Kissipo Learning for Deep Learning

Topic 9: Machine Learning basics (20min)

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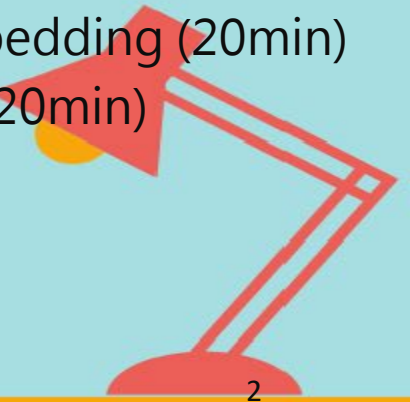
KLDL-W3-09

Topics

- Topic 01: Introduction to Deep Learning (20min)
- Topic 02: Kissipo Learning for Deep Learning (20min)
- Topic 03: Python quick tutorial (20min)
- Topic 04: Numpy quick tutorial (15min)
- Topic 05: Pandas quick tutorial (15min)
- Topic 06: Scikit-learn quick tutorial (15min)
- Topic 07: OpenCV quick tutorial (15min)
- Topic 08: Image Processing basics (20min)
- Topic 09: Machine Learning basics (20min)
- Topic 10: Deep Learning basics (20min)
- Topic 11: TensorFlow overview (20min)
- Topic 12: CNN with TensorFlow (20min)
- Topic 13: RNN with TensorFlow (20min)
- Topic 14: PyTorch overview (20min)
- Topic 15: CNN with PyTorch (20min)
- Topic 16: RNN with Pytorch (20min)
- Topic 17: Introduction to AOI (20min)
- Topic 18: AOI simple Pipeline (A) (20min)
- Topic 19: AOI simple Pipeline (B) (20min)
- Topic 20: Introduction to Object detection (20min)
- Topic 21: YoloV5 Quick Tutorial (20min)
- Topic 22: Using YoloV5 for RSD (20min)
- Topic 23: Introduction to NLP (20min)
- Topic 24: Introduction to Word Embedding (20min)
- Topic 25: Name prediction project (20min)



Content

- Topic 09: Machine Learning basics (20min)
  - Types of Machine Learning
  - Supervised classification
  - ML VS DL

Types of Machine Learning

scikit-learn

Machine Learning in Python

scikit-learn Install User Guide API Examples Community More

scikit-learn

Machine Learning in Python

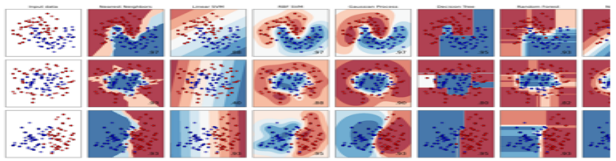
Getting Started | Release Highlights for 1.1 | GitHub

- Simple and efficient tools for predictive data analysis
- Accessible to everybody, and reusable in various contexts
- Built on NumPy, SciPy, and matplotlib
- Open source, commercially usable - BSD license

Classification

Identifying which category an object belongs to.

Applications: Spam detection, image recognition.
Algorithms: SVM, nearest neighbors, random forest, and more...

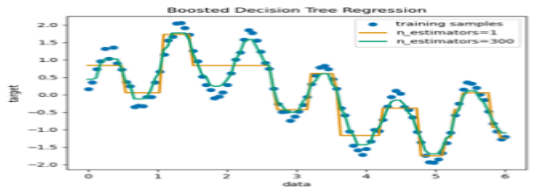


Examples

Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.
Algorithms: SVR, nearest neighbors, random forest, and more...



Examples

Clustering

Automatic grouping of similar objects into sets.

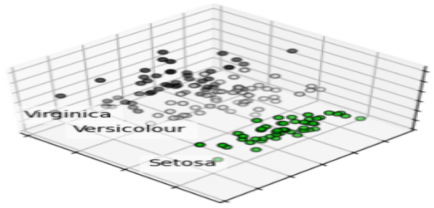
Applications: Customer segmentation, Grouping experiment outcomes
Algorithms: k-Means, spectral clustering, mean-shift, and more...

Examples

Dimensionality reduction

Reducing the number of random variables to consider.

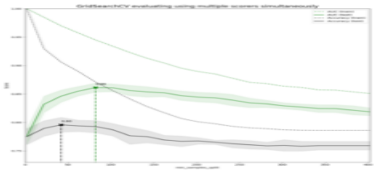
Applications: Visualization, Increased efficiency
Algorithms: PCA, feature selection, non-negative matrix factorization, and more...



Model selection

Comparing, validating and choosing parameters and models.

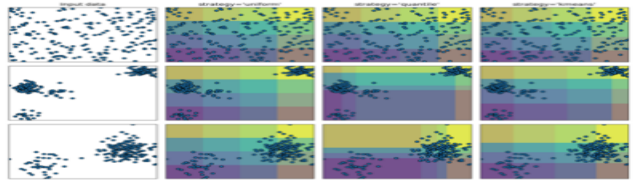
Applications: Improved accuracy via parameter tuning
Algorithms: grid search, cross validation, metrics, and more...



Preprocessing

Feature extraction and normalization.

Applications: Transforming input data such as text for use with machine learning algorithms.
Algorithms: preprocessing, feature extraction, and more...



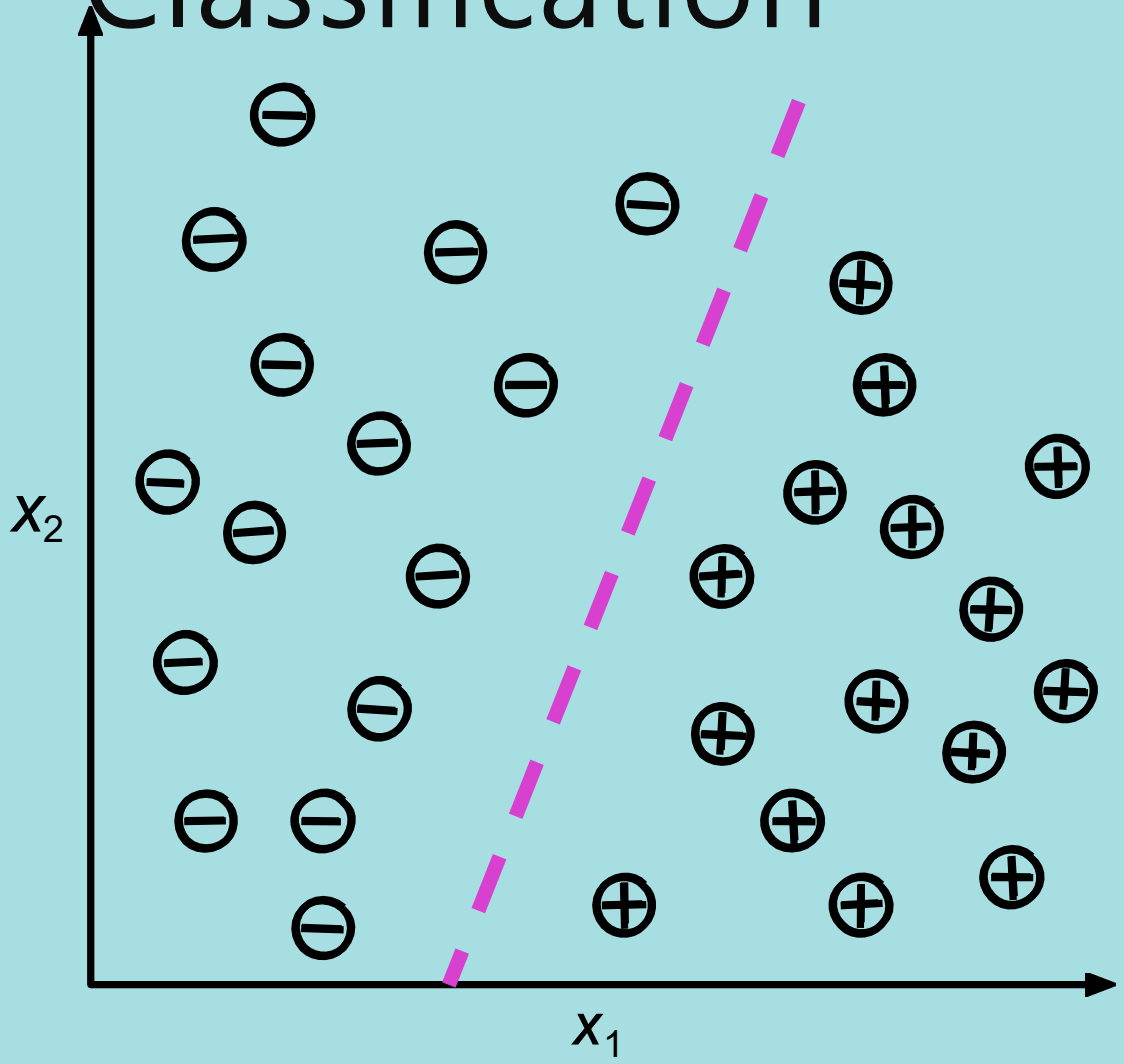
https://scikit-learn.org/

Categories of Machine Learning

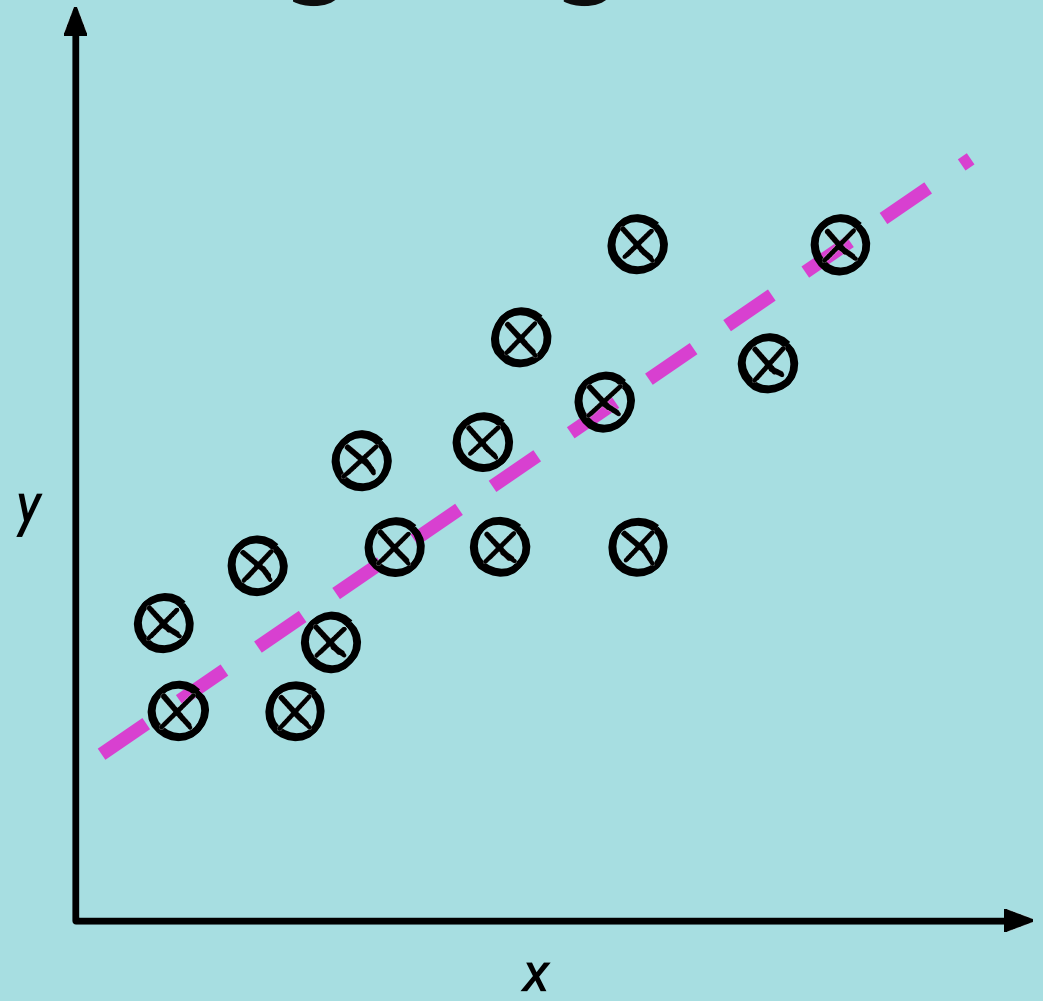
Supervised Learning

- Labeled data
- Direct feedback
- Predict outcome/future

Supervised Learning: Classification



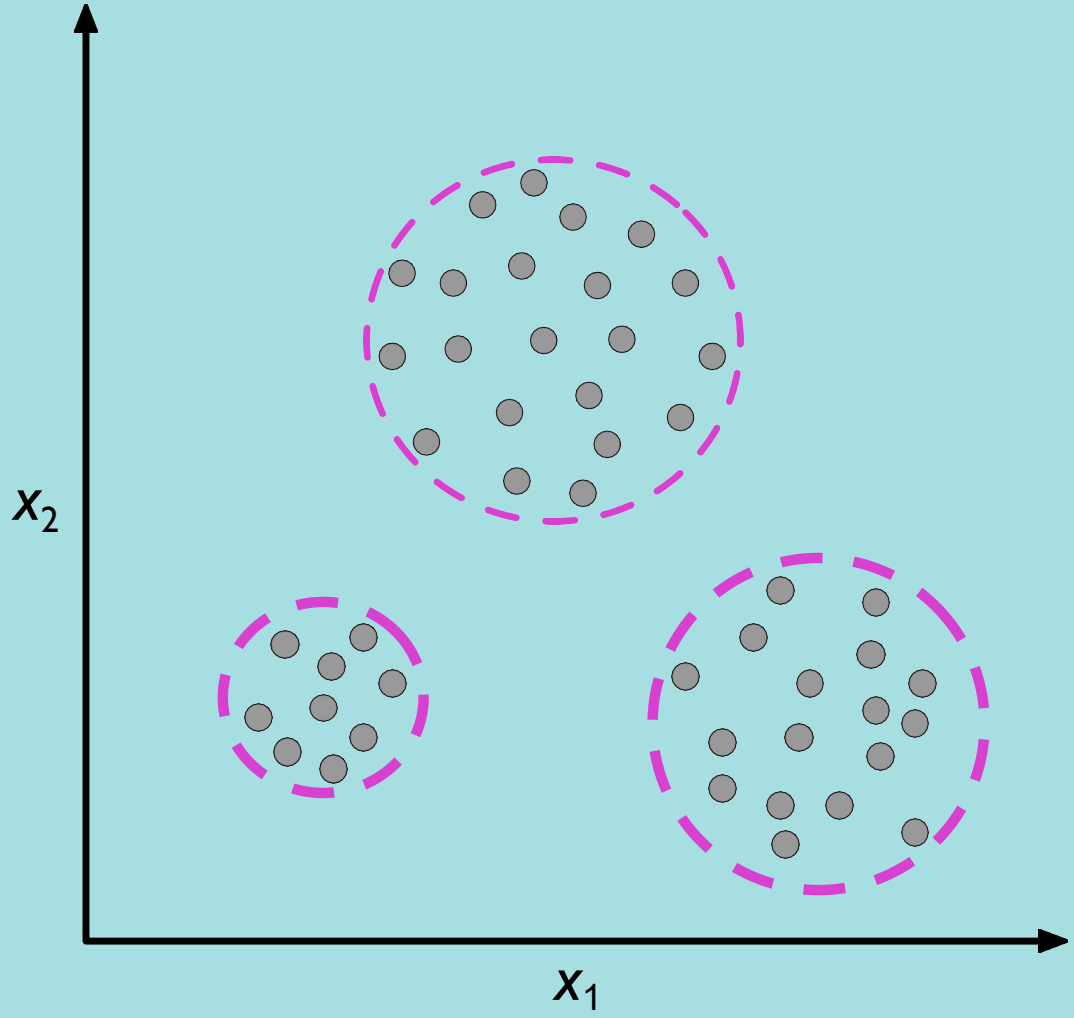
Supervised Learning: Regression



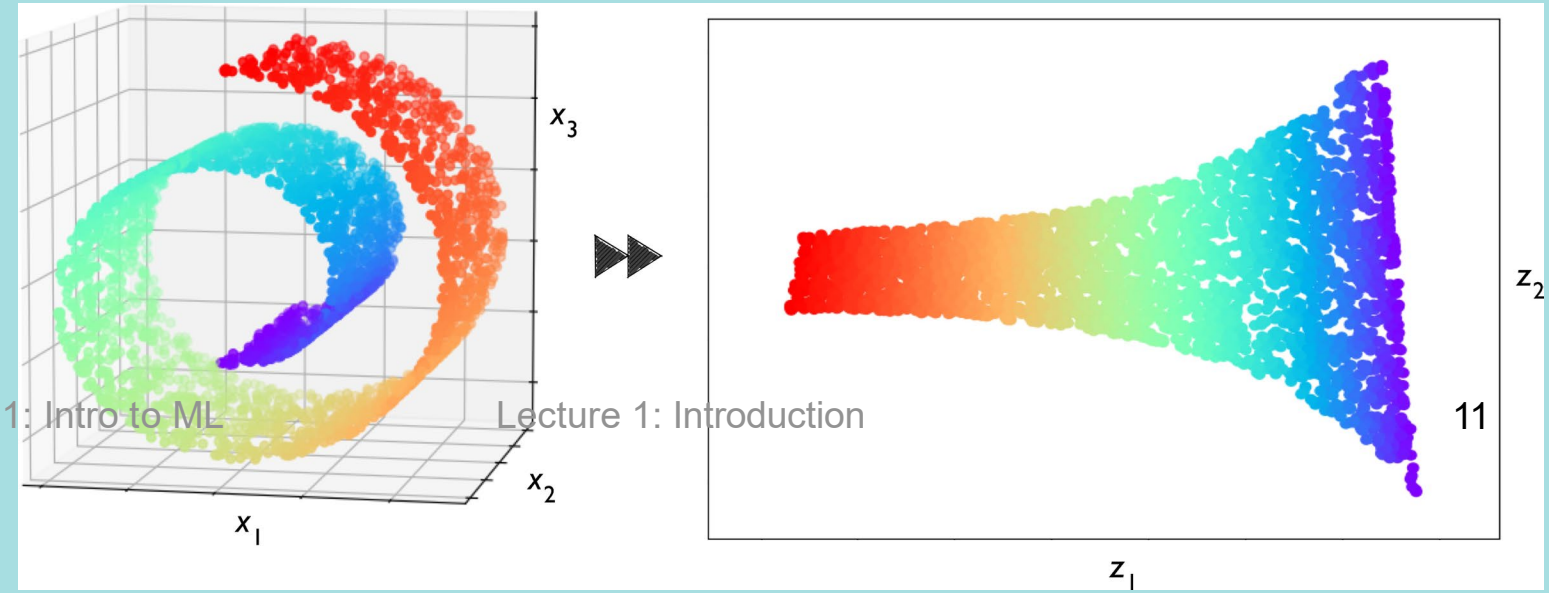
Regression vs. classification

- A **regression** model predicts continuous values. For example, regression models make predictions that answer questions like the following:
  - What is the value of a house in California?
  - What is the probability that a user will click on this ad?
- A **classification** model predicts discrete values. For example, classification models make predictions that answer questions like the following:
  - Is a given email message spam or not spam?
  - Is this an image of a dog, a cat, or a hamster?

Unsupervised Learning - Clustering



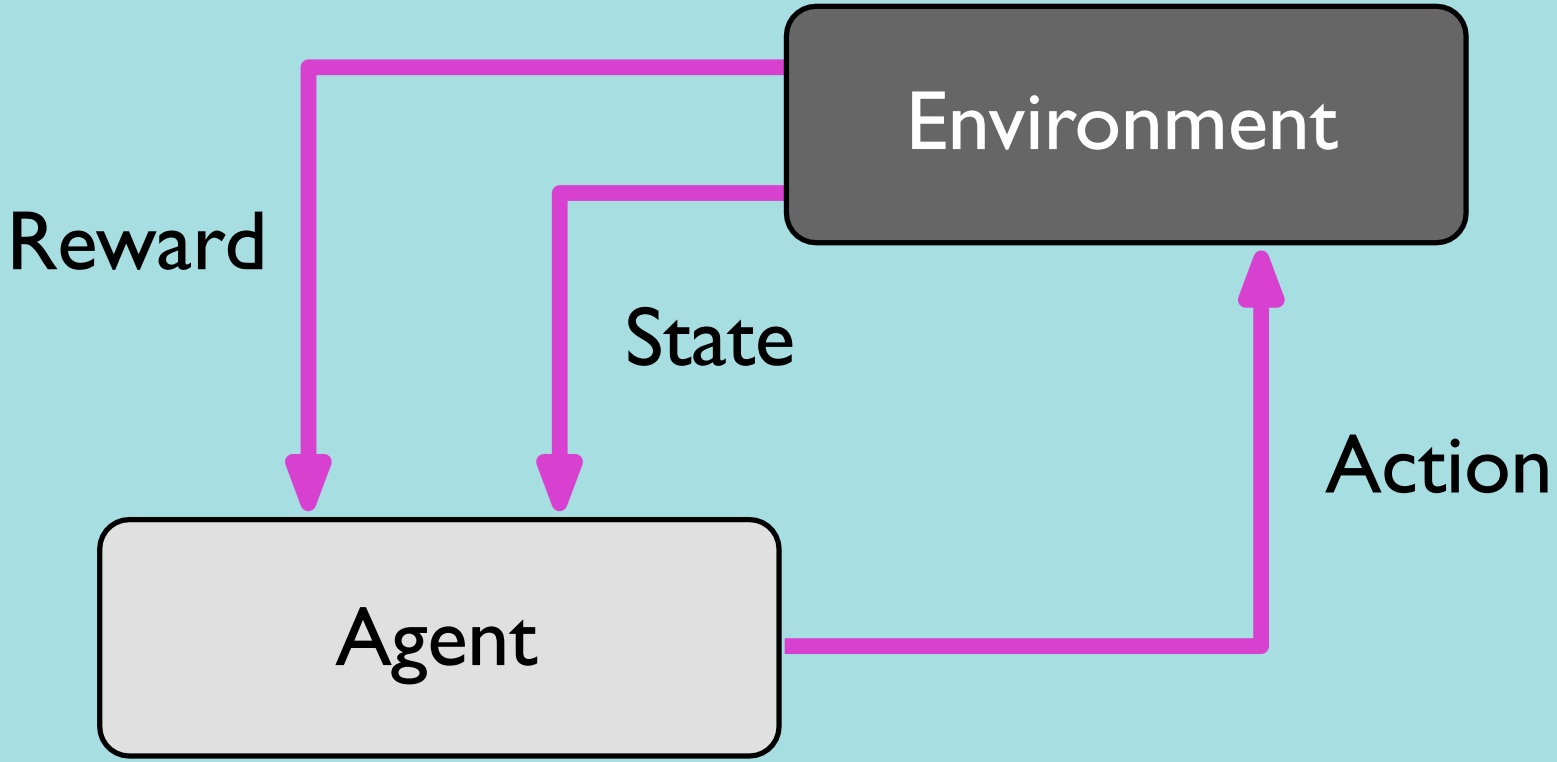
Unsupervised Learning - Dimensionality Reduction



Categories of Machine Learning

Supervised Learning	Labeled data Direct feedback Predict outcome/future
Unsupervised Learning	No labels/targets No feedback Find hidden structure in data
Reinforcement Learning	Decision process Reward system Learn series of actions

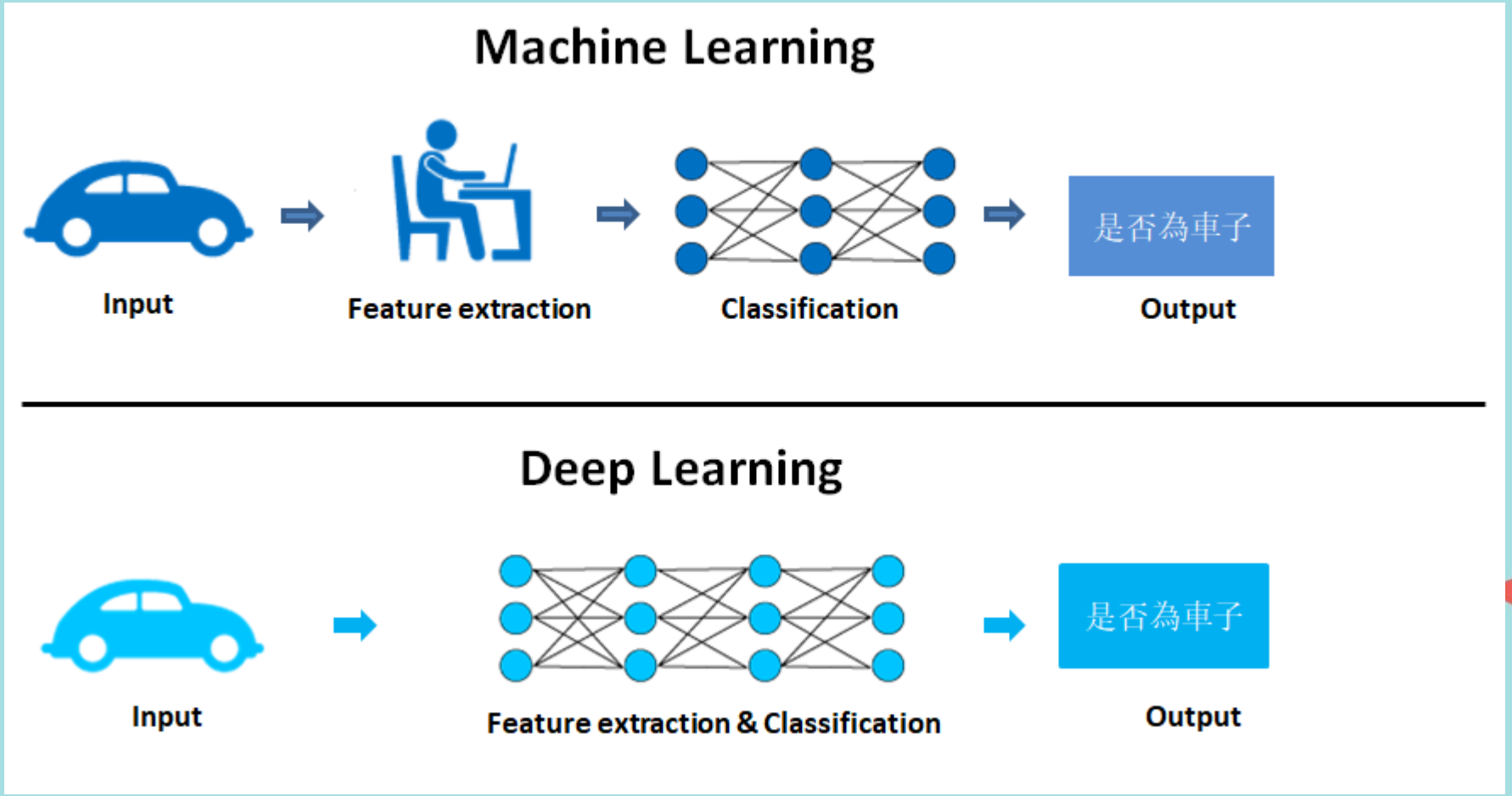
Reinforcement Learning



Supervised classification

- KNN-K nearest neighbour
- SVM-Support Vector Machine
- ANN-Artificial Neural Network
- RF-Random Forest

ML VS DL


Machine Learning
Input
Feature extraction
Classification
是否為車子
Output
Deep Learning
Input
Feature extraction & Classification
是否為車子
Output

Classification:
True vs. False and Positive vs. Negative

Confusion matrix

True Positive (TP): • Reality: A wolf threatened. • Shepherd said: "Wolf." • Outcome: Shepherd is a hero.	**False Positive (FP):** • Reality: No wolf threatened. • Shepherd said: "Wolf." • Outcome: Villagers are angry at shepherd for waking them up.
False Negative (FN): • Reality: A wolf threatened. • Shepherd said: "No wolf." • Outcome: The wolf ate all the sheep.	**True Negative (TN):** • Reality: No wolf threatened. • Shepherd said: "No wolf." • Outcome: Everyone is fine.

Accuracy

True Positive (TP): • Reality: Malignant • ML model predicted: Malignant • **Number of TP results: 1**	**False Positive (FP):** • Reality: Benign • ML model predicted: Malignant • **Number of FP results: 1**
False Negative (FN): • Reality: Malignant • ML model predicted: Benign • **Number of FN results: 8**	**True Negative (TN):** • Reality: Benign • ML model predicted: Benign • **Number of TN results: 90**

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} = \frac{1 + 90}{1 + 90 + 1 + 8} = 0.91$$

Recall

True Positive (TP): • Reality: Malignant • ML model predicted: Malignant • **Number of TP results: 1**	**False Positive (FP):** • Reality: Benign • ML model predicted: Malignant • **Number of FP results: 1**
False Negative (FN): • Reality: Malignant • ML model predicted: Benign • **Number of FN results: 8**	**True Negative (TN):** • Reality: Benign • ML model predicted: Benign • **Number of TN results: 90**

$$\text{Recall} = \frac{TP}{TP + FN}$$

F1-score

$$
\begin{aligned}
precision &= \frac{TP}{TP + FP} \\
recall &= \frac{TP}{TP + FN} \\
F1 &= \frac{2 \times precision \times recall}{precision + recall} \\
accuracy &= \frac{TP + TN}{TP + FN + TN + FP} \\
specificity &= \frac{TN}{TN + FP}
\end{aligned}
$$

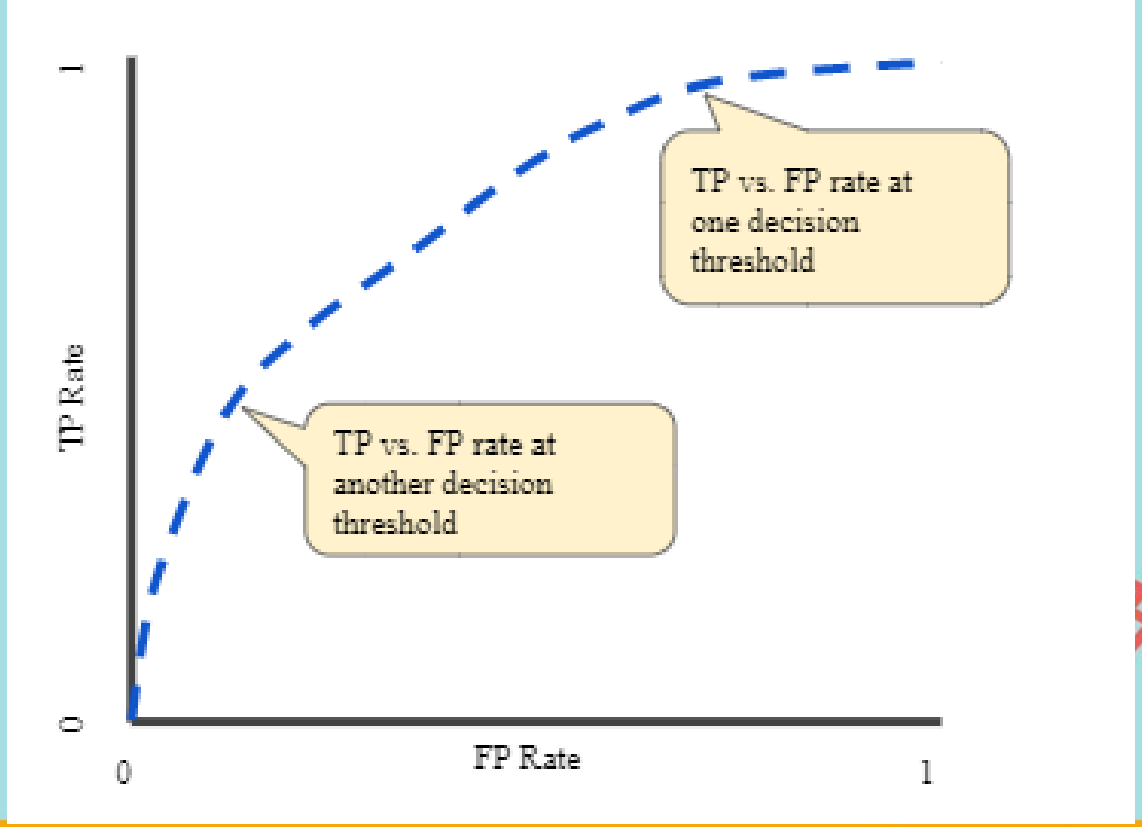
ROC Curve
(Receiver operating characteristic curve)

True Positive Rate (**TPR**) is a synonym for recall and is therefore defined as follows:

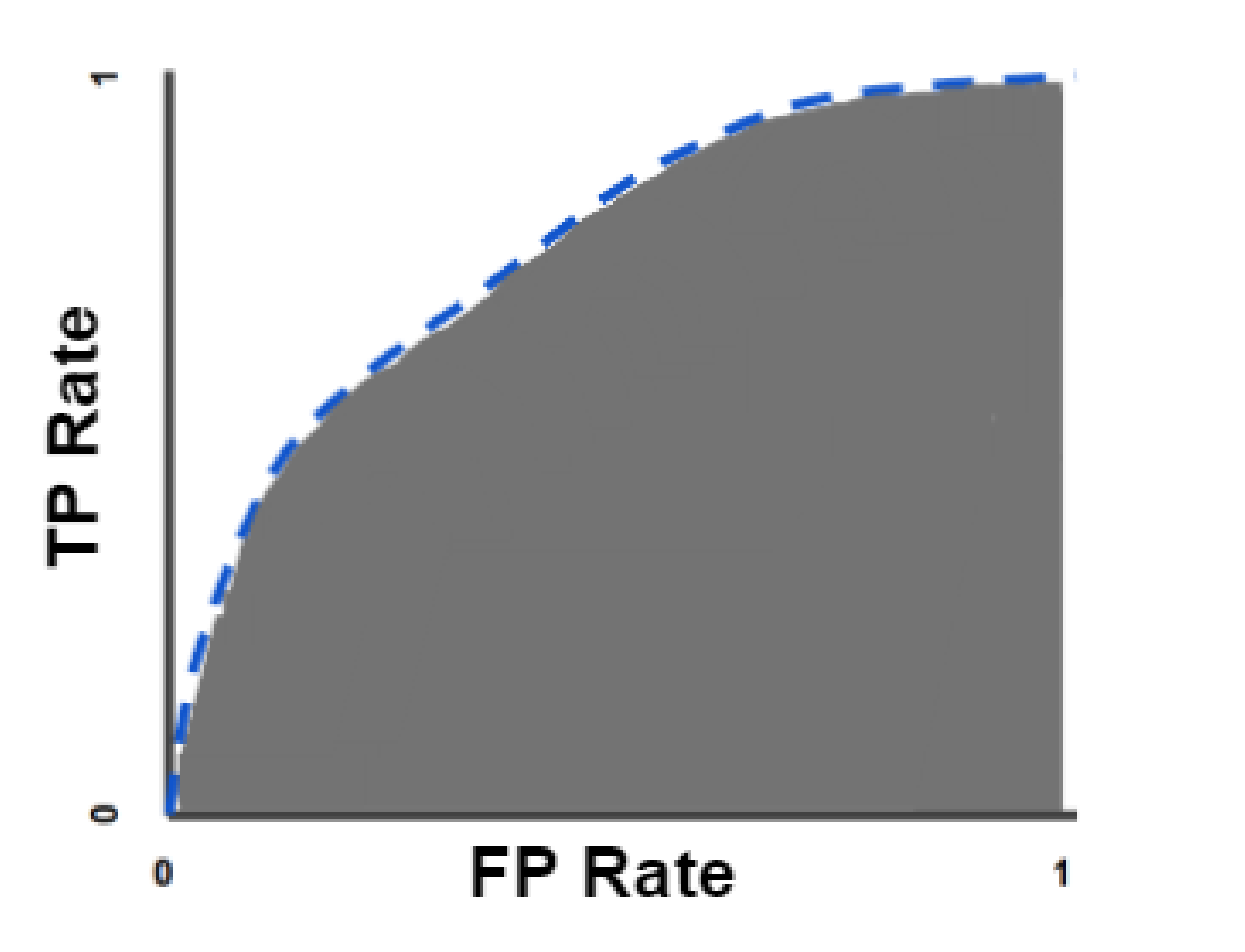
$$TPR = \frac{TP}{TP + FN}$$

False Positive Rate (**FPR**) is defined as follows:

$$FPR = \frac{FP}{FP + TN}$$



AUC: Area Under the ROC Curve



Thanks!

Q&A