Integration of an Augmented Reality System for the Visualization of the HRMAS NMR Analysis of Brain Biopsy Specimens Using the Brainlab Cranial Navigation System

Authors : Abdelkrim Belhaoua, Jean-Pierre Radoux, Mariana Kuras, Vincent Récamier, Martial Piotto, Karim Elbayed, François Proust, Izzie Namer

Abstract : This paper proposes an augmented reality system dedicated to neurosurgery in order to assist the surgeon during an operation. This work is part of the ExtempoRMN project (Funded by Bpifrance) which aims at analyzing during a surgical operation the metabolic content of tumoral brain biopsy specimens by HRMAS NMR. Patients affected with a brain tumor (gliomas) frequently need to undergo an operation in order to remove the tumoral mass. During the operation, the neurosurgeon removes biopsy specimens using image-guided surgery. The biopsy specimens removed are then sent for HRMAS NMR analysis in order to obtain a better diagnosis and prognosis. Image-guided refers to the use of MRI images and a computer to precisely locate and target a lesion (abnormal tissue) within the brain. This is performed using preoperative MRI images and the BrainLab neuro-navigation system. With the patient MRI images loaded on the Brainlab Cranial neuro-navigation system in the operating theater, surgeons can better identify their approach before making an incision. The Brainlab neuro-navigation tool tracks in real time the position of the instruments and displays their position on the patient MRI data. The results of the biopsy analysis by 1H HRMAS NMR are then sent back to the operating theater and superimposed on the 3D localization system directly on the MRI images. The method we have developed to communicate between the HRMAS NMR analysis software and Brainlab makes use of a combination of C++, VTK and the Insight Toolkit using OpenIGTLink protocol.

Keywords : neuro-navigation, augmented reality, biopsy, BrainLab, HR-MAS NMR

Conference Title : ICVAR 2017 : International Conference on Virtual and Augmented Reality
Conference Location : Paris, France
Conference Dates : January 23-24, 2017