

Analyzing Environmental Influences on Corn Yield: A Data-Driven Study in Champaign, Illinois

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Abstract

Project proposal

Environmental factors significantly impact agricultural production. Factors such as precipitation, humidity, temperature, fertilization, and soil properties all influence agricultural yield. Therefore, it is crucial to investigate these factors and identify patterns in agricultural yields based on accessible data.

In this project, we aim to replicate Hartmut Bossel's 'Field Crop Cultivation' simulation model as a white-box reference and develop a black-box model using SVD, PCA, and Fourier series. The original model was created in BASIC (Hartmut, 1985) and Vensim (Hartmut, 2007) for educational purposes, the model simulates the impact of water and nutrient (Nitrogen) availability on plant growth dynamics. Constructed from first principles, it captures the complex interactions between water and nutrient dynamics and can be adapted to different scenarios by assigning local plant and soil parameters.

Our goal is to create a second model that provides predictions similar to the reference model, while approaching the system from a different perspective. By using the simulation model as reference, we can test and improve our black-box model in a controlled environment to ensure accuracy.

Data description

The dataset we plan to use is the meteorological records of Champaign, Illinois. We want to predict corn yield by analyzing precipitation and temperature. Data will be obtained from wunderground.com (Savoy, IL Weather History | Weather Underground). And daily temperature and the annual precipitation amount would be needed. The format would be primarily in CSV. The four columns will be temperature (including max, avg and min) and precipitation every day, while the rows will be the date for a whole year.

References

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Hartmut Bossel. (1985). Umweltdynamik - 30Programme für kybernetische Umwelterfahrungen auf jedem BASIC-Rechner. Tewi Verlag