[機器與深度學習基礎知識初探]
ML Basic

黃志勝

義隆電子人工智慧研發部

國立陽明交通大學AI學院合聘助理教授

基礎機器學習

- 機器學習的方法最簡單的參考文件: python module: Scikit-learn文件
- 早期是MATLAB - PRtool

Classification

Identifying to which category an object belongs to.

Applications: Spam detection, Image recognition.
Algorithms: SVM, nearest neighbors, random forest, … — Examples

Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.
Algorithms: SVR, ridge regression, Lasso, … — Examples

Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes
Algorithms: k-Means, spectral clustering, mean-shift, … — Examples

Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency
Algorithms: PCA, feature selection, non-negative matrix factorization. — Examples

Model selection

Comparing, validating and choosing parameters and models.

Goal: Improved accuracy via parameter tuning
Modules: grid search, cross validation, metrics. — Examples

Preprocessing

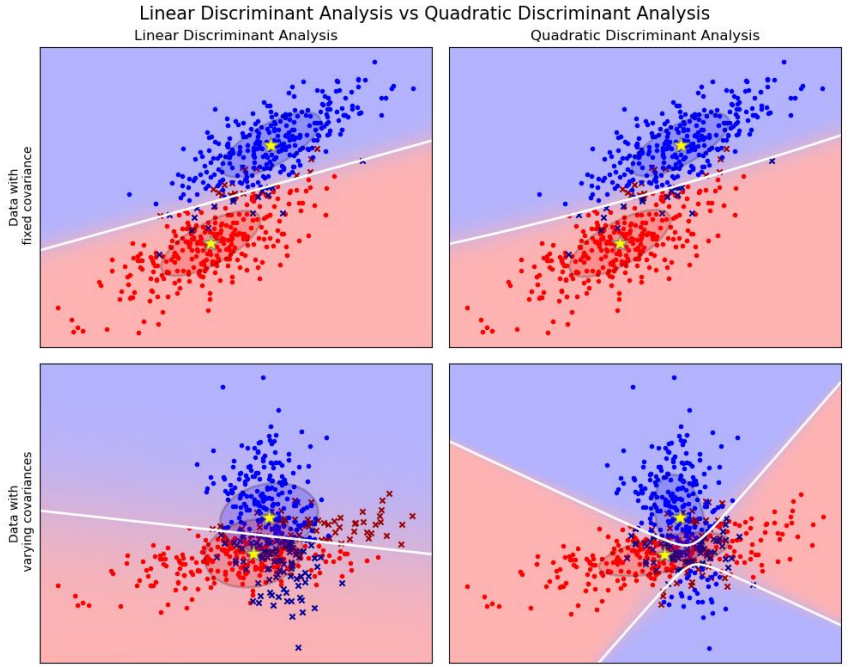
Feature extraction and normalization.

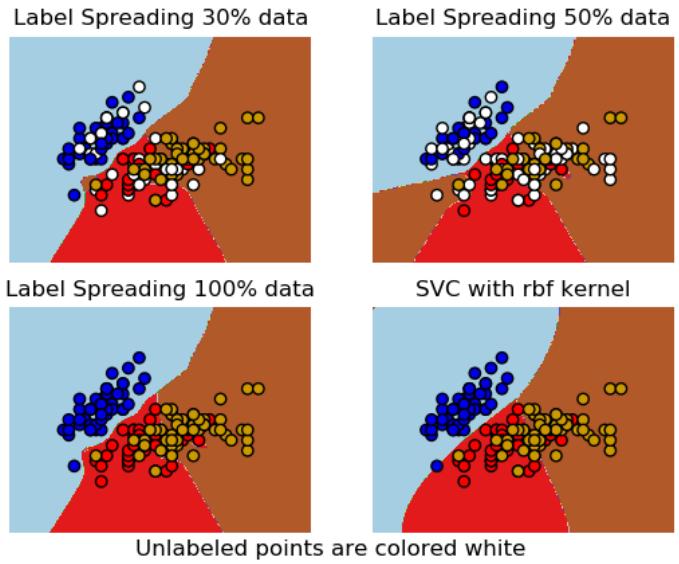
Application: Transforming input data such as text for use with machine learning algorithms.
Modules: preprocessing, feature extraction. — Examples

Classification

Identifying to which category an object belongs to

- **1. Logistic Regression**
- **2. Support Vector Machine**
- **3. Nearest neighbors**
- **4. Random forest**
- **5. Neural Network**





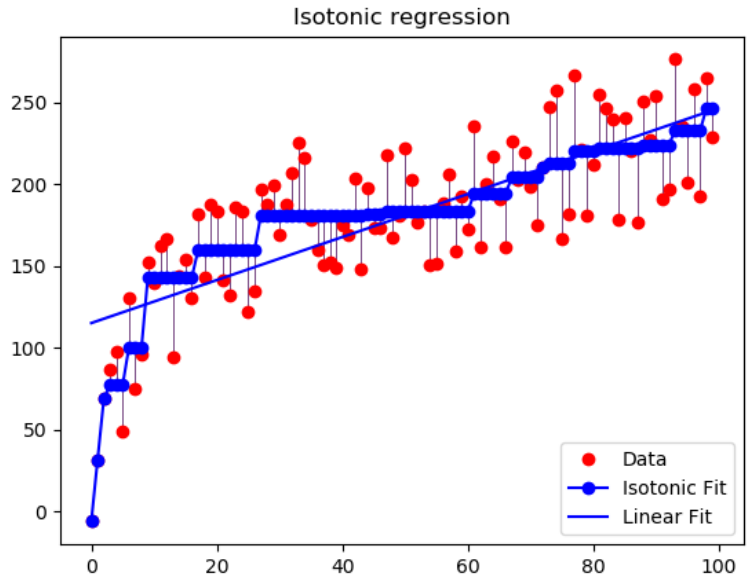
Regression

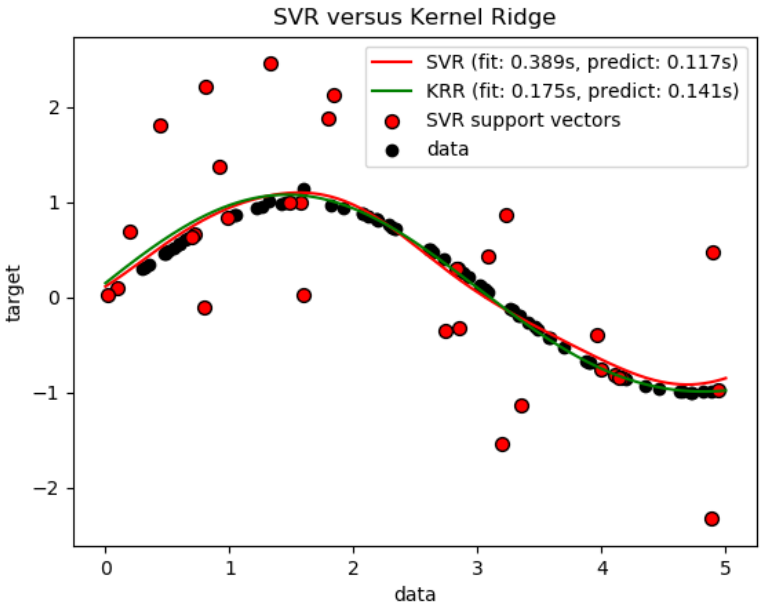
- Predicting a continuous-valued attribute associated with an object.
- **1. Linear Regression**
- **2. Regularized Regression:**

  Ridge Regression: L2-norm linear regression

  LASSO (least absolute shrinkage and selection operator): L1-norm linear regression

  Elastic Net: L1+L2-norm linear regression
- **3. SVR (support vector regression)**
- **4. Neural Network**



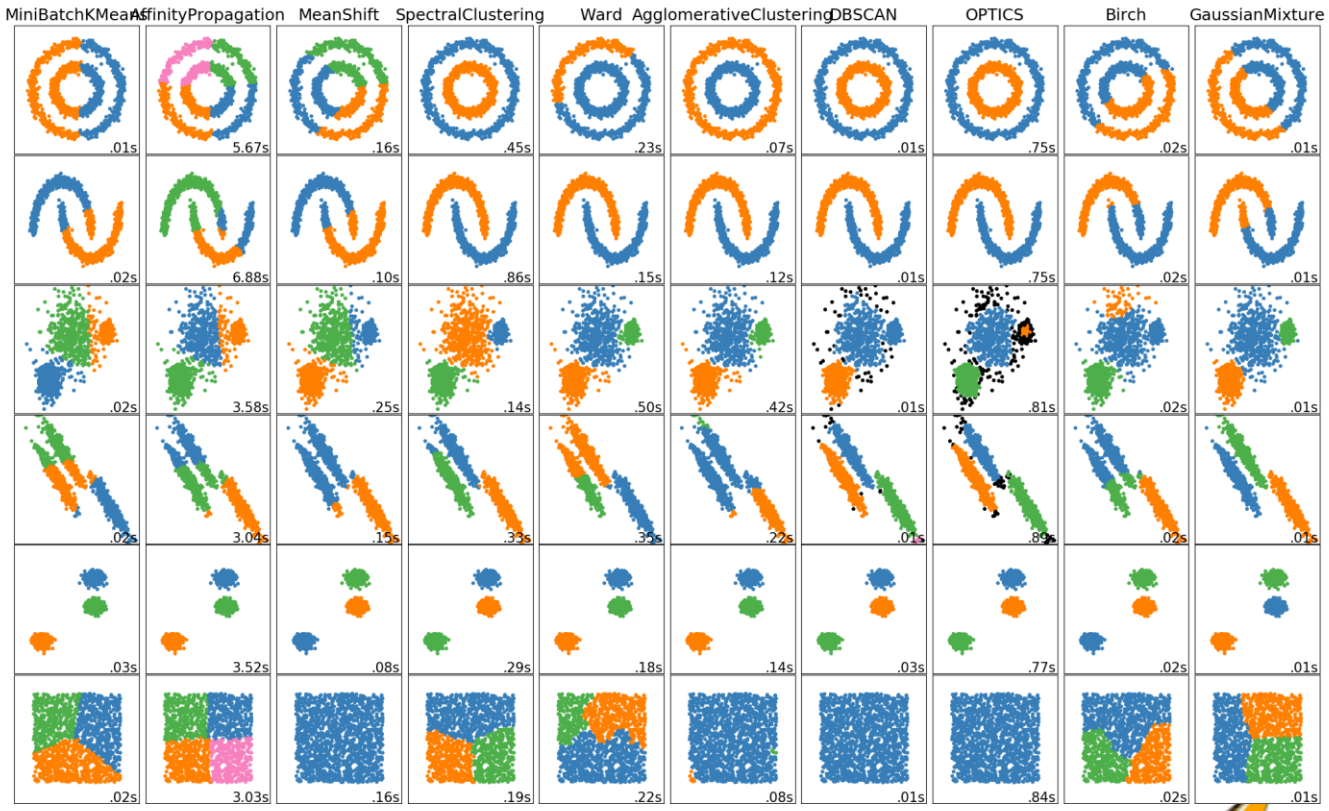


Clustering

Automatic grouping of similar objects into sets.

(物以類聚)

- **1. k-Means**
- **2. spectral clustering**
- **3. Gaussian mixtures**
- **4. Neural Network**



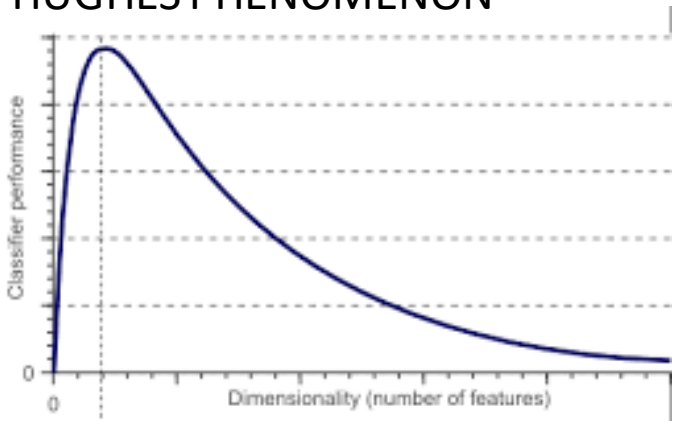
Dimension Reduction

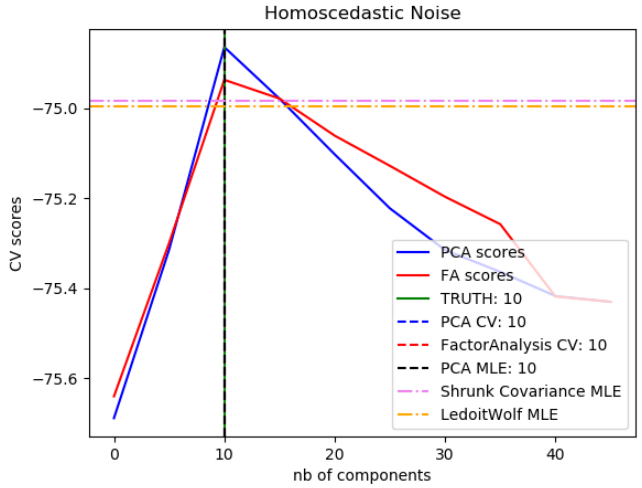
Reducing the number of random variables to consider.

To overcome curse of dimensionality.

- Principal component analysis (PCA)
- Independent component analysis (ICA)
- Canonical component analysis (CCA)
- Non-negative matrix factorization
- Discriminant Analysis Feature Extraction(DAFE)
- Neural Network

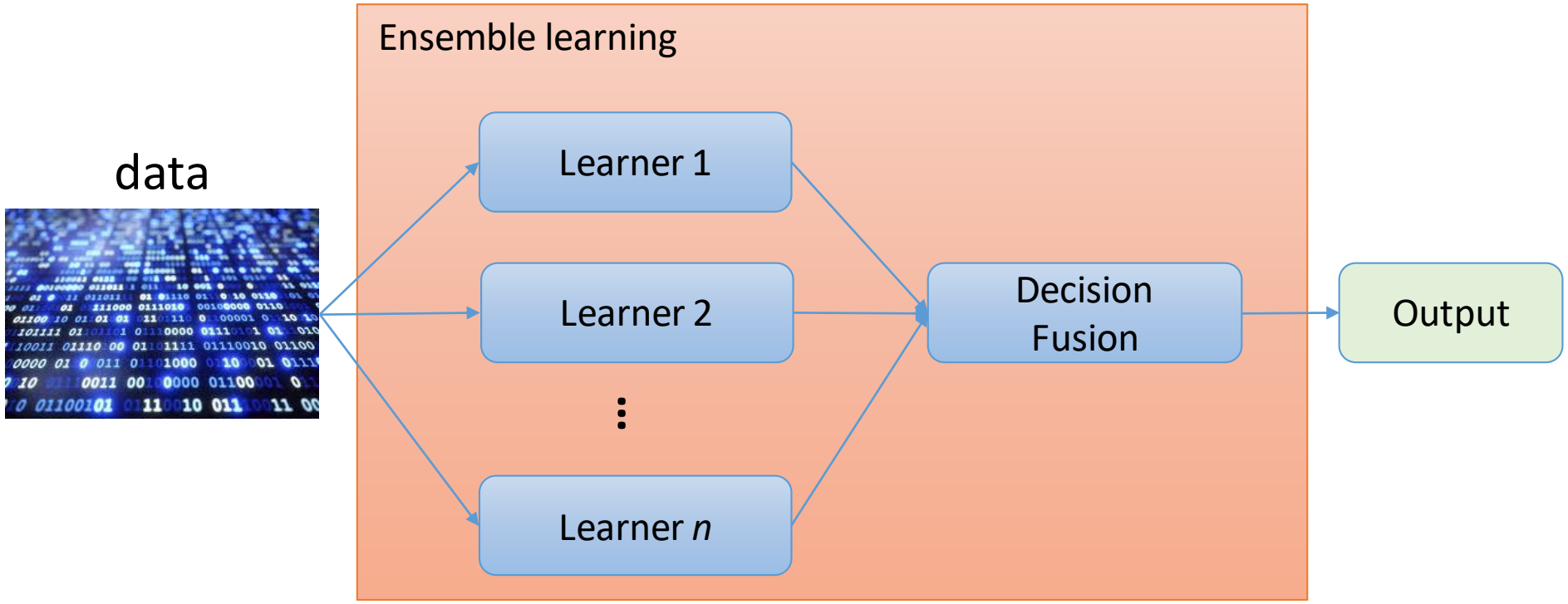
HUGHES PHENOMENON





Ensemble learning

Multiclassification System (三個臭皮匠勝過一個諸葛亮)



基礎機器學習

針對前述的介紹，每個topic都介紹一個演算算法

1. Regression: Linear regression (supervised learning)
2. Classification: Linear and Quadratic Discriminant Analysis (supervised learning)
3. Clustering: K-means (unsupervised learning)
4. Dimension Reduction: PCA (unsupervised learning)
5. Ensemble learning: 不介紹。

深度學習

- 深度學習是機器學習的subset，大部分的task是一樣的，所以這個部分的深度學習，我將講述的深度學習的基礎。
- 1. 神經網路如何運作
- 2. 梯度下降法
- 3. 神經網路如何利用導傳遞找解
- 4. Batch Normalization在幹什麼
- 5. Activation Function為什麼要採用ReLU，而不是用Sigmoid。

Note:卷機神經網路的介紹會在卷機神經網路的課程來說明。