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Editorial

Machine Learning in Health Care Medicine

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EDITORIAL

Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL) are buzzwords that, at times, are used interchangeably so a brief explanation of these terms is in order. AI is used to automate tasks such as decision making, language processing, recognitions of patterns, pictures and sounds, and other forms of learning. ML is an approach used in AI, and DL is one of the ML methods that uses Artificial Neural Networks (ANN) to solve the problem at hand; a network of neurons organized in layers is referred to as a neural network, and DL is essentially an ANN with a large number of layers. The first application of AI is the arithmetic machine named Pascaline invented by Blaise Pascal [1], the mathematician who laid the foundation for the theory of probability in collaboration with another famous French mathematician Pierre de Fermat [2]. AI is now ubiquitous: it is being used in data security [3], healthcare [4], and customer segmentation for marketing [5], and fraud detection [6], to name a few applications.

The applications of AI in healthcare are quite diverse, ranging from significantly reducing the rate at which in-patients suffered dangerous falls in a hospital [7] to improving cyber security and customer service [8]. ML tools are applied in prediction and prognosis of serious diseases [9-10]. While most of the ML tools (e.g., Decision Tree (DT), Artificial Neural Networks (ANN), and Support Vector Machine (SVM)) are predictive in nature, the method of Logistic Regression (LR) yields a predictive model that is also explanatory and therefore it is one of the commonly used methods used for prediction and prognosis of diseases. With heart disease and cancer being the top two leading causes of death in the United States [11]. (Figure 1), these two diseases have received quite a bit of attention from the AI community. Sony, Ansari, Sharma, and Sony [12], provide an overview of AI literature on heart disease prediction. Cruz and Wishart [13], in their expository article on cancer prediction by AI methods, note that machine learning "can be used to substantially (15-25%) improve the accuracy of predicting cancer susceptibility, recurrence and mortality. At a more fundamental level, it is also evident that machine learning is also helping to improve our basic understanding of cancer development and progression". Austin, Tua, Ho, Levy, and Lee [14], show that modern, flexible tree-based methods from the data-mining literature offer substantial improvement in prediction and classification of HF subtype compared with conventional classification and regression trees; logistic regression, however, performed the best for predicting

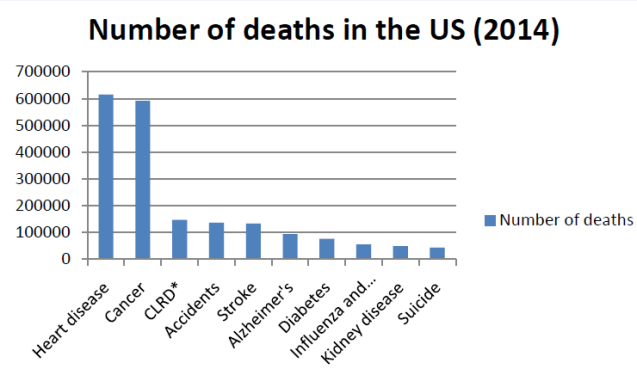

Figure 1 Number of deaths in the US (2014 data).

the probability of the presence of heart failure with preserved ejection fraction (HFPEF) among the methods from the data-mining literature. Bozorgi, Taghva, and Singh [15], used a SEER dataset of 1079102 records on 20 variables to predict five-year survivability of breast cancer patients via Logistic Regression. The entire data set was first randomly split into a training set of 740506 records, and a test set of 338596 records; a logistic regression model was fitted to the training set, and then validated using the test set. The performance measures of the fitted LR model turned out to be same for both training and test sets:

Precision = 90%, Recall = 99%, and F1 measure = 94%.

ML has made significant contributions to healthcare and medical research, and its usage is expected to grow exponentially. There is one issue with the use of ML, however: no one quite understands how majority of the ML methods work, and total reliance on such black box methods might be problematic.

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