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Bernese Biotechnology Has International Triumph

MRI data are essential in the treatment of neurological illnesses. Self-learning software from Bern respectively evaluates them so that the imaging of brain tumours, strokes and now also multiple sclerosis can profit from it.

Precisely mapping a brain tumour in record time. Predicting which tissue will recover after a stroke. Accurately recording the extent of the damage that multiple sclerosis has caused in the brain. Self-learning software from Bern, which implements machine learning concepts, can do all of this. At the largest specialist conference in medical imaging worldwide, MICCAI (www.miccai2016.org), it achieved top rankings in all three disease patterns.

One Idea – Many Applications

The joint venture between biomechanics and medicine was initiated in 2011 with a paper submitted to MICCAI by Stefan Bauer, who was then at the Institute for Surgical Technology and Biomechanics (ISTB) at the University of Bern. His idea of the automatic segmentation of neurological image data was now distinguished as being the most influential of the last five years. Since then, physicians and engineers under the leadership of Professors Roland Wiest (Department of Diagnostic and Interventional Neuroradiology, Bern University Hospital) and Mauricio Reyes (ISTB) have continued to develop the system further.

The first software for brain tumour imaging, BraTumIA, could recently be licensed to a French company. On the basis of registered data sets, the self-learning system analyses neuroradiological images in three dimensions and quickly offers the attending physician additional information on the best possible treatment for the patient. A second offshoot of the modular approach from Bern can, for example, recognise which tissue has a chance for a complete recovery after strokes. A clinical study on the applicability of the FASTER software recently appeared in the *Journal of Cerebral Blood Flow & Metabolism*.

Accurately Recognising the Progression of MS

The latest advancement is learning how to capture the volume of brain lesions typical for multiple sclerosis using a special “deep learning” algorithm from the biomedical computer scientist Richard McKinley. This information indicates whether the illness is remaining stable or if medication needs to be changed in order to prevent advancement. In an initial test on all standard MRI machines, the programme from Berne provided similar estimations to that of a panel of designated MS experts.

Cooperation Between Man and Machine

The independently working system is constantly learning and, in addition, can be trained by experienced doctors to characterise MRI images without errors in a matter of minutes. This simplifies the difficult manual evaluation for the attending physician and directly plays a role in the improved treatment of the patient. With sitem, the national competence centre for translational medicine and entrepreneurship (sitem-insel.ch), the Bern research location will continue to expand its strengths in the development of biomedical technology and clinical applications.

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Study on the "FASTER" stroke software.
Fully automated stroke tissue estimation using random forest classifiers, JCBFM, 19 Oct. 2016.

Captions:
Longitudinal profile of the brain of an MS patient. Right: the raw imaging created by MR tomography. In the middle, there is the volumetry of MS lesions carried out by experts (marked in red); left, there is the lesion volumetry created by the computer. The computer precisely recognises the changes in the brain comparably to the work of the doctor who has been trained for it.
(Image: Neuroradiology, Bern University Hospital).

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