

Supervised Learning

1.Introduction

From the three types of machine learning ie supervised, unsupervised and reinforcement, supervised learning is the type of machine learning used whenever we want to predict a certain outcome from a given input, and we have examples of input/output pairs. We build a machine learning model from these input/output pairs, which comprises our training set.

2. Classification and Regression

Supervised machine learning consists of two types which are classification and regression. In classification the goal is to predict a *class label*, which is a choice from a predefined list of possibilities. Classification is divided into two categories *binary classification* and multiclass classification where the first distinguishes between exactly two classes and the second is classification between more than two classes

3.Generalization, Overfitting, and Underfitting

Since we need to make accurate predictions on new, unseen data that has the same characteristics as the training data then we should build a model that is able to generalize our data. If it will be able to make accurate predictions on unseen data, we say it is able to *generalize* from the training set to the test set. We want to build a model that is able to generalize as accurately as possible.

Overfitting occurs when you fit a model too closely to the particularities of the training set and obtain a model that works well on the training set but is not able to generalize to new data and this is the result of having too complex model.

Underfitting occurs when a model or algorithm cannot capture the underlying trend of the data. This is when the algorithm shows high bias but low variance.

4.Algorithms in supervised learning

Supervised machine learning consists of many algorithms which some of them can perform classification problems only, some both and some regression problems. In general, the following are the supervised learning algorithms

- i. The k -NN algorithm is the simplest machine learning algorithm in which to make a prediction for a new data point, the algorithm finds the closest data points in the training dataset—its “nearest neighbors.”
- ii. Linear regression is a linear model for regression which finds the parameters w and b that minimize the *mean squared error* between predictions and the true regression targets, y , on the training set
- iii. Ridge regression, is a linear model for regression though, the coefficients (w) are chosen not only so that they predict well on the training data, but also to fit an additional constraint

Others are logistic regression, naive bayes classifiers, support vector machines, decision tree etc