Unlocking brain treatment potential from MRI data

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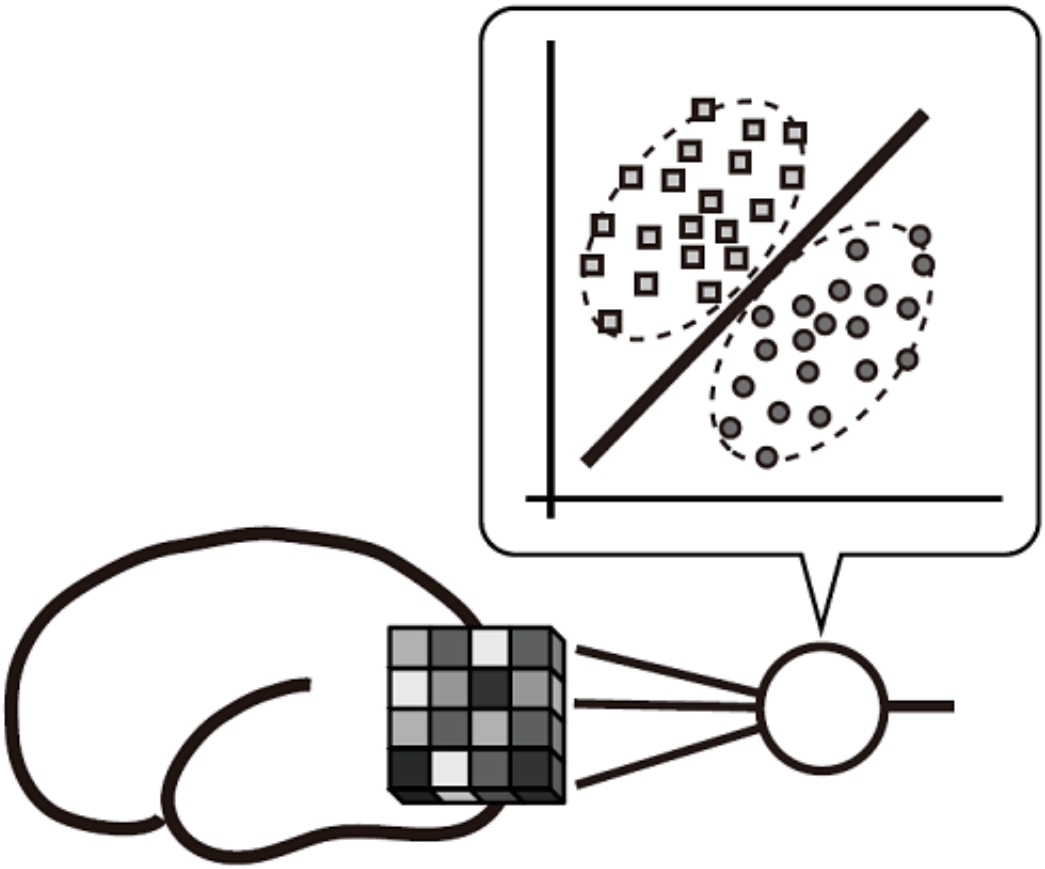

Multivariate pattern analysis of magnetic resonance imaging (MRI) signals. Credit: University of Electro Communications

Magnetic resonance imaging (MRI) plays a vital role in medical and neuroscience research as a non-invasive, highly sensitive way of imaging

both physical structures and activity inside the human brain. The data from each MRI scan contain a vast amount of information, which is divided up into a three-dimensional grid comprising individual 'voxels'.

Comparing individual voxel signals in a healthy subject with corresponding individual voxel signals in a patient can help uncover areas of the brain significant for specific diseases, for example. However, this 'univariate' analysis can lose valuable information stored in patterns between multiple voxels.

Yoichi Miyawaki at the University of Electro-Communications in Tokyo reviewed recent progress in the field of 'multivariate' MRI analysis, exploring its potential in the fields of medical imaging and neuroscience.

'Pattern classification models' can be trained to find signal patterns associated with specific diseases, such as Alzheimer's or autism, which have complex neural signatures. When presented with a new MRI signal, the model can classify it - an invaluable tool for medical diagnostics. Fine-tuning the models' ability to read dynamic neural signatures could revolutionise the study of highly complex conditions like schizophrenia.

The high sensitivity of pattern classifiers means that they pick up finer details at the sub-voxel level. Recent studies have shown that the models can reproduce visual images from signals generated in a person's brain when they look at a picture - this could one day be expanded to explore hallucinations in schizophrenia and post-traumatic stress disorder.

Advances in multivariate MRI analysis could also lead to better brain-machine interfaces for motor-paralysis patients.

More information: Multivariate analysis of magnetic resonance imaging signals of the human brain. *Curr Top Med Chem*. 2016 Apr 13. [Epub ahead of print]