# USING NEURAL NETWORK BASED APPROXIMATION TO IMPROVE HPC APPLICATION

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# Introduction

- What is HPC Application ?

HPC Applications are algorithmically designed specifically to take advantage of the parallel nature of high-performance computational computing systems.

- What is Neural Network based approach ?

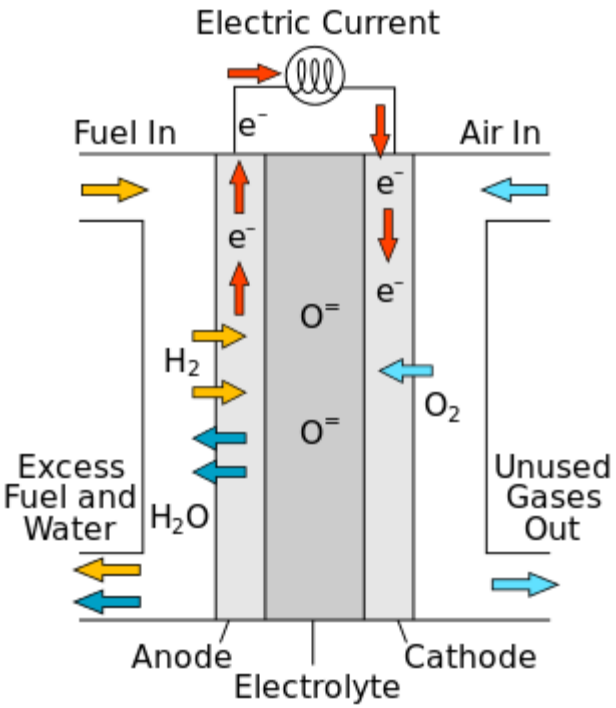
Neural Networks are those algorithms that are used to recognize the pattern in data by mimicking the way the human brain works.

They are good at recognizing hidden pattern in data set.

# SOFC ?

- What is SOFC ?

Solid oxide fuel cell (SOFC) is a type of fuel cell which converts chemical energy into electrical energy.



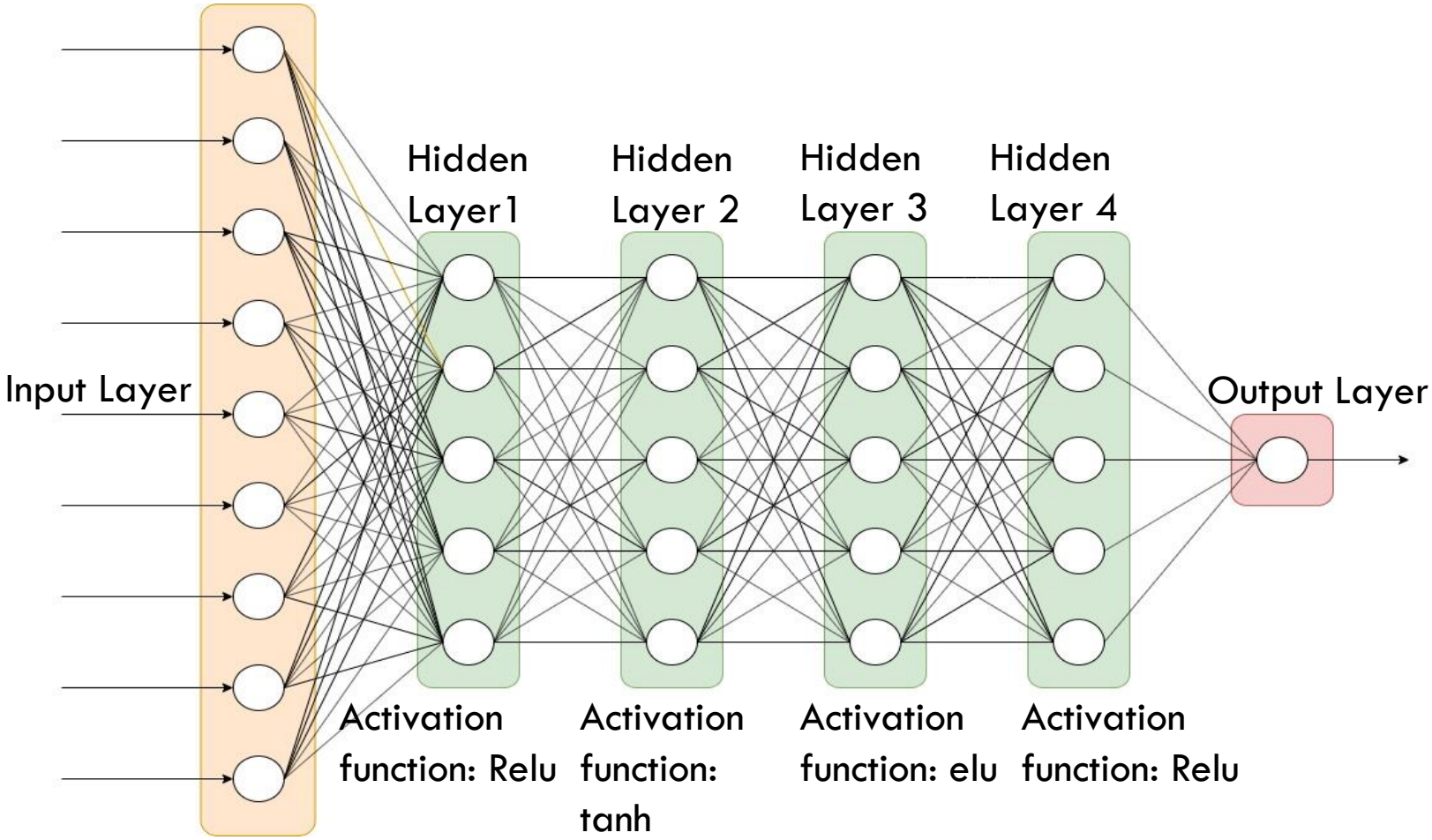
# TensorFlow

- TensorFlow is core open source library to develop and train the machine learning models.
- Keras API is used with TensorFlow to develop neural network in this project.
- TensorFlow is a dataflow graph with edges as tensor or data and nodes carrying out the mathematical operation.

# Model Used

- Multi layer perceptron (MLP) model is being used in this project.
- MLP is widely used in solving the problems that requires supervised learning which make's it suitable for this project.
- This model consists of 4 hidden layers of 5 neurons in each layer.

# Multi-Layer Perceptron



# Data

- Model Used for Data Collection

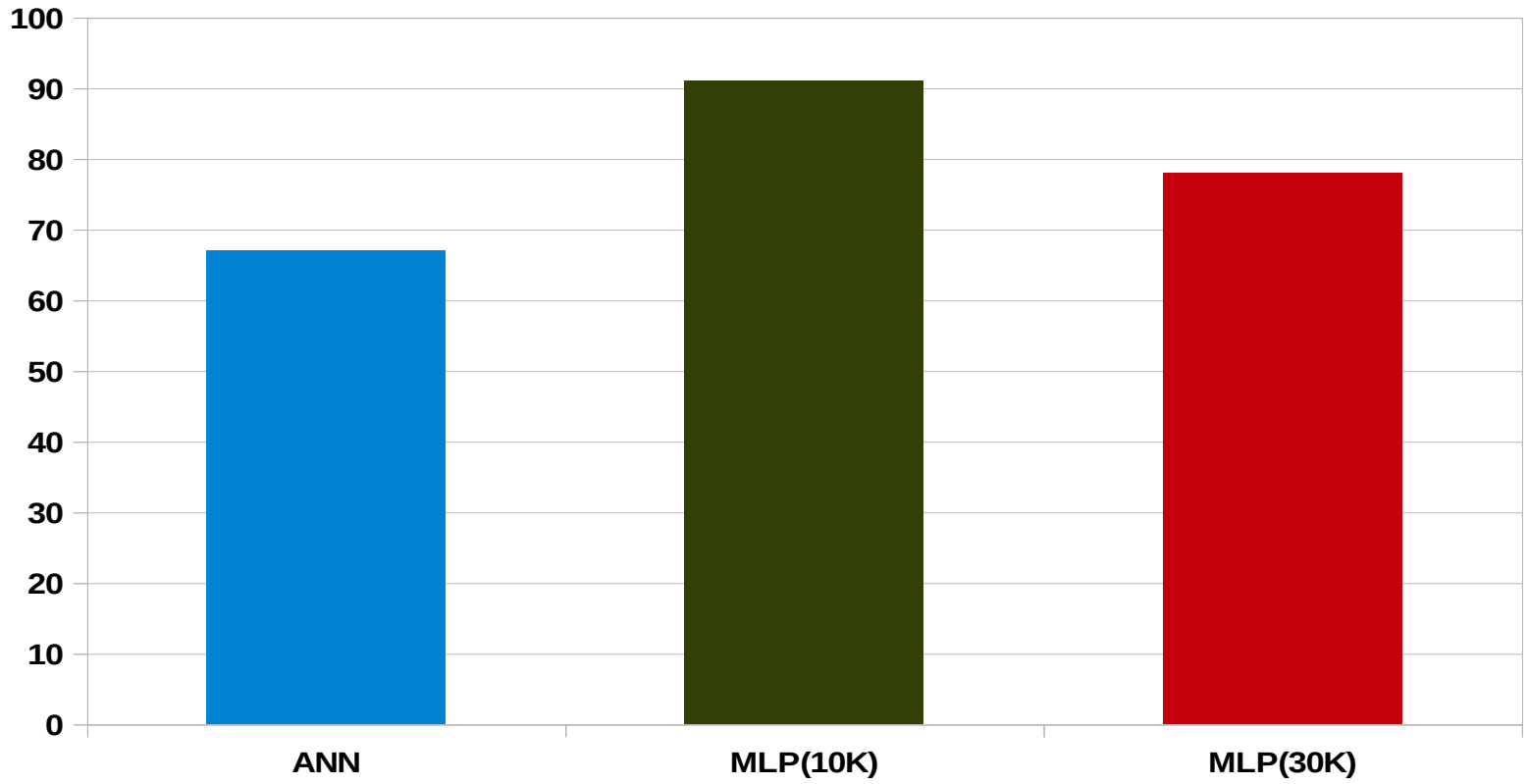
1. OpenFuelCell

    - Took 25 – 120 minutes to generate one single datapoint

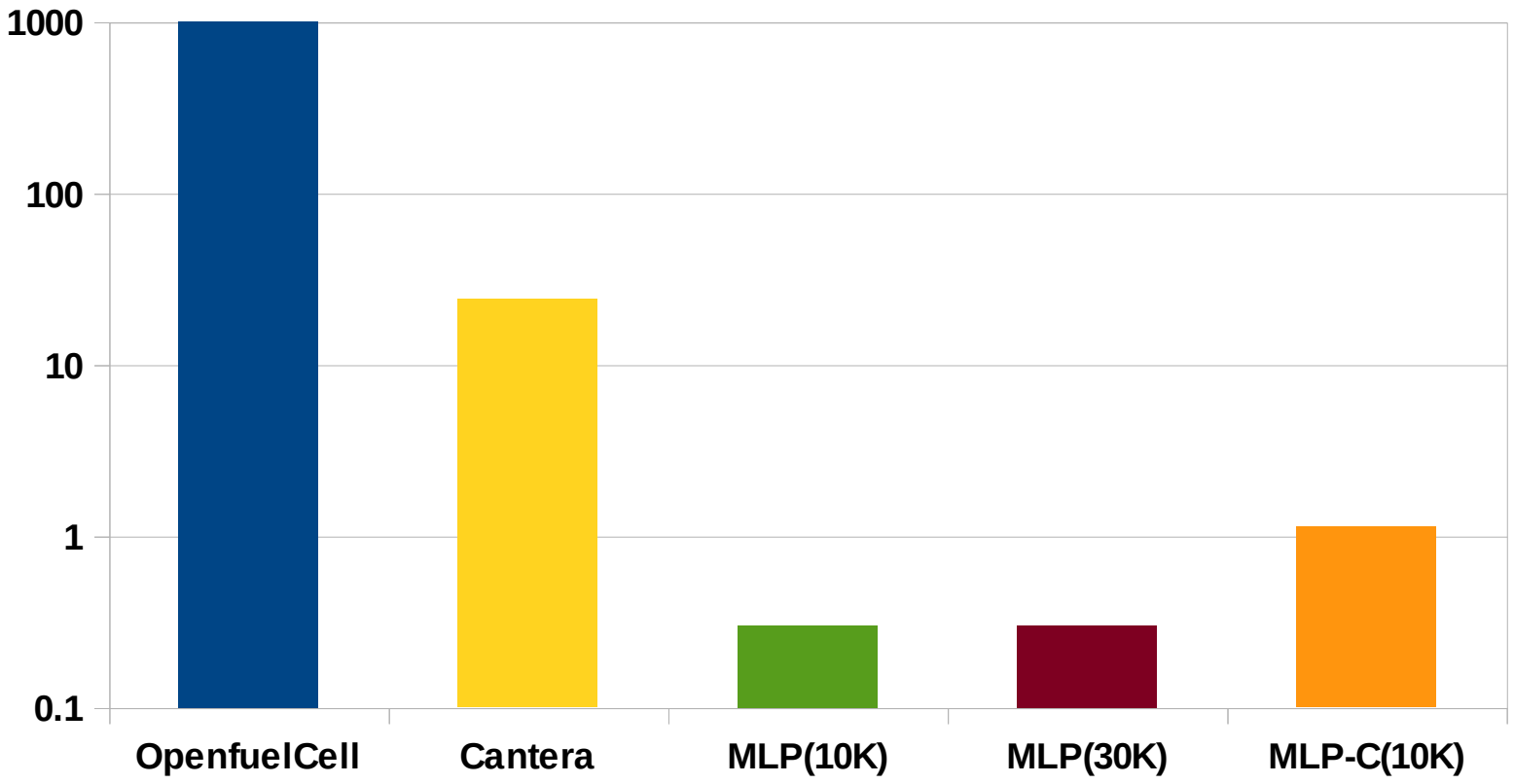
2. Cantera

    - Took 24 minutes to generate 10k datapoints.

# Results | Model vs Accuracy



# Results | Model Vs. Time



# Summary

- Sacrifice some accuracy we can save extensive amount of computation, time and energy.

# References

[1] http://openfuelcell.sourceforge.net/

[2] https://github.com/Cantera/cantera

[3] http://courses.washington.edu/mengr331/

[4] Regarding Solid Oxide Fuel Cells Simulation through Artificial Intelligence: A Neural Networks Application.

[5] Modelling the SOFC behaviours by artificial neural network.