

On some computational questions raised by Deep Brain Stimulation

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Deep Brain Stimulation (DBS) is a surgery consisting in the implantation of electrodes in the deep nuclei of the pathological brain. To be performed, it requires the targeting of the deep nuclei and structures. This localization procedure could be either indirect with the use of atlases and co-registration or direct using dedicated MRI sequence. In Clermont-Ferrand (France), we have developed a dedicated acquisition called WAIR (White Matter Inversion Recovery) which permits direct targeting. However, the acquisition is quite long in clinical practices and the SNR is high but irregular. We will introduce the denoising problem on WAIR imaging and the build of a reference atlas for the non pathological brain. This problem will show to correspond to a reconstruction problem in irregular space acquisitions with several angles for which a geometric solution will be presented. The second part of the talk will focus on the measurement of the effect of DBS in the specific case of brain trauma with severely damaged brain. This question will be solved using a voxel approach in PET acquisitions. We will also show that a statistical characterization of PET variations is a key point to obtain more standardized results than an atlas based method currently used.