



## Editorial

## Learning to think like Machines



Machine learning is the field of computer science that deals with algorithms to make predictions and learn from the data without being explicitly programmed. Simply stated, the overarching idea is to design algorithms that don't anticipate instructions, but reason themselves. They can understand both linear and non-linear relationships in the data and find patterns that would be otherwise cumbersome to obtain. Smart phone applications (apps) based on machine learning algorithms are opening new avenues in the field of cardiology to improve both work-flow efficiency and patient care.<sup>1</sup>

There are several emerging mobile phone apps available for predicting different cardiovascular diseases.<sup>2–4</sup> For example, a readily available app “MESA Score” uses coronary artery calcium score and traditional risk factors to predict the 10-year coronary heart disease risk in a patient.<sup>5</sup> Along similar lines, Amutha and colleagues, in this issue of *Indian Heart Journal*, explored the development and validation of an android mobile app, which gives a pretest probability to rule out coronary artery disease (CAD) by predicting the results of treadmill test (TMT) in patients without performing the TMT physically.<sup>6</sup> Authors used a training set of seven hundred and fifty patients, a test set of two hundred and fifty patients and a validation set of 300 patients. They used three machine learning algorithms to predict the results of TMT based on six basic features, namely, age, gender, BMI, dyslipidemia, diabetes Mellitus, and systemic hypertension. Authors reported relatively high specificity in their models of 91% with lower sensitivity of 69%.

CAD is extremely prevalent in the South East Asian countries where any effort to provide a cost-effective strategy to improve the screening of patients at risk is certainly welcome. The use of data mining methods is particularly appealing as these techniques are preferable over common statistical methods for making predictions. The app presented by Amutha and colleagues, however, had lower diagnostic yield in prospective three hundred patients group as compared to two hundred and fifty test patients. Interestingly, their data also predicted the results of coronary angiograms with a specificity of 80% and negative predictive value of 80%; however, the sensitivity was diminutive (35%). This may be related to variations in population or disease features and questions the overall generalizability of the test results. In addition, data mining approaches are “data driven”, since these rely principally on input data rather than model based, where a model is build following empirical or theory-based principles. For data driven algorithms, it is important to give a statistical description of the input dataset since the presence of bias or uncommon patterns can make the

trained algorithm biased toward unwilling patterns. Furthermore, decision trees, K-sorting and searching, and curve fitting are well known methods for classification and retrieval. More information on how these algorithms were trained and the performance metrics used could illuminate the next needed steps. However, methods like support vector machine or random forest are used more commonly than curve fitting method.

It should be highlighted that authors did not use traditional machine learning evaluation strategies like K-Fold cross validation to avoid the model overfitting on data pattern. The proposed app also uses a majority voting approach to formulate results; however, different fusion approaches may be more proficient than majority voting for computing results. A comparison with other non-invasive tests like carotid intimal medial thickness, coronary computed tomography angiography and stress echocardiography would be needed to see if the app could function as a gatekeeper for further noninvasive assessments.<sup>7</sup> Therefore, the study may be considered an inception of a concept while leaving the door ajar for more research in optimizing modern data analytic techniques prior to generalizing the results.

Despite the limitations, this study by Amutha and colleagues is symbolic of the burgeoning interest in developing the next-level patient care by using cost-effective technologies and using artificial algorithms that imitate intelligent human behavior. However, as medical professionals, apart from reckoning the synthetic cognition in illness detection, it is also imperative to valorize efforts toward risk factor mitigation and ameliorate manifested disease through behavioral modifications. As machine learning starts to progressively influence human decisions and patients subjected to artificial non-intuitive ways of reasoning, it will be our responsibility to modulate machine learning and its influence explicitly patient-centered for developing trust and ensuring long-lasting patient-doctor relationships.

### Disclosures

Dr. Sengupta is a consultant for Heartsciences., Hitachi Aloka Ltd. All other authors have nothing to disclose.

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