Brain Tumor Classification using Deep Learning (CNN)

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1. Project Planning

The *Brain Tumor Classification Project* aims to develop an **AI-based system** capable of identifying and classifying brain tumors from MRI images.
Using **Convolutional Neural Networks (CNN)** and **Transfer Learning**, the system enhances diagnostic accuracy and efficiency, supporting radiologists in early tumor detection.
The project started on **August 28, 2025**, and will be completed before the end of **November 2025**.

Project Objectives

- Automate the classification of brain MRI scans into four categories: *Glioma, Meningioma, Pituitary, and No Tumor*.
- Improve diagnostic accuracy and reduce human errors using deep learning.
- Apply **Transfer Learning** to boost performance and efficiency.
- Develop a simple and user-friendly interface for quick analysis.
- Contribute to the integration of **AI in medical imaging** and healthcare innovation.

Milestones & Timeline

Milestone	Duration	Description
1	Aug 28 – Sep 10	Dataset collection, preprocessing, and exploratory data analysis (EDA).
2	Sep 11 – Oct 5	Build and train baseline CNN model (achieved 95% accuracy).
3	Oct 6 – Oct 25	Apply Transfer Learning and optimize model performance.
4	Oct 26 – Nov 15	Model deployment with a simple web or cloud interface.
5	Nov 16 – Nov 28	Final evaluation, documentation, and presentation.

Team Members and Roles

Name	Role
Mahmoud Sayed Sofy	Team Leader – Image Classification Model , MLOps Implementation
Habiba Yeiha Emam Nasr	Data Preprocessing , Transfer Learning and Fine-Tuning, Azure Cognitive Services
Mariam Nasser Rabia	Model Evaluation & Visualization, Web Interface for Image Predictions
Mazen Alaa Fathy Osman	Data Collection, Model Integration, Model Monitoring:
Shams Metwally Abdelhaleem	Model Optimization, Model Retraining Strategy
Ashrakat Yasser Hamdy	Exploratory Data Analysis (EDA), Object Detection Model, Cloud Deployment

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2. Stakeholder Analysis

The project involves multiple stakeholders who either benefit from or contribute to its success.

Stakeholder	Role	Interest	Impact
Doctors	End Users	Faster and more accurate tumor diagnosis	High
Patients	Beneficiaries	Better and earlier medical treatment	High
AI Development Team	Developers	Create accurate and efficient models	High
Hospitals	Implementers	Improve diagnostic efficiency	Medium
Researchers	Observers	Study advancements in medical AI	Medium

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3. Database Design

The dataset used is a **Brain MRI Image Dataset** obtained from *Kaggle*, containing four main classes of MRI scans:
Glioma, Meningioma, Pituitary, and No Tumor.

It is structured in folders for supervised learning:

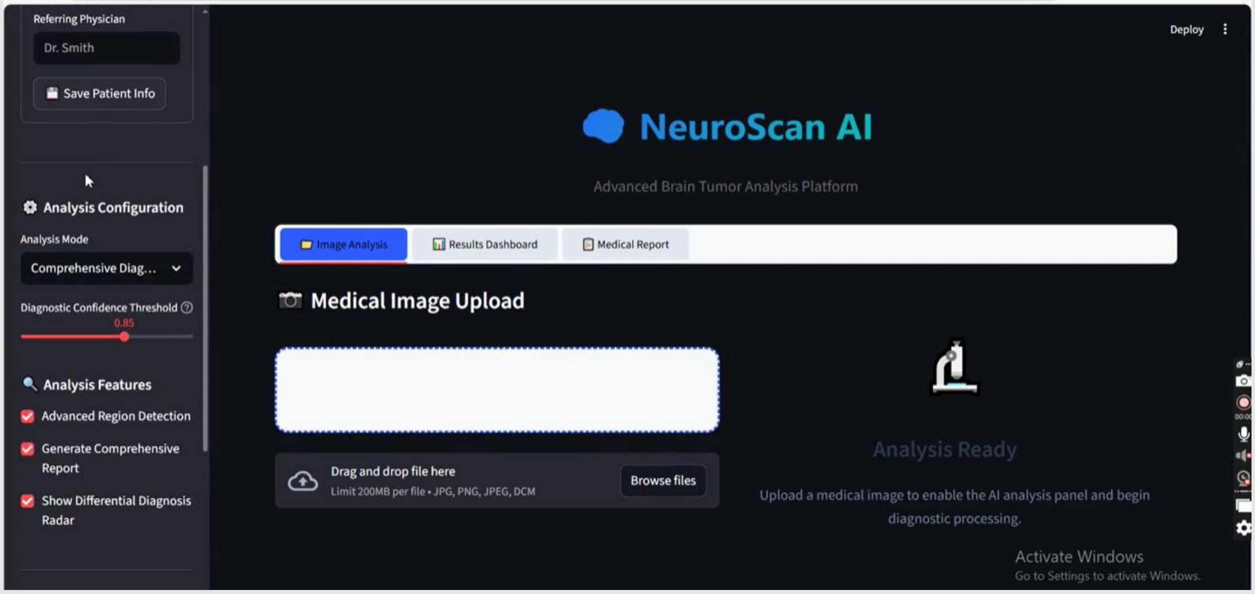
```
/Dataset
    /Training
        /Glioma
        /Meningioma
        /Pituitary
        /No Tumor
    /Testing
        /Glioma
        /Meningioma
        /Pituitary
        /No Tumor
```

Each folder includes MRI images labeled based on tumor type.
No relational database is required since the project relies on **image-based classification**, not tabular data.
Data preprocessing includes **resizing, normalization, and augmentation** to improve model generalization.

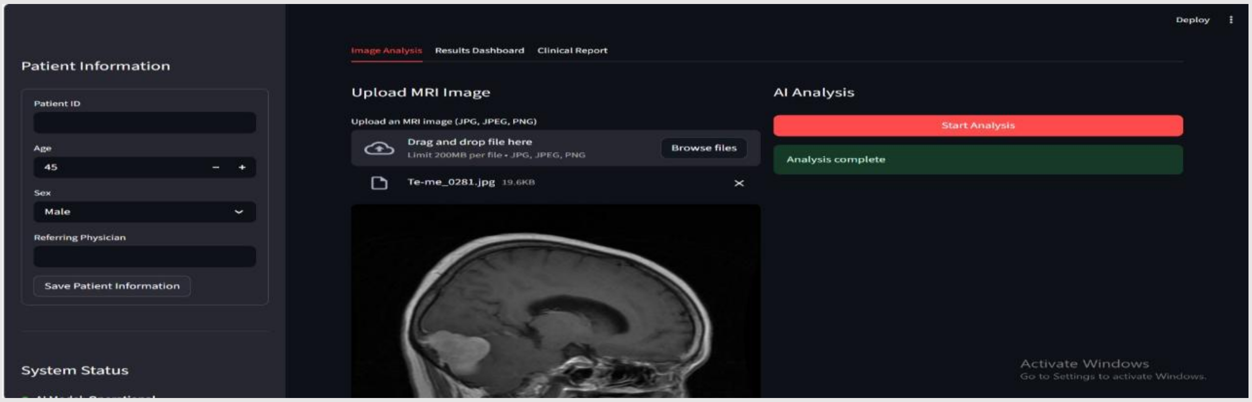
4. Deployment & Design

The user interface is designed to be **simple and intuitive** for healthcare professionals.
The system allows users to upload MRI scans, process them, and instantly view results.

Image Upload & Analysis Configuration

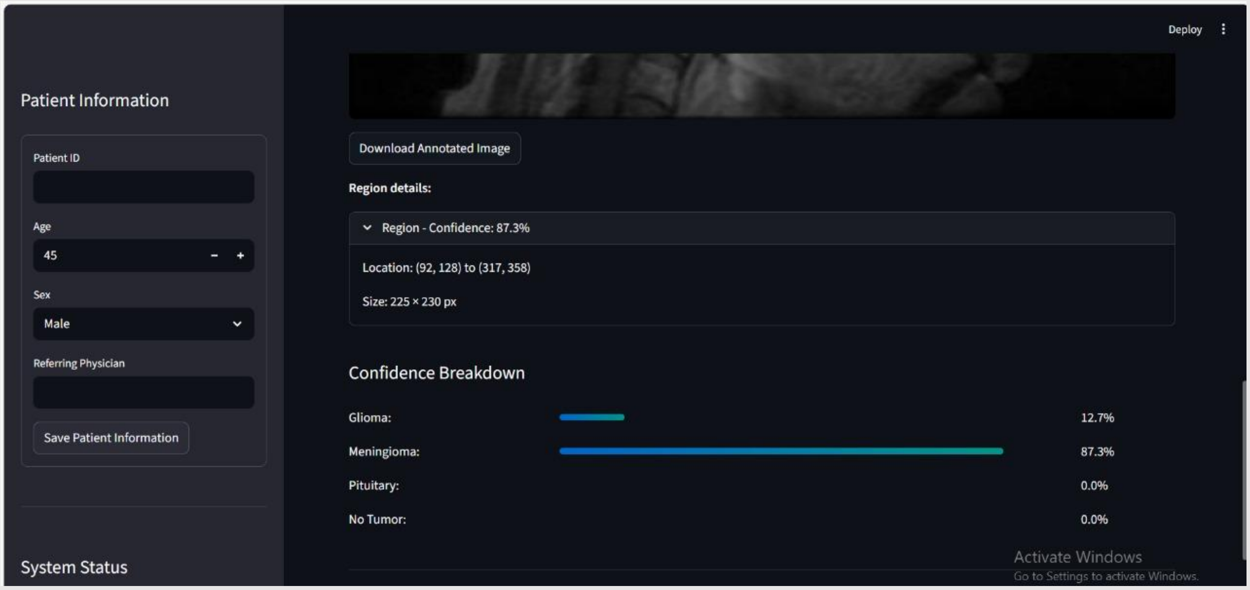


This screen shows the **main interface** of the *NeuroScan AI* platform.
The user can upload an MRI brain image for analysis using the **“Medical Image Upload”** section.



On the left side, there are configuration settings where the physician can choose the **analysis mode** (e.g., comprehensive diagnosis) and adjust the **diagnostic confidence threshold**. Additionally, users can enable advanced analysis features such as **region detection**, **comprehensive report generation**, and **diagnostic radar visualization**.
This interface provides a clean and user-friendly experience for doctors to initiate the brain tumor analysis process.

Detection & Confidence Results



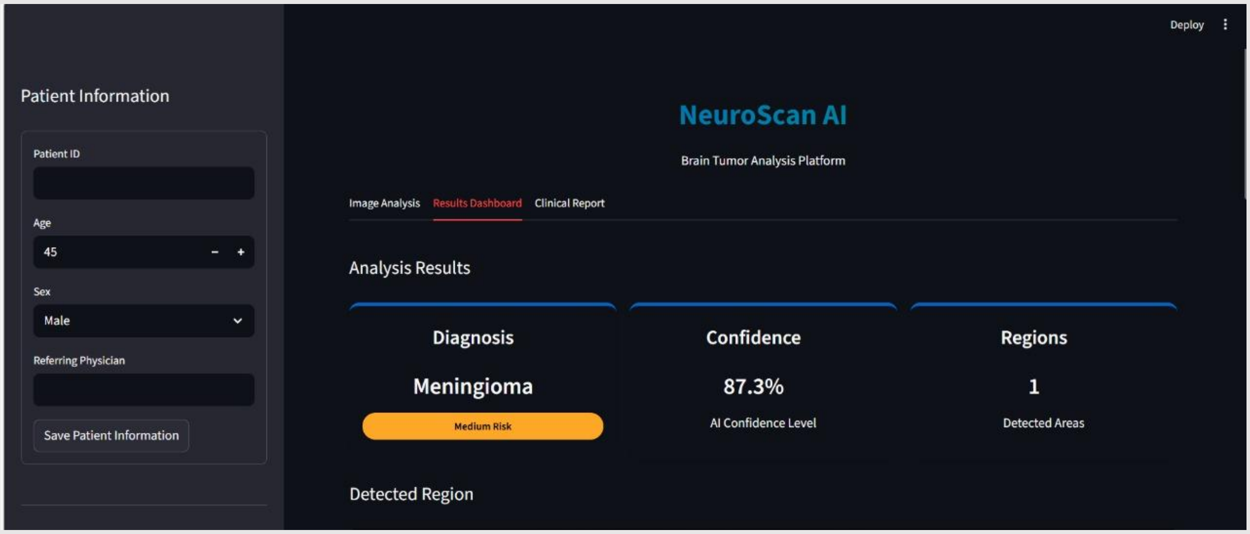
This screen displays the **detection output** after uploading a brain MRI image.
On the left side, there is a **patient information form** (age, gender, referring physician).
On the right side, the results panel shows the **detected tumor region** with details such as:

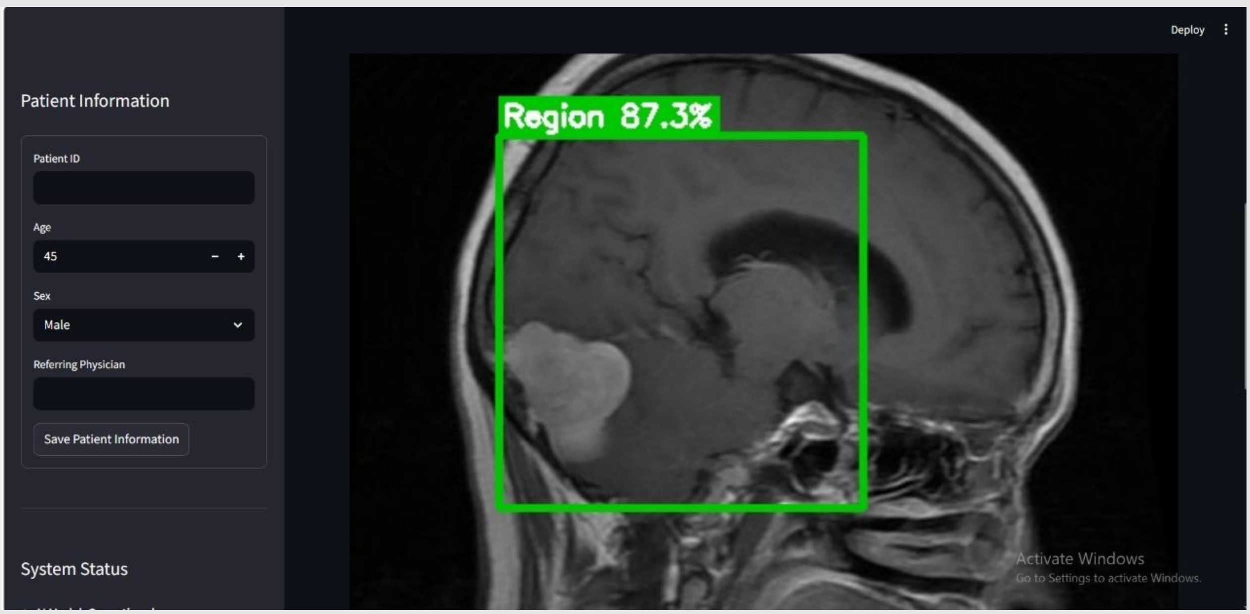
- Region confidence (e.g., 87.3%)
- Location and size of the tumor area
  Below that, a **Confidence Breakdown** is presented for all tumor types (Glioma, Meningioma, Pituitary, and No Tumor), helping the doctor understand the model's confidence level for each possible diagnosis.

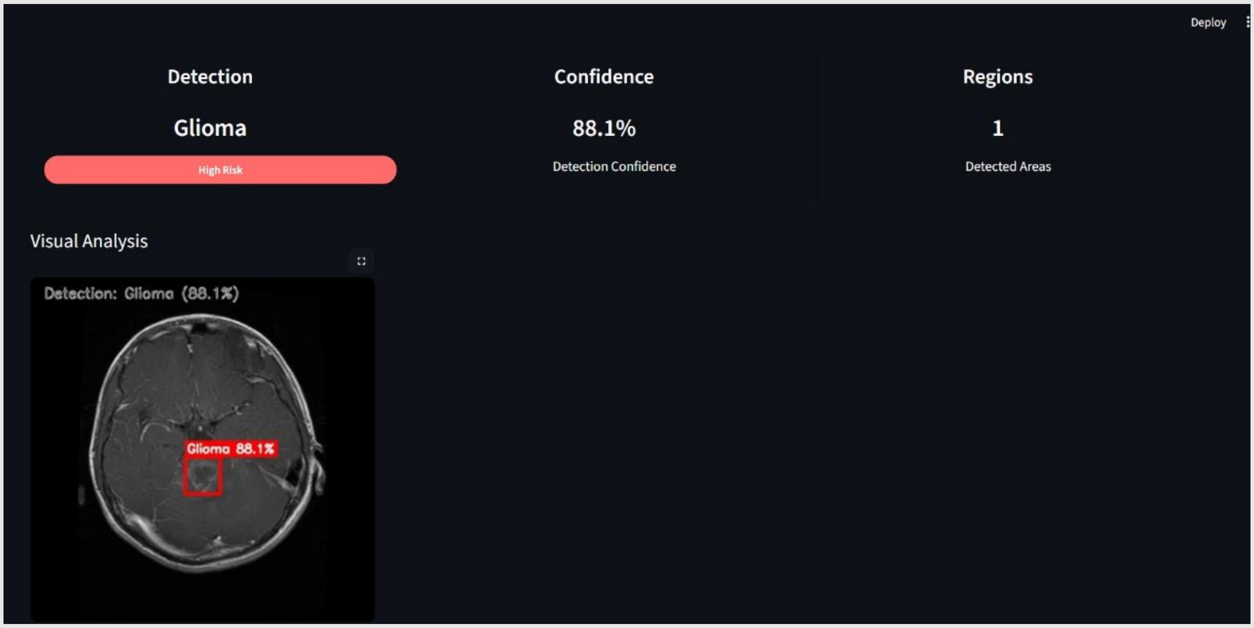
Medical Report

This is the **final report screen** generated after the AI analysis.
It includes:

- **Patient details** (age, sex, ID, physician)
- **Analysis date and time**
- **Primary diagnosis** (e.g., Meningioma)
- **Confidence percentage** (e.g., 87.3%)
- **Risk level** (e.g., Medium)
  The report provides a comprehensive summary of the diagnostic results and can be downloaded or printed for clinical documentation.
  This feature enhances transparency and allows physicians to review AI-supported findings easily.


Deploy
Patient Information
Patient ID
Age
45
Sex
Male
Referring Physician
Save Patient Information
NeuroScan AI
Brain Tumor Analysis Platform
Image Analysis
Results Dashboard
Clinical Report
Analysis Results
Diagnosis
Meningioma
Medium Risk
Confidence
87.3%
AI Confidence Level
Regions
1
Detected Areas
Detected Region


Deploy
Patient Information
Patient ID
Age
45
Sex
Male
Referring Physician
Save Patient Information
System Status
Region 87.3%
Activate Windows
Go to Settings to activate Windows.



The UI follows a minimal design for clarity and speed, ensuring doctors can interpret the results easily.
Future versions will include **visual tumor detection** using **Object Detection models (YOLOv8)** to highlight tumor areas on the MRI image.

5. Project Links

- **GitHub Repository:** https://github.com/sofy315/Image-Classification-and-Object-Detection-System-project
- **Documentation Link (Google Drive):** https://drive.google.com/drive/folders/1elqSLlpX4ycvkcEAH8KLhU-AX8BHqDRV?usp=drive_link

Conclusion

This project demonstrates how Artificial Intelligence can revolutionize healthcare by automating medical image analysis.
By combining **CNN classification** and **object detection (YOLO)**, the system aims to support radiologists in identifying tumors faster and more accurately.
Currently, the team has completed **Milestones 1 and 2** (achieving 95% accuracy) and is now working on **Transfer Learning and optimization** for improved performance before deployment.