**Applied Program: Electrical Engineering**

Many people search their entire lives and never find their one true calling in life, but I am very fortunate to have discovered an intense interest in electronics. My dedication to this calling was significantly tested when I was severely injured in a terrible automobile accident in August xxxx. I put into action my personal motto “Attitude determines everything” and vowed to not let myself be defeated by such severe injuries. After 6 months of sick leave, and while still hobbled on crutches, I returned to work with a positive attitude and received several commendations for my work performance during this difficult time. My accident and severe injuries made me realize how powerful my interest in Electrical Engineering, particularly in the field of wireless communications. I would like to explore this field to the fullest extent possible, as I have discovered that there is an endless possibility for significant research in this area.

My initial interest in the coding field was spurred by the challenge of an exercise in my Digital Circuit course. The exercise is a weight-measuring game--“Find one special ring out of twelve and judge whether it is heavier or lighter by measuring the rings three times on a scale”. Rather than giving the common answer using logical deduction for limited ring number, I generalized the problem into “Find one special ring out of [(3n -1)/2]-1 rings and judge whether it is heavier or lighter by measuring the rings n times”, and came up with an ingenious solution based on encoding all rings and results of measurement, a principle which I demonstrated in a paper I subsequently published. My positive attitude in trying radical and creative solutions to the exercise helped me not only solve the problem at hand but it also sparked my interest in detecting malfunctions in digital system and judge its property by using the coding method.

While working on my final project in the Digital Mobile Communication Lab, I was offered the opportunity to participate in the second stage of the project “Key Technologies in 3GPP system”, in cooperation with the Ericsson.  Following my interest, I joined the channel coding research group to research on Turbo Code.

In this project, I first finished the software design and implementation of the base-band codec system for Turbo Code. I then shifted my research focus to improving Soft Output Viterbi Algorithm (SOVA) based on iterative decoding for Turbo Code.  I was able to make encouraging improvements on SOVA for Turbo Code in improving BER performance and decreasing decoding delay by reading a lot of published papers in this area and actively discussing the situation with my colleagues. From this research work, I gained valuable knowledge of wireless communications and the theory of channel coding, as well as practice in developing software in C Language and simulating algorithms with MATLAB & COSSAP.  Here I found my overriding interest in the research of channel coding algorithms.

During my research, I had shown a special aptitude for algorithm research, most likely due to my intense interest and excellent mathematical skills. I won awards four times in international and domestic mathematical contests in modeling.  In participating in those contests, I was not daunted by the fact that I lacked in-depth mathematical knowledge, instead, I actively faced the challenge by studying widely in the mathematical field, including Operational Research, Optimum Theory, Graph Theory, Advanced Probability and Statistics, Fuzzy Mathematics, etc. I was a member in a competition group of three members, and each time I was the one that proposed the essential idea in each contest. These competitive experiences taught me how to work in a team as well as how to apply mathematics to solve realistic problems, which will make an important contribution to my future research on algorithms.

Awarded various scholarships and ranking No.1 among 150 students, I was qualified for graduate study at BIT without admission exam in xxx. As a Masters candidate, I continued on with my work on the second stage of the project “Key Technologies in 3GPP System”, researching improvements in iterative decoding with SOVA, trellis termination structure and interleaver design for Turbo Codes. During this time, I proposed a new SOVA that abandons updating process for soft value and produces soft value by comparing metrics between two integral paths, based on synthetically utilizing forward and backward searching in trellis, Furthermore, the new algorithm introduces the most effective EIC at different SNR with self-adaptive way. BER performance of the new SOVA is superior to that of Max-Log-MAP at higher SNR and has approached that of MAP, without an increase in decoding complexity. This exciting result was verified and highly approbated by Ericsson, which demonstrated my innovative methods and creativity in algorithm research.

When I began work on my Masters degree project in xxxx, I also participated in the third stage of the “Key Technologies in 3GPP System” cooperative project. Due to my excellent performance, my director placed me in charge of the study on Space-Time codes for wireless communications, which is a revolutionary development for exploring the multiple-input-multiple-output (MIMO) channel. Welcoming the new challenge, I poured much enthusiasm and energy in to my research efforts.  This became a turning point in my research career.. My research focused mainly on two types of Space-Time Code based on transmission diversity: Space-Time Trellis Code and Space-Time Block Code. Based on achieving the basic codec of the two kinds of Space-Time Code on flat Rayleigh fading channel, I proposed a sub-optimum decoding algorithm utilizing bit log-likelihood for the concatenated system of Space-Time Block Code and Turbo-TCM based on binary Turbo codes. To resolve the shortcoming of the Space-Time Trellis Code on optimizing Euclidean distance of transmitted symbols, I proposed a novel code applying Multidimensional TCM technology.  Because of the inspirational research results, my graduate thesis “Study on Applying Space-Time Codes to Wireless Communication Systems” was chosen as the Excellent Master Thesis of BIT.

This project taught me how to be self-disciplined while independently working on in-depth and innovative research.  I realized that there are significant capacity gains to be explored through the inherent parallelism of the MIMO wireless system, which uses multiple antennas at both end of the wireless links. For the point-to-point MIMO system, Space-Time Coding is the most popular transmit diversity technique to explore spatial diversity gain without requiring channel knowledge in the transmitter. For the multiple-user MIMO system or the so-called downlink MIMO broadcasting channel (MIMO BC), whose advantage is that the capacity of the whole system is not limited by the number of antennas equipped in each mobile user, the channel state information is assumed to be available to both the base station and mobile users. The interference from one user to another is known at the base station, and can be pre-cancelled before transmission by using the so-called dirty paper coding. Of course, there are still a lot of open problems in the area of MIMO BC on both the theoretical study and real implementations. I am extremely motivated to conduct further research on the MIMO wireless system.

Based on above research in wireless communication field, I have published six papers in Chinese core periodical and one English paper in international conference. At the same time, I researched on Mathematical Modeling in my spare time and published a paper for the problem B of xxxx’ Chinese Mathematical Contest in Modeling. These fully testify to my research capacity and potential.

In April xxxx, I began work for the Beijing Research Center of HuaWei Technologies Ltd. Co.  As a software engineer in the Wireless Communications department, I participated in the “User Equipment for 3G WCDMA Systems” project, where I was deeply involved on research on channel decoding algorithms based on Convolutional Code or Turbo Code according to 3GPP TS 25.212 V3.60 and simulated those algorithms with COSSAP.  Unfortunately, my traffic accident interrupted my participation in that project, but just 6 months after my severe injuries I was back at work on crutches and assigned to the project “Media Gateway for CS Domain of 3G Core Network”.  With this project, I developed software for the lu User Plane protocol based on 3GPP TS 25.415 V4.70, and I am currently involved with software development for the 3GPP TS 29.232 V4.40 protocol.

From my work experience, I have not only gained a deeper understanding of the importance of highly efficient channel coding in wireless communication, but I have also gained tremendous experience in developing high layer protocols and deepened my comprehension of the entire 3G network. Simultaneously, my software development skills have strengthened because software development in my company is completely based on the Capability Maturity Model (CMM). Furthermore, my perseverance in working through my serious traffic injuries has been invaluable for me – it has made me realize the depth of my fortitude, optimism and devotion to my telecommunications career.  Now that I have completely recovered, I know that I can achieve my future goals no matter what difficulties may arise.

I am highly motivated by the challenging research that will be required in the future in order to fulfill my goals.  My past research experience in wireless communications is only the first step of my dream of becoming an expert Electrical Engineer.  This solid foundation of knowledge and experience has prepared me to face all of the future challenges involved in wireless communications research.

Of the six schools to which I am applying, Massachusetts Institute of Technology is my first choice, not only because your Department of Electrical Engineering and Computer Science is one of the best in the world, but also because there is a strong overall academic atmosphere that is conducive to studying at the highest level. Your Department offers the fields of research I want to concentrate on: (1) Wireless Communications and (2) Signal Processing. In the first concentration, I would like to focus on coding, wireless and cellular systems, and multi-access systems and the professors I am interested in working with include xxxx, xxxxl, andxxxxx. In the second concentration, I would like to focus on Array Processing. Among all the required core courses, I am especially fascinated by Introduction to Mathematical Programming, Principles of Digital Communication, Array Processing, and Transmission of Information. Your strong faculty, comprehensive curriculum and a multitude of research opportunities will give me the best education I can expect in my proposed fields.

I know that all of the time and energy that I dedicate to the program will be rewarded with positive results.  I realize that the competition for admission to your program is extremely strong, but I will bring a unique combination of prior education, work experience, a commitment to teamwork, and a strong history of success as my contributions to your university.