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AI BASED BRAIN TUMOUR DETECTION AND CLASSIFICATION FROM MRI

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ABSTRACT

Among other serious neurological disorders, brain tumour has been posing severe health risks to humans since their early stages. Manual analysis of MRIs conducted by radiologist is one of the common methods that have been used over time for detecting brain tumour.Thismethod,however,couldtakequitesometimeandmayalsocontainerrorsdueto human involvement, Recent developments in artificial intelligence, deep learning, and the application of medical image processing using convolutional neural networks (CNN) have greatly contributed to identification of brain tumours and classification systems.

This paper presents an AI-based system for the identification and classification of brain tumours from MRI images. Some of the research works that relate to the pre-processing of MRI scans, learning-based framework, CNNs, transfer learning, brain tumour segmentation and medical imaging technologies have been discussed in this paper.Additionally, this paper provides a clear description of the current systems' strength and weaknesses while also exploringthefuturetrendsandresearchgaps.Thesignificanceofintelligenthealthcaresystems has also been highlighted.

KEYWORDS: Intelligent computing methods, learning-based framework, identification of brain tumours, analysis of MRI scans, CNN architecture, TensorFlow, Medical Image Processing, categorisation of tumour types, Tumour Segmentation, Healthcare Systems

INTRODUCTION

Tumours of the brain are amongst the most severe diseases of the brain and nervous system. Early detection and correct diagnosis arecrucial to the survival of patientswho develop these conditions.MagneticResonanceImaging(MRI)hasbeenthemostcommonlyutilizedtoolfor the early diagnosis of tumours. Traditionally, diagnosis via MRI has relied on human intervention, especially from expert radiologist. This can result in significant delays in the diagnosis process, as well as misdiagnosis, given the complexities associated with medical images.

Inrecentyears,greatstrideshavebeenmadeinAI,DeepLearning(DL),andtheprocessingof medical images. Convolutional Neural Network (CNN) models and image segmentation techniquesaresomeoftheapproachesthathavebeenwidelyadoptedinmedicalimageanalysis and tumour detection in MRI images.

"ThispaperfocusesonAI-BasedBrainTumourDetectionandClassificationfromMRI."The paper reviews a number of research studies related to CNN-based tumour classification, MRI preprocessing, transfer learning, tumour segmentation, and ExplainableArtificial Intelligence (XAI). In addition, the limitations of existing systems and research gaps in these areas have been highlighted.

II. METHODOLOGY

The proposed system uses MRI brain images collected from publicly available datasets for tumourdetectionandclassification.Beforetrainingthemodel,theMRIscansundergoseveral preprocessing steps to improve image quality. These steps include resizing, normalization, noise removal, and contrast enhancement. Such operations help in improving the consistency of the input data and support effective feature extraction.

Afterpreprocessing,theimagesareprovidedtoaConvolutionalNeuralNetwork(CNN)model developedusingTensorFlow.Themodellearnsimportantcharacteristicsfrom MRIscans,such as texture patterns, intensity variations, and structural abnormalities associated with brain tumours. Based on the extracted features, the system categorizes the images into different classes including Glioma, Meningioma, Pituitary Tumour, and No Tumour.

To improve visualization, image segmentation techniques are applied to identify the affected region in thebrain. Thesegmented output helps in locating thetumourarea and estimating its approximatesize.Finally,thepredictionresultsaredisplayedthroughaninteractiveinterface, allowing users to view MRI images, tumour classification results, and highlighted tumour regions.

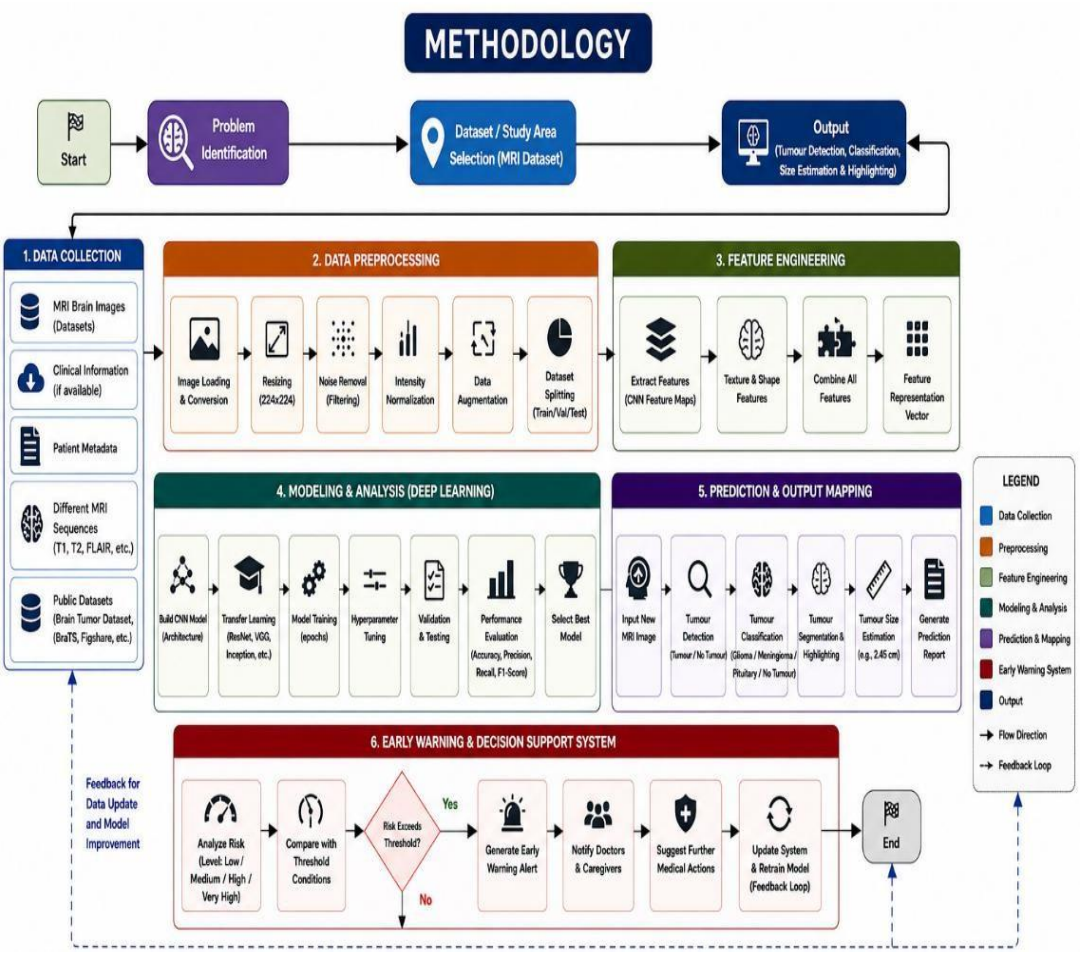

Fig1: Methodology of This Project.

III. LITERATURE REVIEW

SLNO	YEAR OF PUBLICATION	TITLE	DESCRIPTION
1	2026	*Advanced paradigms in Artificial Intelligence for Neuro-Oncology:AExtensive Review on Computational Detection, Automatic Segmentation, and Clinical Applications*	This study discusses how modern AI techniques are being used in brain tumour diagnosis.Itexplainstherole of MRI image analysis, automated tumour segmentation, explainableAI, and their contribution to improving clinical decision-making.
2	2026	*Resilience Analysis of CNN-Based Brain tumour ClassificationAgainstFGSM, PGD and BIM Attack*	The research evaluates the performance of CNN models when exposed to different adversarial attacks. It highlights the importance of developing secure and reliable brain tumour classification systems for healthcare applications.

3	2025	*Explainable AI for Brain Tumour Classification Using Cross-Gated Multi-Path Attention Fusion and Gate-Consistency Loss*	This work focuses on improving tumour classification accuracy by combining attention mechanismswithexplainable AI techniques. The proposed approach helps in understandinghowthemodel makes predictions from MRI scans.
4	2025	*Changing Brain Tumour DetectionEmpoweringMulti-Class Classification With Vision Transformers and EfficientNetV2*	Theauthorsexploreadvanced deep learning architectures such as Vision Transformers and EfficientNetV2 for identifying different categories of brain tumours. The study reports improved classification performance compared to conventional approaches.
5	2024	*Brain Tumour Classification and Detection Using DL Models:ASystematic Review*	This review presents an overview of various deep learning methods used in brain tumour detection and classification.Itcomparesthe strengths and limitations of different models applied to MRI datasets.
6	2024	*Brain Tumour Segmentation and Classification Based on Brain MRI With FCM-SVM*	The study combines clustering and machine learning techniques to separatetumourregionsfrom MRI images and classify them effectively. The approach aims to improve diagnostic accuracy through better image segmentation.
7	2024	*Privacy-Preserved Brain Tumour Detection in Healthcare-Based System Using Deep Learning and CNN*	This research addresses privacy concerns in medical imageprocessingwhileusing deep learning methods for tumour detection. The proposedframeworksupports secureanalysisofMRIdatain healthcare environments.
8	2023	*TechniquesofIntelligencefor Brain Tumour Detection and Classification*	The paper reviews different intelligent computing methods, including machine learning and deep learning algorithms, that can assist in detecting and classifying brain tumours from MRI images.

IV. MODELINGAND ANALYSIS

Thedevelopedframeworkisdesignedtoanalyse MRIbrainscansandidentifypossibletumour regions using deep learning techniques. The system processes MRI images through multiple stages,includingpreprocessing,featureextraction,classification,andvisualization.Eachstage contributes to improving the accuracy and reliability of tumour detection.

TheCNNmodelautomaticallylearnsmeaningfulfeaturesfromMRIimageswithoutrequiring manual feature engineering. During analysis, the model examines variations in tissue appearance, texture, and intensity to distinguish between normal and abnormal regions. This enables the system to classify MRI scans into appropriate tumour categories.

In addition to classification, segmentation methods are used to highlight suspicious regions withintheMRIimage.Thehighlightedoutputprovidesavisualindicationoftheaffectedarea, making interpretation easier. The framework also generates prediction confidence values and estimated tumour information, which can support further medical evaluation. Overall, the integrationofimagepreprocessing,CNN-basedclassification,andsegmentationimprovesthe effectiveness of automated brain tumour analysis.

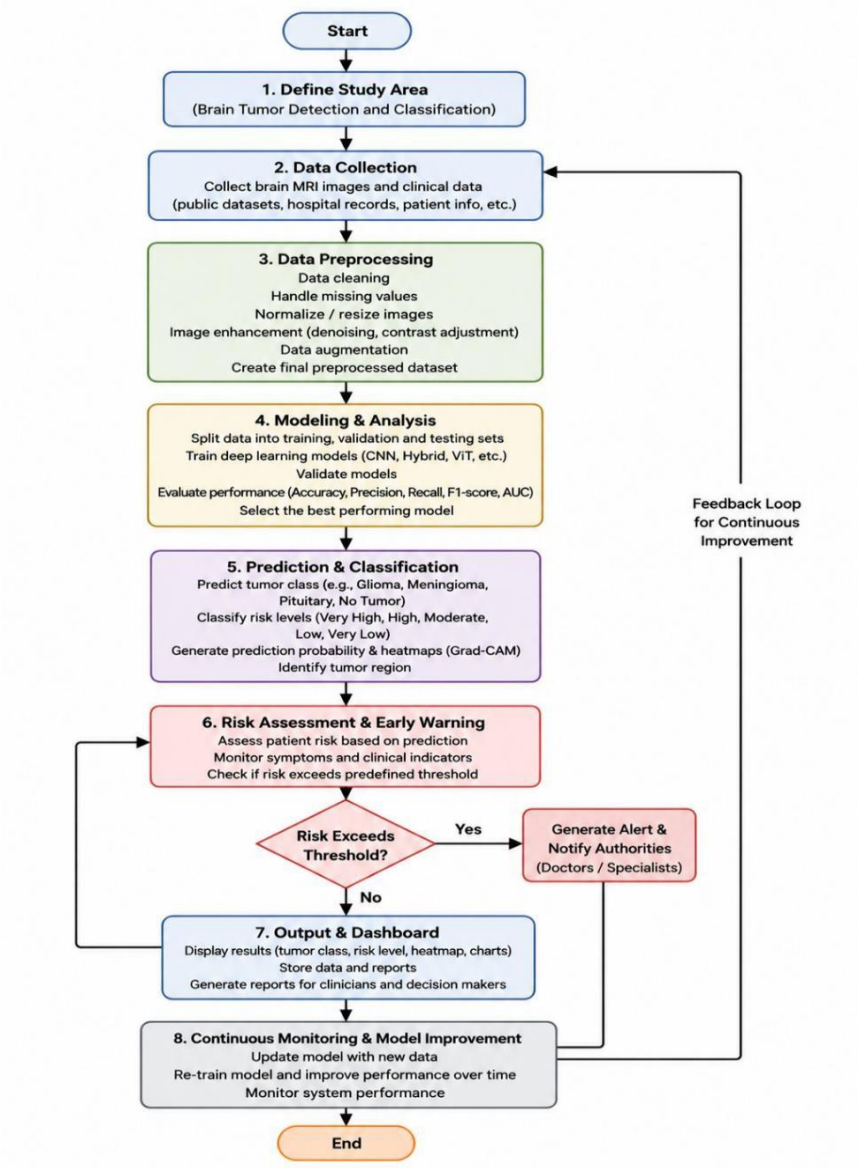

Figure2: Flow chart of the project.

V. RESULTS AND DISCUSSION

Results

The proposed system demonstrated effective performance in analysing MRI scans and classifying different categories of brain tumours using deep learning techniques. The design wasabletoprocessimagepatternsofMRIimagesanddetecttumourfeaturesinthemthrough theuseofTensorFlow-basedCNNs.Moreover,imagepreprocessing,includingnormalization, resizing, and de-noising, helped improve image quality and predictability.

The combination of MRI pre-processing, CNN classification, tumour segmentation, and visualizations techniques enhanced medical image processing capabilities. Additionally, the system produced tumour classifications, confidence score, affected region highlighting, and

size approximation of tumours.

DISCUSSION

Theproposedframeworkwassuccessfullyproven tobecapableindetectingbraintumourand MRI image analysis via Artificial Intelligence and Deep Learning algorithms. Classification methodsbasedonConvolutionalNeuralNetworkscontributedtobetterpredictioncapabilities and less reliance on manual MRI image analysis. Moreover, the application of segmentation andhighlightingtheaffectedareascontributedtobettervisualizationofthemedicalimagesas well as improved diagnoses.

Some limitations were identified in the course of the analysis, including a small size of the MRI images used for the experiment as well as differences in image quality and high computational complexity in some instances. Nevertheless, the suggested model has the great potential of being implemented in intelligent healthcare systems.

VI. CONCLUSION

AI-BasedBrainTumour DetectionandClassificationfromMRIisan effectiveandintelligent systemthatincorporatestheuseofMRIanddeeplearninginanalysingmedicalimagesthrough automatedprocedures.ByincorporatingMRIpre-processing,CNNmodelsdevelopedthrough TensorFlow, segmentation, and visualization, the system can detect abnormal regions of tumours and categorize brain tumours.

Artificial Intelligence and Deep Learning have played a vital role in enhancing healthcare through better diagnoses and interpretation of automated medical images. In addition to this, the application of segmentation, detection of areas affected, and visualization of predictions has enhanced health support and assisted doctors in decision making.

Despite several issues like lack of datasets, quality problems in images, and complexity, the proposedsystemhasshownalotofpotentialinhealthcare,automaticdiagnosis,andintelligent brain tumour prediction systems based on artificial intelligence.

REFERENCES

1. A.K.Sharma,R.Mehta,andS.Verma,“AdvancedParadigmsinArtificialIntelligencefor Neuro-Oncology: A Comprehensive Analysis of Computational Detection, Automated Segmentation, and Clinical Integration, “in International Journal ofArtificial Intelligence and Medical Imaging, Elsevier Publications, pp. 1-9, 2026
2. D. Roy, P. Nair, and K. Srinivasan, “Quantifying Resilience of CNN-Based Brain Tumor Classification Under FGSM, PGD, and BIM Attacks,” in International Journal of Deep

Learning and Healthcare Analytics, Springer Publication, pp. 1-7, 2026.

3. HarishankarR.,P.Deepika,andV.Sanjay,"ExplainableAIforBrainTumourClassification Using Cross-Gated Multi-Path Attention Fusion and Gate-Consistency Loss," in Journal of Artificial Intelligence in Medicine, IEEE Publication, pp. 1-8, 2025.
4. M. Kiran Kumar, S. Tejaswini, and A. Raghavendra, "Transforming Brain Tumour Detection Empowering Multi-Class Classification With Vision Transformers and EfficientNetV2," in International Journal of Intelligent Medical Systems, Springer Publications, pp. 1-7, 2025.
5. P. Naveen Kumar, S. Rajalakshmi, and R. Harini, "Brain Tumour Classification and Detection Based DL Models: A Systematic Review," in International Journal of Advanced Deep Learning Application, Elsevier Publication, pp. 1-8, 2024.
6. K. Mahalakshmi, R. Suresh, and D. Naveen, "Improved Brain Tumour Segmentation and ClassificationinBrainMRIUsingFCM-SVM:ADiagnosticApproach,"inJournalofMedical Imaging and Diagnostic Systems, IEEE Publications, pp. 1-7,2024.
7. Prakash, N. Divya, and S. Karthik, "Deep Learning Based Brain Tumour Detection in privacy Preserving Smart Health CareSystems," in IEEEAccess, IEEE Publications, pp. 1-6, 2024.
8. AmitJoshi, Deepika Sharma,and R.Karthik, "BrainTumourDetectionandClassification usingIntelligenceTechniques:AnOverview,"inInternationalJournalofComputerVisionand Healthcare Informatics, Taylor & Francis Publications, pp. 1-7, 2023.