



INGV - Volcanic Eruption Prediction

CS 5665

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Problem



Scientists are monitoring volcanoes with sensors to find if they are close to eruption. They do this by surveying volcanic tremors from seismic signals. The problem is that the patterns from the seismic signals are difficult to interpret. Scientists' current approach helps predict eruptions in a short time period but fails at long time periods.

Approach

Steps I took for Project

1. Download data
2. Create More Features
3. Create Neural Network
4. Train Neural Network
5. Review Results
6. Predict Eruption Times

There are only 10 sensors for a volcano which is only 10 inputs to the neural network. To be able to get more features for the neural network, more information was created from the 10 inputs: sum, standard deviation, variation, etc., to reach 90 features to feed into the neural network.

Data/Task

The task is to predict volcanic eruptions from 10 sensor's data that are setup around a volcano. The table below is the 10 sensor's data for one volcano.

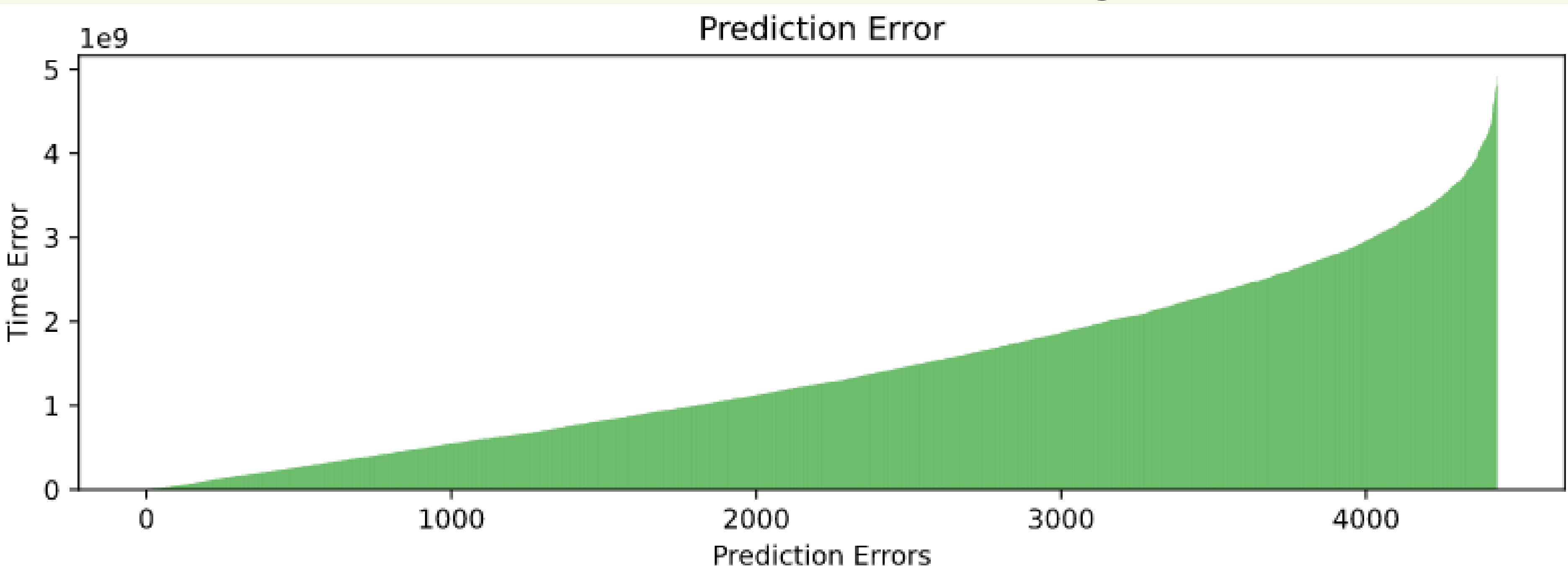
	sensor_1	sensor_2	sensor_3	sensor_4	sensor_5	sensor_6	sensor_7	sensor_8	sensor_9	sensor_10
0	260.0	64.0	-232.0	-36.0	-2.0	-35.0	103.0	389.0	67.0	41.0
1	233.0	175.0	146.0	160.0	-4.0	29.0	-120.0	498.0	59.0	63.0
2	216.0	236.0	321.0	202.0	2.0	113.0	-230.0	554.0	97.0	90.0
3	156.0	205.0	382.0	6.0	12.0	70.0	-228.0	580.0	141.0	122.0
4	158.0	101.0	272.0	-154.0	16.0	45.0	-162.0	624.0	145.0	154.0
...
59996	245.0	75.0	-306.0	307.0	-49.0	118.0	361.0	824.0	-25.0	371.0
59997	248.0	29.0	-398.0	145.0	-29.0	196.0	308.0	892.0	-38.0	408.0
59998	146.0	-100.0	-525.0	10.0	-5.0	344.0	217.0	837.0	-137.0	509.0
59999	86.0	-275.0	-619.0	-72.0	16.0	354.0	171.0	602.0	7.0	648.0
60000	103.0	-313.0	-648.0	-162.0	33.0	527.0	137.0	238.0	-40.0	695.0

60001 rows x 10 columns

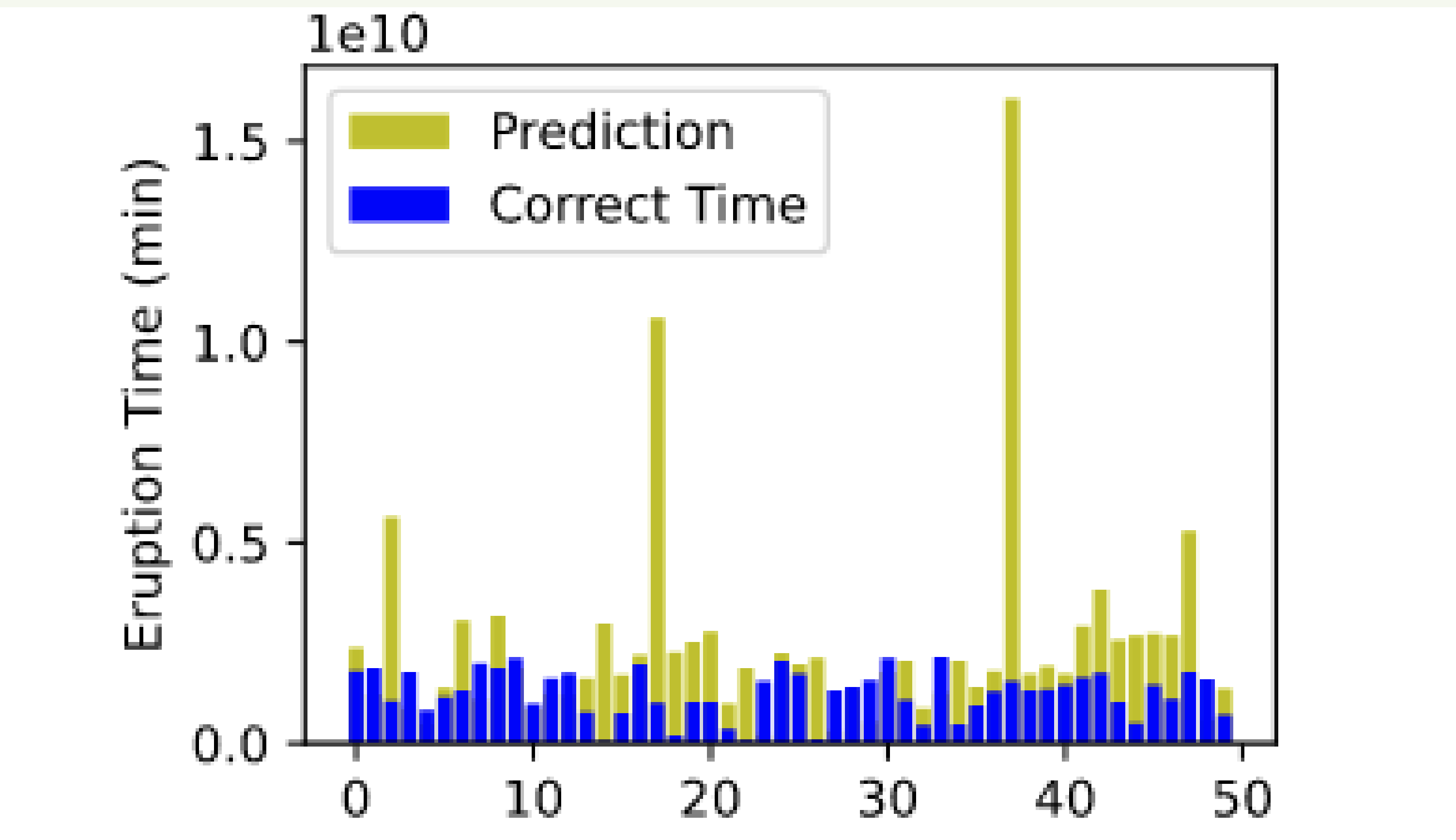
Results

Prediction Error = |Correct Time - Prediction Time|

Max: 4917394832 Min: 96572 Avg: 145082561



Predictions Time vs Correct Time (min)



Source Code

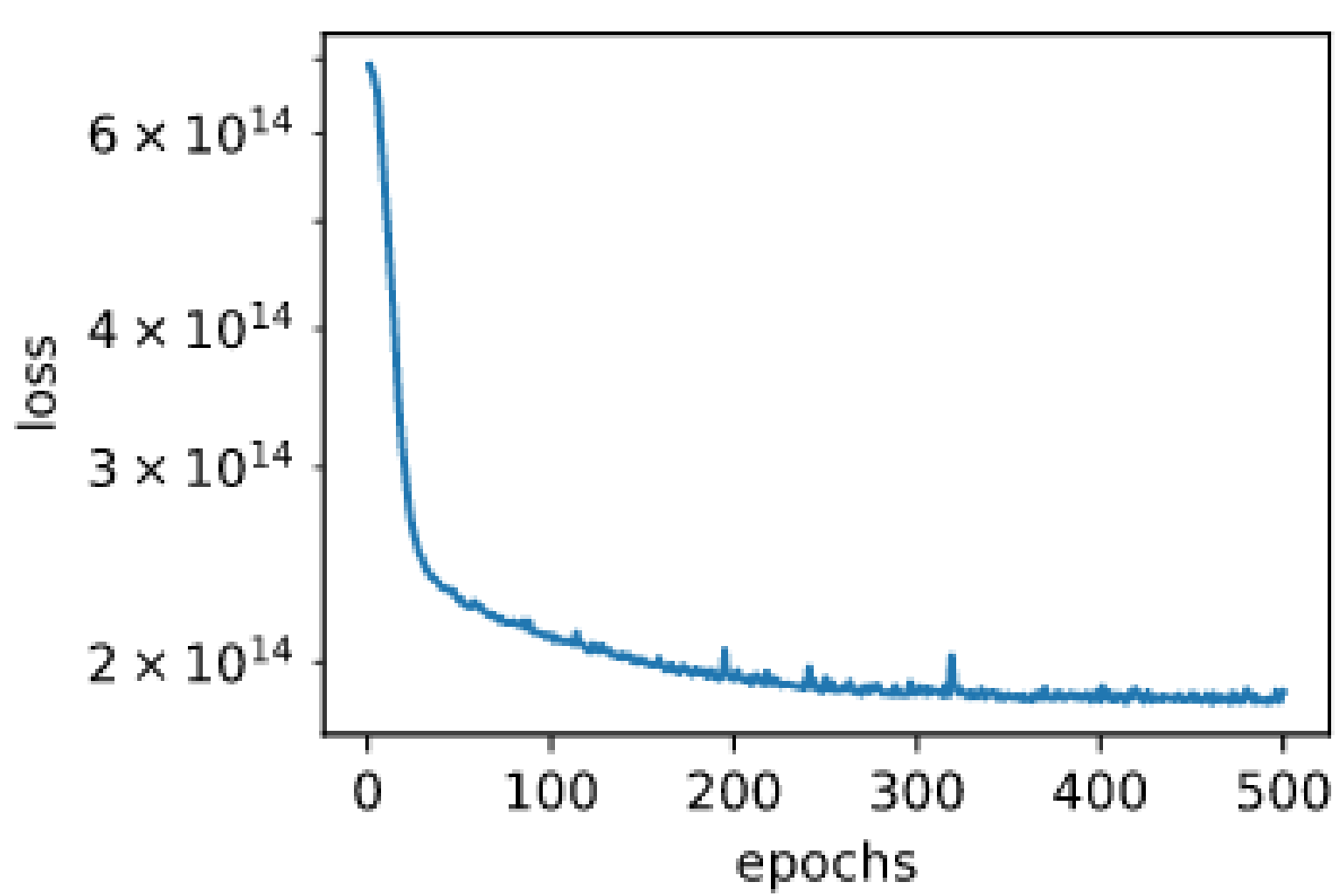
[Colab: File](#)
[Github: Repository](#)

Analysis

Model for Neural Network

```
nn.Linear(90, 75),  
nn.ReLU(True),  
nn.Linear(75, 50),  
nn.ReLU(True),  
nn.Linear(50, 25),  
nn.ReLU(True),  
nn.Linear(25, 1)
```

1. Loss Converging



Conclusions

The neural network was able to learn how to predict a time, but seemed to guess higher and some predictions were way off.

Kaggle Score: 12370277
Kaggle Position: 327

References

- [Kaggle: Eruption Prediction](#)