CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

S1527

Project Title

Mitigating Flood Risk by Predicting River Gauge Heights Using a Neural Network

Abstract

Objectives/Goals

The objective of this experiment was to apply artificial neural networks (ANN) to the prediction of river gauge height two days in the future at a specific station in order to mitigate flood risks and damages. As the current method of flood prediction in the US involves a complex mathematical model, a forecast method involving neural networks could offer an extremely important cost effective alternative to not only the US, but also to developing countries around the world.

Methods/Materials

A java program was developed to prepare input data for three different ANNs for assessing the usefulness of specific types of data. All three were given river and precipitation data, however the first ANN was given additional precipitation forecast data. The second ANN was given additional soil moisture data, and the third ANN was given all of the data types. The best network was compared with the National Weather Service forecast (NWS) model.

Results

Soil moisture was found to be essential to predictions, and including predicted precipitation was found to make a statistically significant improvement in the predictions. The best performing network was compared with the NWS model for the year of 2016. The NWS model reached an accuracy of 97.8%, and the ANN model reached an accuracy of 96.6%.

Conclusions/Discussion

This project supplemented traditional forms of data for the training of neural networks for flood forecasting with soil moisture data and precipitation forecast data, and found that both proved to be valuable. In comparing with a current model, the NWS model, the ANN model reached a comparable level of accuracy. While the NWS model requires vast amounts of processing power and data, the ANN model can predict with comparably less processing power and data. Thus, in countries or areas where a supercomputer cannot be afforded, or the vast amounts of data for a mathematical model are not available, the neural network serves as a very important cost effective alternative.

Summary Statement

This project succeeded in utilizing artificial neural networks for flood forecasting, overall managing to predict future water levels with a 96.6% accuracy rate for the year of 2016.

Help Received

Parent helped with code review of the data parsing program.