**Tasks**

1)Download the dataset. Make sure that you are able to visualize MRI scans and read .plq files with lesion coordinates and cropped views. The example is in the attached notebook.

A)The dataset was downloaded without any difficulty. I was able to run the complete python notebook. The dataset contained MRI TIFF Images from the first and second examinations (0 months, 6-12 months). There were 38 subjects with diagnosed CIS MS and 20 healthy subjects with different age, gender, and degree of disability. The .plq file contained the cropped lesion and the lesion mask. It also contained the coordinates(x,y) of the lesion area and with the help of these coordinates, this area was marked on the MRI scan image.

2)Describe the attached picture. What is the region highlighted on MRI scan, and how is this scan connected to the MS disease?

A)The attached image is of brain MRI Scan. The region highlighted in the image is the lesion. In MS, the term lesion refers to an area of damage or scarring (sclerosis) in the central nervous system caused by MS. Lesions are sometimes also called plaques, and are caused by inflammation that results from the immune system attacking the myelin sheath around nerves.

An MRI scan can differentiate between active and non-active lesions. Active lesions show up in the scan as white patches when a contrast fluid containing gadolinium is injected. If the lesion does not light up, then it is likely to be an older lesion, and more than 3 months old.

3)What is the target variable in the dataset? What is the meaning of this score?

A)The target variable in this dataset is the EDSS score. The Expanded Disability Status Scale (EDSS) is a method of quantifying disability in multiple sclerosis and monitoring changes in the level of disability over time. It is widely used in clinical trials and in the assessment of people with MS. The EDSS scale ranges from 0 to 10 in 0.5 unit increments that represent higher levels of disability. Scoring is based on an examination by a neurologist.EDSS steps 1.0 to 4.5 refer to people with MS who are able to walk without any aid. EDSS steps 5.0 to 9.5 are defined by the impairment of walking. The scale is sometimes criticized for its reliance on walking as the main measure of disability. Here we can take EDSS score > 2 as a cut-off point as at the scores higher than 2 the body starts showing neurological signs of disability.

4)Propose the hypothesis about the lesion features that, in your opinion, can be connected with the further progress of MS disease.

In people with MS, the body's own immune system attacks the tissue surrounding the nerve fibers in the brain, spinal cord, and optic nerves. This covering is made of a fatty substance called myelin. It insulates the nerves and helps them send electrical signals that control movement, speech, and other functions. When myelin is destroyed, scar tissue forms, and nerve messages are not transmitted properly. The area where myelin is destroyed is referred to as Lesion. Different shape parameters associated with it are *x*-coordinate maximum length, *y*-coordinate maximum length, area, perimeter, eccentricity, equivalence diameter, major axis length, etc. So an increment in these spatial features like the increment in area, *x*-coordinate maximum length, *y*-coordinate maximum length would be directly proportional to the area where myelin sheath is destroyed and the nerve messages would not be transmitted.

There are also other spatial features like statistical features like mean, variance, median value and skewness and texture features as introduced in the paper. These features can be used to differentiate between Normal Appearing White Matter and Normal White Matter. Further, the texture features for brain lesions and NAWM recorded at 0 and 6—12 months between subjects with an EDSS score lower than or equal to 2 and subjects with an EDSS score greater than 2 can estimated in two and five years from initial diagnosis respectively. The different between these feature can be related to any change in myelin sheath affected area (in case when EDSS>2).

References:

1. <https://www.mstrust.org.uk/a-z/lesion>
2. <https://www.webmd.com/multiple-sclerosis/ss/slideshow-multiple-sclerosis-overview>