XAI.PY

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NAME

xai.py - explainable multi-objective optimization using decision trees

SYNOPSIS

./xai.py [*OPTIONS*] [*ACTION*] [*FILE*]

DESCRIPTION

xai.py is a lightweight, zero-dependency Python framework for multi-objective optimization. Unlike "black box" AI models, it focuses on interpretability by generating decision trees that isolate the "best" outcomes ("heaven") from the rest. It uses a recursive partitioning algorithm ("backpacking" code style) to cluster data, maximizing the separation between high-scoring and low-scoring rows based on weighted Euclidean distance to specific goals.

DATA FORMAT

The input must be a CSV file. The first row (header) defines column roles using casing and suffixes:

[A-Z]* (Starts with Uppercase) Numeric columns (e.g., "Age", "Weight").

[a-z]* (Starts with Lowercase) Symbolic/Categorical columns (e.g., "job", "color").

name+ (Ends with +) A numeric goal to **maximize** (e.g., "Salary+").

name- (Ends with -) A numeric goal to **minimize** (e.g., "Cost-").

nameX (Ends with X) A column to **ignore** (e.g., "idX").

? Denotes a missing value in the data.

OPTIONS

Configuration flags control the internal algorithms.

-b *bins* Set the number of bins for discretizing continuous values. Default is **7**.

-B *Budget* Set the max number of rows to evaluate during optimization. Default is **30**.

-C *Check* Set the number of guesses to check during stochastic search. Default is **5**.

-d *file* Set the default data file to load. Default is **data.csv**.

-h Print the help message and exit.

-l *leaf* Set the minimum size for leaf nodes. The tree stops growing if a node has fewer than *2 * leaf* rows. Default is **2**.

-s *seed* Set the random number generator seed. Default is **1**.

ACTIONS

Action flags trigger specific analysis routines.

--all Run all test suites and examples.

--bins Show the rankings of bins found in the data.

--clone Test internal table replication logic.

--csv Test the CSV loader; prints raw parsed rows.

--data Test column generation; prints column statistics.

--distx Sort/print rows by distance to a specific row (independent vars).

--disty Sort/print rows by distance to "heaven" (dependent goals).

--num Run unit tests for the **Num** class.

--sym Run unit tests for the **Sym** class.

--tree Run the decision tree optimizer once and display the rule hierarchy.

--xais Run the optimizer 20 times and display stability statistics.

EXAMPLES

Generate a decision tree for a custom dataset:

 ./xai.py --tree data/auto93.csv

Run stability analysis with a specific seed:

./xai.py -s 12345 --xais

Debug data parsing:

./xai.py --csv data.csv

AUTHOR

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LICENSE

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