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Progress in a New Visualization Strategy for ML Models

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A Mid-Project Summary of Design and Ongoing Problems

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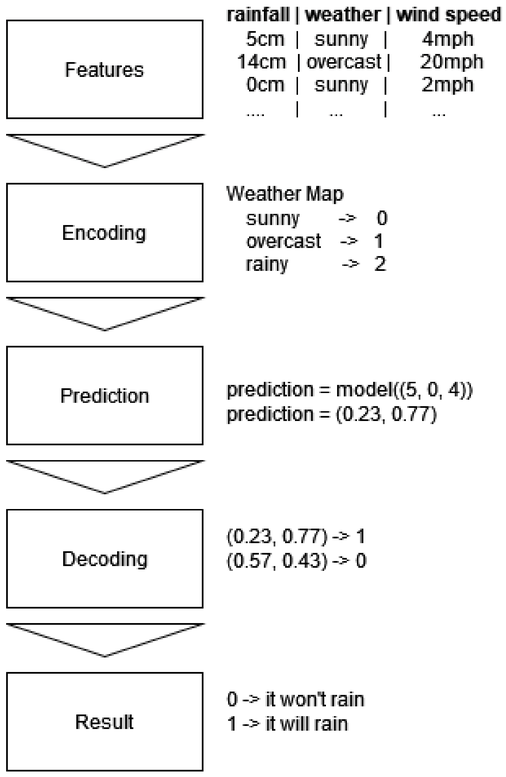
Background

Overview of ML Models

Machine Learning Models are trained on datasets which are encoded into numbers. The models are then evaluated for effectiveness, eventually yielded a model which can somewhat accurately make predictions based on correlations from the input.

Machine Learning Models take a set of features, or categories of data, and encode them into numbers; a model then is able to be sent information to make predictions. After a prediction is made, it must be interpreted via decoding. This then leads to a result.



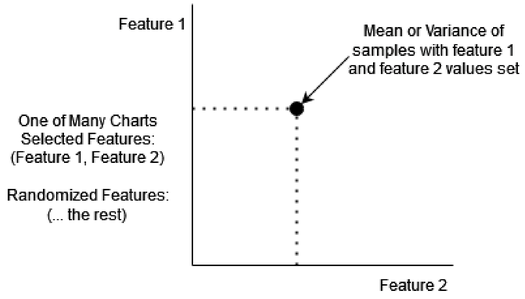
Visualization

Main Idea

This visualization strategy takes two selected features and draws a graph with the model's output embedded in a color gradient.

At a coordinate (feature 1, feature 2), the model can be ran by generating random, acceptable values for additional features. The model is polled a number of times, each time with the selected features remaining the same, but other features randomly generated. Model output is aggregated in a arithmetic mean value.

This mean value is used as the third dimension in the graph, the color gradient.

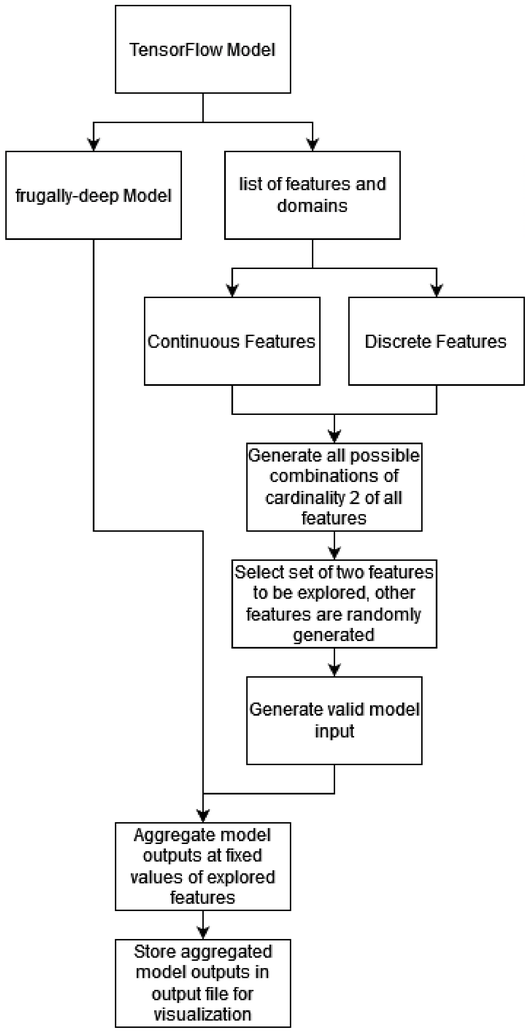


Usefulness of Visualization

Explores Model's Learned Boundary Lines

Decision Tree models create linear, single-axis boundaries, but most other models, including deep-learning models create non-linear boundaries. The goal of this visualization is to find and show those boundary lines as they exist in a relation between two features.

Design



Visualization

D3.js is used to create a heatmap, a cell a coordinate whose color is determined by a linear interpolation along a gradient using the mean.

Challenges

- Achieving linguistic performance and memory control when models originate from Python-based Tensorflow programs
  - Resolved with the frugally-deep github repository and using C++ to generate visualization data
- Learning about ML and how it's organized just before and just after a prediction is made
  - Talking with my team members and experimenting with the model in Python and C++ has given me a better understanding of machine learning
- .Managing different types of input (Discrete vs Continuous)
  - An incremental approach was used to explore the continuous space, represented using floating-point values. The discrete values are only calculated once if not matched with a continuous, saving runtime

Work In-progress

- Incremental Variance Algorithm alongside arithmetic mean
- Expanding visualization technique beyond binary models
- Managing inter-feature constraints during random generation and feature selection
- Usage of this visualization technique to explore a model trained on the Iris dataset

Acknowledgements

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