1. What is your most significant technical achievement?

The most significant technical contribution that I achieved is a new approach for solving an acoustic and elastic waves propagation. For the first time, my numerical solution was validated by an experimental data from National Institute of Standard and Technology.

1. Are there areas of research you are particularly interested in? If so, please let us know.

I am particularly interested in developing filtering technique for solving sound or acoustic wave propagation problem in frequency domain. As a part of my dissertation, I focused on development for filtering of numerical error in time domain.

1. Tell us more about what teams or types of projects you're interested in. (Long answer)

Based on my area of expertise, I believe that works in Algorithms, Alignment, Applied AI Research, and Scaling teams share my interest in machine learning and how I can help to build a speech-recognition application to use for human feedback and interactions.

Filtering low and high frequencies for acoustic wave is my area of expertise. In many cases high frequencies create an error or extra ‘noise’ that affects low frequency which is the real identity that distinguish one voice to another. Throughout my career in mechanical engineering, frequency domain is mainly use to understand natural or resonant frequency of mechanical system. In acoustic wave problem at high speed, an emphasis puts in time domain to understand the change in time likes a velocity field. As a result, the law of conservation of energy is still hold for solving the acoustic wave equation and filtering a certain range of high-frequencies violates this law. For acoustic wave at low speed in a normal-conversation speech, I think frequency domain should be a focus for the future area of research and filtering of certain amount of ‘noises’ has several interesting properties relating to the conservation of energy. Since we want to develop an effective and efficient for voice recognition application, any conservation law can be ignored and neglected; therefore, machine learning can be used to improve and enhance the quality of sound for this application.

1. Please share anything else you want us to know, such as your motivation to apply or additional context for your application. (Long answer)

Having solve acoustic wave problems in parallel-computing clusters, I understand that even a small improvement in efficiency will have a major impact for many real-world applications which may require several days of computing. In most engineering problems, we can reduce relative and absolute errors when we have analytical solutions for comparison. Improving computing performance and reducing relative error is a part of my interest, especial for speech-recognition problems.

I have an interest for space exploration when I was in high school. I have worked in space industry for more than 10 years. I believe machine learning and AI will play a crucial role in space exploration because there are many health-related risks for human to live and work in space environment with high radiation.

1. Please provide an example or evidence of your exceptional ability. \*(Long answer)

At a young age, I often wondered how the natural world works and how we as a human species have developed tools or methods in predicting the future. I became interested in mechanical engineering and developed insight of how to design a mechanical system and be able to predict the behavior of this system.

Most physical and natural phenomena can be modeled as a differential equation in space and time. Because both space and time are inseparable problems, a mechanical system can be modeled as the change in space and change in time in the same equation. To symbolize a smooth and continuous geometry in the real world, a discrete spacial domain is used, so that a certain loading condition can be applied and a functional field can be used to describe its behavior, such as velocity, stress, and strain. However, as a result of the solution, an inherent error (or systematic error) as a finite domain is divided into smaller regions for the purpose of achieving accuracy. This is known as a dispersion error due to the application of a space-discretization method. For the first time, we can filter out this error correctly, so that we can observe a physical phenomena in its true form, especially for acoustic wave propagation problems.

Even though there are many numerical methods, such as standard Finite Element Method (FEM), Isogeometric Analysis and Spectral Finite Method, the approach that I developed is called Explicit Time-Integration Methods and Finite Linear Elements with Reduced Dispersion Error, which is the most efficient and most accurate method for wave propagation problems. Together with my advisor, we won a research funding of $288,500 from the US Air Force Office of Scientific Research for the applications of elastic and acoustic waves. We published three professional journal papers as a result of this funding.