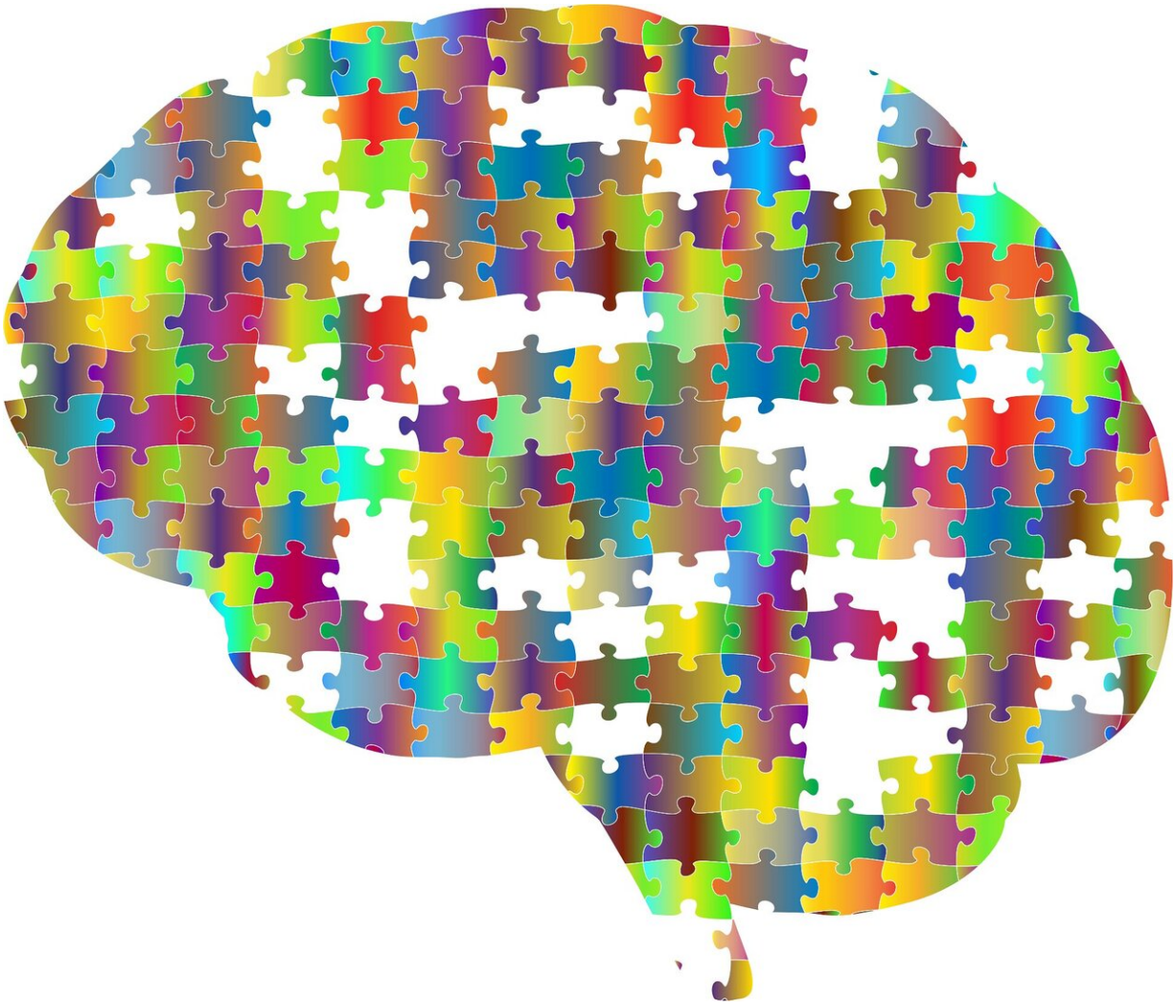
MedicalXpress

AI gives reliable coma outcome prediction

June 4 2019, by Wiebe Van Der Veen



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After cardiac arrest and resuscitation, some patients will still be in a

coma and treated at an intensive care unit. Their prospects are uncertain. Clinicians seek a reliable method to predict their outcomes. Researchers of the University of Twente and the Medisch Spectrum Twente hospital have developed a learning network that is capable of interpreting EEG patterns. Artificial intelligence (AI) can give a reliable outcome prediction, providing a valuable extra source of information for decision-making. The researchers present their approach in *Critical Care Medicine*.

In the Netherlands, about one-third of the people with cardiac arrest followed by resuscitation will require ICU treatment. About 7000 each year fall into a coma, and more than half of them will not regain consciousness. Families want to know what the prospects are and what their quality of life will be if they regain consciousness. Determining the effectiveness of further treatment requires careful analysis of the situation.

One new option is the SEPP test, which determines if an electrical signal applied to the wrist reaches the brain. EEG scans measured via electrodes on the head also provide important information. Analysis of EEG using AI gives a highly accurate outcome predicition, as the researchers now show in their paper. Twelve hours after resuscitation, the learning network is capable of predicting a good outcome with 58 percent accuracy and a bad outcome with 48 percent. This is a better performance than a trained neurologist alone. Nonetheless, if EEG data is not specific enough, neither doctors nor the AI method can reach a conclusion.

Training

The first author, Marleen Tjepkema, argued for using EEG in the outcome prediction in her Ph.D. thesis in 2014 as a UT Technical Medicine graduate. She and her colleagues have now introduced

automated interpretation of EEG scans. The deep learning network was trained using 600 EEG patterns, and did not get any hints on what to look at. Then it analyzed 300 EEG patterns and made predictions. Neurologists have to look at hundreds of EEG's as well, as part of their training, guided by an experienced neurologist who points out what they have to look at. Because the EEG patterns are so information-rich, the computer outperforms human judgment.

Once trained, the network is capable of judging the EEG data quickly, well within a second. The researchers expect that this adds valuable information to human judgment. Another advantage is its flexibility—analysis is possible at any time of the day. Testing he new technology in ICUs will determine whether clinicians also see the system as a valuable tool. One of the next steps in this research is having a closer look at the learning strategy of the network, making it more transparent than the current black box approach. For this, the neurophysiologists will collaborate with computer scientists and mathematicians at the University of Twente. Deep learning is already in use for medical purposes, for example, in interpreting X-ray images or classifying skin injuries.

The paper "Outcome prediction in postanoxic coma with deep learning," is published in *Critical Care Medicine*.

Provided by University of Twente