Hybrid Clustering Technique for Enhanced MRI Brain Image Segmentation

Related Work
Fuzzy C-mean algorithm; a popular algorithm used in image segmentation; is sensitive to the noise and its initial parameters. There have been recent hybrid approaches claiming to improve on Fuzzy C-Mean, increase its robustness to noisy images and its adaptability [1][2][3][4].

Objective
Our project will first consist in implementing the algorithm described in [1], then it will validate its performances in different datasets and finally it will compare them with performances obtained with more traditional or recent established segmentation algorithms. If time permits, we will implement DiNovo algorithms described in [2], [3] or [4] and compare their performances on the algorithm in [1].

Methodology
- **Implement and Evaluate the Modified Fuzzy Bat Algorithm (MFBA):** Reproduce the MFBA-based Fuzzy C-means (MFBAFCM) algorithm discussed in the paper [1]. This step involves integrating the MFBA optimization into the FCM clustering for MRI brain image segmentation.
- **Noise Robustness Testing**: Test the robustness of the MFBAFCM algorithm on MRI brain images with varying noise levels and non-uniform intensity. This would showcase its effectiveness in handling common MRI images.
- **Algorithm Comparison**: Compare the performance of MFBAFCM against other clustering-based segmentation methods like standard Fuzzy C-Means (FCM), K-means, and other recent algorithms mentioned in the literature.
- **Segmentation Accuracy Metrics**: Use different clustering validity and segmentation accuracy metrics such as Dice Similarity Coefficient (DCS), other clustering metrics to evaluate the performance of the segmentation.
- **Visualization**: Create visual plots of segmentation results using MRI images to demonstrate the improvements brought by the proposed method.

Expected Outcomes
The modified segmentation algorithm, MFBAFCM, should have superior performances compared to FCM, and other brain segmentation approaches including intensity-based and traditional Machine Learning approaches. We will also if time-permits include hybrid approaches such as contour-based, or metaheuristic machine learning. We will not consider by lack of adequate infrastructure deep learning algorithms.

<u>Milestones - Timeline</u>
- Dataset(s) identification and acquisition (Beginning-October)
- MFBAFCM implementation (Mid-October)

- Noisy Image Generation (End-October)
- Experimental Setup (End-October)
- Experimental Results (Beginning-November)
- Visualization Plot Creation (Beginning-November)
- Report Writing (Mid-November)
- Presentation Deck Creation (Mid-November)

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<u>**References**</u>

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