Research Statement

# Future Research

Moving forward, I plan to deal with two subjects. The first subject is to develop various accelerated iterative method, especially Newton’s method to solve nonlinear matrix equations. A well-known strategy in the acceleration of Newton’s method is giving appropriate scalar multiplication to the differences of each step. To find the appropriate scalar, the technique of exact line search can be used. A disadvantage of exact line searches is in that it requires too many computing resources. On the other hand, in mathematical sense, there is an advantage that it gives the most appropriate next step for each iteration. Going through several simulation experiments, I gained an insight that there is a tendency that the sequence of differences between each Newton step converges to a one-dimensional space. As a next step, I plan to give a proof of the tendency and show the efficiency of the technique which applies only one time of exact line searches on the middle part of existing Newton sequence.

As a second subject, I will keep studying deep learning models and exert them to tackle industrial problems. In the institute I previously worked, my task was to apply deep learning models to process medical images. Consequently, I dealt with various types of medical images like fundus, dental, and lung CT images. In a future, I wish to have a chance to process other types of data including language data. In particular, I would like to study language processing models for SOV(Subject-Object-Verb) and agglutinative language like Korean language. Although there exist many natural language processing algorithms for English, as English and Korean have different language structure and history, I wish to understand the difference of them and develop a model which fit to Korean.

As a final goal, I hope to find solutions of various nonlinear matrix equations with neural network models. To find solutions of nonlinear matrix equations with iterative methods, we need a lot of computing resources. The acceleration techniques for iterative methods save resources such as electric power or time. On that account, I am going to develope a novel neural network model aiming to discover an efficient technique to find solutions. In fact, some researchers of DeepMind published an article entitled “Discovering faster matrix multiplication algorithms with reinforcement learning.” With my background of solving nonlinear matrix equations, I believe I can develope a new model to advance acceleration techniques.