

Chapter 12

Machine Learning and Its Application in Monitoring Diabetes Mellitus

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ABSTRACT

Data science is a fast-growing area that deals with data from its origin to the knowledge exploration. It comprises of two main subdomains, data analytics for preparing data, and machine learning to probe into this data for hidden patterns. Machine learning (ML) endows powerful algorithms for the automatic pattern recognition and producing prediction models for the structured and unstructured data. The available historical data has patterns having high predictive value used for the future success of an industry. These algorithms also help to obtain accurate prediction, classification, and simulation models by eliminating insignificant and faulty patterns. Machine learning provides major advancement in the healthcare industry by assisting doctors to diagnose chronic diseases correctly. Diabetes is one of the most common chronic disease that occurs when the pancreas cells are damaged and do not secrete sufficient amount of insulin required by the human body. Machine learning algorithms can help in early diagnosis of this chronic disease by studying its predictor parameter values.

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INTRODUCTION

The discipline of machine learning is covered under the umbrella of Artificial Intelligence. Analytical and reasoning skills are essential component for building intelligence. Learning from past experience enhances these skills. The current need of all the industries is to inculcate this intelligence into machines. A machine cannot deal directly with the collected data in an intelligent way. It does not have the capability to analyze data on its own. A machine can be made intelligent by training it using past experience. A machine can decide about a disease from its symptoms only when it is trained by the symptoms gathered in the past. Therefore every growing industry needs powerful machine learning algorithms to train machines using past structured or unstructured data.

Machine learning algorithms are the computer programs that make machines learn from old data and enable them to perform predictions, classification, summarization and many more. The learning by machine involves construction of models that takes past data as input and produces the desired output using mathematical functions. Various machine learning techniques are there depending upon the type of data used for learning: supervised, unsupervised and reinforcement. Supervised learning algorithms are using labelled data whereas unsupervised learning algorithms uses unlabelled data. Reinforcement Learning is a machine learning technique in which a learning algorithm is based on a feedback system and no past data is used for training. Supervised learning involves different algorithms for classification task which includes decision tree, regression, support vector machine, k -nearest neighbours etc. The model built from training data is applied on the test data to check its validity (Callahan, A., & Shah, N. H. 2017).

The healthcare sector has always been a quick adapter of technological advances. Nowadays, machine learning plays a major role in many health related realms such as managing patient history and records in hospitals (Bhardwaj, R.et al. 2017), the development of advanced medical methods (Ghassemi, M.et al. 2018), effects of medicine, medical image diagnosis and the treatment of chronic diseases. Computer-aided diagnosis of some chronic diseases uses pattern recognition techniques of machine learning to detect infected structures in the medical image (Panch, T. et al.2018). Here, the labelled data can be in the form of images which are given to the machine learning algorithm as input, such as Bayesian classifier, artificial neural network and support vector machine. The resulting classifier is expected to classify new medical images correctly.

MAIN FOCUS OF THE CHAPTER

This chapter mainly provides detailed description of about data science discipline network, machine learning applications, type of machine learning approaches and machine learning algorithms available in these approaches. The first subsection gives brief about type of machine learning approaches Unsupervised, Supervised, Reinforcement, and deep learning. The next subsection describes the algorithms of unsupervised learning approach and dimensionality reduction technique with the associated python libraries to handle them practically. Further, in the subsection of supervised learning algorithms, all algorithms like Regression, Decision Tree, K-Nearest Neighbours, Support Vector Machine, Artificial Neural Network and Naïve Bayes are discussed in detail with examples and their supportive python libraries and functions are provided for help in practical implementation. Last subsection provides detailed case study of applying simple and weighted K-Nearest Neighbours classification algorithm in Python

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