multiple sclerosis

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Researchers of the Unit for Systems Biology of the University of Jaén in Spain are developing software to analyse magnetic resonance images to detect multiple sclerosis even before the typical brain damage of this neurodegenerative disease appears.

The multidisciplinary team is calculating the fractal dimension of the brain images registered on magnetic resonance imaging. They are also starting to adapt the technique to other neurodegenerative diseases in collaboration with the Centre for Applied Medical Research of the University of Navarra and Hospital Clínico of Barcelona.

Multiple sclerosis is a degenerative disease of the nervous system that cannot be cured and whose exact causes are unknown. When the first symptoms appear, one of the tests that is usually carried out is an MRI scan to find out if the brain suffers the typical damage of this disease.



3-D brain image generated by the new application

In the early stages of the disease it may be that no damage has been caused yet or that the damage caused is under the resolution limit of the MRI. In such cases the brain of an ill person is said to be 'apparently normal' as it shows the same features than that of a healthy person. However, a group of Jaen scientists has calculated the fractal dimension of an ill person's brain and they have proven that it is different from a healthy person's brain.

Unlike the Euclidean dimension (a point has a dimension of zero, a line has a dimension of one, a plane has a dimension of 2, and a volume has a dimension of 3), the fractal dimension is a parameter that allows the use of dimensions ranging between 1 and 2 and 2 and 3.

The fractal dimension is the dimension of irregular digitalized curves, and for some years now it has been applied to different biological structures, but the application to the brain was rare. For the first time, this group of biologists, computing engineers, mathematicians, neurologists, neurosurgeons, psychologists and statisticians are carrying out this type of calculations on 3D magnetic resonance imaging of brains to try to solve clinical problems. "It is a tool for clinical use to try to see if persons suffering the early symptoms of multiple sclerosis, with an apparently normal brain, can suffer this disease. It could be a very useful tool for the early diagnosis of brain-related diseases," said team leader Francisco J Esteban

"When fractal dimension is applied to the brain, we are able to detect certain alterations in the brain structures that cannot be observed with any other method used so far. By using this new technique, we can detect alterations that the eye cannot see," said Professor Esteban Ruiz.

"We are using this method, in collaboration with Hospital Clínico of Barcelona, to detect possible changes in the brain of children that can develop learning difficulties. An early diagnosis can minimise such problems by applying a suitable treatment."

"The next step in our study consists of seeking the collaboration of Andalusian hospitals to see if there are successful results in different groups of patients," he added.