BRAC UNIVERSITY

Inspiring Excellence

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SECTION 1
CSE 438

PAPER REVIEW

A brief review of Detection of Brain Tumor in MRI Images, using Combination of Fuzzy C-Means and SVM

Abstract overview

The abstract summarizes the paper that proposes a new hybrid technique for brain tumor classification using data mining methods. The paper describes the steps involved in the proposed technique, such as image enhancement, skull striping, segmentation, feature extraction, and classification. The paper claims that the proposed technique, which combines support vector machine (SVM) and fuzzy c-means (FCM) clustering, provides accurate and more effective results for classifying brain MRI images.

THE METHOD OVERVIEW

- **1. Data Collection:**
  - Brain MRI images were obtained from different medical centers.
  - Images converted into 2D matrices using MATLAB.

- **2. Image Enhancement:**
  - Contrast improvement and Mid-range Stretch techniques were applied.
  - These methods aim to improve image quality for better perceptibility.

- **3. Skull Stripping:**
  - Double thresholding, erosion, and region filling are used to remove non-brain tissues.
  - Skull stripping crucial for accurate segmentation.

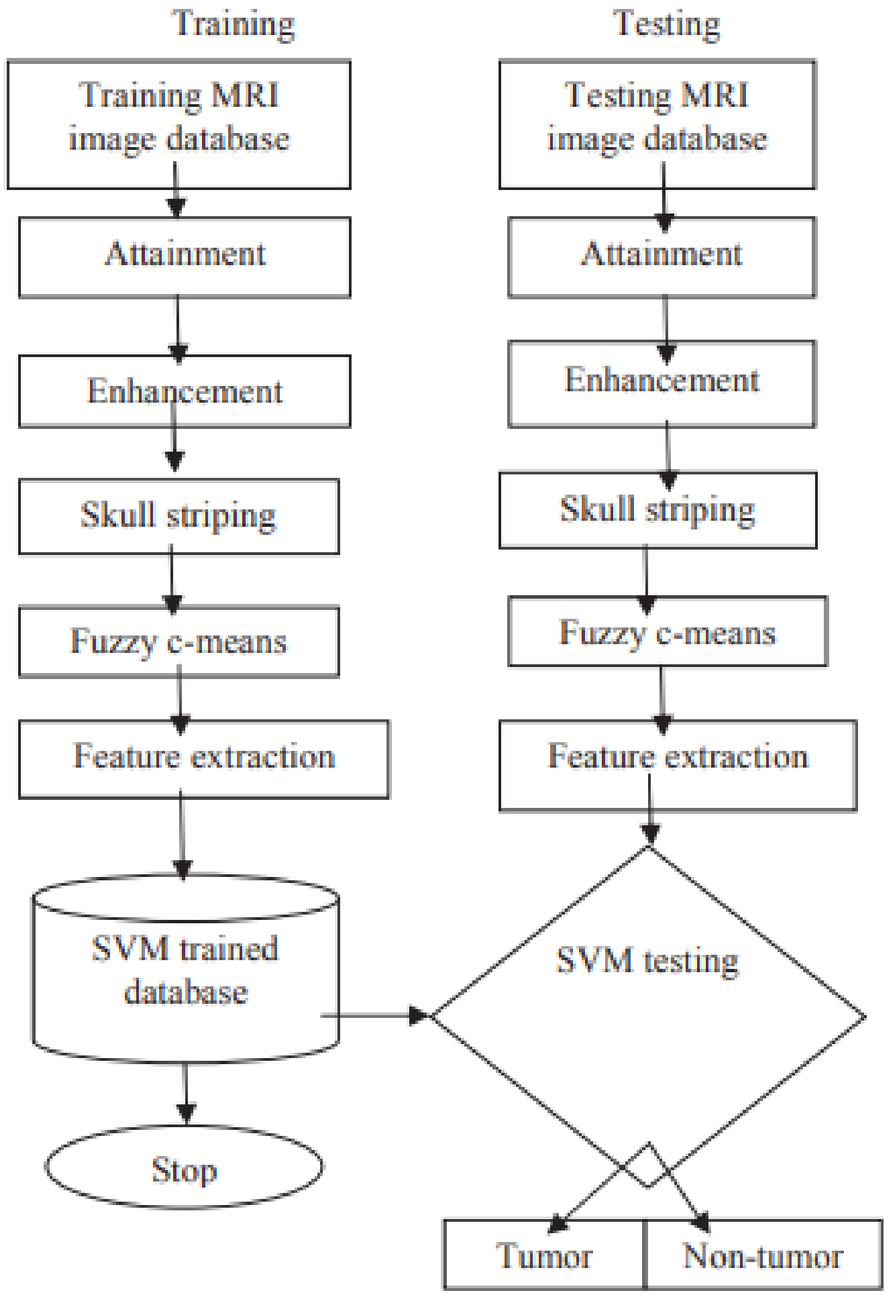
- **4. SEGMENTATION (FUZZY C-MEANS):**

FUZZY C-MEANS (FCM) CLUSTERING APPLIED FOR SEGMENTATION.
FCM IS USED TO FIND SUSPICIOUS REGIONS IN BRAIN MRI IMAGES.

- **5. FEATURE EXTRACTION (GLRLM):**
  - GRAY LEVEL RUN LENGTH MATRIX (GLRLM) IS USED FOR FEATURE EXTRACTION.
  - RELEVANT FEATURES EXTRACTED TO UNDERSTAND AND CLASSIFY BRAIN MRI IMAGES.

- **6. SVM CLASSIFICATION:**
  - SUPPORT VECTOR MACHINE (SVM) EMPLOYED FOR CLASSIFICATION.
  - SVM TRAINED USING GLRLM FEATURES OBTAINED FROM BRAIN MRI IMAGES.
  - SVM IS USED TO CREATE A DECISION BOUNDARY FOR TUMOR AND NON-TUMOR CLASSES.

- **7. PERFORMANCE MEASURES:**
  - SENSITIVITY, SPECIFICITY, AND ACCURACY WERE CALCULATED FOR CLASSIFIER PERFORMANCE EVALUATION.



DATA COLLECTION:

- BRAIN MRI IMAGES WERE COLLECTED FROM VARIOUS MEDICAL CENTERS. THESE IMAGES WERE THEN CONVERTED INTO TWO-DIMENSIONAL MATRICES USING MATLAB (R2013A).

DATA CLEANING:

- THE MRI IMAGES, WHICH ARE RGB IMAGES, WERE
1. CONVERTED INTO GRAYSCALE IMAGES, ALSO KNOWN AS INTENSITY IMAGES.
2. INTENSITY VALUES WERE MAPPED INTO LOW AND HIGH-INTENSITY VALUES (USING IMADJUST FUNCTION IN MATLAB.)

- A MID-RANGE STRETCH ENHANCEMENT TECHNIQUE -
1.MIDDLE-RANGE MRI IMAGE INTENSITY VALUES WERE STRETCHED.
2.THE GRAYSCALE IMAGE PIXELS WERE MAPPED BETWEEN 0 AND 1 VALUE BY DIVIDING 255 INTENSITY VALUES.

- THE FUNCTION F(X) WAS COMPUTED ON THE X MATRIX OBTAINED FROM THE ABOVE OPERATION. HELPED CONVERT THE GRAYSCALE IMAGES TO INDEXED IMAGES.

- THE SKULL STRIPPING PROCESS INVOLVED DOUBLE THRESHOLDING
1. SEGMENTATION TECHNIQUE - CONVERTS THE IMAGE INTO BINARY FORM
2.EROSION - REMOVAL OF UNWANTED PIXELS
3.REGION FILLING - FILLING THE HOLES IN THE IMAGES AFTER EROSION
THIS PROCESS HELPED IN REMOVING NON-BRAIN TISSUES PIXELS AND UNWANTED PIXELS CONTRIBUTING TO THE BRAIN MRI IMAGES.

THE CLEANED DATA, WITH IMPROVED IMAGE QUALITY, WAS PREPARED FOR FURTHER ANALYSIS.

Result Comparison

- **OBJECTIVE:** SEGMENTATION AND CLASSIFICATION OF BRAIN MRI IMAGES USING SVM TECHNIQUE WITH FUZZY C-MEANS.

- **DATA SET:** REAL DATA SET OF 120 PATIENTS' MRI BRAIN IMAGES.

- **TRAINING AND TESTING:** SVM CLASSIFIER WAS TRAINED USING 96 BRAIN MRI IMAGES, AND TESTED ON 24 BRAIN MRI IMAGES.

- ***PERFORMANCE METRICS:***

1. LINEAR KERNEL FUNCTION:
   - ACCURACY: 91.66%
   - SENSITIVITY: 83.33%
   - SPECIFICITY: 100%
2. QUADRATIC KERNEL FUNCTION:
   - ACCURACY: 83.33%
   - SENSITIVITY: 66.66%
   - SPECIFICITY: 100%
3. POLYNOMIAL KERNEL FUNCTION:
   - ACCURACY: 87.50%
   - SENSITIVITY: 75.00%
   - SPECIFICITY: 100%

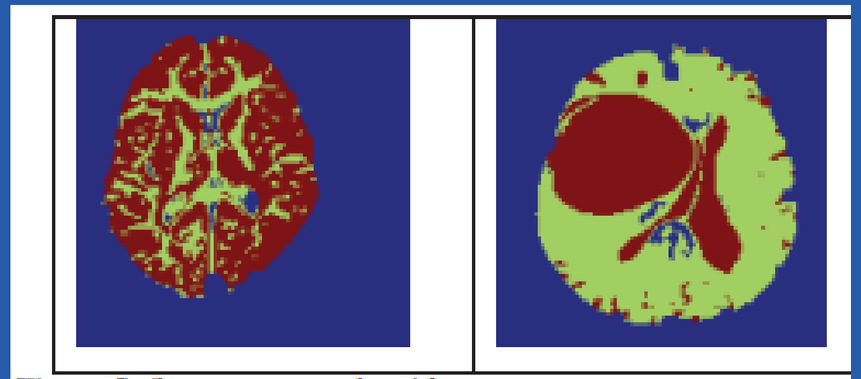


Figure 5: fuzzy c-mean algorithm

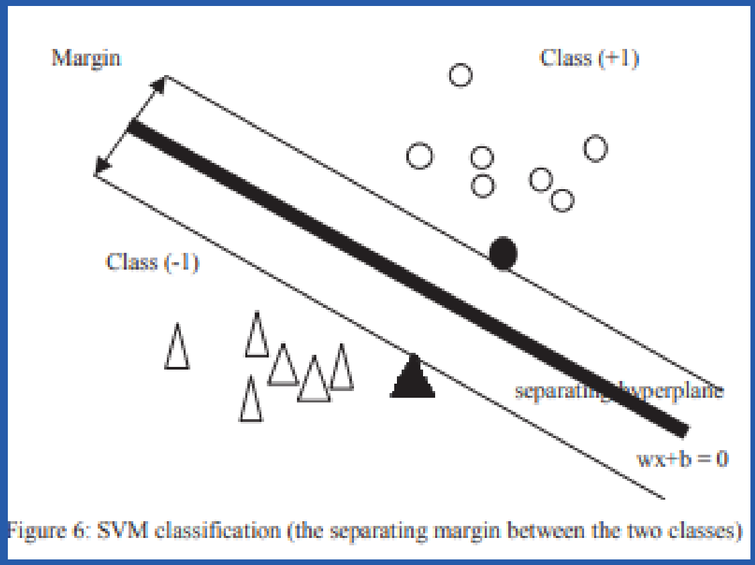


Figure 6: SVM classification (the separating margin between the two classes)

THE SVM CLASSIFIER DEMONSTRATED EFFECTIVE PERFORMANCE IN CLASSIFYING LARGE DATA SETS OF BRAIN MRI IMAGES. THE LINEAR KERNEL FUNCTION PROVIDED THE BEST BALANCE OF SENSITIVITY AND SPECIFICITY.

limitations

- LIMITED DIVERSITY IN DATA
- DEPENDENCE ON IMAGE ENHANCEMENT TECHNIQUES
- SENSITIVITY TO PARAMETER TUNING
- LIMITED COMPARISON WITH OTHER TECHNIQUES
- EVALUATION ON A SINGLE MODALITY: THE DOCUMENT FOCUSES ON THE CLASSIFICATION OF BRAIN MRI IMAGES, BUT IT DOES NOT EXPLORE THE POTENTIAL LIMITATIONS OF APPLYING THE PROPOSED METHOD TO OTHER MODALITIES.
- ASSUMPTION OF BINARY CLASSIFICATION
- GENERALIZATION TO DIFFERENT TUMOR TYPES

THANK YOU