Paris, June 11, 2018

Press information

A Computer Program Able to Automatically Detect and Identify Brain Lesions

Will the radiology of the future come from machine learning? That is the view of Inserm and Inria researchers working in collaboration at the Université Grenoble Alpes who have developed a program able to localize and diagnose various types of brain tumors via MRI image analysis. These analyses have produced highly reliable results, with tumor localizations and tumor-type diagnoses accurate in 100% and over 90% of cases, respectively. This innovative method and its results are the subject of a study published in *IEEE-TMI*.

MRI – or magnetic resonance imaging – with its ability to reveal various brain tissue characteristics is the medical imaging technique of reference when it comes to obtaining highly-detailed images of the brain. It can produce what is known as "quantitative" images, which each map a measurable brain parameter (such as blood flow or blood vessel diameter). Although the quality of these quantitative images is less dependent on the calibration of the measuring apparatus than that of the standard images obtained with MRI - and so is more reliable - this type of technique is still infrequently used in the clinical MRI setting.

Inserm researchers have been working in conjunction with a research team from Inria on the analysis protocols of these quantitative images at the Université Grenoble Alpes. The researchers combined various innovative mathematical tools in order to teach a computer program how to analyze quantitative brain MRI images and diagnose any tumors present.

First of all, the program learned how to recognize the characteristics of a healthy brain. Then, when it was shown images of brains with cancer, it became able to automatically localize the regions whose characteristics diverge from those of healthy tissues and to extract the distinguishing characteristics.
Finally, in order to teach the artificial intelligence how to discriminate between the different types of tumor, the researchers then gave it the diagnosis associated with each of the pathological brain images which had been presented to it.

In order to test the ability of the program to differentiate healthy from diseased tissue, the research team provided it with images that it had not seen before – sometimes of healthy brains, sometimes of pathological brains. The program had to indicate whether a tumor was present in these images and, if so, be able to characterize it. And, by succeeding in localizing the lesions perfectly (100%) and diagnosing them very reliably (over 90%), the artificial intelligence turned out to be a very quick study.

"At present, the acquisition of quantitative images does not correspond to what is happening in routine clinical practice in the MRI departments", specifies Emmanuel Barbier, Inserm researcher leading the study. "But this research shows the value of acquiring these types of images and informs radiologists of the analytical tools that could be available to them in the near future to aid their interpretations. "
In the meantime, the research team will focus on the most relevant images to acquire in order to diagnose brain tumors as precisely as possible and with the greatest possible reliability. It will therefore continue to develop mathematical tools with the aim of improving the program's self-learning abilities, with the ultimate objective being to extend the diagnostic potential of this artificial intelligence to other brain diseases, such as Parkinson's.

These quantitative MRI machine learning tools applied to brain tumors are currently being evaluated as part of the Cancer Plan driven by Inserm, within the Tumor Heterogeneity and Ecosystem program.

Their development in the context of Parkinson's disease diagnosis is also underway via the NeuroCoG multidisciplinary project funded by the Université Grenoble Alpes IDEX.

Sources

Fully Automatic Lesion Localization and Characterization: Application to Brain Tumors using Multiparametric Quantitative MRI Data

Alexis Arnaud
Mistis team, Univ. Grenoble Alpes, INRIA, Laboratoire Jean Kuntzmann, France.
Florence Forbes
Mistis team, Univ. Grenoble Alpes, INRIA, Laboratoire Jean Kuntzmann, France.
Nicolas Coquery
Grenoble Institut des Neurosciences, Inserm U1216, Univ. Grenoble Alpes, France.
Nora Collomb
Grenoble Institut des Neurosciences, Inserm U1216, Univ. Grenoble Alpes, France.
Benjamin Lemasson
Grenoble Institut des Neurosciences, Inserm U1216, Univ. Grenoble Alpes, France.
Emmanuel L. Barbier
Grenoble Institut des Neurosciences, Inserm U1216, Univ. Grenoble Alpes, France.

IEEE, http://dx.doi.org/10.1109/TMI.2018.2794918

Researcher contact

Emmanuel Barbier

Inserm Researcher
Head of the Functional Neuroimaging and Brain Perfusion team
Unit 1216 Grenoble Institute of Neurosciences
Email: emmanuel.barbier@univ-grenoble-alpes.fr
Tel.: +33 (0)4 56 52 05 88

Press contact

presse@inserm.fr

Access the Inserm press room