ARTS1422——HW2

包佳诚 2021533098

Step1 Data Preparation & discription

We will be working with the famous “Iris” dataset that has been deposited on the UCI machine learning repository (https://archive.ics.uci.edu/ml/datasets/Iris). (but I use `sklearn.datasets import load_iris` to get it)

The iris dataset contains measurements for **150** iris flowers from three different species.

The three classes in the Iris dataset are:

- Iris-setosa (n=50)
- Iris-versicolor (n=50)
- Iris-virginica (n=50)

And the four features of in Iris dataset are:

- sepal length in cm
- sepal width in cm
- petal length in cm
- petal width in cm

Step2 The methodology used for dimensionality reduction

- PCA
- t-SNE
- MDS

Step3 An evaluation of the different methods

PCA:

- Linear dimensionality reduction, preserving the direction in which the variance of the data is greatest
- Suitable for data compression, noise removal, visualization
- Simple and efficient, but unable to capture nonlinear relationships

t-SNE:

- Non-linear dimensionality reduction, preserving the local structure of high dimensional data
- Good at high-dimensional data visualization, display clustering effect
- The calculation cost is high, and the parameter selection needs to be careful

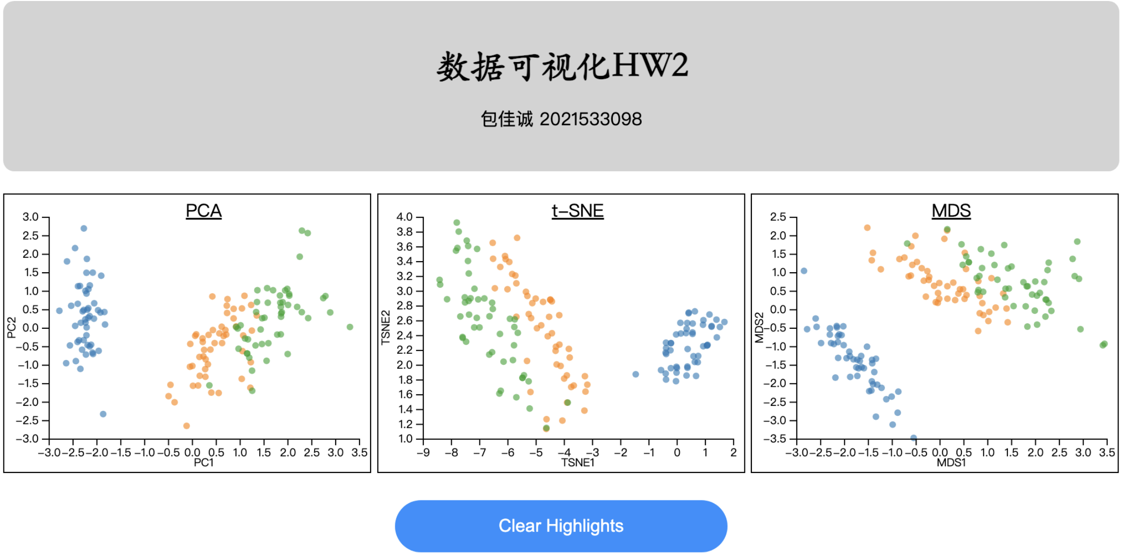
MDS:

- Dimensionality reduction method aiming to visualize data similarities/dissimilarities in a lower-dimensional space.
- Begins with a similarity/dissimilarity matrix representing pairwise relationships between objects.
- Seeks a configuration of points in lower dimensions while preserving original pairwise distances.

According to figures:

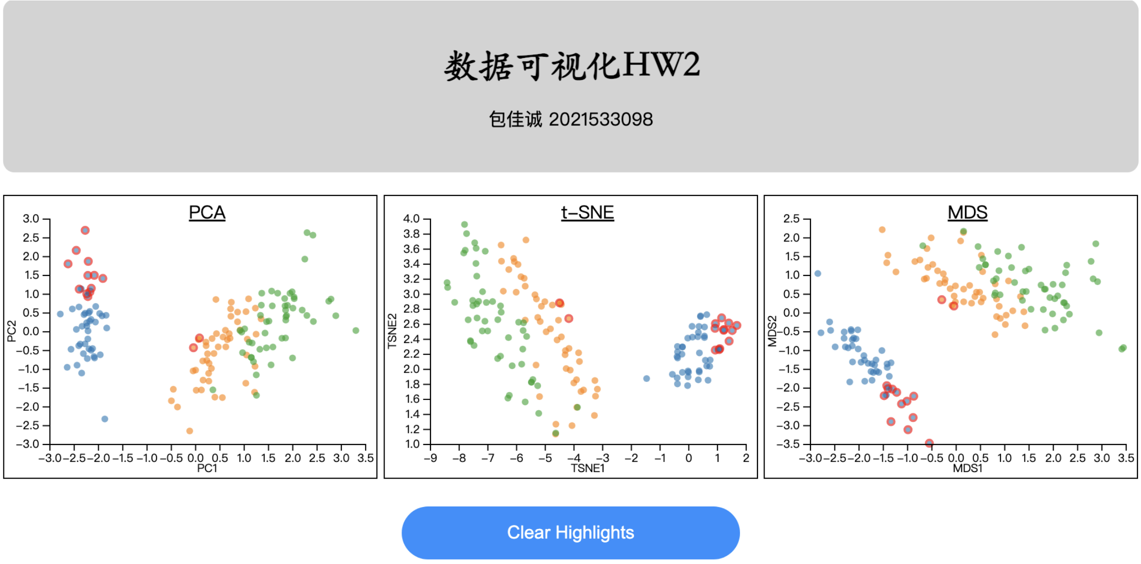
- PCA is good at separating Setosa classes, but not fully separating versicolor and virginica classes with nonlinear superposition.
- t-SNE: Retaining local structure, three classes form compact and clearly separated clusters, Versicolor and Virginica clusters overlap a little but are largely separate.
- MDS: MDS reveals the underlying similarities or dissimilarities between classes by transforming high-dimensional data into a lower-dimensional space. Setosa classes are completely separated, Versicolor and Virginica classes are also well separated but still overlap more than t-SNE method.

Step4 screenshots of visualization result



数据可视化HW2

包佳诚 2021533098



数据可视化HW2

包佳诚 2021533098

- You can click the dots and corresponding dots will also be highlighted in other graphs. Click the highlighted dot will erease the highlighted corresponding dots.
- The button Clear Highlights will help you clear all the highlighted dots.