

Research Project

Brain Shift Compensation

Third-party funded project

Project title Brain Shift Compensation

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Organisation / Research unit

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Department

Project Website <https://dbe.unibas.ch/en/cian/image-segmentation/>

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Status Completed

Neuronavigation has become an essential tool in cranial and spinal neurosurgery. Currently it is based on preoperatively acquired images of modalities like CT or MRI, which are then coregistered with anatomic landmarks on the patient's skin or using surface matching via laser

scanning [1,2,3]. Overall navigation accuracy to date ranges between 1 and 6mm. In the worst case, useful neuronavigation during surgery is completely lost [1,2,3,4]. The major biological factor for accuracy loss is the so called brain shift. It occurs after a craniotomy, the opening of the dura, and after removal of tissue within the skull. The length of the surgery also contributes to its increase [3]. This remains one of the most significant shortcomings of neuronavigation that can so far only be corrected using intraoperative imaging such as ultrasound, CT or MRI.

The goal of this project is the development of an intraoperative brain-shift correction system that does not change the surgical setup or require additional devices. The correction system will be embedded in the surgical microscope OHX of Leica Microsystems. It will rely fully on already available preoperative images, the stereo images of the microscope, and a corresponding intra-operatively taken ICG-dyed fluorescence image provided by the microscope (Figs. 1,2). For an outline of the proposed principal workflow, see Section "What is your proposed solution?"

The project will be carried out in collaboration between the Center of medical Image Analysis & Navigation (CIAN) of the Department of Biomedical Engineering, University of Basel, the Neurosurgery Department at University Hospital Basel (USB), and Leica Microsystems (Switzerland) Ltd. (Heerbrugg, SG).

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