Personal Statement

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I. Boston University is Right for Me

During the summer vacation in 2017, I travelled the U.S. and visited Boston University for the first time. The visit was love at first sight. I was drawn to the gorgeous architectures and beautiful scenery of Boston University. Other than that, I felt at home during the visit, as Boston University had lots of Chinese alumni and there were many Chinese restaurants in Boston. The thought of studying at Boston University came to me after the visit. After conducting some research afterwards, I found the M.S. in ECE at Boston University a great fit for me as I can make full use of my experiences to understand the theories taught in this program. In return, the prestige faculty and wide platform of Boston University will provide me with the opportunities to study in-depth specialization about this subject. This is why I am motivated to pursue the M.S. in ECE at Boston University.

II. I am Right for Boston University

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 ECE because of my strong will, hands-on skills, and teamwork spirits.

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 the data from National Forensic Laboratory Information System, and found the growth pattern of drug reported quantity and the 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 studies in Data Science & Machine Learning Lab in your department.

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 Beijing. 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*. The knowledge gained from these experiences has prepared me well for the concentration study of Imaging and Optical Science, and I aspire to study chemical imaging technologies or computational imaging in Cheng's Group or Computational Imaging Systems Lab.

Internship

Based on my knowledge and experiences in Machine Learning, I practiced my 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 topic of Reinforcement Learning in Network Optimization & Control Lab, and I am well-prepared for further study in this field.

After this internship, I was attracted to Computer Networks, which ignites my interests to explore other application scenarios, as I realized how powerful and scalable this technology could be. After many rounds of interviews, I was offered 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. It was a great teamwork experience, which taught me to respect others' roles in the team and to be responsible both at work and in life.

Research & Publications

Since my sophomore year, I have researched in Prof. Chen's 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* and submitted it to 2020 IEEE Cloud. During this process, I realized that there was 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, it is aligned with the studies in Networking & Information Systems Lab at Boston University. 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 Trustworthy Systems, Cryptography, Distributed Systems, *etc*.

III. My Research Interests & Future Goals

If admitted, I am inclined to work on Data Science, Optical Science, Network Optimization, and Networking and Information Systems to make full use of my experiences. In the short term, upon obtaining my Master degree, I expect to complete my program with excellent performance to consolidate my knowledge. In the next 3-5 year, I aspire to become a reliable employer in a reputable company. In the long run, I would like to set up my own company and to promote promising products or service to better our lives. I firmly believe I can lay a solid foundation and develop useful skills at Boston University to achieve my dream.