

Transient Stability Assessment of Machine Learning Algorithm using Support Vector Machines

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DESCRIPTION

Most of the tasks machine learning does today include image classification, language translation, processing large amounts of data from sensors, and predicting future values based on current values. There are many different algorithms for processing different kinds of data. The two most commonly used strategies in machine learning are supervised learning and unsupervised learning. Supervised learning is training a machine learning model on labeled data. This means that a person already has data with appropriate classifications associated with it. A common use of supervised learning is to help predict values in new data. Unsupervised learning is training a model on unlabeled data. This means that the model must find its own characteristics and make predictions based on the data's classification. Support vector machines are a set of supervised learning methods used for classification, regression, and outlier detection. The goal of support vector machine algorithms is to find a hyperplane in N-dimensional space (N-number of features) that uniquely classifies data points. SVMs work by mapping data into a high-dimensional feature space, allowing data points to be classified even when the data cannot otherwise be linearly separable.

A Support Vector Machine (SVM) uses a supervised learning model to perform an optimal data transformation that determines the boundaries between data points based on predefined classes, labels, or outputs, thereby solving complex classification, regression, and machine learning algorithms that solve outlier detection problems. SVMs are used in many areas such as healthcare, natural language processing, signal processing applications, and speech and image recognition. SVMs are sometimes designed for binary classification problems. However, with the rise of computationally intensive multiclass problems, multiple binary classifiers have been constructed and combined to formulate SVMs that can implement such multiclass classification through binary means. Support vector machines are linear models for classification and regression problems. It can solve linear and nonlinear problems and is suitable for many practical problems. SVM chooses extreme/vectors to help create hyperplanes. These extreme cases are called support vectors, and

the algorithm is called a support vector machine. Support vector machines can be classified into two types.

Linear SVM

Linear SVM is used for linearly separable data i.e., if a dataset can be classified into two classes using a single straight line, the data is called linearly separable data and the classifier is called a linear SVM classifier. Linear kernels work very well when they have many functions and text classification problem has many functions. Linear kernel functions are faster than most functions and have fewer parameters to optimize.

Nonlinear SVM

Nonlinear SVM is used for nonlinearly separated data i.e., when a dataset cannot be classified using a straight line, such data is called nonlinear data and the classifier used is called SVM nonlinear classifier. An SVM kernel is a function that takes a low-dimensional input space and transforms it into a high-dimensional space. In other words, it transforms an inseparable problem into a separable problem. This is especially useful for nonlinear separation problems. The dimension of the hyperplane depends on the number of features.

If the number of input features is 2, the hyperplane is just a line. If the number of input features is 3, the hyperplane will be a 2D plane. It becomes hard to imagine when the number of features exceeds three. Introducing additional dimensions does not completely transform the data. This is because it can seem like a computationally intensive process. This technique, commonly called the kernel trick, provides an efficient and inexpensive way to transform data to higher dimensions. SVM differs from other classification algorithms in how it chooses decision boundaries that maximize the distance from the closest data points for all classes. The decision boundary created by SVM is called the max-margin classifier or max-margin hyperplane. The idea behind the SVM algorithm was first captured in 1963. SVMs are gaining enough popularity to continue to have far-reaching impacts in areas as diverse as protein sorting processes, text classification, facial recognition, self-driving cars, and robotic systems.

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