SLISEMAP

SUPERVISED DIMENSIONALITY REDUCTION THROUGH LOCAL EXPLANATIONS

Anton Björklund, Jarmo Mäkelä, Kai Puolamäki.
SLISEMAP: Supervised dimensionality reduction through local explanations.
arXiv: 2201.04455 [cs] (2022). DOI: 10.48550/arXiv.2201.04455.

`https://github.com/edahelsinki/slisemap`

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BACKGROUND

SLISEMAP = Supervised dimensionality reduction + Local explanations

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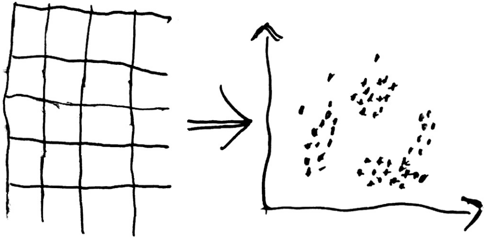
Dimensionality reduction



Dimensionality reduction can be used for manifold visualisation.

SLISEMAP = Supervised dimensionality reduction + Local explanations

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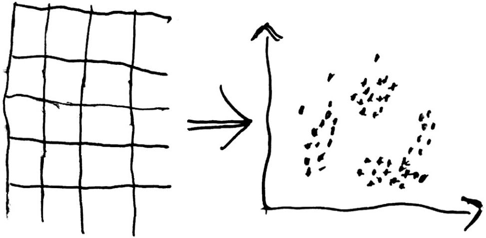

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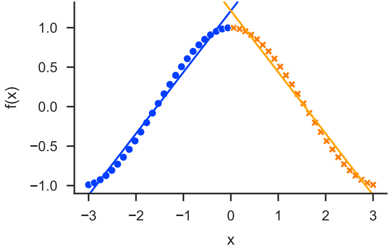
Local Explanations



We can approximate this non-linear function with two local linear models.

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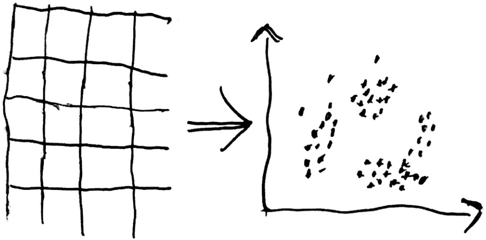
Dimensionality reduction



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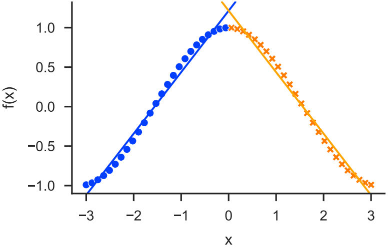
Local Explanations



We can approximate this non-linear function with two local linear models.

SLISEMAP = Supervised dimensionality reduction + Local explanations
– *"Find an embedding such that data items with similar local models are next to each other".*

PROBLEM DEFINITION

- Given a dataset of n items: $(\mathbf{x}_1, \mathbf{y}_1), \ldots, (\mathbf{x}_n, \mathbf{y}_n)$.
- Find the embedding coordinates $\mathbf{z}_1, \ldots, \mathbf{z}_n$ and local models $g_1, \ldots, g_n$.
- That minimises the loss:

$$\mathcal{L} = \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{e^{-\|\mathbf{z}_i - \mathbf{z}_j\|_2}}{\sum_{k=1}^{n} e^{-\|\mathbf{z}_i - \mathbf{z}_k\|_2}} l(g_i(\mathbf{x}_j), \mathbf{y}_j)$$

- Where l is a loss function for the local models.
- Under the constraint that $(\frac{1}{n} \sum_{i=1}^{n} \sum_{k=1}^{d} \mathbf{z}_{ik}^2)^{\frac{1}{2}} = z_{radius}$.

Usage

Installation

```
pip install slisemap
```

Code

```python
from slisemap import Slisemap
# Use Lasso regularisation
sm = Slisemap(X, y, lasso=0.01)
# Remember to optimise
sm.optimise()
# Plot the solution
sm.plot(clusters=5, bars=5,
    jitter=0.01, variables=names)
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USAGE

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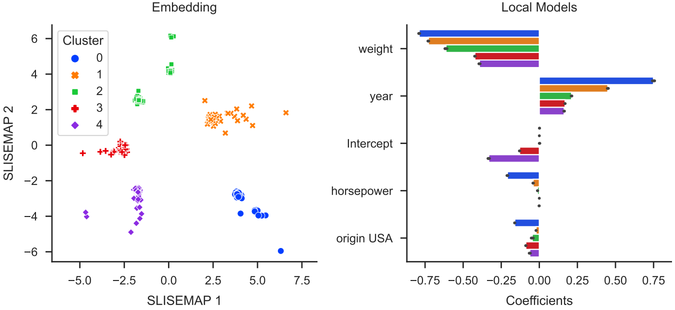
Plot



Cluster the local models to make them easier to read (using a dataset about cars).

SUMMARY

SLISEMAP is a novel supervised manifold visualisation method that embeds data items into a lower-dimensional space such that the same white box model models nearby data items.

A. Björklund, J. Mäkelä, K. Puolamäki.
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