Comparing Precipitation Prediction between Regression Machine Learning Algorithms

Occam's Razor: Vivian Nguyen, Revanth Sai Kumar Reddy Patel, Samyam Shrestha, Jason Yoo

Introduction

Our group chose to explore regression machine learning algorithms to predict the amount of precipitation in Nebraska. Being able to predict precipitation accurately is important for several different reasons. Agriculture relies heavily on precipitation for crop growth and irrigation practices. Places that experience droughts need to know how much rain will be expected for preparation. Natural disaster prediction, such as tsunamis or hurricanes, would benefit from having accurate precipitation prediction. Construction projects need to know when it will rain to ensure proper planning. Overall, precipitation can affect the quality of human life in positive and negative ways, and being able to improve upon prediction using machine learning algorithms would benefit the well-being and safety of society.

Precipitation is responsive to particular variables such as pressure, wind, relative humidity, dewpoints, locations, and elevations. However, predicting precipitation can vary from different machine learning algorithms. Therefore, this research aims to find which machine learning algorithm has better predictions by answering these questions:

1. What variables affect precipitation?
2. Do the models we reviewed perform well on out-of-distribution data?
3. How does prediction accuracy vary from different machine learning algorithms?

Our data compiles airport weather data on the Iowa Environmental Mesonet through Iowa State University. The dataset includes air temperature, dew points, 1hour precipitation, cloud coverage, and so on. The full list and other information for the dataset can be found here:
https://mesonet.agron.iastate.edu/request/download.phtml?network=NE_ASOS

Related Works

Grace, R. K., & Suganya, B. (2020, March) used a Multiple Linear Regression model which took in multiple meteorological parameters to predict precipitation. Mean Square Error (MSE), correlation and accuracy were used as the performance parameters to validate the efficiency of their model. They found that their model showed better results than the other works that they had included in their literature with a 99% accuracy on their data.

Larraondo, P. R. et al., (2019) showed that encoder-decoder CNNs can be used to improve upon precipitation prediction, instead of Numerical Weather Prediction (NWP) models that require domain-specific knowledge. They only used geopotential height as input and achieved an accuracy similar to NWP models, which require a multitude of different input variables, to show that even the simplest CNN can be used instead.

Oswal, N. (2019) compares various evaluation metrics of machine learning techniques and their reliability in predicting rainfall by analyzing the Australian weather dataset. Their input variables were date, location, temperature, rainfall, etc. This research implemented Logistic Regression, Decision Tree, K Nearest Neighbor, Rule-based, and Ensembles models. For the result, they compared different datasets such as the original dataset, undersampled dataset, and oversampled dataset. They also compared different models to compare accuracies.

Sasikala, V. et al., (2020) talked about dataset preprocessing techniques to reduce noise, and redundancy and make it compatible with various classifiers & ML models for predicting weather and compared the efficiencies of these models along with their complexity.

References

Grace, R. K., & Suganya, B. (2020, March). Machine learning based rainfall prediction. In 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS) (pp. 227-229). IEEE.

Larraondo, P. R., Renzullo, L. J., Inza, I., & Lozano, J. A. (2019). A data-driven approach to precipitation parameterizations using convolutional encoder-decoder neural networks. arXiv preprint arXiv:1903.10274.

Oswal, N. (2019). Predicting rainfall using machine learning techniques. arXiv preprint arXiv:1910.13827.

Sasikala, V., Venkatramaphanikumar, S., Babu, P. A., Kumar, M. E., & Krishna, N. G. (2020). Weather Predictive System using Machine Learning Algorithms. Journal of Xi'an University of Architecture & Technology, 12(VI).