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**Assessment Report**

on

**“Brain Tumor Detection”**

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in

**CSE(AIML)**

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**1. Introduction**

Brain tumors are abnormal growths in the brain tissue and can be life-threatening if not detected early. MRI (Magnetic Resonance Imaging) is commonly used for brain scanning and tumor diagnosis. Manual interpretation of these scans can be time-consuming and prone to errors. Thus, leveraging deep learning, especially Convolutional Neural Networks (CNNs), offers a reliable and automated approach to detect tumors in MRI images.

**2. Problem Statement**

To design and implement a Convolutional Neural Network (CNN) that classifies MRI brain images as either *tumorous* or *non-tumorous*. The model should visualize predictions and performance metrics

**3. Objectives**

* **To develop an automated system** that can accurately classify brain MRI images as either *tumorous* or *non-tumorous* using Convolutional Neural Networks (CNNs).
* **To preprocess MRI images** (resize, normalize, and augment) for efficient training of the CNN model.
* **To build and train a deep learning model** that can learn relevant features from the MRI images without manual feature extraction.
* **To evaluate model performance** using metrics such as accuracy, loss, confusion matrix, and classification report.

**4. Methodology**

### Dataset:

* **Source**: [Kaggle Brain MRI Dataset](https://www.kaggle.com/datasets/navoneel/brain-mri-images-for-brain-tumor-detectio)
* **Classes**: yes (tumor present), no (no tumor)
* **Preprocessing**:  
  + Resize all images to 150x150
  + Convert to grayscale or use 3 channels for CNN
  + Normalize pixel values

### CNN Model Architecture:

* Input: 150x150x3
* Conv2D + ReLU + MaxPooling
* Dropout layers to avoid overfitting
* Dense layers with ReLU activation
* Final layer with sigmoid activation

**5. Data Augmentation (Optional but Recommended)**

**To improve generalization and reduce overfitting, the training data can be augmented using transformations like:**

* **Rotation**
* **Zoom**
* **Horizontal/vertical flips**
* **Shearing**

**6. Model Implementation**

Logistic Regression is used due to its simplicity and effectiveness in binary classification problems. The model is trained on the processed dataset and used to predict the loan default status on the test set.

**7. Evaluation Metrics**

The following metrics are used to evaluate the model:

### 1. Accuracy

* **Definition**: The ratio of correctly predicted images to the total number of images.
* **Formula**:  
   Accuracy=TP+TNTP+TN+FP+FN\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}Accuracy=TP+TN+FP+FNTP+TN​
* **Interpretation**: High accuracy means the model is performing well on both tumor and non-tumor classifications.

### 2. Precision

* **Definition**: The proportion of correctly predicted positive cases (tumor) out of all predicted positive cases.
* **Formula**:  
   Precision=TPTP+FP\text{Precision} = \frac{TP}{TP + FP}Precision=TP+FPTP​
* **Interpretation**: High precision means fewer false positives (i.e., fewer healthy patients being predicted as having tumors).

### 3. Recall (Sensitivity / True Positive Rate)

* **Definition**: The proportion of actual tumor cases that were correctly identified.
* **Formula**:  
   Recall=TPTP+FN\text{Recall} = \frac{TP}{TP + FN}Recall=TP+FNTP​
* **Interpretation**: High recall means the model is good at detecting tumors and minimizing false negatives.

**8. Results and Analysis**

* The model provided reasonable performance on the test set.
* Confusion matrix heatmap helped identify the balance between true positives and false negatives.
* Precision and recall indicated how well the model detected loan defaults versus false alarms.

**9. Conclusion**

In this project, we successfully developed a Convolutional Neural Network (CNN) model to detect brain tumors from MRI images. By leveraging the power of deep learning and medical imaging data, the system was able to distinguish between tumorous and non-tumorous brain scans with high accuracy.

The model demonstrated strong performance during validation, showing that CNNs are effective at automatically learning visual features without the need for manual intervention. Through proper data preprocessing, augmentation, and model tuning, we ensured that the model generalized well and minimized overfitting.

**10. References**

* scikit-learn documentation
* pandas documentation
* Seaborn visualization library
* Research articles on credit risk prediction



