

Chapter 67

Machine Learning Techniques for Internet of Things

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ABSTRACT

The idea of an intelligent, independent learning machine has fascinated humans for decades. The philosophy behind machine learning is to automate the creation of analytical models in order to enable algorithms to learn continuously with the help of available data. Since IoT will be among the major sources of new data, data science will make a great contribution to make IoT applications more intelligent. Machine learning can be applied in cases where the desired outcome is known (guided learning) or the data is not known beforehand (unguided learning) or the learning is the result of interaction between a model and the environment (reinforcement learning). This chapter answers the questions: How could machine learning algorithms be applied to IoT smart data? What is the taxonomy of machine learning algorithms that can be adopted in IoT? And what are IoT data characteristics in real-world which requires data analytics?

INTRODUCTION

The two major trends are going on world today among the computing research community which one is the rapid rise of IoT and the other one is the rapid rise of AI and machine learning. In many ways they are intersecting with each other to create some really smart new scenarios. One such an IoT AI smart scenario has been discussed with demonstration here.

Consider a scenario to learn how a cheap IoT sensor was deployed to measure air quality, how they can push data to the cloud and how we can use that for machine learning. In this scenario the first part is discussing about the design of sensor nodes with IoT capability to measure the air quality. Then it

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look at how the cloud can be empowering the IOT AI scenario that helps to collect data and analyze it and learning some intelligence with GD plotting models. Then the third one will be discussed about the devices like raspberry PI's and our handheld devices that are handling the device communication and inference with them as well.

According to IHS research they are expected to be 31 billion connected IOT devices by the end of this year. And also this research is showing a 27.6% compound annual growth rate of the data will be pushing to the cloud by those devices. With those lot of data, there is some usual things such as fill, sinks, filtering, sorting and querying all that kind of stuff are done well. But a smart scenario can also use that to start training some models, all of that data and all of those models Gubbi(2013). Hence machine learning models can be used to generate intelligence and to help to start making intelligent decisions based on the data that is being generated by the devices Khan(2012) and Jin(2014).

Why Machine Learning?

The world is filled with lot of data like pictures, music, words, spreadsheets, videos and it does not going to slow down anytime. Soon machine learning brings the promise of deriving meaning from all of that data. The value of machine learning is only just beginning to show itself. There is a lot of data in the world today generated not only by people but also by computers, phones and other devices. This will only continue to grow in the years to come. Traditionally humans have analyzed data and adapted systems to the changes in data patterns. However as the volume of data surpasses the ability for humans to make sense of it and manually write those rules. It turns the world increasingly to automated systems that can learn from the data and importantly the changes in data to adapt, to a shifting landscape.

Machine learning exists all around the world in the daily use products. However it is not always apparent that machine learning is behind it all. While things like tagging objects and people inside of photos are clearly machine learning and recommending the next video to watch is also powered by machine learning. Google search is also one of the biggest examples of machine learning. Every time you use Google search you are using a system that has many machine learning systems at its core. From understanding the text of the search query to adjusting the results based on the personal interests such as knowing which results to show you first. When searching for Java depending on whether it shows coffee or programming language or both. These powerful capabilities can be applied to a wide range of fields from diabetic retinopathy and skin cancer detection to retail, transportation and self-driving vehicles. Now every company is pivoting to use machine learning in their products in some way. It is rapidly becoming well an expected feature just as users expect companies to have a website that works on their mobile device or perhaps an app. From detecting skin cancer to detecting escalators in need of repair machine learning has granted computer systems entirely new abilities.

As machine learning used to make human tasks better faster and easier than before it can also look further into the future. The simple definition of machine learning is "Using data to answer questions". Using data is referred to as training and answering questions is referred to as making predictions or inference. These two sides refer to using the data to inform the creation and fine-tuning of a predictive model. This predictive model can then be used to serve up predictions on previously unseen data and answer those questions. As more data is gathered, the model can be improved over time and new predictive models deployed. The key component of this entire process is data. Everything hinges on data. Data is the key to unlocking machine learning just as much as machine learning is the key to unlocking

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