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**Programming Project Document**

*TITLE* Segmentation of MRI brain images for tumor detection.

1. The project has been implemented in matlab.
2. Segmentation is done based on the pixel value characteristics of the image.
3. All sections defined in the initial project design document: definitely be completed, possibly be completed, will try if done with the above two, have been implemented.
4. Additionally, tried watershed algorithm using gradient magnitude.

**Following have been implemented in the project:**

* Preprocessing –
	+ Image enhancement
		- Used the matlab function imadjust.
	+ Noise removal from the image
		- File name in the project: *normal\_shrink.m*
		- Implemented Normal Shrink denoising algorithm.
		- To get an understanding of how Normal Shrink algorithm works, I referred the Wikipedia link to the algorithm.
	+ Edge preservation
		- File name: *bilateral.m*
		- Implemented Bilateral Filter algorithm on the output obtained after denoising.
		- Referred the Wikipedia link to the algorithm.
* Segmentation –
	+ Edge based segmentation
		- File names: *krisch.m, krisch55.m, sobel55.m*
		- Implemented kirsch operator using a 3 \* 3 mask.
		- Implemented sobel operator using a 3 \* 3 mask.
		- Implemented advanced sobel operator using a 5 \* 5 mask.
		- Referred the Wikipedia link to get the mask values for each of the operators.
	+ Threshold based segmentation of the MRI brain image.
		- File name: *ostu.m*
		- Implemented ostu threshold algorithm.
		- Referred the Wikipedia link to the algorithm.
		- Referred the matlab implementation of graythresh and im2bw function to get a better idea on ostu algorithm.
		- Reference http://dx.doi.org/doi:10.1109/TSMC.1979.4310076
		- Referred the notes from the link: <http://homepages.inf.ed.ac.uk/rbf/CVonline/LOCAL_COPIES/MORSE/threshold.pdf>
	+ Clustering based segmentation i.e. k means algorithm
		- File name: *kmeans.m*
		- Implemented kmeans clustering algorithm with fixed number of iterations and k value.
		- Went through the lecture offered in coursera and referred Wikipedia to understand the working of kmeans algorithm.
		- File name: *adaptive*\_*kmeans.m*
		- Implemented adaptive kmeans clustering algorithm. The number of iterations were not initialized. Instead found the appropriate number of iterations needed until the algorithm converges i.e. until the cluster assignment does not change.
		- File name: *fuzzyCMeans.m*
		- Implemented fuzzy c means clustering algorithm.
		- Taken help from the notes: <http://yaikhom.com/res/fcm/fcm.pdf> which describes the algorithm step by step.
		- This is available in public domain.
		- Referred Wikipedia link to the algorithm.
	+ Marker Controlled Watershed Algorithm
		- File name: *watershedSeg.m*
		- Implemented watershed algorithm using gradient magnitude as the segmentation function.
		- To get an understanding of how the algorithm works taken help from <https://www.hindawi.com/journals/ddns/2008/384346/>
		- Taken help from the official documentation of Marker-Controlled Watershed Segmentation in matlab.
		- Used matlab in-built functions.
	+ File name: *main1.m*
		- Calls all the above functions.