Introduction
During tumor resection, the brain shifts. This negatively impacts the location of vital structures and the original tumor location. This poses as an implication to the original surgical plans that neurosurgeons designed.

Aim
During this internship, 35 patients’ 3D MRI data were curated for deep learning-based brain shift simulation during tumor surgery to take into account brain tissue variation and a variety of tumor surgery scenario.

Method
During this internship, a combination of preoperative, intraoperative, and postoperative images after partial tumor resection were retrospectively collected from 35 patients.
- 15 patients were collected from the MD Anderson intraoperative data (MDACC Brain Suite)
- 14 patients were collected from BITE
- Four patients’ T1 data were retrieved from the NAMIC Brain Modality data.

For each patient, the following steps were taken to measure the brain shift amplitude.

Brain tissue segmentation
- Brain tissue segmentation is also known as contouring segments of the brain. The brain tissues were contoured in a radiation therapy treatment planning system (Raystation v10). The preoperative tumor was contoured on preoperative Magnetic Resonance (pMR) T2. The cerebellum and the brainstem were also contoured.
- The brain segmentation was then reviewed for accuracy by a neuroradiologist. The brainstem, cerebellum, and dura were manually contoured on both the pMR and intraoperative Magnetic Resonance(iMR)T1 images.

Landmark Placements
- The landmarks between the preoperative (pMR) and intraoperative (iMR) images were strategically placed on the sulci close to the tumor. To do this, the landmarks were placed on the T1A iMR.
- Screenshots were taken of the T1A iMR to estimate where the exact locations of the landmarks placed shifted on the T1B iMR (image taken after opening the skull). The landmarks were then placed on the T1B iMR. This was done to measure the brain shift amplitude.

Skull stripping
Skull stripping serves to extract all of the extrameningial tissues and delineates the brain boundaries. Having extrameningeal tissues like the dura and the eyes can complicate co-registration of iMR images such as T1A and T1B.
- The skull strip was completed by using both the Putty and command-line softwares.

Method (cont.)

Landmark Placements

Results

Table 1: In the table above, the tumor scenario (measured from brain segmentation) that a patient has and its volume is portrayed.

Figure 1: Above is a skull strip from a patient made from using Putty and command line scripting.

Figure 2: Above is the image of a tumor that has been contoured in 3D resolution on a T2 iMR.

References