked model agnostic meta learning for its simplicity. The NeRF team published their code in TensorFlow 1.14, but I first decided to implement mine from ground up in Jax. The implementation took me 4 months until I gave up. I was stuck on the memory loss issue and was never able to fix it. After stubbornly trying a lot of methods, and even contacting the Jax developers, I decided to switch to TensorFlow. It then took me 1 month to intensively implement the code, and I was finally able to train a MAML model. However, the result was unsatisfactory. The meta-learning model was less than 10% faster than the blank model on a full training, and the former had an even worse result on few-shot learning. I concluded that the reason it did not work was due to the limits of MAML training.

- 大概讲一下MAML大概是怎么work的，以及我为什么要用它跟NeRF结合。高度总结地写一下这个东西！

Because of the memory consumption, MAML could only trace up to 5 inner steps; because of that, it could only update via SGD instead of Adam. Therefore, it could not learn to learn several thousand steps of Adam optimization.

- 把“四个月”放到这里。科研就写科研，心路历程就写心路历程。

I was really frustrated at the point, and I almost gave up. Nonetheless, I then found an equally simple meta-learning method – Reptile. I started over and made good results with Reptile NeRF. I have submitted the work to IVCP conference in November and am waiting for notifications. I am the only author in this paper.

In the whole process, since I basically worked alone, I dealt with countless bugs and problems. There were quite a few moments where I thought of giving up, but the desire to make it motivated me again and again. Admittedly, I could have finished the project earlier if I chose to implement from the NeRF code. Nonetheless, I cherish this period of frustration, since it fostered my tenacity.

**Misha Sra:**

“我不太知道一个好的HCI的科研是什么样的”

- 还是那个问题——你为什么要这样做，加citation，what is your motivation

- 不能说we plan to publish，用submit

- 现在白的感觉就是还没有确定是不是help了language learning。最好能有些theory证明它。以及怎么研究的方法。这也是相当重要的部分。我现在只有前半部分。11月做的时候要把这部分完善一下。

The NeRF project told me that visual technology was broader than what I thought of. Therefore, I then moved on to another emerging field – AR. In August, I started working with professor Sra from UCSB on an AR project. The goal was to create an AR language learning app and conduct a user experiment to see if it actually helps language learning. I had no experience with Android development before, but the idea attracted me, so I learned everything along the way. Professor Sra’s original idea was to develop a detect-and-show app. When a user viewed the street views through the phone, the app would detect the objects using object detection models, and then the names of the objects are displayed as AR objects in the DepthAPI scene. After I implemented the plan, I found that waiting for the phone to recognize planes in AR mode diminished the learning experience, and the capacity of object detection models was limited. For the first problem, I proposed to put anchors in the air and enable the users to drag them around. For the second, I proposed that we let the users to create the contents by themselves. This totally circumvented the second problem and gives the community much more freedom and communication. Eventually, professor Sra accepted both changes and it took me another month to implement the cloud anchors. Right now, we are writing the paper, and we plan to publish the work in January.

Not every period of my research experience was fruitful, yet I learned a lot in each of them. By constantly exploring, I gained a better understanding of what was required to be a researcher. It needs a well-rounded knowledge in the field, a collaborative spirit and leadership, a tenacious mind and a constant willingness to learn new things. I have harnessed these merits in my experience, and thus I believe I will be a qualified researcher.

-- Conclusion and future research plan --

Over 2000 years ago, the Greek philosopher Plato argued that the theater was a futile activity since it was an imprecise representation of real subjects. For instance, those who enjoyed a work about war could learn about it much better by consulting a general. Nonetheless, his disciple Aristotle contended that theater was not meant to offer knowledge, but a source of emotional catharsis. I have a very similar view on technology. While we develop more capable machines and algorithms, we should also give people better ways to express their feelings and build communications. Life is not all about functionality.

- 这个转变一定要写清楚一些。我为什么想做AR / VR？要多些一点。

I envision the future entertainment in full-view live VR and AR. As we develop real-time neural rendering, we can apply it in VR scene generation. People can enjoy a theater work on a VR headset and be able to view from all angles – even standing on the stage with the actors. They can also see other audience and make contact with each other. I wish to help build this immersive and interactive experience.

- 最后的套话一定是我想跟哪位教授合作。先夸一下学校，然后夸一下教授。

Finally, University of Washington is my top choice. I will definitely come if I receive admission.

- Fellowship, Scholarship, RA, TA / 全勾

- 有的学校不需要official成绩单，先unofficial就行。具体问题具体分析。需要的话就寄送。

硕士项目本身是什么类型的不是太关键，关键是你可以进去跟这个学校的老师合作了。

CMU的硕士项目特别难。看准这个项目的地理位置。比如匹兹堡要比硅谷更适合学术。