\*\*I have opted for question number 4. Please find the copy of the journal in my GitHub link.

Automated Ischemic Lesion Segmentation in MRI Mouse Brain Data after Transient Middle Cerebral Artery Occlusion

OBJECTIVE OF THE WORK

The main purpose of this project is to get through the complexity of quantitative analysis of MRI data. This is mainly because segmentation of mouse brain lesions in MRI data heavily depends on manual tracing and thresholding techniques which consumes a lot of time and effort. In order to overcome this problem they have proposed an effective and efficient way through which it can automatically analyze longitudinal MRI data for quantification of lesion volume. This proposed way is a result of an in-depth analysis of limitations of past and current networks proposed for this kind of applications. Their work shows that they have done a deep discriminative analysis and incorporate both local and larger contextual information. To keep it short, they want to propose a method which is computationally efficient and can be used in various clinical applications.

TECHNIQUE USED TO ACQUIRE THE SIGNAL

Though the journal mainly focuses on the method used to process and condition the signal. I would like to stress on the techniques used to acquire the brain data is situations like this. A brain lesion is mainly detected using a brain imaging test. The two major methods to do perform this data acquisition is by going through MRI (Magnetic Resonance Imaging) or CT(Computerized Tomography). Usually, a brain lesion is an incidental finding unrelated to the condition or symptom that led to the imaging test in the first place. In MRI, brain lesions appear as dark or light spots that don't look like normal brain tissue.

* MRI

This is a data acquisition process in which magnetic field and radio waves are used which results in detailed picture of Brain and other organs. And there are two types of MRI’s namely Closed and Open MRI. Closed MRI’s are more powerful than open MRI since the strength of the magnet determines the quality of the image and scan time.

The MRI is done at different time intervals on three main groups of male mice belonging to different age groups. Scans were done using small-animal burker MRI systems using a multi slice multi echo sequence protocol at different time intervals after induction.

TECHNIQUES USED TO CONDITION THE SIGNAL

Since it is impossible to segment the ischemic lesion with a normal threshold as different objects structures surrounding the brain and other regions in the periventricular zone of the brain, share similar imaging values to that of the infarct lesion. Hence Manual detection of the ischemic lesion by experts takes into account all this information, together with possible stroke density differences of the lesion area throughout the MRI image stack. So in order to overcome this challenge segmentation is done in order to condition and analyze the signal.

### Semi-Automated Ischemic Lesion Segmentation

This process mainly involves four stages as shown below

* Threshold determination: Threshold is determined as mean plus standard deviation of two vector containing two T2 values.
* Threshold mask: All the high intensity pixels are masked.
* Infarct ROI segmentation: Confused regions are removed individually.
* Infarct ROI volume quantification: All MRI slices are multiplied by a voxel size in order to get complete lesion volume.
* Automated Ischemic Lesion Segmentation

In semi-automated approach several other objects appearing on the T2 map share similar T2 values to that of the infarct lesion. To differentiate the infarcted area from other brain structures and to quantify the infarct lesion volume, they have developed a fully automated approach. This involves two main tasks as discussed below

* Image Registration: For every subject, the sum of all its echo images is used to register the scan of that particular subject to a reference brain scan. These templates were given labels and these labels were used to initialize the segmentation of whole brain.
* Segmentation: Initially pre-processing is done in order to get the labels resized and cropped to rectangular image depending on the area of interest. Then various kinds of segmentations such as Whole brain segmentation, contralateral ventricular segmentation, Ventricle segmentation and stroke segmentation are done by modifying the energy levels using relevant mathematical relation. (E(ϕ)=α⋅g(x)⋅Length (∂ΩO)+μ⋅Area (ΩO)−logP(I(x);ΩO)−logP(I(x);ΩB))

REFERENCES

1[. https://www.frontiersin.org/articles/10.3389/fninf.2017.00003/full#F1](.%20https:/www.frontiersin.org/articles/10.3389/fninf.2017.00003/full%23F1)

2. <https://www.reference.com/health/mri-scan-f05a80d693d2a7a0?qo=contentSimilarQuestions>

3. [https://www.webmd.com/brain/brain-lesions-causes-symptoms-treatments#1](%20https:/www.webmd.com/brain/brain-lesions-causes-symptoms-treatments%231)