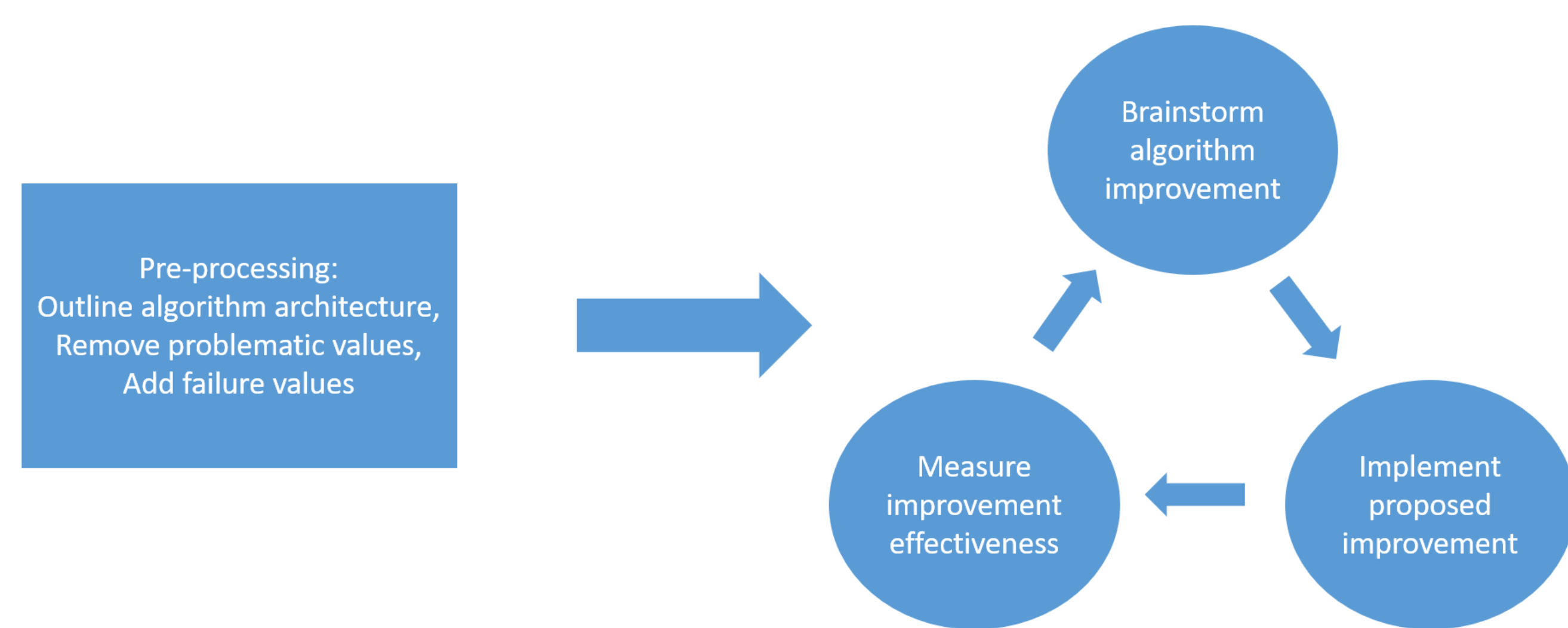


Introduction and Motivation

Failure and energy overproduction are problems that limit the economic and energy efficiency of wind turbines. Due to the large cost of windmills, it is advantageous to ensure that the machines run as efficiently as possible. This helps support the U.S. Department of Energy's goal of creating a "smart grid".

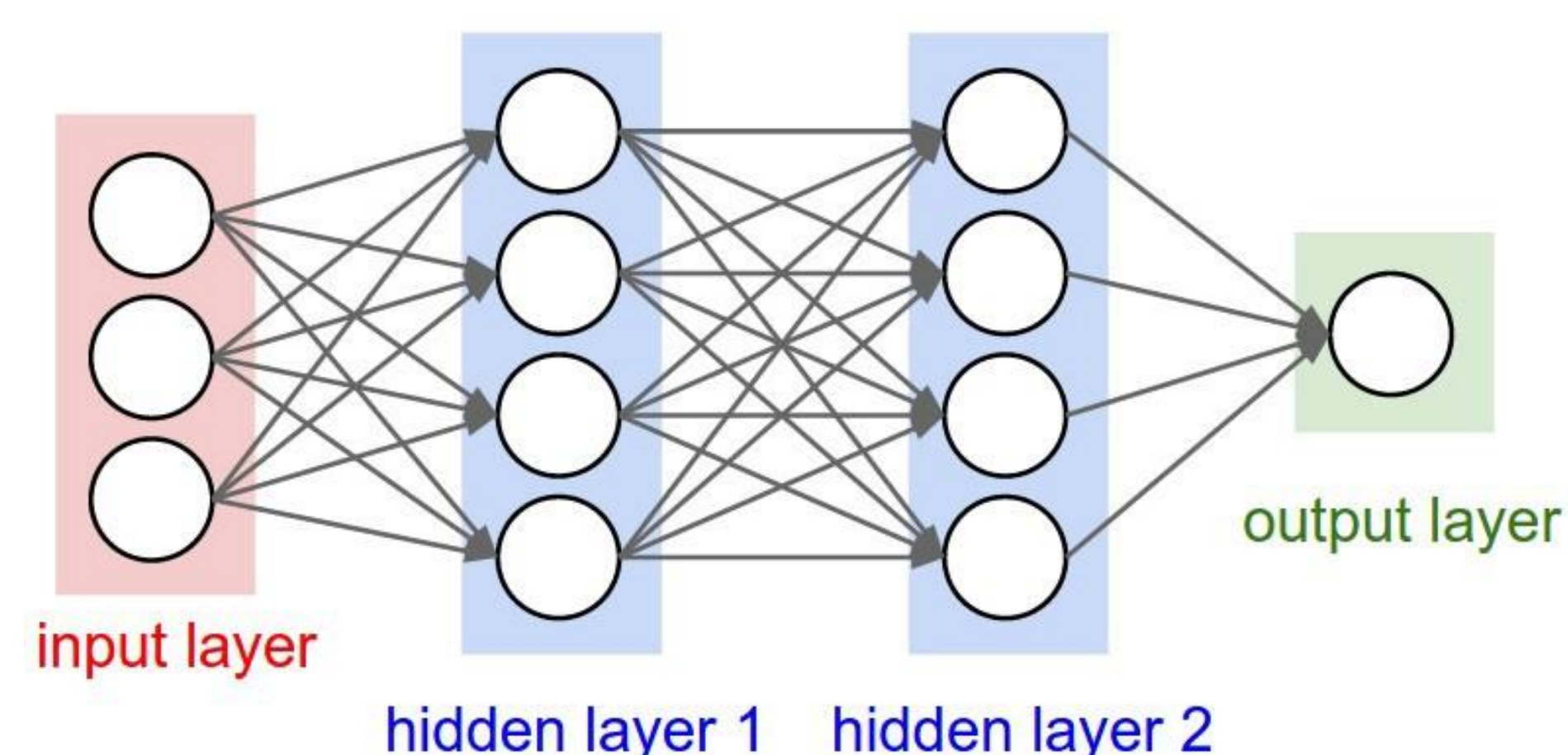


Methods



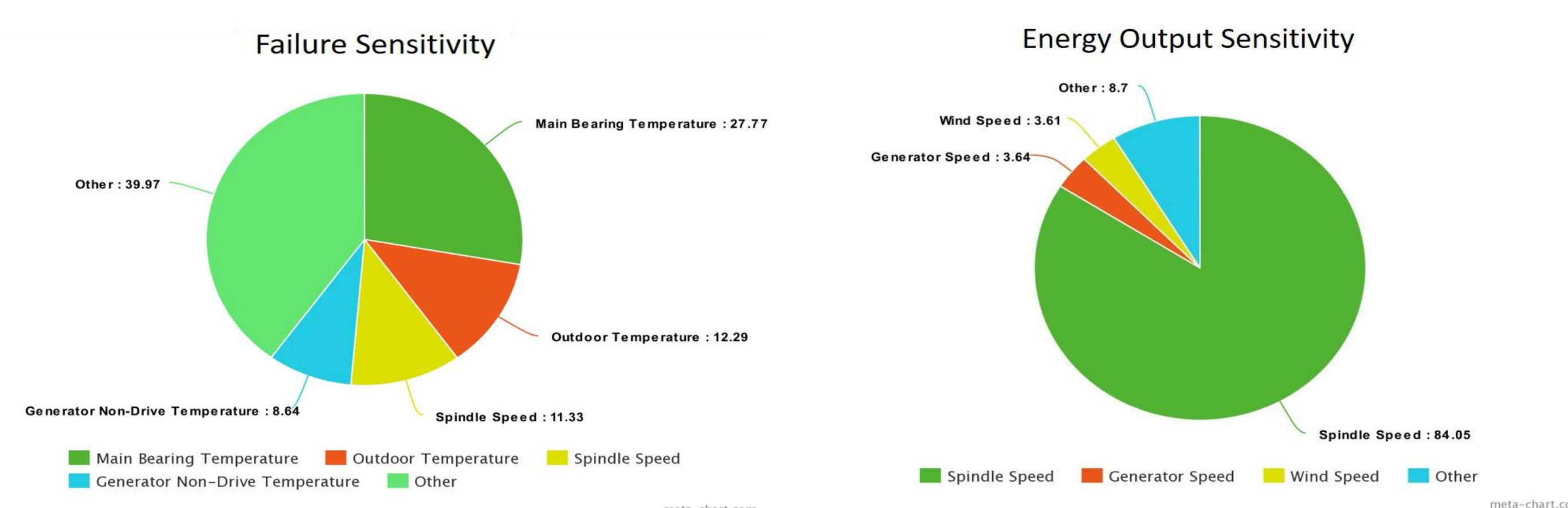
Neural Network Algorithm

A neural network is a deep learning algorithm that essentially finds a regression equation for the inputs. This is found through feeding "training" data into the algorithm, then running optimization techniques.



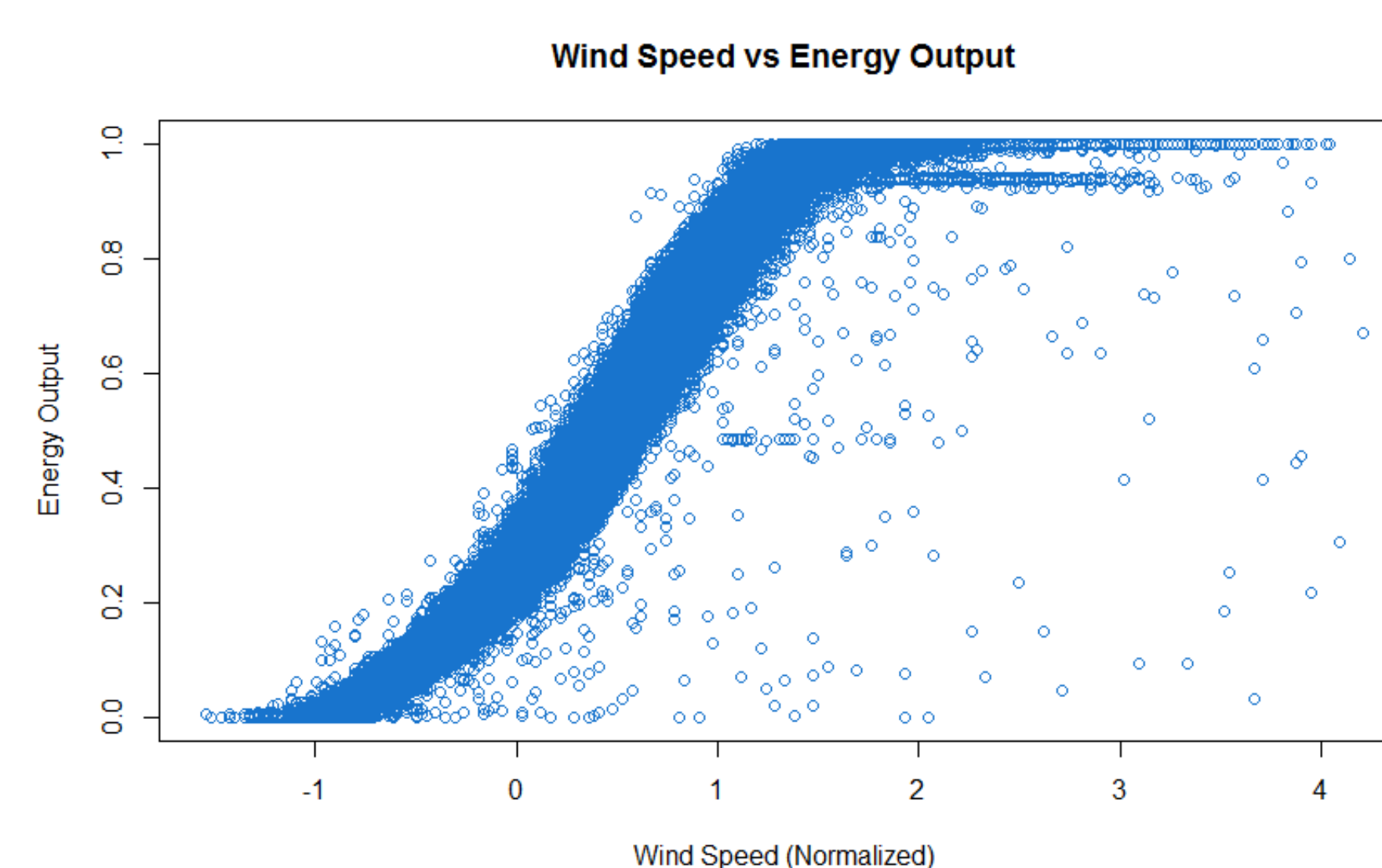
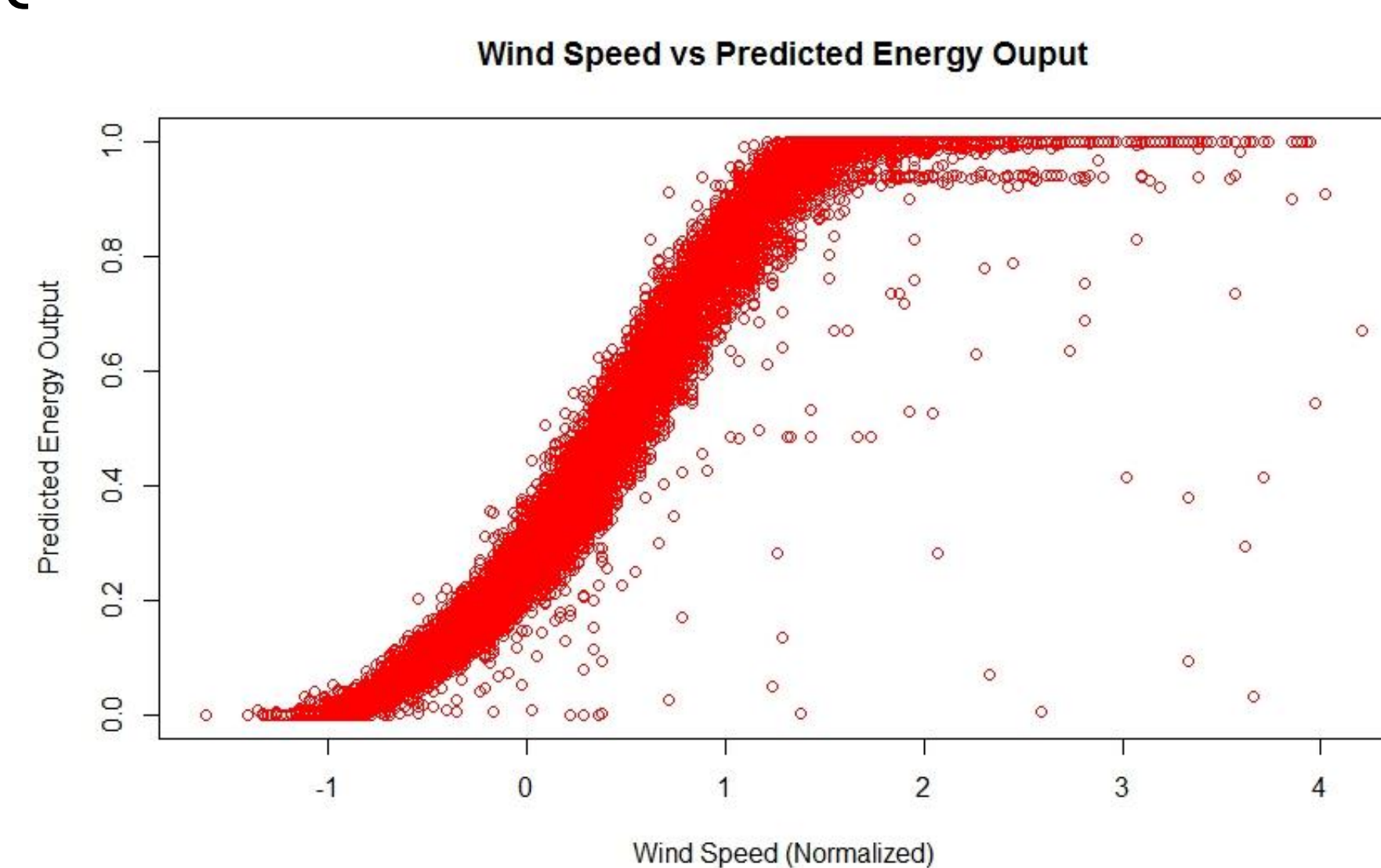
Sensitivity Analysis

A sensitivity analysis is an algorithm that takes many random samples of the parameter values and inputs them into the neural network. An analysis is then done to see which variables have the most "effect" on the output.



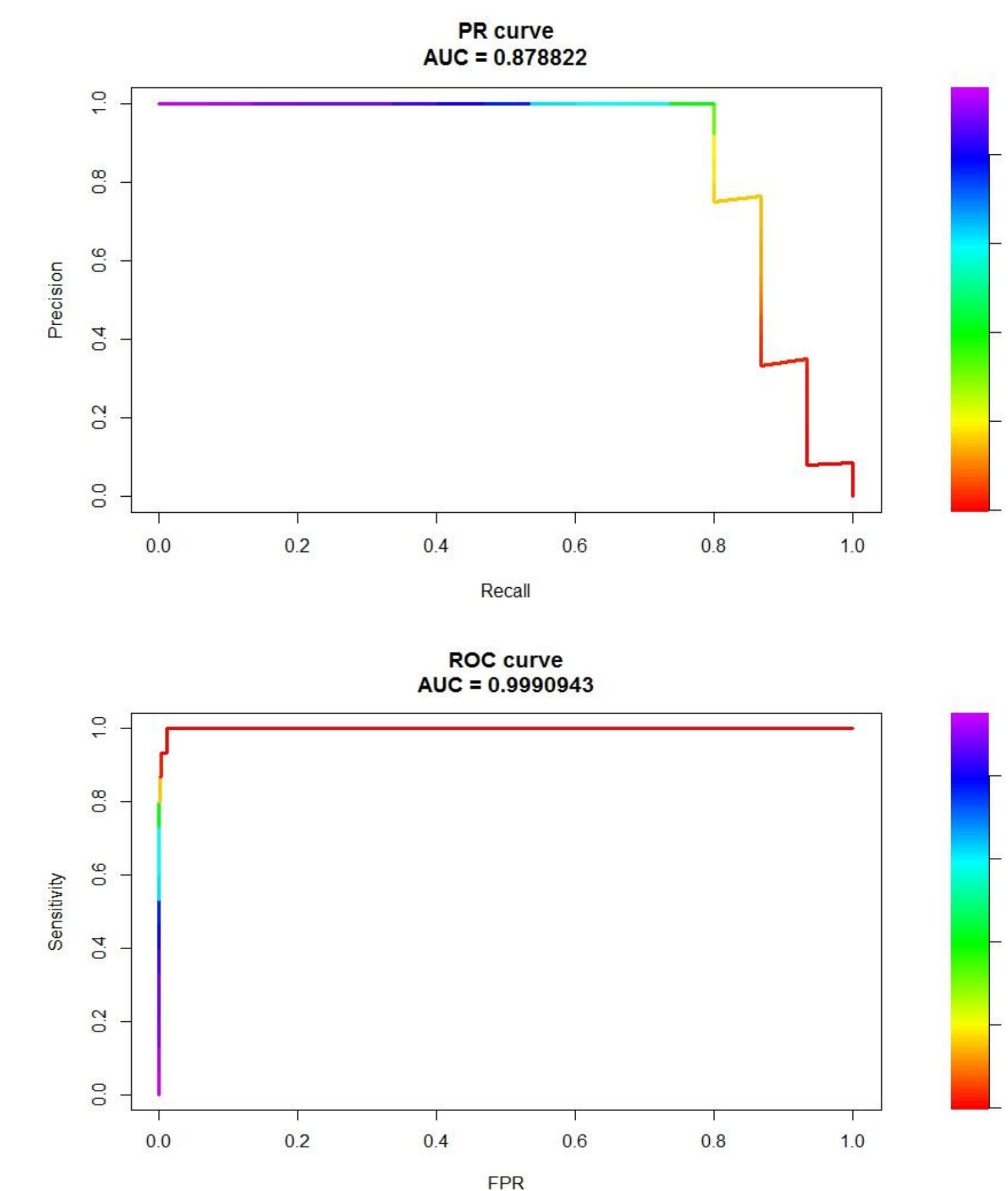
Energy Prediction

The algorithm was able to predict energy output very well. The variable wind speed was chosen because of its relatively linear relationship with energy output, thus making the relationship easy to see



Failure Prediction

The algorithm was also able to predict failure with a high degree of accuracy. Using wind speed, the algorithm was able to predict occurrences of failure with an accuracy of 99.12%



Conclusion and Future Work

The algorithm performed very well in energy output and failure prediction. This solidifies the neural network's ability to be used as a tool to provide accurate energy output estimations and predict potential safety and economic hazards caused by failure.

Future work in this area can be directed towards using recurrent neural networks to incorporate temporal information into the network, thus providing a more accurate prediction.

Acknowledgements

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