Barcelona Supercomputing Center
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EXCELENCIA SEVERO OCHOA

Distributed machine learning with dislib

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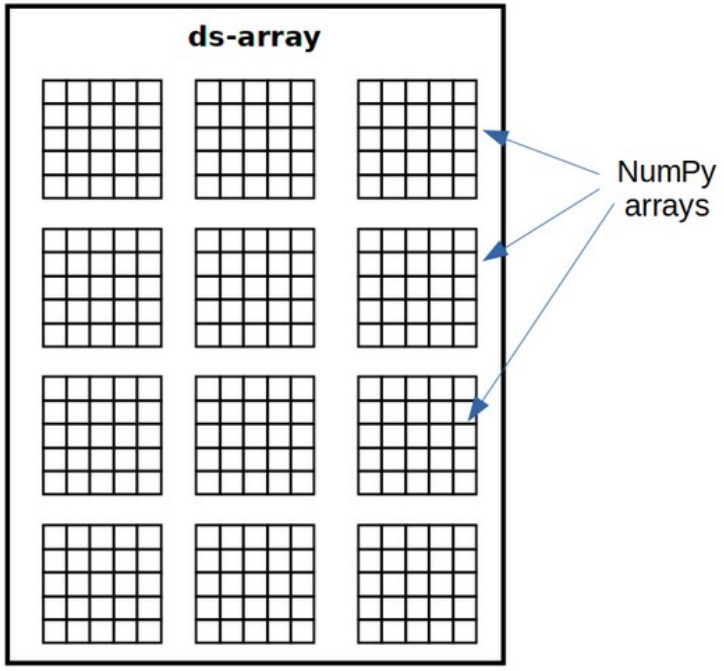
dislib | distributed computing library

- Built on top of PyCOMPSs
- Distributed array
  - similar to NumPy
- Distributed machine learning models
  - similar to scikit-learn

Distributed arrays

- 2-dimensional structure (i.e., matrix)
  - Divided in blocks (NumPy arrays)
- Work as a regular Python object
  - But not stored in local memory!
- Internally parallelized with PyCOMPSs:
  - Loading data (e.g., from a text file)
  - Indexing (e.g., x[3], x[5:10])
  - Operators (e.g., x.min(), x.transpose())

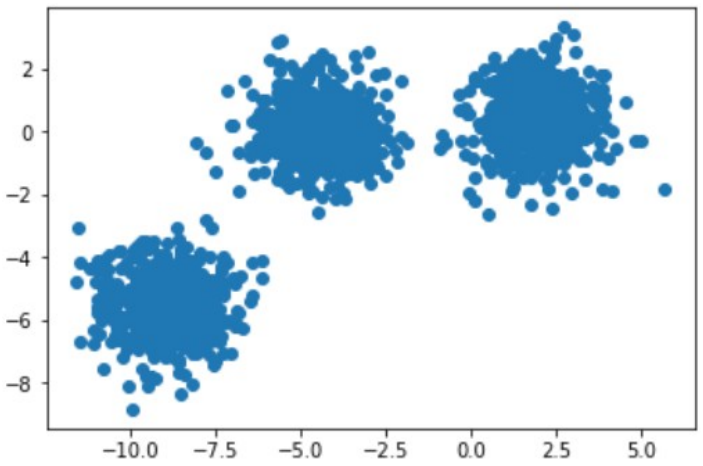


Machine learning basics

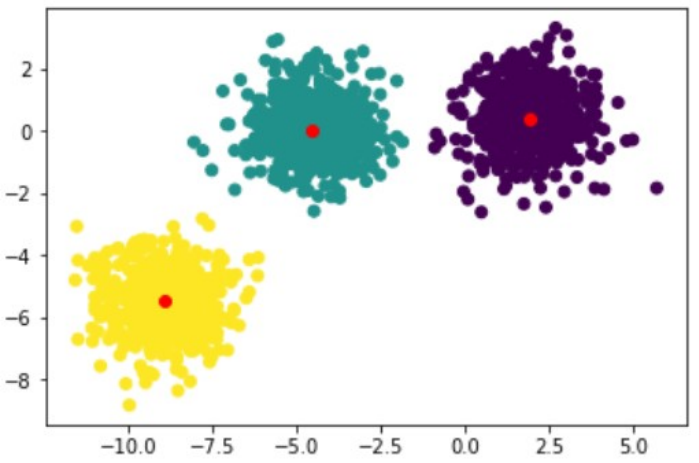
- Unsupervised:
  - Find unknown patterns in (unlabeled) data
  - Example: clustering

- Supervised:
  - Learn a decision function from labeled data
  - Example: classification

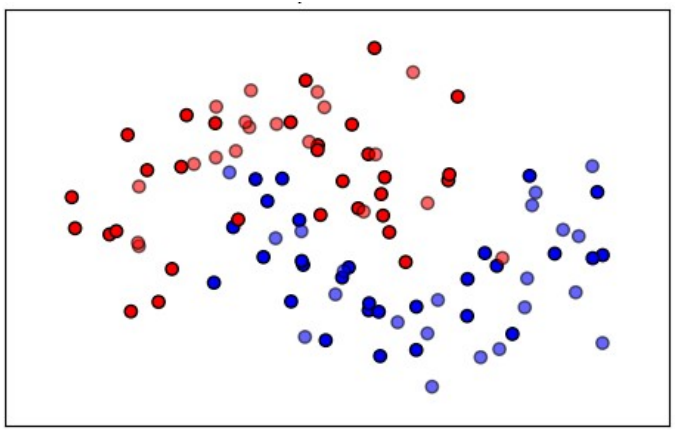
Clustering



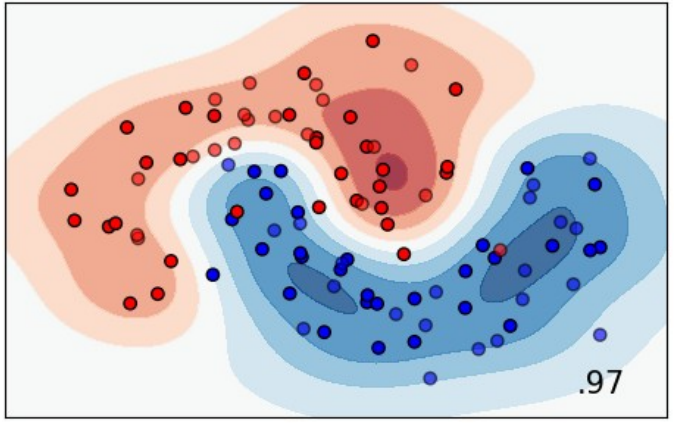
Unlabeled data



Classification



Labeled data



Estimators

- Based on scikit-learn
- Estimator = anything that learns from data (labeled or unlabeled)
- Two main methods:
  - `fit` → learns something from data (e.g., a decision function)
  - `predict` → provides new information based on a fitted model (e.g., labels data based on the computed decision function)

Typical workflow

1. Read input data from file/s

```
x = load_txt_file("train.csv", (10, 780))
x_test = load_txt_file("test.csv", (10, 780))
```

2. Instantiate estimator with parameters

```
kmeans = KMeans(n_clusters=10)
```

3. Fit estimator with training data

```
kmeans.fit(x)
```

4. Make predictions on test data

```
kmeans.predict(x_test)
```

Supported algorithms

- Supervised:
  - Support vector machines
  - Random forests
  - Linear regression
  - ALS
- Unsupervised:
  - K-means
  - DBSCAN
  - K-nearest neighbors
  - Gaussian mixtures
  - PCA

dislib notebook

```
git clone https://github.com/bsc-wdc/dislib.git
cd dislib
pycompss init -i compss/compss-tutorial:2.6
pycompss jupyter notebooks
```