23 – 25 July 2018

Lviv Data Science Summer School 2018

Machine Learning for Medical Applications:

Algorithms

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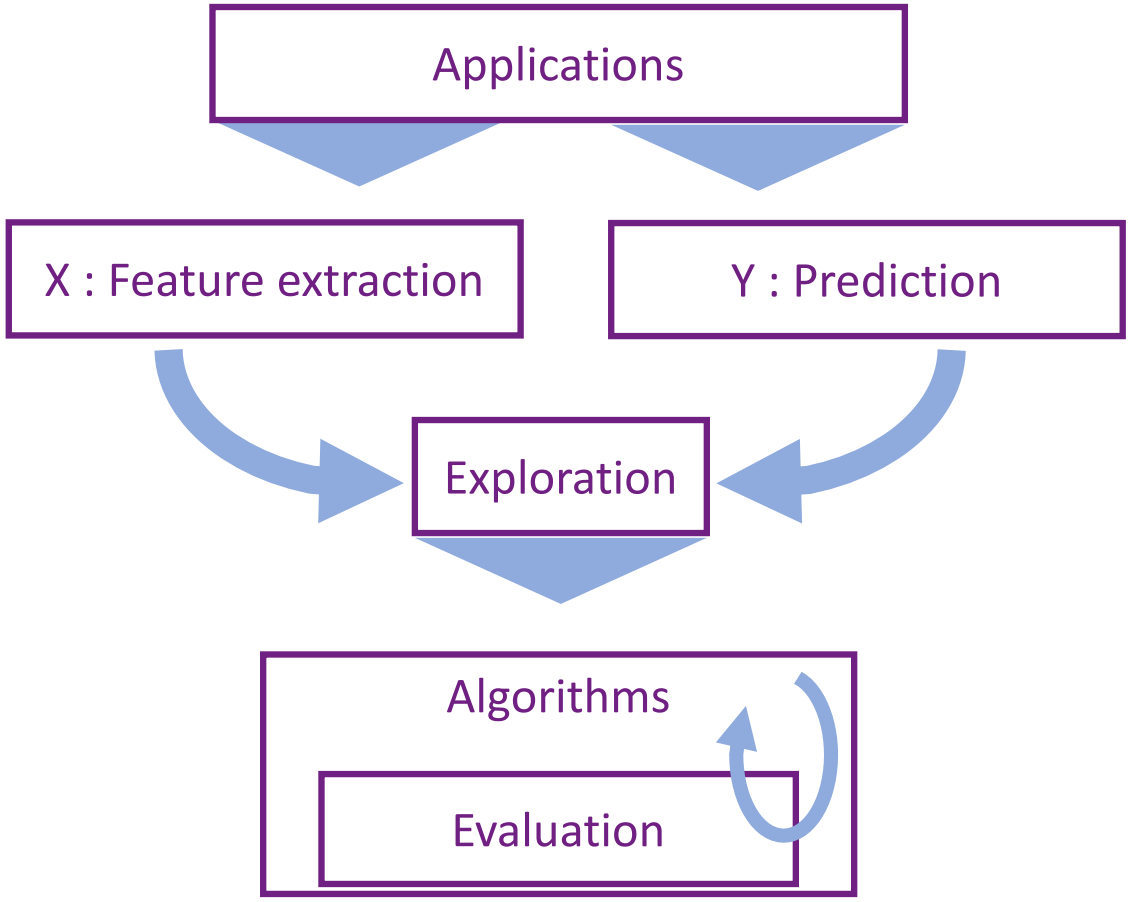
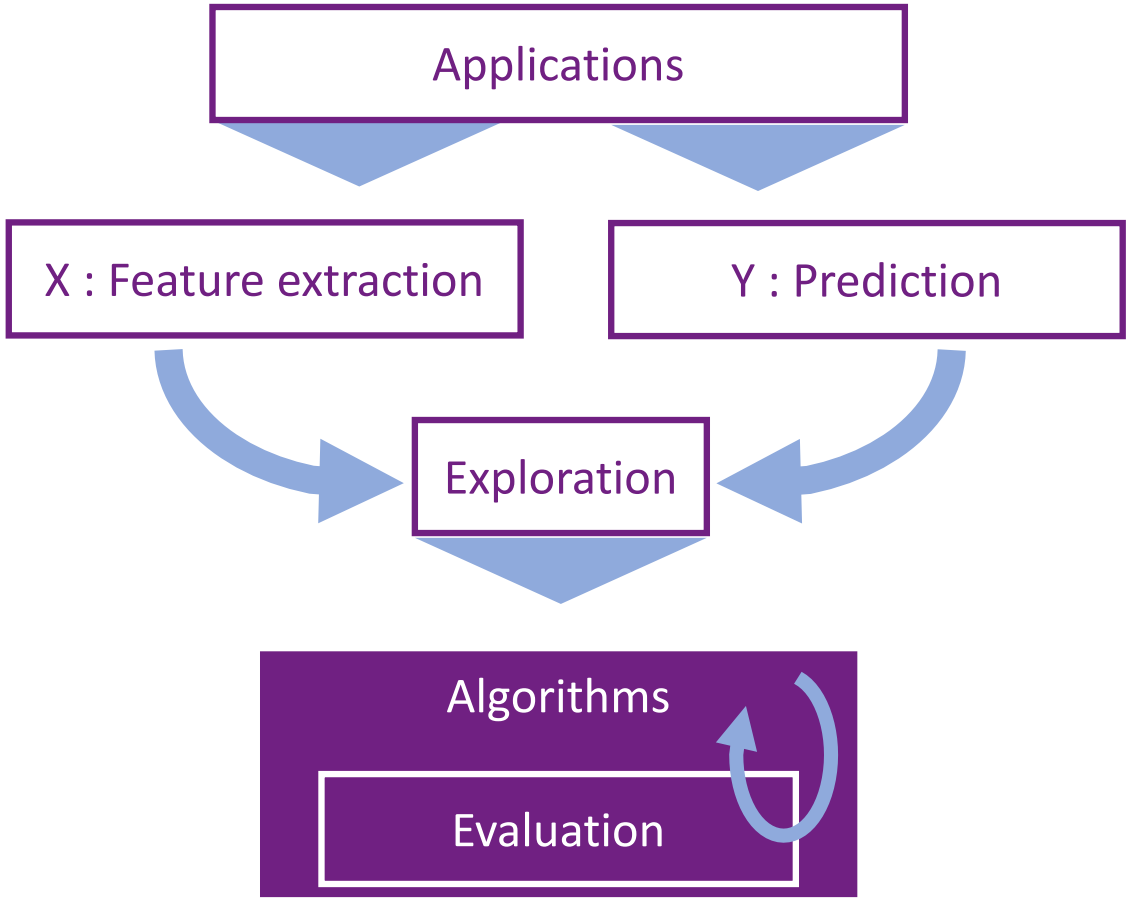
Plan


Applications
X : Feature extraction
Y : Prediction
Exploration
Algorithms
Evaluation

Plan


Applications
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Algorithms

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Unsupervised

Clustering

- K-Means
- DBSCAN
- Spectral clustering
- Density models
- ...

Supervised

Classification

- SVM & Kernels
- Logistic Regression
- Decision Trees:
  - RandomForest
  - AdaBoost
  - ...
- ...

Regression

- Regression
  - Linear
  - Ridge penalty
  - Lasso penalty
  - ElasticNet penalty
- Decision Trees
- ...

Will be deepen during the practical session

sklearn is your best friend
http://scikit-learn.org/stable/tutorial/machine_learning_map/index.html

Deep Learning in Lecture 5.

Semi-Supervised

Part of the data is not labeled but used to determine some "density" around labeled data

Weakly-Supervised

The data are not labeled with the good labels

Metrics & Loss function

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The algorithm optimizes a loss function

≠

Algorithms are compared according to a given metrix

Unsupervised

Clustering

- The key challenge is to know if a metric fits the task of comparing clustering algorithms

Supervised

Classification

- ROC Curve & AUC
- True/False Positive/Negative https://en.wikipedia.org/wiki/Precision_and_recall

Regression

- Mean absolute error L1-norm
- Mean squared error L2-norm
- Median absolute error
- R^2 score
- ...

Too vast to cover all the metrics

http://scikit-learn.org/stable/modules/classes.html#module-sklearn.metrics

Be careful for unbalanced classes !

Validation

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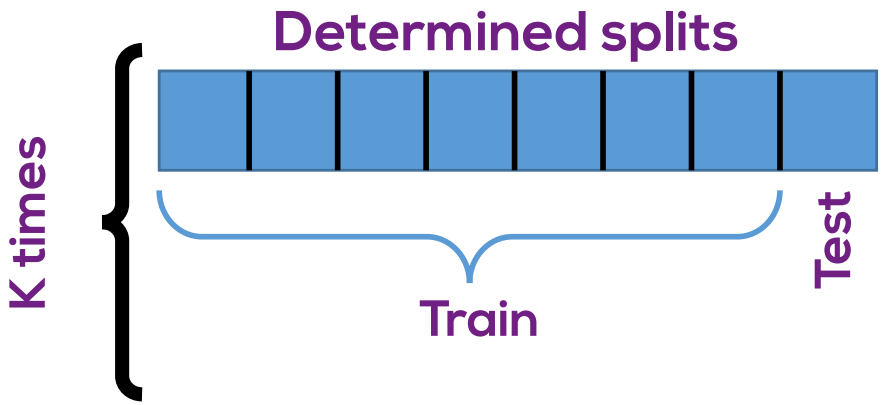
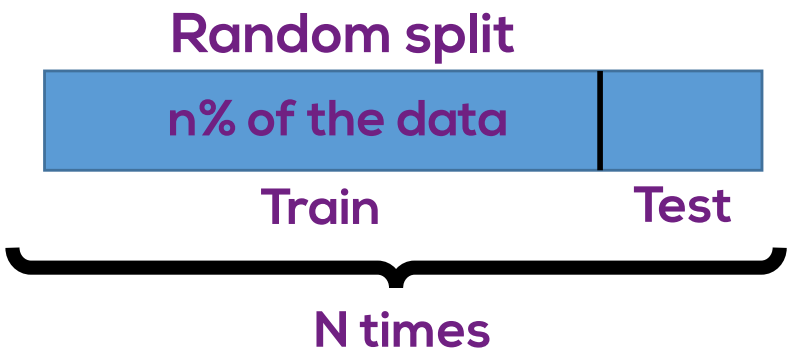
K-Fold



K-scores from which you compute the mean and standard deviation

Holdout Method



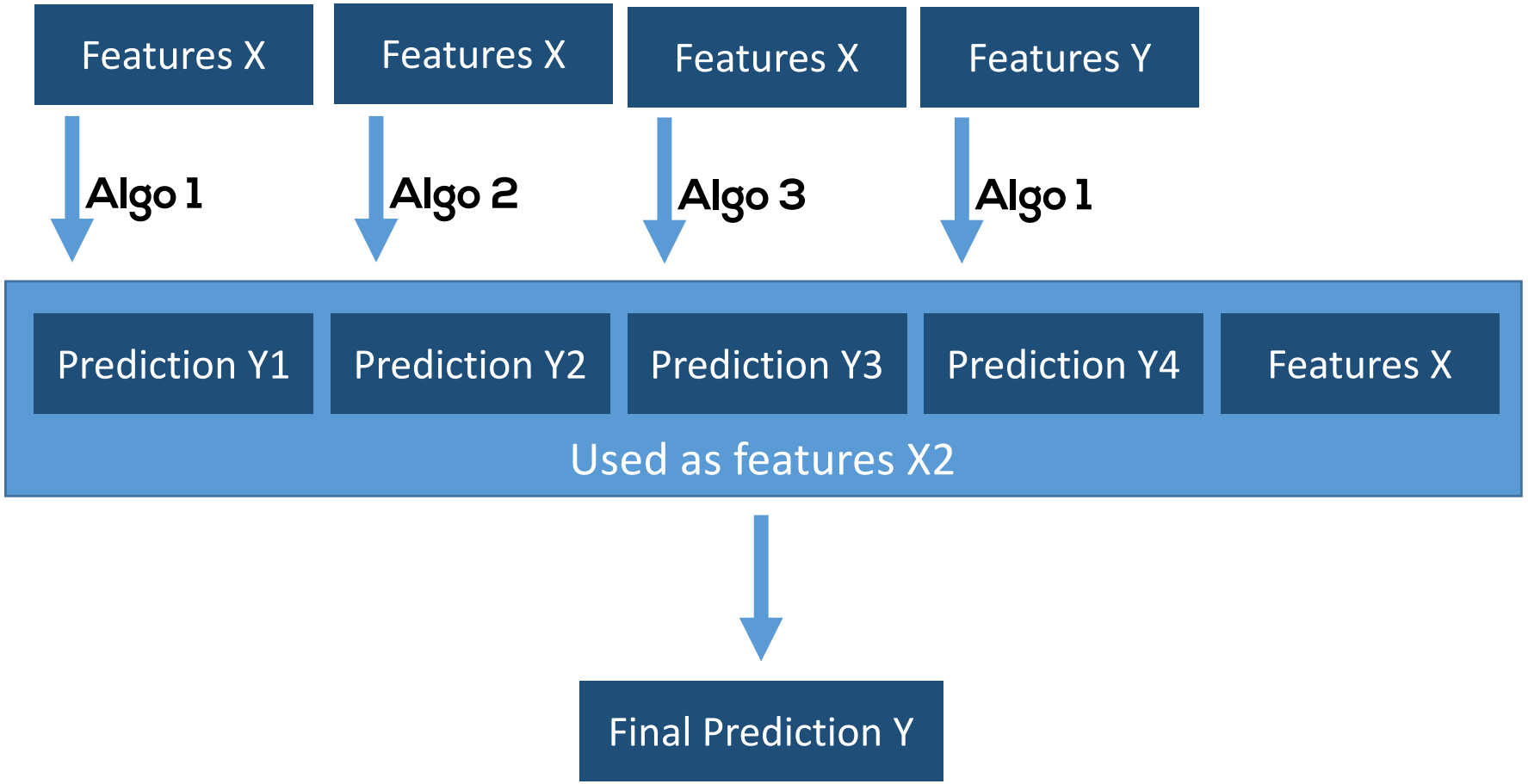
N-scores from which you compute the mean and standard deviation

It is possible to mix : N k-Fold

Hyperparameters learning

But you need part of the data to learn the hyperparameters

Ensembling methods



Practical session

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Objective :

1. Prediction of current stage of Alzheimer's Disease

2. Prediction of future stages

3. Trajectory patterns with longitudinal data

Data :

TADPOLE

- Different algorithms
- Hyperparameters tuning
- Cross-validation