My goal in applying to the PhD program is to prepare myself for a career in research and development in space systems engineering. My motivation for the doctoral studies comes from my experience in the MOXIE (Mars Oxygen ISRU Experiment)- the Mars 2020 project and aspiration to be at the forefront of space systems and continual contribution to the space sciences community. I am confident that from my interdisciplinary technical skills in software and AI research, I can succeed in the core requirements for PhD. My focus is to establish credibility and depth in software-autonomy and space systems logistics along with gaining fundamental understanding of the space systems.

Every opportunity to contribute in space science gives me a sense of satisfaction and accomplishment. I am actively involved in this field through volunteering research projects (MOXIE- Mars 2020 and modeling the radiation and its effects on astronaut health), delivering talks to inspire public (NASA-JPL Solar System Ambassador), and attending conferences. I have been volunteering as a Technical Staff for the MOXIE project for nearly 1.5 years. This project inspired me to pursue my carrier in aerospace engineering. Having been working for nearly 4 years with The MathWorks, it is a tough decision to quit a stable job to pursue my PhD. However, my passion for this field of science has helped me make a conscious decision to get in to doctoral studies.

I learned about the MOXIE project by Dr. Michael Hecht at the Mars Society’s convention in 2015. I got intrigued by MOXIE’s concept of generating O2 from Martian Co2. I approached Dr. Hecht regarding volunteering opportunities in the project and soon got the chance to work in the development of the software toolkit of MOXIE. I contributed in the development of MOXIE’s fault detection system and a MATLAB GUI to automate the MOXIE’s flight dynamics systems model. Everyone from the MOXIE Science Team liked the GUI because it automated existing model running and data analysis workflows. My contribution was appreciated by the peer science team members and I was included in the official Mars 2020 Science Team as a Technical Staff. I also received the inventor status on the NASA’s New Technology Report through JPL for software creation. This project has been a wonderful learning experience where I worked on a real space system project in a development team. I feel very accomplished with my contribution to the project and am confident that I can bring the unique experience I gained from this project to the doctoral program.

I am working in the MATLAB graphics team in my current position at the MathWorks. I have worked on more than 30 high impact projects in the MATLAB graphics area, such as the charts and plots for data visualization in MATLAB, appdesigner- the MATLAB application building tool, to name a few. As a software engineer in test, I developed tests and tools to ensure high quality and performance of the graphics system. In one of the projects, I collected data and drew inferences, which were then used for project prioritization and design decisions. While fulfilling the responsibilities of this position, I honed my problem analysis, critical thinking, and effective communication skills. I also perfected my engineering, programming, and team collaboration skills from this position. In my free time I enjoy teaching MATLAB and am currently co-authoring a book on MATLAB programming targeted for medical data analysis. I am confident that the skills I developed from this experience will aid me in the PhD program.

Most of my AI research experience was gained during my master’s thesis. Hyperspectral Imaging (HSI) is one of the widely used spectral imaging techniques for image analysis. My masters research solved one of the problems of HSI using machine learning techniques. A major task in hyperspectral image analysis is spectral Unmixing, which is the extraction of material signatures and estimating proportions in which each material is present in the scene. In addition, dimensionality reduction is often a necessary step in hyperspectral image analysis because of its large data sizes. In my research I addressed these two problems and developed unique algorithms for dimensionality reduction and spectral unmixing of the hyperspectral data [paper1][thesis]. My master’s thesis increased my grasp in AI, specifically in, image processing, pattern recognition, and machine learning.

During the course of three years of my master’s research I have strengthened my engineering skills and developed good research culture and practices. For solving a problem one first needs to understand why the problem exists and most importantly why that hasn’t been solved. I developed this understanding along with experimental design skills through the paper surveys I did for my research. I frequently gave feedback to my lab members research, presented my research progress, and work done by others in my research area in our weekly seminars. In my free time I served as the lab’s “social chair” and organized lab lunches for establishing good camaraderie between lab members. I am confident that the experience from my master’s research will help me in becoming a successful researcher and solving the problems in human automation using AI for the development of advanced space systems.

I believe that my continued interest in space science and experience in the development of space system, software, and AI will help me contribute to the knowledge of space system community and to the PhD program at MIT. For the PhD program I am interested in researching in spaceflight technology and space system logistics. Among the existing faculty at MIT, I would like to work with Dr. Jeffery Hoffman. I have had the privilege of working with him in the MOXIE project. I have gained valuable experience and am interested in contributing to Dr. Hoffman’s research in the future development of the fullscale MOXIE system. I am also interested in Dr. David Miller’s research, such as the PRISM project.