AI systems found to be better than doctors at gauging heart attack risk

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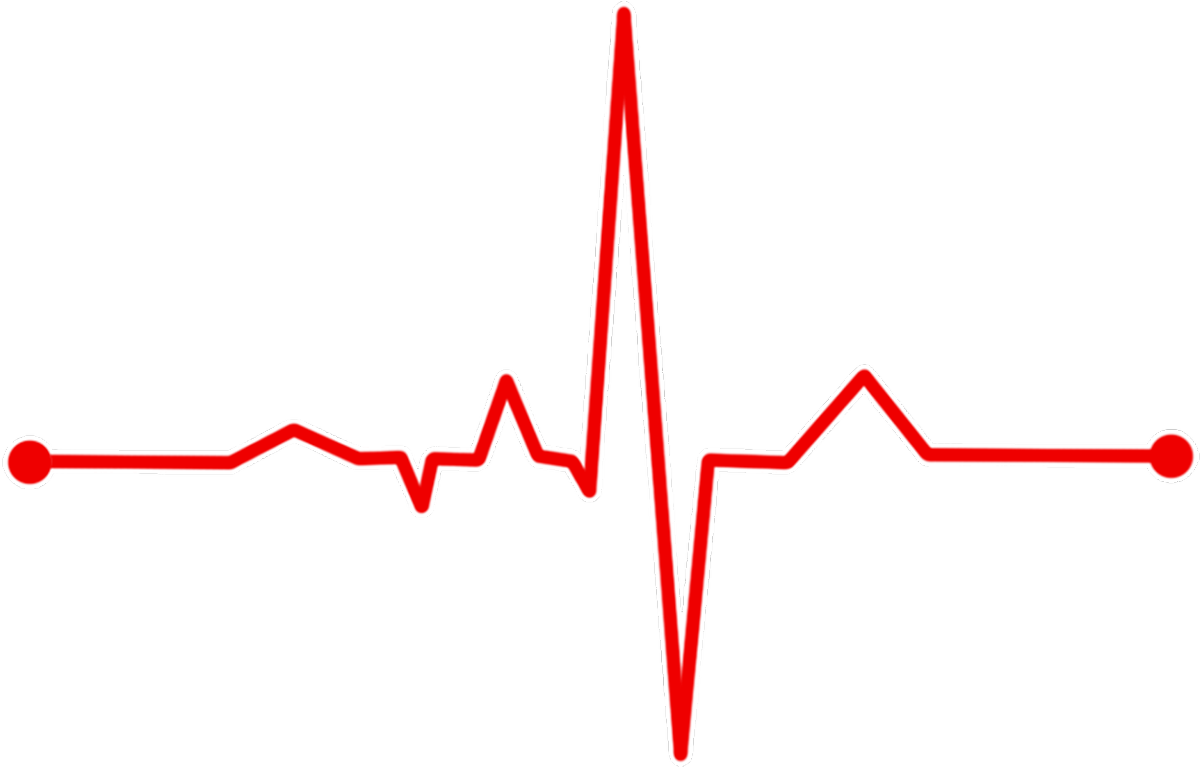

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(Medical Xpress)—A team of researchers at the University of

Nottingham in the U.K. has found that artificial intelligence systems can be better at gauging a patient's risk of a heart attack than doctors using a standard protocol. In their paper uploaded to the open access site *PLOS ONE*, the team describes how they tested four AI systems against humans using a protocol, what they found, and why they believe there is still room for improvement.

Most doctors today use a protocol or guideline very much like the one created by the American College of Cardiology/American Heart Association (ACC/AHA). It is essentially a questionnaire assessing health factors and generating a statistical result. The guideline accounts for such factors as a patient's age, weight, blood pressure and cholesterol levels. Prior research has shown that by using such a guideline, doctors can correctly assess a patient's risk of having a heart attack at a rate of 72.8 percent, which is quite impressive. But it still leaves a lot of room for improvement, because that failure rate of 27.2 percent oftentimes represents people who die.

In this new effort, the researchers sought to find out if computers running AI systems might do a better job of it. They set up four such AI systems: logistic regression, random forest, neural networks and gradient boosting. Each was given thousands of patient data records from a British medical database as a means to study health patterns in patients and to identify risk factors. They were then each assigned the task of predicting a heart attack in those same patients over the course of the next 10 years—the data covered the period 2005 to 2015.

The researchers report that all four AI systems did better than the human average using the ACC/AHA guidelines, ranging from 74.5 percent to 76.4 percent correct, which, the team noted, possibly amounted to 355 patients whose lives could have been saved had they known they were at risk. They report also that the systems found risk factors that are not currently used by doctors to assess heart attack risk, such as mental

illness and the use of oral corticosteroids. They suggest that tweaking the system and perhaps adding other known risks manually could improve the rate even more.

More information: Stephen F. Weng et al. Can machine-learning improve cardiovascular risk prediction using routine clinical data?, *PLOS ONE* (2017). DOI: 10.1371/journal.pone.0174944

Abstract

Background
Current approaches to predict cardiovascular risk fail to identify many people who would benefit from preventive treatment, while others receive unnecessary intervention. Machine-learning offers opportunity to improve accuracy by exploiting complex interactions between risk factors. We assessed whether machine-learning can improve cardiovascular risk prediction.

Methods
Prospective cohort study using routine clinical data of 378,256 patients from UK family practices, free from cardiovascular disease at outset. Four machine-learning algorithms (random forest, logistic regression, gradient boosting machines, neural networks) were compared to an established algorithm (American College of Cardiology guidelines) to predict first cardiovascular event over 10-years. Predictive accuracy was assessed by area under the 'receiver operating curve' (AUC); and sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) to predict 7.5% cardiovascular risk (threshold for initiating statins).

Findings
24,970 incident cardiovascular events (6.6%) occurred. Compared to the established risk prediction algorithm (AUC 0.728, 95% CI

0.723–0.735), machine-learning algorithms improved prediction: random forest +1.7% (AUC 0.745, 95% CI 0.739–0.750), logistic regression +3.2% (AUC 0.760, 95% CI 0.755–0.766), gradient boosting +3.3% (AUC 0.761, 95% CI 0.755–0.766), neural networks +3.6% (AUC 0.764, 95% CI 0.759–0.769). The highest achieving (neural networks) algorithm predicted 4,998/7,404 cases (sensitivity 67.5%, PPV 18.4%) and 53,458/75,585 non-cases (specificity 70.7%, NPV 95.7%), correctly predicting 355 (+7.6%) more patients who developed cardiovascular disease compared to the established algorithm.

Conclusions

Machine-learning significantly improves accuracy of cardiovascular risk prediction, increasing the number of patients identified who could benefit from preventive treatment, while avoiding unnecessary treatment of others.