EXECUTIVE SUMMARY OF UGC MINOR RESEARCH PROJECT

1. **NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR**:   Ms. Ceena Mathews, Associate Professor, Dept. of Computer Science, Prajyoti Niketan College, Pudukad, Thrissur, Kerala - 680301.

2. **NAME AND ADDRESS OF THE INSTITUTION**: Prajyoti Niketan College, Pudukad, Thrissur, Kerala -   680301.

3. **UGC APPROVAL NO. AND DATE**:

No. F. MRP/12ᵗʰ Plan/14-15/KLCA056 dated 10-12-2014

F.No. 1672-MRP/14-15/KLCA056/UGC-SWRO dated 04/02/15

 4. **DATE OF IMPLEMENTATION**:   4th February 2015

5. **TENURE OF THE PROJECT**: 2 years.

6. **TOTAL GRANT ALLOCATED**: Rs.4,60,000/-

7. **TOTAL GRANT RECEIVED**: Rs. 4,00,000/-

8. **FINAL EXPENDITURE**:   Rs. 4,48,676/-

9. **TITLE OF THE PROJECT**:   *Identification and Differentiation of Tumor Components, Edema and Healthy tissue in Brain Diffusion Tensor MR Images using Clustering.*

10. **OBJECTIVES OF THE PROJECT**:

   a. Effective brain tumor treatment ideally calls for an accurate identification of boundaries between tumor,   edema and healthy tissue. The proposed research project attempts to achieve accurate identification in an effort to provide effective treatment.

   b. To provide a better understanding of the spatial distribution of healthy tissue, tumor and edema, thereby assisting in treatment or surgical planning.

c. Accurate and consistent tumor classification results for several tumor brains

11. WHETHER OBJECTIVES WERE ACHIEVED:

A cluster based segmentation framework was developed to differentiate between tumor components, edema and healthy tissue from Diffusion Tensor brain tumor images. The framework could partially classify the tumor from the DTI images. This research project has immense relevance and significance in the treatment of one of the most debated health issue of our time.

12. **ACHIEVEMENTS FROM THE PROJECT**:

A cluster based segmentation framework was developed to differentiate between tumor components, edema and healthy tissue from Diffusion Tensor brain tumor images. The framework could partially classify the tumor from the DTI images. The findings of the project can be extended to get a more accurate tumor classification which can be useful in the proper treatment of the tumor and can help medical practitioners in planning the surgery. This minor research project has also helped me to enrol for Ph.D on the same topic.

13. SUMMARY OF THE FINDINGS:

The project resulted in the development of a cluster based segmentation framework for identification of boundaries between tumor, edema and healthy tissue.

The machine learning and pattern recognition techniques are substantially important in the development of the framework. Pattern recognition is the act of extracting features from some objects in raw data and making a decision based on the classifier output such as classifying each object into one of the possible categories of various patterns. The framework has

mainly four modules namely pre-processing, segmentation using fuzzy c-means, Feature extraction, and approximate reasoning. According to the need of the next level the pre-processing step converts the image. It performs filtering of noise and other artifacts in the image and sharpening the edges in the image. RGB to gray conversion and reshaping also takes place here. It includes a median filter for noise removal. The feature extraction is extracting the cluster, which shows the predicted tumor at the FCM (Fuzzy C-means) output. The extracted cluster is given to the threshold process.

The fuzzy logic is a way of processing the data by giving the partial membership value to each pixel in the image. The membership value of the fuzzy set ranges from 0 to 1. Fuzzy clustering is basically a multi valued logic that allows intermediate values member of one fuzzy set can also be members of other fuzzy sets in the same image. There is no abrupt transition between full membership and non-membership The membership function defines the fuzziness of an image and also to define the information contained in the image.

The tumor area is calculated using the binarization method. The size of the tumor is determined by calculating the number of white pixels (digit 0) in binary image. The stage of the tumor is based on the area of tumor. The simulation tool used for the experimental purpose is MATLAB R2010a and DTI studio. The dataset for the study was collected from KIMS hospital, Trivandrum. The efficiency of segmentation is measured by Dice Similarity Index (DSI) which quantifies the region overlap between the automatic and manual segmentation.

Brain image segmentation is one of the most important parts of clinical diagnostic tools. Brain images mostly contain noise, inhomogeneity and sometimes deviation. Cluster based segmentation framework converts a given RGB diffusion tensor brain image into a gray scale

image and then separate the position of tumor objects. This improves the identification of the tumor boundaries accurately and is less time consuming when compared to many other clustering algorithms. This helps the medical practitioners in performing radiotherapy, where the tumor cells are irradiated and killed with a very high precision, avoiding damage to the neighboring healthy tissues. The results are imperative in the treatment planning and surgical planning.

14. CONTRIBUTION TO THE SOCIETY:

Cancer , a disease which has enormously increased over the last few decades is , attacking millions of people all over the world irrespective of gender, age or colour. The latest data issued by the National Cancer Registry Program of the India Council of Medical Research (ICMR) has clearly shown that cancer has become the biggest cause of death in India with 1,300 deaths daily, and close to 5 lakh every year.

More than 500 new cases are diagnosed with brain tumour everyday worldwide. Number of patients with tumours that cause brain metastases is even higher than that. This is the most common type of cancer among children.The incidence and prevalence of brain tumour is growing in India. Brain tumors account for 85% to 90% of all primary central nervous system (CNS) tumours. The worldwide incidence is close to 3,00,000 cases, out of which 10% are from India.

The Cluster based segmentation framework differentiates between tumor components, edema and healthy tissue from Diffusion Tensor brain tumor images. It helps in the proper diagnosis of the grade of the tumor, which aids medical practitioners in treatment planning and surgical planning. It also helps the medical practitioners in performing radiotherapy,

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where the tumor cells are irradiated and killed with a very high precision, avoiding damage to the neighboring healthy tissues.

16. WHETHER ANY PH.D. ENROLLED/PRODUCED OUT OF THE PROJECT :

Yes. Enrolled for Ph.D at Mahatma Gandhi University, Kottayam, Kerala and completed the coursework and is continuing my research under the same title.

17. NO. OF PUBLICATIONS OUT OF THE PROJECT :One. (Detail is as follows)

1. **Ceena Mathews**, *"*Segmentation of Diffusion Tensor Brain Tumor Images using Fuzzy C-Means Clustering*"*, International Journal of Computer Science and Information Security, ISSN 1947-5500 IJCSIS April 2018 Volume 16 No. 4[ACCEPTED]

Ms. Ceena Mathews   Dr.Shijan Paul
(PRINCIPAL INVESTIGATOR)   (REGISTRAR/PRINCIPAL)