Statement of Purpose

I. Why M.S. in CE at Washington University in St. Louis

During the summer vacation in 2017, I travelled to the U.S. and visited Washington University in St. Louis for the first time. The visit was love at first sight. I was drawn to the gorgeous architecture and beautiful scenery in the campus. The thought of studying at Washington University came to me after the visit. After conducting some research afterwards, I found that the M.S. in Computer Engineering at Washington University in St. Louis is a great fit for me, as I can make full use of my experiences to better understand the theories taught in this program. In return, Washington University's prestige faculty and wide platform will provide me with the opportunities to study in-depth specialization about this subject, and the alumni network of Washington University will also be a great asset to my development in the future. This is why I am motivated to pursue the M.S. in Computer Engineering at Washington University in St. Louis.

II. Academic & Professional Accomplishments

I accumulated a fair amount of knowledge during my undergraduate studies and developed many interdisciplinary skills from my experiences in different areas. I believe I am qualified for the M.S. in Computer Engineering at Washington University in St. Louis because of my strong will, hands-on skills, and teamwork spirits shown from the following experiences.

Learning & Competitions

My knowledge of Machine Learning mainly derives from my undergraduate courses and academic competitions. In 2019 Mathematical Contest in Modeling, I led my teammates to complete a Data Mining project about Opioid Crisis. We analyzed data from National Forensic Laboratory Information System, and found the growth pattern of drug reported quantity and important demographic features to make a breakouts prediction, *i.e.*, when and where a drug epidemic will occur. Besides, in my final projects in *Introduction to Data Mining* course (scored 99, ranked 1st), I made a prediction for NBA players' salary by analyzing the correlation between their performance and earnings from Basketball Reference records. From these experiences, I become familiar with the process and methods of Data Mining, *e.g.*, data preprocessing, correlation analysis, classification algorithms, *etc.*, which could be of great value to the concentration of Prof. Zhang and Chen in Data Mining.

My interest in Machine Learning involves other fields, too. I started to learn about Computer Vision from my *Artificial Neural Networks* course (scored 99, ranked 1st), where I practiced many kinds of neural networks. To further study, I led a team in a Kaggle competition relevant to cactus identification and achieved a 99.97% accuracy in the test set. Afterwards, I extended my studies to dynamic objects capture through my research in China University of Mining & Technology. I employed Back Propagation Neural Network and Partial Swarm Optimization to track targets and published a paper *Optimal Analysis of Target Dynamic Tracking Strategy Based on Computer Vision*. I believe aforementioned experiences has prepared me well for Prof. Chakrabarti and Ju's focus on Computer Vision, and I look forward to exploring more in this area under their instruction.

Research & Publications

Since sophomore year, I have conducted research in Inplus Lab and focused on the contract and application layer of Blockchain technology. Referring to theories in *A Primer in Game Theory* and *Convex Optimization*, I proposed a two-layer Stackelberg Game data trading mechanism in Blockchain-based Internet of Vehicles (IoV) and evaluated the robustness and efficiency of my algorithms by implementing several smart contracts on Rinkeby, a test net of Ethereum. I completed a paper *Blockchain-Based Digital Goods Trading Mechanism in Internet of Vehicles: A Stackelberg Game Approach* with my colleagues and

submitted it to 2020 IEEE Cloud. During this process, I realized that there is a big gap between idea origination and perfect implementation. Specifically, we need to take more factors into consideration to ensure the stability and efficiency of operation in the system, such as security and cost of execution and storage, *i.e.*, gas cost. As this work employs a consortium Blockchain to guarantee IoV security and uses Game Theory methods to facilitate trading, I believe it is aligned with the studies of Prof. Jain in Blockchain Systems and Prof. Lu in Internet of Things. During my research in Inplus, I also participated in *Perishable Digital Goods Trading Mechanism for Blockchain-based Vehicular Network* and published a survey *Application of Blockchain in IoT Data Trust and Information Available Technology*. Currently, I am working on *BCShare: A Decentralized Data Storage and Sharing on Blockchain*, which employs InterPlanetary File System and certificateless cryptography to address the control on user data from the giant companies. The research in Inplus Lab not only helps me to master Blockchain technology, but also deepens my understanding of Game Theory, Cryptography, Security and Privicy, *etc*.

Internship

Based on my knowledge and experiences in Machine Learning, I put into practice knowledge of Reinforcement Learning while interning in the Institute of Automation, Chinese Academy of Sciences. Because of my interests in Game AI, I participated in StarCraft team to build StarCraft II Learning Environment with Tensorflow. Initially, I trained the soldiers with Advantage-Actor-Critic and Deep Deterministic Policy Gradient (DDPG) algorithms, but neither brought satisfactory outcomes. After communicating with my advisor and colleagues, I enhanced my DDPG-based work by allowing the soldiers to cooperate. By referring to *Multi-Agent Actor-Critic for Mixed Cooperative-Competitive Environments*, I applied the novel Multi-Agents Deep Deterministic Policy Gradient (MADDPG) algorithm to this scenario and took more factors into consideration in the rewards. Derived from DDPG, the MADDPG critic not only inputs its own state and action, but also includes others' information to make a global optimization. Due to this revision, the average winning rate of soldiers was improved from 26% to 43% with only 120 training epochs. From this internship, I picked up more knowledge in reinforcement learning, including traditional algorithms, training methods, evaluating criteria, *etc*. Furthermore, I learned more about business cases where Reinforcement Learning methods are being applied, which inspires me to integrate them into other studies in the future. I believe my work in this internship matches well with the studies of Prof. Das in Reinforcement Learning and Prof. Yeoh in Artificial Intelligence, and I would like to engage myself in these areas.

After this internship, I was attracted to Computer Networks, which inspired me to explore other application scenarios, as I realized how powerful and scalable this technology could be. After many rounds of interviews, I seized the chance to intern at Microsoft to work on the *Predictable Remote Direct Memory Access (RDMA) for AI Training* project, which aims at guaranteeing bandwidth for Data Manipulation Language training tasks in RDMA networks. In this project, I managed to implement the central logic controller and the adaptive data backup mechanism, *i.e.*, adaptively specifying the traffic classes of VM-pairs to guarantee the bandwidth of users. Unlike the previous internship, corporate assignments place more emphasis on teamwork and project integrity, so it is necessary for the team to work closely together to ensure smooth progress. This teamwork experience prepared me well for further studies in Networked Systems, and taught me to be responsible both at work and in life.

III. Interests & Goals

If admitted with honor, I am inclined to work on Machine Learning & Artificial Intelligence, Networked Systems, and Graphic, Vision & Imaging to make full use of my experiences. Besides, I would like to explore Human-Computer Interaction as a new field of study because of my creativity and eyes for beauty.

In the short term, upon obtaining my Master degree, I expect to complete my program with excellent performance to broaden my horizon and consolidate my knowledge. In the next 3-5 year, I aspire to become a reliable researcher by pursuing my Doctor degree. In the long run, I would like to work as a professor to guide students and to promote promising technologies to better our lives. I firmly believe I can lay a solid foundation and learn useful skills at Washington University to achieve my dream.