Patient-specific Segmentation of Cerebral Structures for Deep Brain Stimulation

https://neurodegenerationresearch.eu/survey/patient-specific-segmentation-of-cerebral-structures-for-deep-brain-stimulation/

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Country

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Title of project or programme

Patient-specific Segmentation of Cerebral Structures for Deep Brain Stimulation

Source of funding information

FNR

Total sum awarded (Euro)

€ 162,069

Start date of award

01/01/2014

Total duration of award in years

3

Keywords
Research Abstract
The implantation of electrodes into structures in deep brain regions (deep brain stimulation, DBS) in order to modulate neuronal activity is an effective treatment for various diseases, such as Parkinson?s disease. For the intervention, the neurosurgeon plans the target and entry point of the electrode manually using medical imaging. A general problem is the weak image contrast in the area of interest, leading to a high degree of variability during planning. Currently there are no methods for the automatic creation of patient-specific 3D segmentations of relevant structures that are suitable for clinical DBS interventions.It is hypothesized that the generation of accurate patient-specific 3D models of cerebral structures for DBS can be performed

automatically, even under clinical conditions.This project aims at finding a solution for the automatic generation of individual 3D models of specific cerebral structures from patient images acquired in a clinical setting. The purpose is to improve the DBS process in order to benefit both patient and surgical staff. With having such a method, several aspects of the DBS process can be improved: automatic entry and target point planning with respect to individual brain structures that may not be harmed; simplified intra-operative electrode positioning due to more powerful visualisation capabilities; individual risk analysis that is more accurate due to enhanced structural information available. Various existing segmentation methods will provide the basis for the development of a novel Hierarchical Semantic Segmentation (HSS) algorithm. The idea of HSS is to segment structures in a hierarchical manner, starting with the segmentation of structures that can easily be identified. Consecutive segmentations are then based on results of the preceding steps. Eventually, the results produced by HSS are compared to manually segmented patient images in order to validate segmentation accuracy. Additionally, the integrability into clinical practice will be evaluated.

Further information available at:

Types:
Investments < €500k

Member States:
Luxembourg

Diseases:
N/A

Years:
2016

Database Categories:
N/A

Database Tags:
N/A