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Machine Learning

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Activity

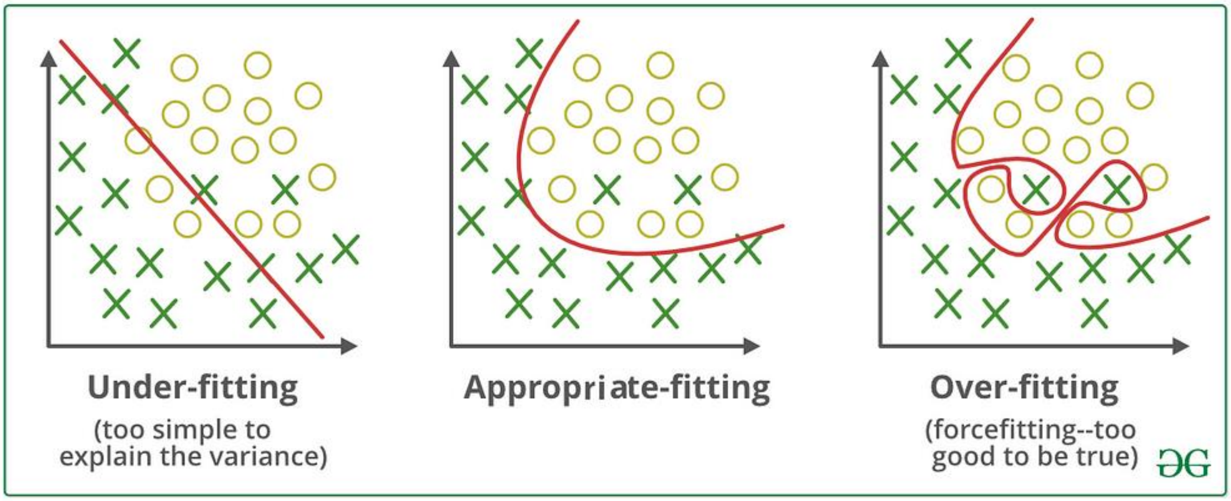
Solution to most common problems in Machine Learning

09/15/2023

Overfitting and Underfitting

Overfitting frequently occurs in machine learning when a model attempts to excessively scrutinize and adapt to the training data, leading it to memorize all the data patterns. This behavior can cause a predictive algorithm to produce inaccurate results with low accuracy, especially when making predictions with high variability.

Underfitting arises from overly simplistic representation of the input data in the model, leading to a decline in data accuracy. In cases of underfitting, a module is unable to adequately represent the dataset or generalize to new datasets. Similarly, the model cannot establish a meaningful relationship between the input variables and the target variables.


Under-fitting
(too simple to explain the variance)
Appropriate-fitting
Over-fitting
(forcefitting--too good to be true)

Outliers

An outlier is a data point that deviates significantly from its nearest neighbors and the surrounding values in a data graph or dataset you are analyzing. Outliers are data points that exhibit extreme values, markedly distinct from the general trend within a dataset or graph.

Common solutions for overfitting, underfitting and presence of outliers in datasets

Overfitting: Divide our data into training, validation, and testing, obtain a larger amount of data, adjust the parameters of our models, use simpler models, the data come from different distributions, lower the number of iterations in iterative algorithms.

Underfitting: Treat data correctly, eliminating outliers and unnecessary variables, use more complex models, adjust the parameters of our models, increase iterations in iterative algorithms.

Outliers: Trimming or remove outliers, replace the outliers with the median value, reduce the weight of outliers, changing the values, use robust estimation techniques.

Dimensionality Problem

Dimensionality refers to the challenges encountered when dealing with high-dimensional data, where dimension signifies the number of attributes or features in a dataset. High-dimensional data often exceed a hundred or more features. These challenges arise when attempting to analyze or visualize data to detect patterns, as well as during the training of machine learning models. The issues associated with training machine learning models on high-dimensional data are commonly termed the 'Curse of Dimensionality'.

Dimensionality reduction involves the act of reducing the quantity of attributes within a dataset while retaining the maximum amount of original dataset variability. This constitutes a data preprocessing step, implying that we conduct dimensionality reduction prior to model training."

Bias-variance trade-off

It means that if our model is overly simplistic with few parameters, it can result in high bias and low variance. Conversely, a model with numerous parameters tends to exhibit high variance and low bias. Therefore, striking the correct balance is crucial to avoid both overfitting and underfitting.

This trade-off in complexity illustrates the inherent balance between bias and variance. An algorithm cannot simultaneously be more complex and less complex.

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