Improving **cranial navigation** with an **advanced microscope**

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Background

After a craniotomy, the brain deforms and the preoperative volume used for navigation does not match the surgical situation anymore.

Cortical structures are visible and are acquired by the surgical microscope.

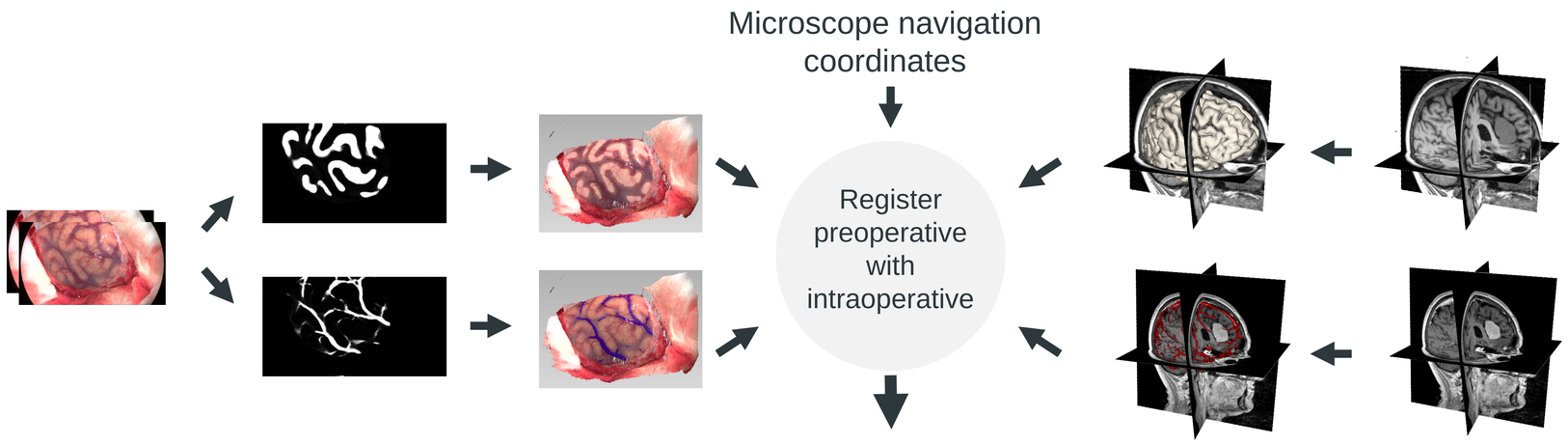
Using image processing, we can realign the preoperative volume with the intraoperative images.

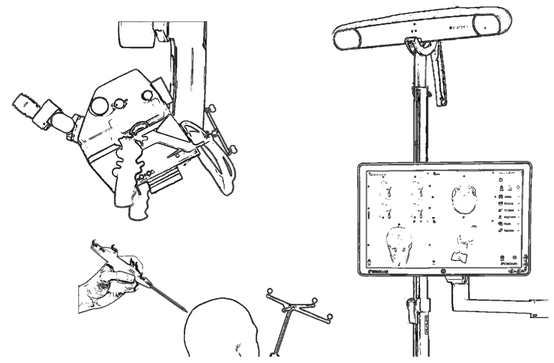
Methods

Gyri and superficial cerebral vessels are segmented in both preoperative and intraoperative images using deep learning.

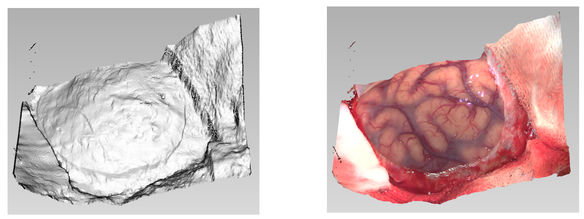
With the stereo capabilities of the microscope, we can reconstruct the intraoperative scene in 3D.

The gyri and the vessels of the two domains are matched to update the planning data.

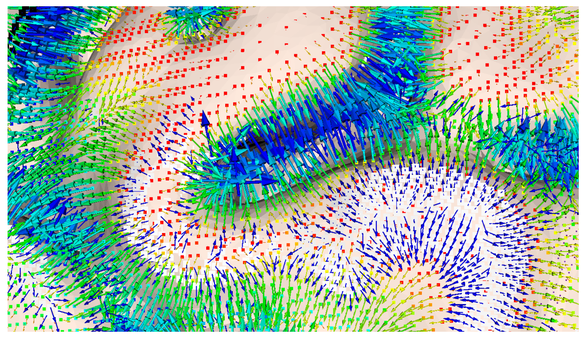




Neuronavigation setting with microscope integration



3D reconstruction of stereoscopic images (left: surface rendering, right: same with colors rendering)



Structures directions alignment between intraoperative (white) and preoperative points (colored)

Next steps

Acquire intraoperative CT scans to quantify the compensation accuracy.
Update the navigation data during a surgery to provide intraoperative brain shift compensation.
Add a biomechanical modeling of the brain to estimate the deformation of deeper structures.

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