GBEx – towards Graph-Based Explanations

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Outline

1. Introduction
2. Implementation and Experiments
3. Conclusions and Future Work
Black-box models

Input → Black-Box Machine Learning Model → Output
Why do we need explanations?

Source: "Why Should I Trust You?": Explaining the Predictions of Any Classifier.
Trade-off between explainability and accuracy

Source: Characterising risk of in-hospital mortality following cardiac arrest using machine learning: A retrospective international registry study.
State-of-the-art methods
Implementation and experiments
Main equation

\[ \hat{y} = W^1 \mu^1 + W^2 \mu^2 + \beta \]  \hspace{1cm} (1)

where:

- \( \hat{y} \) – the vector to approximate or explain.
- \( W^1 \) – the input matrix of arguments.
- \( \mu^1 \) – the vector of nodes importance.
- \( W^2 \) – the input matrix of connections.
- \( \mu^2 \) – the vector of edge importance
- \( \beta \) – the base value.
Solving the equation

- Splitting equation in two parts
- Using heuristic methods
- Combine it into one big equation to solve

\[ W^0 = [W^1 \ W^2] \]  \hspace{1cm} (2)

\[ \mu^0 = \begin{bmatrix} \mu^1 \\ \mu^2 \end{bmatrix} \]  \hspace{1cm} (3)

The Equation 1 could be transformed to the following form:

\[ \hat{y} = W^0 \mu^0 + \beta \]  \hspace{1cm} (4)
Preparing data and presenting results

Preparing data

- GBEx can handle only categorized data
- To approach real numbers as input we performed clustering

Presenting results

- Single case - bar-chart, heatmap
- Single case - graph
- General explanation - pie-chart, heatmap
- General explanation - graph
Values achieved in experiment

- Date = 24.12.2011
- Ground truth = 1011.
- MLP Regressor = 2026.
- Base value = 3624.
- GBEx = 1939.
- GBEx (without interactions) = 2274.
Single case explanation - bar chart
Single case explanation - heatmap
Single case explanation - graph
General explanation - pie chart
General explanation - heatmap
Feature analysis

(a) 5 clusters.

(b) 10 clusters.

(c) 15 clusters.
Conclusions and Future Work

Future Work

- Work on scalability and efficiency of the algorithm
- Verify explainability on some real life example with users
- Research some methods to obtain optimal number of clusters
The End

Thank you for your attention!
Any questions?

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