My professional goal is to become a leading scientist in the field of biomedical imaging. I have worked toward this goal by doing research with several outstanding experts at Purdue University, completing relevant graduate-level coursework with a master's thesis, and co-authoring academic articles for relevant research work. However, I realized the necessity to further upgrade my knowledge and expertise. Generally, I have a strong interest in developing novel image analysis approaches and medical imaging technologies for clinical applications and other healthcare issues.

I presently work as a researcher at Purdue University. I am developing an automated multi-spectral optical imaging system and image analysis software. This project is focused on the frontier area of microbial identification using optical imaging technologies. This system has two features. First, it is able to automatically guide the incident laser beam to pinpoint the selected microbial colonies on the medium surface. I developed the approach to inversely calculate the desired trajectory of the laser spot in the world reference coordinates. Second, this system can adaptively adjust the incident point of the laser beam in order to generate complete optical scattering patterns. I designed computer vision algorithms to estimate the intensity distribution of the optical scattering patterns and adaptively calculate the new incident points of the laser beam. Meanwhile, I am also developing new image processing approaches for analyzing multi-spectral images. In addition, this project started with my master’s thesis and is sponsored by Environmental Protection Agency.

My thesis study was focused on analyzing optical scattering patterns of the fix-wavelength laser within the context of microbial source tracking. I developed Gabor wavelets-based algorithm to create signatures for corresponding optical scattering patterns. To classify these signatures into different host species, I implemented a decision-directed acyclic graph (DDAG) based on a multi-class support vector machine. I compared several other image analysis algorithms to find the optimal feature analysis algorithms, such as Zernike moments, gray level co-occurrence matrix, etc. I also examined the feasibility of other pattern recognition methods like k-means, Gaussian mixture model, probabilistic neural network, etc. In addition, I investigated the optimal selection of microbial colony size and its influence on the variation of optical scattering patterns as well as the identification rate. The identification rate of microbial host species by using a fix-wavelength laser has achieved 85%. More details can be found in the publication listed in my resume. In 2009, I was awarded a student research award as the first-place recipient of this project.

Besides the projects mentioned above, I also completed other image processing-related course projects like MRI brain image segmentation and license plate number recognition. As for MRI brain image segmentation, I implemented three versions of fuzzy clustering methods to separate the gray matter, white matter, and cerebrospinal fluid. The three methods included standard fuzzy c means, spatial information encoded fuzzy clustering and bias field information encoded fuzzy clustering. The modified versions of fuzzy clustering demonstrated robustness under certain levels of noise and intensity inhomogeneity. In addition, I completed several graduate-level coursework to accumulate basic knowledge about biomedical imaging. These courses include medical imaging, biomedical instrument design, medical visualization technologies, pattern recognition, etc.

My experiences with machine learning started with my senior design project at Purdue University. This project was about redesigning the setup model of Temper Mill at ArcelorMittal plants. I developed the real-time rolling force predictor based on a back-propagation neural network. The offline test of this predictor demonstrated a more accurate prediction of the Temper Mill rolling force than the old one used in the factories. The average deviation was less than 5%.

I am strongly interested in the research work of the Intelligent Imaging and Neural Computing lab because studying human visual processing and natural signal representation is a promising direction for advancing image analysis technologies. I am also interested in developing novel imaging technologies for non-invasive diagnosis and some other fundamental medical research. Specifically, I was impressed by the research on cardiac imaging and skin imaging which are conducted in the Functional Optical Imaging lab.

I am requesting admission to the Ph.D. program in biomedical engineering. My previous research experience, academic preparation, and personal qualities have prepared me for the expectation of your program. My objectives for the Ph.D. program are to educate myself to be an outstanding scientist in biomedical imaging and contribute to the improvement of healthcare research. I believe [XYZ] University provides extraordinary opportunities to such petitioners. Finally, I believe I can contribute to your program through research, academic publication, and interdisciplinary cooperation.