Probe-AI

Visual Analytics based ML Model Interpretation System

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Introduction

- Machine Learning is used everywhere today.

- Model interpretability is crucial for building trust in machine learning systems and ensuring they are used ethically.

- Probe-AI is a visual analytics tool that helps users understand complex machine learning models by identifying and interpreting different model strategies.

Related Work

- Post-hoc explanation methods: LIME and SHAP are popular examples and are not model specific but they give only local interpretation.
- iForest (Interpretable Random Forest) is a visual analytics tool that enables the interpretation of predictions made by Random Forest models.
- Gamut is a visual analytics tool designed to understand how data scientists interpret additive models.
- StrategyAtlasis a visual analytics approach for understanding complex machine learning models by identifying and interpreting different model strategies using a projection-based StrategyMap visualization.

Data Used

- The primary dataset used is the Breast Cancer Wisconsin (Diagnostic) which contains 569 instances and 32 features, out of which 19 are used while training ML model.
- LIME algorithm is used to obtain feature contribution vectors for each instance in the dataset.
- The feature contribution vectors are represented by weights assigned to each feature, with positive indicating positive impact and negative indicating negative impact on the prediction.
- Real data and feature contribution values are scaled to have values between 0 and 1 for effective comparison and interpretation of feature contributions.
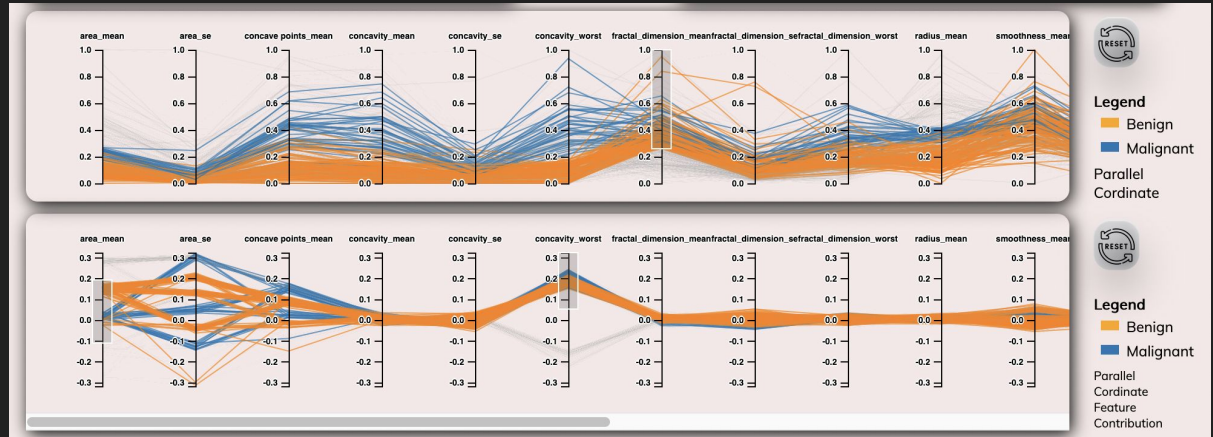
Visualizations

Scatter Plots:
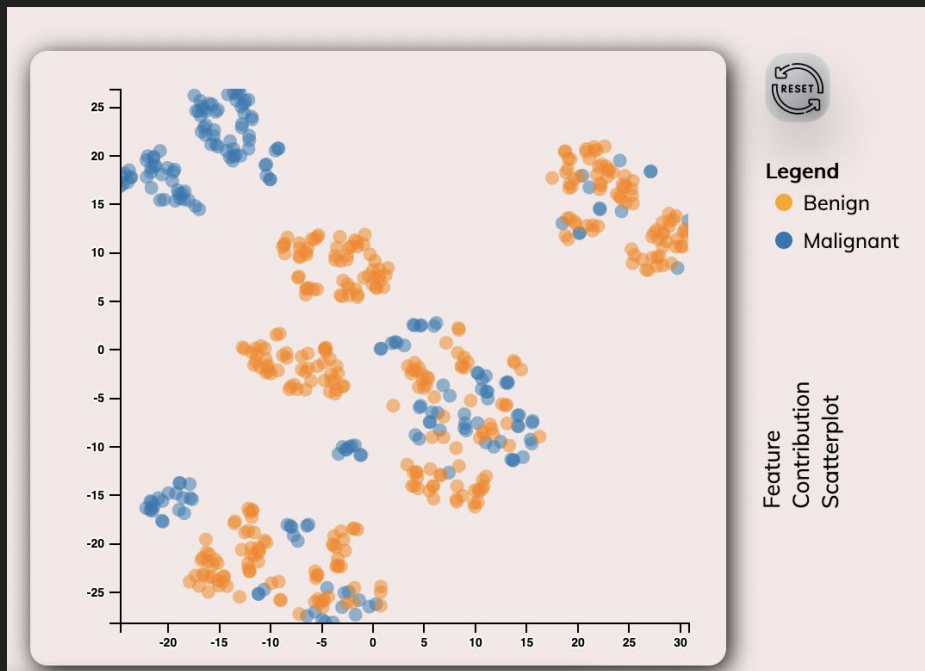
- Scatter plots are a type of visualization that allows us to represent two or more variables in a two-dimensional space.

- t-SNE ,a dimensionality reduction technique is applied on data to display in scatterplots.

- We use it identifying the clusters in feature contribution data.

- Data points in clusters are assumed to be treated in similar way by model.
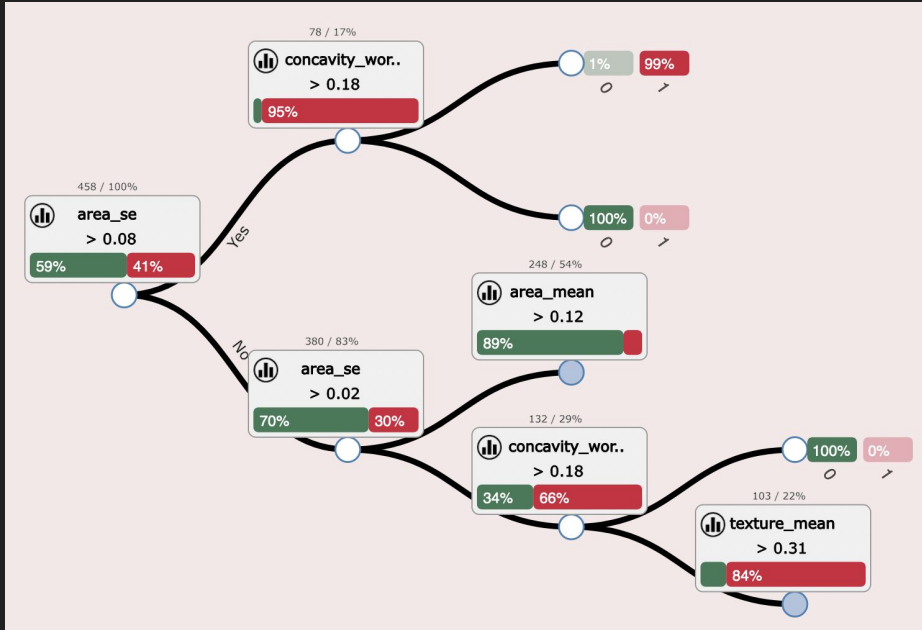
Visualizations

Parallel Coordinates:

- Parallel coordinates are a type of visualization technique used to plot multidimensional data. The technique involves plotting each data point as a polyline along parallel axes

- Parallel Coordinates are used to find patterns on a high level between real data and feature importance vectors.

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Visualizations

Tree Plots:

- Tree visualization is a common technique used to represent hierarchical structures, such as decision trees.

- We use it to display the rules used by our decision tree algorithm to differentiate between clusters selected in Feature contribution scatterplot

Conclusion

- Probe-AI is a visual analytics approach for getting global interpretation of complex ML models

- Identifies and interprets different model strategies and uses decision tree to display them

- Allows for easy identification of relationships and patterns in feature contribution vectors and real data

- Can be used with more complex datasets and different models to discover the full capabilities of the system.

Future Work

- Make it compatible for regression problems

- Improve the system by making it compatible with any datasets and any models.

- incorporating new visualization techniques such as KDE, heat maps to give more granular level information about the data.

Thank you

GitHub link :
https://github.com/hussainmujtaba7/Machine-Learning-Interpretability-using-Visual-Analytics