

Types Of Learning

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1 Introduction

In this note, we are going to categorize types of learning by output space, data label, protocol and input space.

2 Learning with different output space Y

2.1 Binary Classification

Answering yes/no questions. $y = \{+1, -1\}$

Example: Credit card approval

2.2 Multiclass Classification

The classes of the output is more than two. $y = \{1, 2, \dots, K\}$

Example: Written digits pictures $\Rightarrow 1, 2, \dots, 9$

2.3 Regression

The output space is \mathbb{R} . $y \in \mathbb{R}$

Example: Company data \Rightarrow Stock price

2.4 Structured Learning

The output is some kind of structure without explicit class definition. In sentence recognition, the output structure may be like $y = \{PVN, PVP, NVN, \dots\}$, where P is pronoun, V is verb and N is noun.

3 Learning with different data label y_i

3.1 Supervised Learning

Label all y_i for $i \in \{1, \dots, n\}$

Example: Classify US dollars.

3.2 Unsupervised Learning

Label no y_i

Example: Clustering points on a plane

3.3 Semi-supervised Learning

Label some y_i

This learning method is usually used when labeling is an expensive operation.

3.4 Reinforcement Learning

In reinforcement learning, we do not label y_i explicitly, but implicit it by the feedback \hat{y}_i .

Example: A dog learn to sit down.

4 Learning with different protocol $f \rightarrow (x_i, y_i)$

4.1 Batch Learning

Input all known data at one time.

Example: It's a common protocol. No need to give an example.

4.2 Online Learning

Sequentially learning from incoming data.(passive)

Example: Gmail classify incoming email as important, spam, promotion etc.

4.3 Active Learning

The machine strategically query y_i of chosen x_i .

5 Learning with different input space X

5.1 Concrete Features

Give clear physical meaning. The features are determined by human. So, it often include human intelligence on the learning task.

5.2 Raw Features

Give simple physical meaning. Often need feature extraction/conversion.

5.3 Abstract Features

Give no physical meaning.Need feature extraction/conversion as well.

6 References

Almost all of the materials of this note are from Professor Hsuan-Tien Lin , NTU. If you wan to know more information about Machine Learning Foundation, please refer to Professor Lin's homesite.