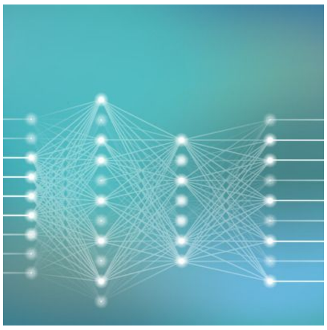
DL vs. ML in Biomedical Research



Deep learning models are more efficient at discerning patterns and discriminative features in brain imaging than standard machine learning models, a new study shows (Abrol A et al. 2021).

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Researchers at the Center for Translational Research in Neuroimaging and Data Science (TReNDS), Georgia State University, USA, are deploying deep learning techniques for brain imaging data analysis. Biomedical technologies like magnetic resonance imaging produce massive amounts of very complex data. Using artificial intelligence tools, specific patterns can be extracted from these data that allow scientists to better understand health and disease. Deep learning (DL) in particular, whose complex architecture is based on advanced neural network, is suitable for analysing heterogeneous data from multiple sources.

Previous research highlighted the disadvantages of DL utilisation for brain imaging data analysis compared to standard machine learning (SML) approaches. According to the TReNDS researchers, however, DL models perform with much better results than SML if they are properly trained and fed the data with little or no preprocessing.

“Results show that if trained following prevalent DL practices, DL methods have the potential to scale particularly well and substantially improve compared to SML methods, while also presenting a lower asymptotic complexity in relative computational time, despite being more complex,” the study says.

The authors conducted a large-scale systematic comparison of several SML and DL methods using a large data set of structural magnetic resonance imaging images to show the importance of representation learning for DL.

While SML models may be more efficient in some cases (e.g. when the input data involve single-number metrics), DL models, although they require substantially more input information, once they are properly trained show better results with more complex data. The study used sample sizes from 100 to 10,000, and the DL approaches overwhelmingly outperformed SML.

In the future, DL may help with discovering not yet known explanations and representations, and expanding available knowledge of the human brain, the researchers hope. They note the need for further research to study the DL models’ weaknesses but emphasise the efficiency of DL against SML from a mathematical point of view.

Source: Georgia State University

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