Machine Learning Applied to Nanoparticle Reseach Development Logs

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# May 2024

The month of May consisted of reviewing and establishing an understanding of the application and development of the nanoparticle field. To be more specific the seach was focused more on the doping of ionic liquid with the nano particles in order to achieve different properties. The purpose was to develop not only an understanding of material science, but to also gain an understanding of the processes necessary to create and implement these solutions.

# June 2024

Research continued with an increasing list of sources being developed to call upon in the case of problems developing in the future that may require further understanding of the field of development. Most of these sources were focused on results and methodologies used to produce specific alignments and shapes of the nanoparticles in the solutions.

# July 2024

The research reached its conclusion around the 16th of July when Doctor Paul Titan requested me to direct my focus on the machine learning proponent of the project. Once this phase began, the usage of python and many of its varied libraries began to be involved. The key focus was on the Pandas library which focused on the pulling of data and editing of excel files through python programs. These developments were run with the Visual Studio code interface in addition to test excel sheets being used for this purpose. Progress remained stable until the 19th of July. Due to a series of errors that occurred on the school computer I used for the project in addition to server issues due to the CrowdStrike incident, much of the developed code became unusable, having to be scrapped and started once more. Due to this and the many technical issues with the computer once the computer was recovered the project’s development reached a standstill.

# August 2024

The project was slow to develop due to a lack of time since the semester began. Additionally, I was no longer able to work on it until my hours were approved once more. Once approved, the scope of the project was discussed, and a new outline was developed with the goal of simplifying the application of the software to clean and present the data in a much simpler format. The project then progressed towards a more manual development with the goal of creating a machine learning model with a user-controlled development. The user would plug the code into the system and their numbers would be processed, standardized and presented on a line graph where they could save the presented information and use it for their purposes.

# September 2024

Once the scope was developed in the previous month, the focus grew on the graphical User interface (GUI). The goal was to make sure the user could understand and implement the code however they saw fit. As a result, the project grew to focus more on broad implementation rather than the nanoparticle doped ionic liquid the project was named for. Anyone with the software could implement it and pick and choose what was processed with manual implementation of the software rather than automatic processing.

# October 2024

At the end of October, a devastating storm hit the Southeastern part of the United States of America. Due to this storm, all progress was halted until much later in the year since I and many others in the state of South Carolina lacked power. The effects of the storm lasted throughout the month of October and into the month of November.

# November 2024

November was a period of Agile development focused on producing a working model in addition to a viable poster for the presentation in Portland, Oregon at the International Mechanical Engineering Congress and Exposition (IMECE) presented by the American Society of Mechanical Engineers (ASME). The model was developed into a GUI based graphing software that could pull data from excel sheets, organize it and plot it into a line graph, then produce a savable file of the graph for further usage. The model was broad in application, having the user select and name the different components of it.

# December 2024

December produced minimal work with little hours logged as a result.

# January 2025

The scope of the project was changed once more to that of an automated Neural Network system that could produce and modify predictions with feedback from the user. The next model would be focused on implementing a sorting method into the previous model in order to verify the effectiveness of the array organization method being implemented. Additionally, the properties being changed from viscosity to Thermal Conductivity.

# February 2025

This month focused on bug fixing and testing the new sorting methods in addition to what would later become the preprocessing segments of the next generation model. The array system was changed from a standard array to a class array to ensure consistent implementation in addition to application flexibility with an easier call function for modular uses.

# March 2025

March was focused on producing a working model with an agile development of the code to make sure that code met all criteria previously discussed. For this period, the Automatic Neural Networks were implemented into the code with the previous sorting method being used. The Tensor flow library, the scikit-learn, and the difflib libraries being added. The Tensorflow library was focused on the Self learning and Neural Networks for the project. The Scikit-learning library was focused on the application of scaling the numbers for the prediction aspect of the coding. The difflib library was used to account for inconsistencies in the data from the excel files. With these implementations the sorting algorithm had to be reworked due to the necessity of preprocessing the data to allow for its functionality to be viable. Additionally, all tests have to be rated by the user to make sure the predictions are becoming more accurate.

# April 2025

April produced minimal progress due to a lack of test data to test with the model. As a result, the system has remained relatively unchanged from the previous month with the only exception being minor corrections to the grammar and characters used by the system to prevent confusion on the user’s side.

# May 2025

May was the month I graduated from USCA. My time on the project ended on the 7th, but I am willing to aid in the transition period for the next group for the rest of the month to aid the project in continuation.