Chapter 9
Applications of Machine Learning in Healthcare

Garima Mathur
University Institute of Technology RGPV, Bhopal, India

Anjana Pandey
University Institute of Technology RGPV, Bhopal, India

Sachin Goyal
University Institute of Technology RGPV, Bhopal, India

ABSTRACT

Machine learning has transformed the world by giving it a wide variety of applications in the field of manufacturing, and now it has proved itself in the field of healthcare too. Its application ranges from cardiac arrest prediction to body organ recognition from images, lung disease detection, etc. Machine learning application has increased the reach of patients to their healthcare record, and with the use of machine learning techniques, many new treatment options and new drugs are now available which was not possible before. This chapter has presented the basic introduction of machine learning techniques and their wide variety of applications in the healthcare system.

INTRODUCTION

Nowadays in the healthcare management system a vast amount of data about patient's healthcare record, medical reports, their examinations, treatment is given to them; medicinal records, hospital records, etc are becoming complex to manage. Improper management of data will lead to wrong decision-making. There is a need for some intelligent technology that can extract and process required information from this huge dataset. For some serious diseases like cancers and heart-related diseases, there is a need for an accurate diagnosis system that can give much better results. This can be done by combining the knowledge of a human with smart computers. Machine learning has already proven itself in various fields for its fast and accurate results, so using this intelligent technology can help doctors in making more precise decisions in their day-to-day life. ML can help doctors and hospitals in managing this vast

amount of data, managing electronic health records of patients that can be accessed from anywhere at any time, for drug discovery and medication, etc.

Machine learning has influenced our day-to-day life that it has become inseparable now. They have already proven themselves in various domains like transport, manufacturing industry, etc, and now gaining popularity by their outstanding results in the field of healthcare like lung disease classification(Anthimopoulos et al., 2016), body organ recognition through medical images(Yan et al., 2016), lung nodules detection(Shen et al., 2015), reconstructing medical image(Mehta & Majumdar, 2017; Schlemper et al., 2017), segmenting brain tumors(Havaei et al., 2017). These intelligent systems are now widely used by radiologists and physicians for the examination of patients (Bourzac, 2013). One such example of machine learning and deep learning model used in medicine without any human interaction is the method adopted by the FDA for diagnosis of an eye-related problem caused due to diabetes can be identified using eye image only. Combining mobile and cloud technology with machine learning provides more predictive outputs that can provide human-like intelligent systems.

Organization of the paper: The paper is arranged in such a way that a basic introduction about machine learning and how it has influenced our day-to-day life has been presented in the introduction part. Section 2 describes the steps involved in machine learning, in section 3 the learning type of machine learning algorithm has been discussed, section 4 gives a detailed description of the application of machine learning in the healthcare system. Section 5 highlights the challenges that are faced while using machine learning as an application in the healthcare system and section 6 has presented some of the related work that has been done in the field of machine learning in previous years. Finally, section 5 concludes the paper.

MACHINE LEARNING STEPS

A machine learning algorithm can be developed using these 6 steps namely-

1. **Data collection:** From various data sources, collected data is streamlined and attributes are selected from this data.
2. **Data pre-processing:** Data pre-processing itself involves 3 steps-
   a. **Formatting:** Format of collected data must be either in XML or in CSV i.e. as per industry standard.
   b. **Cleaning:** The cleaning process involves taking care of missing data and eliminating noise from it.
   c. **Sampling:** The process of sampling is, to remove redundant data at regular intervals.
3. **Data Transformation:** Data transformation is an important step in machine learning as data must suit according to algorithm. Transformation can be aggregating instances into single features or splitting the feature to extract information from it.
4. **Algorithm Training:** In this step, the training data and testing data are separated from the input dataset, here the algorithm extracts and gain the knowledge from the training dataset. The output of this step is stored as a model for an algorithm. In unsupervised learning, there is no concept of algorithm training.
5. **Test the Algorithm:** The data to be tested is given as an input to the output of the previous step. The output is evaluated and if it is not satisfactory then the previous step is repeated.

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