Lazy Learning vs Eager Learning Algorithms in Machine Learning

Introduction

In machine learning, it is essential to understand the algorithm's working principle and primary classification of the same for avoiding misconceptions and other errors related to the same. There are mainly two types of **machine learning algorithms**, lazy and eager learning algorithms, based on their training style and other principles. A proper machine learning algorithm should be selected according to the problem statement for a better-performing model.

This article will discuss the lazy and eager learning algorithms with their core intuition, working mechanisms, advantages, and disadvantages. We will also discuss the best-fit model selection according to the data type and requirements of the model. These concepts will help understand the algorithm's classification better and help understand some common and must-know properties of both types.

Learning Objectives

After going through this article, you will learn the following:

1. The core idea of lazy learning and eager learning algorithms
2. How the lazy and eager learning algorithms work?
3. Difference between both the techniques

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Table of contents

What is a Lazy Learning Algorithm?

In traditional machine learning, algorithms acquire data, train on it, and produce a **trained model** capable of predicting unseen datasets with a certain level of accuracy. However, lazy learning algorithms introduce a distinct approach.

Lazy learning algorithms maintain the same underlying mechanism as traditional algorithms but alter how they handle data. During the training phase of lazy learning, the algorithm accepts the data as input but refrains from actively training on it. Instead, it stores the data for later use. The actual model training occurs during the prediction phase.

One prominent example of a lazy learning algorithm is the **K-nearest neighbors** (KNN) algorithm. KNN stores the data during training and applies its working mechanism when it's time for prediction or testing.

How Does Lazy Learning Algorithm Work?

Lazy learning algorithms are also known as lazy evaluation algorithms because they evaluate data in a very lazy manner. To illustrate, let's consider the KNN algorithm as an example. When building a model using KNN, the algorithm accepts and stores the dataset during the training and fitting phase, essentially doing nothing with it.

However, when the testing phase arrives and you request a prediction for a specific data point, the KNN algorithm springs into action. It calculates the nearest neighbors of the given data point based on its working mechanism and returns the predicted output.

It's essential to note that the training phase for lazy learning algorithms is notably faster since they merely store the data. Conversely, the heavy lifting, involving all the calculations, takes place during the testing phase, making predictions slower and more time-consuming.
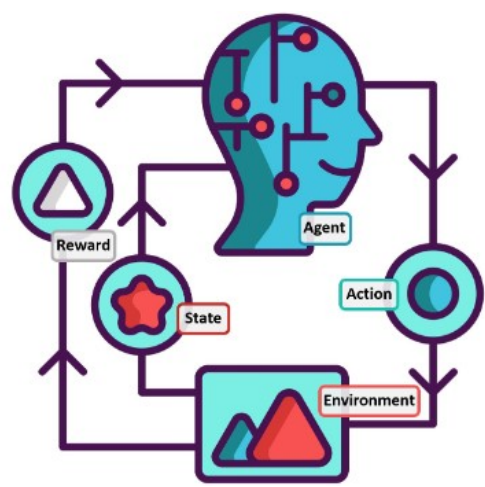

What is Eager Learning Algorithm?

Eager learning algorithms are traditional machine learning methods that process data during the training phase. These algorithms build a model based on the provided training data and use this model to make predictions during the prediction phase. Examples of eager learning algorithms include Linear Regression, Logistic Regression, **Support Vector Machines**, Decision Trees, and Artificial Neural Networks.

How Does Eager Learning Algorithm Work?

Eager learning **algorithms** take the training data as input and apply various functions and techniques specific to the algorithm during the training phase. For instance, using linear regression for model building processes the data during training, resulting in a trained and knowledgeable model. During the prediction phase, when you request predictions for new data points, the model provides instant results based on training and learning from the initial data. While eager learning algorithms have slower training processes, they offer faster predictions than lazy learning algorithms.

Lazy vs. Eager Learning Algorithms: The Difference

Property	Lazy Learning	Eager Learning
Training Speed	Fast, stores the data while training	Slow, Tries to learn from data while training
Prediction Speed	Too Slow tries to apply functions and learnings in the prediction stage	Faster, predicts very fast as there are pre-defined functions
Learning Scope	Medium, it can learn from data while training	Medium, it can learn from data while testing
Pre Calculated Algorithm	Absent, calculations are done while the testing phase	At present, here calculations are already done in the training phase
Example	KNN	Linear Regression

Which One is Best for You?

After this whole discussion, a question might come to your mind which approach is better and which should be used when?

The answer to this question is in only two words: situation based. As we can not control our data with the algorithm and we cannot changes, we can change the algorithm as per the data and its variations, and that is where the answer to this question lies.

Everything depends on the type of data, its patterns, what kind of model you want, and your requirements. Sometimes, it is essential to train the algorithm faster in an emergency; the lazy learning approach is reasonable. Sometimes it is okay for us to train the model for a longer time to make it faster while prediction than the enthusiastic learning approach is reasonable.

In some of the datasets, the behavior of the data matches very correctly to some of the lazy learning approaches, and you also want a fast predictor model; in such cases, you can use sluggish learning methods and apply some other techniques or tune the algorithm in such a way that model becomes less complex and takes less time to predict.

Conclusion

In this article, we discussed the lazy and eager learning algorithms in [machine learning](#) with core intuition and ideas behind them with suitable examples. We also discussed an approach for selecting the best-fit algorithm according to the problem statement. This will help one to identify the algorithm, classify them, and use them correctly.

Key Takeaways

- Lazy learning algorithms are types of algorithms that store the data while training and preprocessing it during the testing phase.
- Lazy learning algorithms take a shorter time for training and a longer time for predicting.
- The eager learning algorithm processes the data while the training phase is only.
- Eager learning algorithms are faster than lazy learning algorithms for predicting data observations.
- A proper approach should be selected according to the model's data type and requirements.

Frequently Asked Questions

Q1. What is the difference between lazy and eager algorithms?

A. Lazy algorithms delay computation until necessary, while eager algorithms perform computations upfront. Lazy learners wait until prediction to generalize, while eager learners build models during training.

Q2. What is an example for lazy learner?

A. An example of a lazy learner is the k-nearest neighbors (k-NN) algorithm, which stores the entire training dataset and computes predictions only when needed.

Q3. What is the difference between lazy and eager learning in machine learning ?

A. In machine learning, eager learning involves building a predictive model during training, whereas lazy learning postpones model creation until prediction time. Eager methods, like decision trees, require upfront model building, while lazy methods, like k-NN, defer it.

Q4. What is lazy learning method?

A. Lazy learning is a machine learning method in which the model is not constructed during training but postponed until prediction time. It relies on storing the training data and making predictions by finding similar instances at runtime.

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