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On the Potential of Machine Learning to Improve Disease Outcomes

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Abstract

The medicine today is advanced into new realm with the growth of applications of artificial intelligence and machine learning in healthcare. This is important as we will not be addressing the target population for a specific disease alone; rather predict the likely outcome of the related disease in an unknown population of interest with the knowledge gained. This is of utmost focus especially with rare diseases, the data for which are available in lower volumes. Further, prediction outcomes available at earlier stages are important to prepare points of care to handle disastrous outcomes resulting from the diseases.

Keywords: ***Preprocessing, Learning, Hybrid, Objective, AI***

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Introduction

A machine learning system primarily aims at addressing major challenges including reduction of errors in diagnostic and therapeutic measures with a view to prove quality healthcare services [14]. This necessitates the systems to be trained on clinical data generated during the process of screening, prognosis and treatment in order to study correlations between features characterizing common subjects in a group [3,5]. A further more challenging problem is to integrate existing AI applications using machine learning within prevailing clinical workflow [8]. We provide a brief review on the preprocessing approaches besides the adoption of appropriate learning algorithms that can build intelligence into the existing systems. Machine learning provides good opportunity to improve accuracy by exploiting complex interactions underlying risk factors [1,12].

Material and Methods

Preprocessing plays a significant role in preparing the data for training especially with respect to clinical data. Features extraction as a part of preprocessing is more central to applications involving health and medical informatics. Demographic data and anthropometric indices included as part of the study are sometimes considered irrelevant to the objective of study. In this regard, the wrapper approaches and filter approaches would be most applicable to achieve the desired task. While the filter approaches involve preliminary removal of features irrelevant to the study, the wrapper approaches would aim at improving the performance efficiency of the learning algorithms developed.

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Commonly used learning algorithms for prediction of diseases include both, supervised and unsupervised approaches [7,10]. With unsupervised approaches our main target would be to identify phenotypes of the disease that would remain distinct from one group to the other, while identifying highly similar subjects with common disease presentations clustered in similar groups. Cluster analysis is the most applicable methodology at this stage. Supervised learning involves the application of classification algorithms with the intention of identifying subjects with the disease as well as predicting severity levels pertaining to the disease outcomes [9,13]. Commonly used classification algorithms including logistic regression, support vector machines and decision trees yield a considerably decent outcome [5,10], however the accuracies with which these algorithms perform will be better with the design of ensemble and hybrid techniques that utilize these algorithms in an efficient way [2,11]. Neural networks have also proved to yield good results with medical data involving images and prediction problems [4].

Conclusion

The performance of the learning algorithms can be justifiable only upon cross validating the results of the models across populations and populations beyond the scope of the study. Early recognition of the attributes influencing the disease outcome is utmost important with a view to address the specific patients at risk. The strategy can be seen as an important means to gain objective opinion to enhance reliability and accuracy with increased efficiency from the perspective of both clinicians and patients.

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