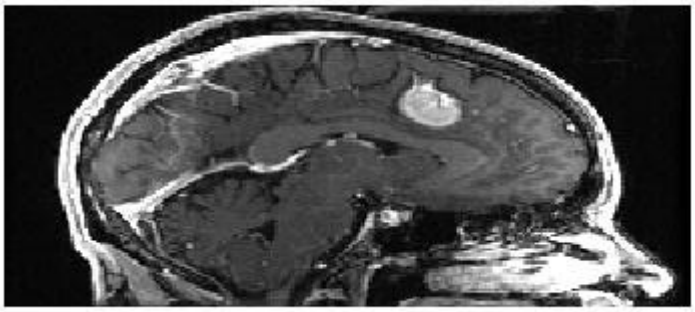
Project focus and aim:

- Introduce the problem of lesion segmentation and implement a specific workflow over an MRI volume
- Implement a pipeline and motivate its main sub-steps for segmenting a lesion on MRI images
- Apply the methods we saw during lessons
- The implemented workflow does not need to be fully automated

Steps:

1. Segment the lesion and calculate the respective cross-sectional area over sagittal slice number 135



2. Identify sagittal slices that contain the lesion and extend the quantification of its cross-sectional area to the whole volume.
3. Repeat steps 1 and 2 with respect to the axial plane. How does the cross-sectional area and volume change with respect to sagittal plane? What are the main challenges of segmenting this lesion with respect to other cerebral tissues and orthogonal views?
4. Add different levels and typologies of noise to the original MRI dataset. Repeat previous steps and check how the estimation of cross-sectional area and volume change
5. [Optional but suggested] manually segment the lesion over sagittal slice number 135 (i.e., step 1) and an axial slice (i.e., step 3). This step allows you to quantify the segmentation performances of your pipeline (e.g., Dice coefficient)

Dataset:

- You are provided with a T1 contrast enhanced MRI volume

Tips:

- Consider implementing your workflow over a ROI of the image
- Useful tool for visualizing the dataset: `VolumeViewer` app (built-in in MATLAB)
- Useful functions for selecting cross-sectional area after edge detection: `getps`, `bwselect`, `imfill`
- Useful function for manually segment the lesion on selected sagittal and axial slices: `imfreehand`

Refences:

[1] A. Wadhwa, A. Bhardwaj, and V. Singh Verma, “A review on brain tumor segmentation of MRI images,” *Magn. Reson. Imaging*, vol. 61, pp. 247–259, Sep. 2019.

[2] I. Despotović, B. Goossens, and W. Philips, “MRI Segmentation of the Human Brain: Challenges, Methods, and Applications,” *Comput. Math. Methods Med.*, vol. 2015, pp. 1–23, 2015.