

# Brain Tumor Detection

From MRI Images Using Two-Pathway-Group CNN

**Name:** Geo Mathews

**Roll No.:** AA.SC.P2MCA24070069

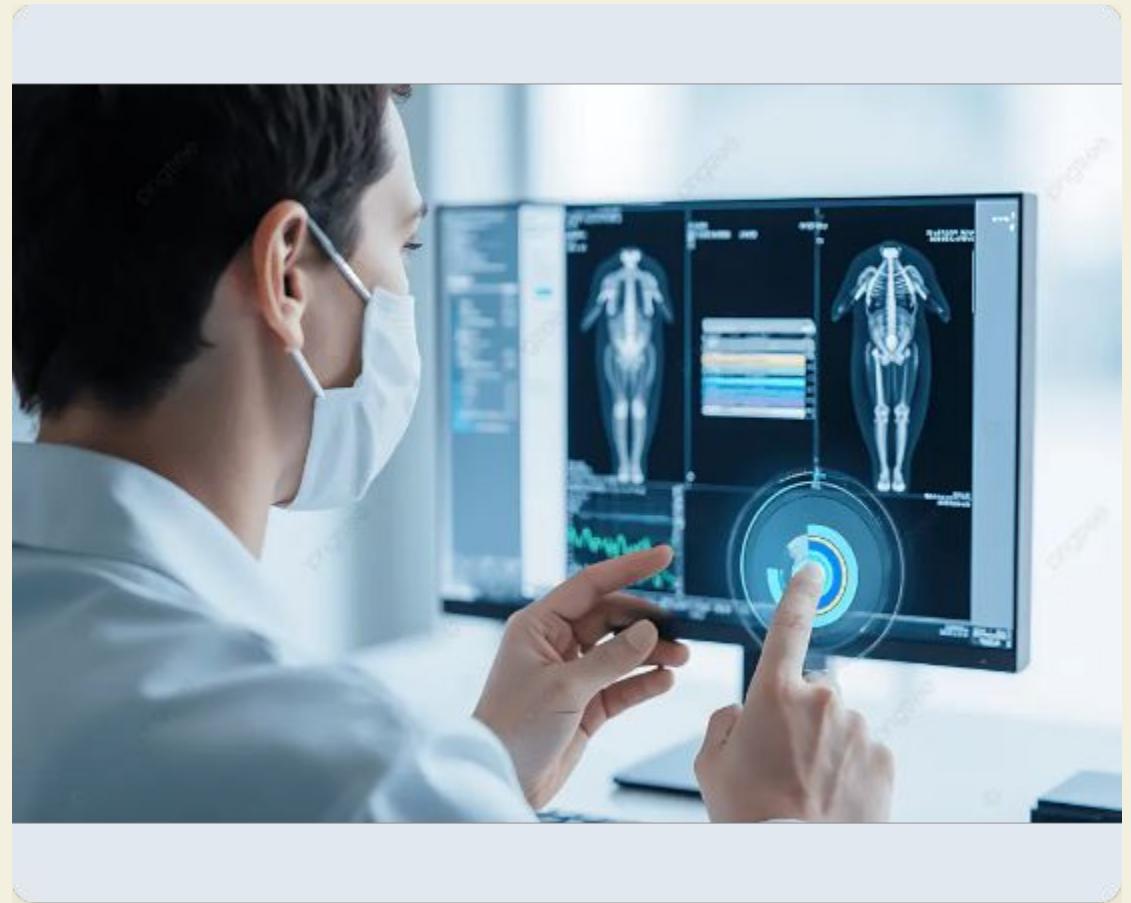
Amrita Vishwa Vidyapeetham | Minor

Project

# The Challenge of Diagnosis

---

- **Time-Consuming:** Manual segmentation of brain tumors from MRI scans is a complex, tedious task for radiologists.
- **Complexity:** Tumors exhibit unpredictable shapes, sizes, and locations, making standard detection difficult.
- **Critical Need:** The accuracy and robustness of segmentation are crucial for treatment planning and patient survival.
- **Goal:** Automate this process using deep learning to assist medical professionals.



# Literature Survey

---



## ANN (Habib)

Used Artificial Convolutional Neural Networks for tumor detection.

**Result:** Achieved ~88.7% accuracy, but lacked deeper feature extraction capabilities.



## K-Means (Lin & Chang)

Utilized clustering algorithms with color-based segmentation to track tumor objects.

**Limitation:** Relies heavily on distinct color/intensity differences.



## Standard CNNs

Traditional deep learning methods require massive annotated datasets.

**Limitation:** Often struggle to balance local details with global context.

## Two-Pathway-Group CNN

We propose a novel architecture designed to overcome the limitations of manual segmentation and standard CNNs.

### ✓ Dual Features

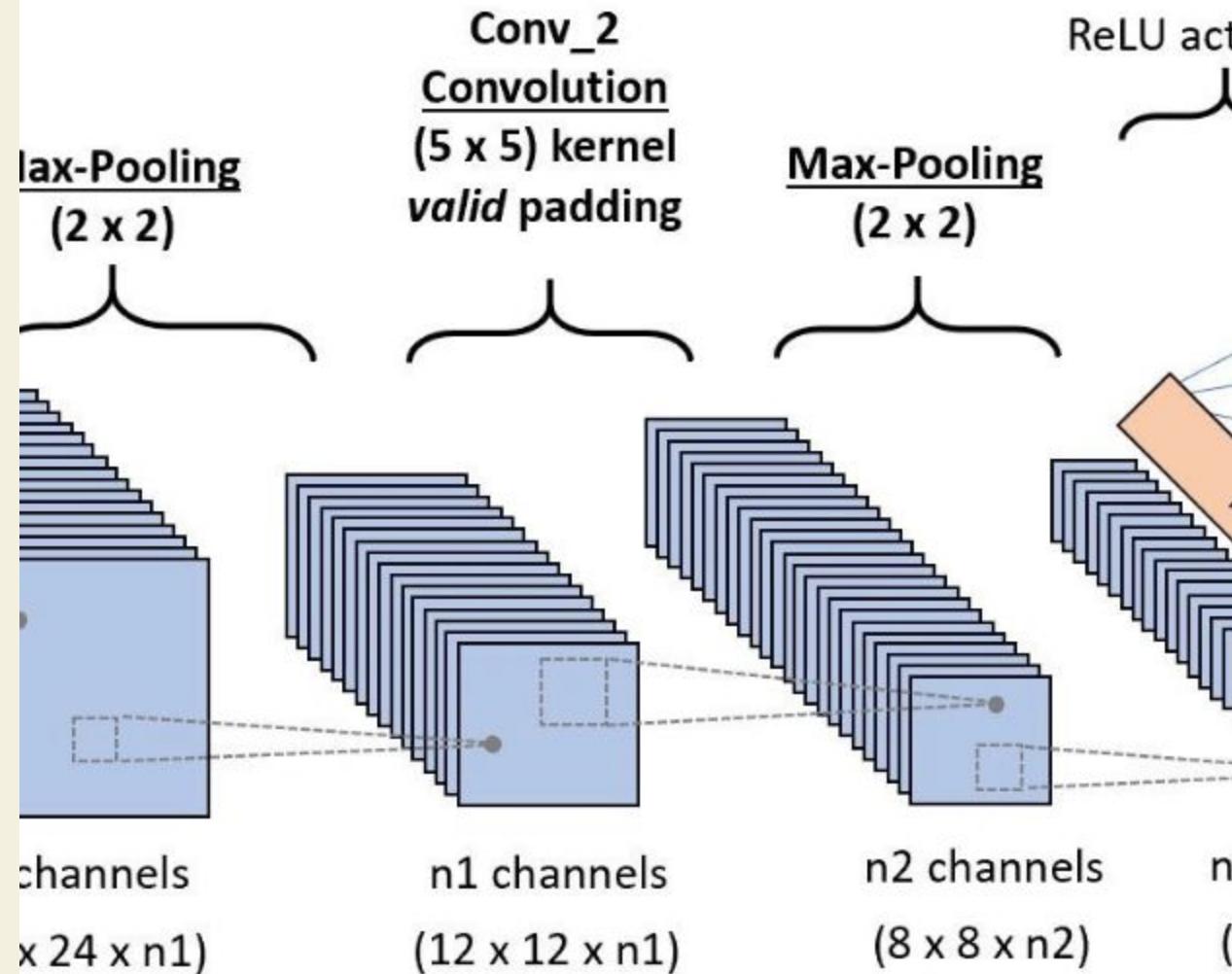
Exploits both local features and global contextual features simultaneously.

### ✓ Stability

Uses the equivalence of the bidirectional CNN model to reduce instability and overfitting.

### ✓ Cascaded Architecture

Merges basic CNN output as an auxiliary source at the final level.



# Methodology Pipeline

---



## 1. Preprocessing

Input MRI images are resized and filtered using Gaussian techniques to remove noise.

## 2. Segmentation

Thresholding (cutoff 128) and morphological erosion are applied to isolate regions.

## 3. Feature Extraction

The Two-Pathway-Group CNN extracts critical local and global features from the segments.

## 4. Classification

Final detection of tumor type: Tumor Detected, or No Tumor.

# System Architecture

---

## Logical Flow

### User Action:

User uploads a single MRI image via the web interface.

### Server Processing:

Image preprocessing, segmentation, and CNN model inference occur on the backend.

### Output:

System displays the confidence score and tumor classification facts.



The system follows a strict MVC pattern, separating the image handling logic from the neural network processing and the user interface.

# Tools & Technologies

---



## Python

The core programming language used for model development and backend logic.



## Keras & TensorFlow

Deep learning libraries used to construct the CNN layers (Conv2D, MaxPool, Dense).



## BRATS Dataset

Trained and validated on the BRATS2013 and BRATS2015 brain tumor benchmarks.



## Anaconda

Used Jupyter Notebooks for iterative development and testing of the model.

# Performance Comparison

---

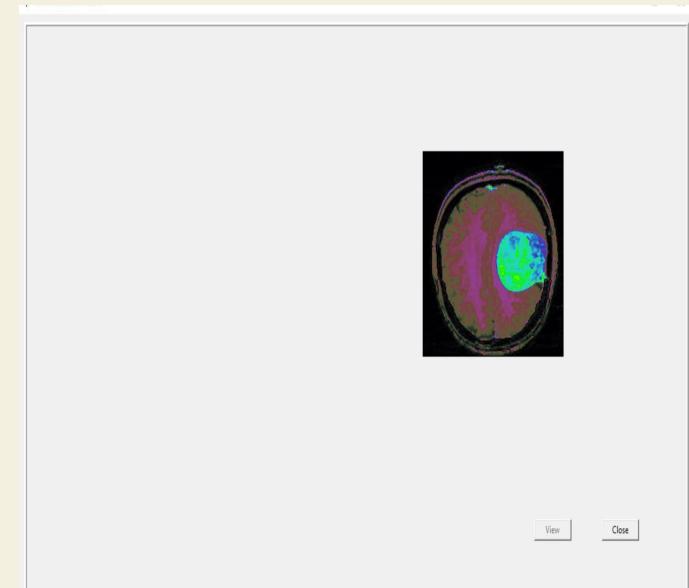
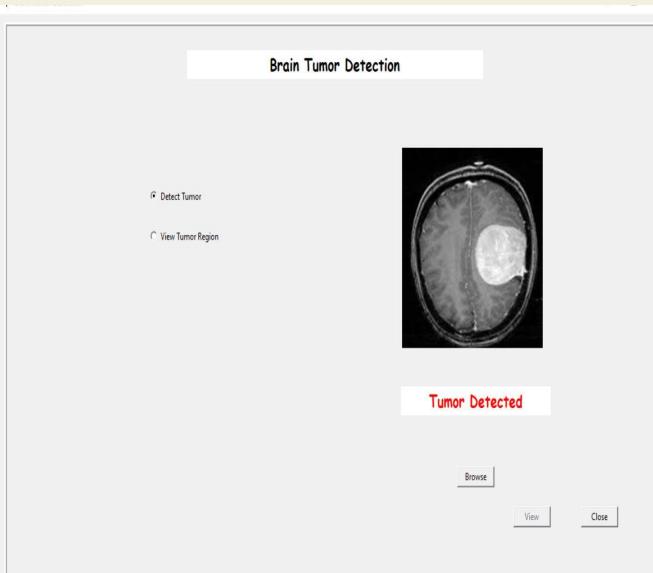
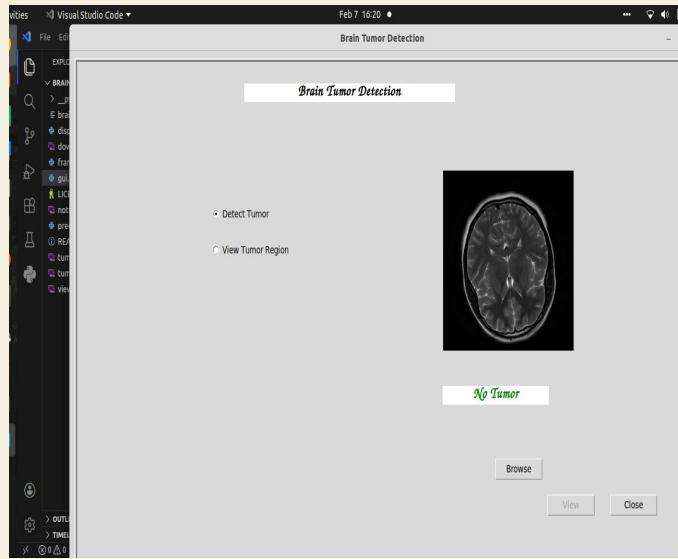
The proposed Two-Pathway CNN significantly outperforms traditional methods in accuracy and confidence.



\*Proposed model shows superior confidence levels in tumor classification.

# Tumor Classification Results

---



# Conclusion

The integration of the Group CNN into a two-pathway architecture successfully improved overall performance over current state-of-the-art methods.

By automating segmentation with high accuracy and low computational complexity, this system offers a viable tool for assisting doctors in early and accurate diagnosis.

# Thank You

Questions?

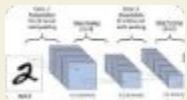
# Image Sources

---



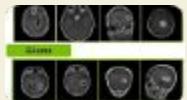
[https://png.pngtree.com/thumb\\_back/fw800/background/20251104/pngtree-doctor-analyzing-medical-imaging-data-displayed-on-digital-computer-screen-image\\_20242698.webp](https://png.pngtree.com/thumb_back/fw800/background/20251104/pngtree-doctor-analyzing-medical-imaging-data-displayed-on-digital-computer-screen-image_20242698.webp)

Source: [pngtree.com](https://pngtree.com)



<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/10/90650dnn2.webp>

Source: [analyticsvidhya.com](https://analyticsvidhya.com)



[https://www.frontiersin.org/files/Articles/1335740/fonc-14-1335740-HTML-r1/image\\_m/fonc-14-1335740-g001.jpg](https://www.frontiersin.org/files/Articles/1335740/fonc-14-1335740-HTML-r1/image_m/fonc-14-1335740-g001.jpg)

Source: [www.frontiersin.org](https://www.frontiersin.org)