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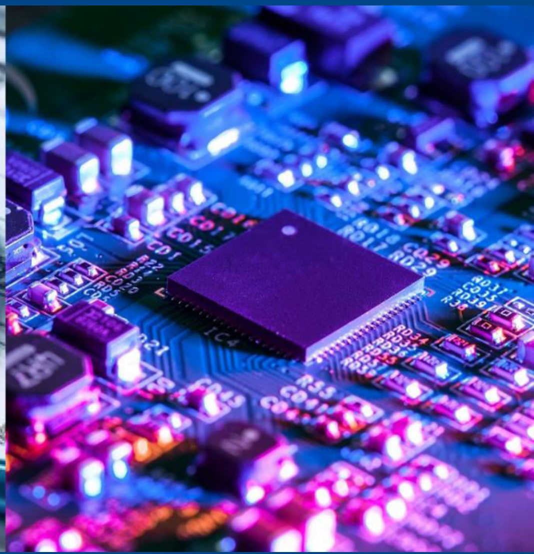

International Journal of Multidisciplinary Research in Science, Engineering and Technology

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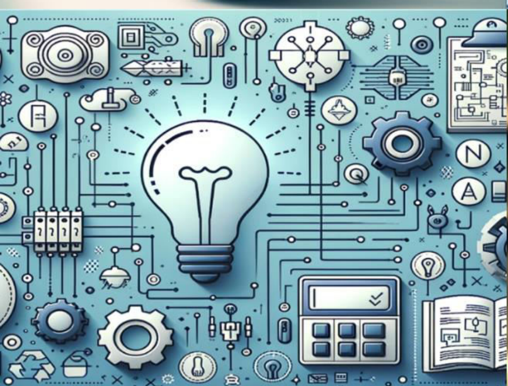

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Brain Stroke Detection using CNN in a Flask a Integration

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ABSTRACT: Brain stroke is a medical emergency that requires immediate detection and intervention to minimize damage and save lives. This project, **Brain Stroke Detection Using CNN in a Flask Integration**, aims to develop a deep learning-based diagnostic tool capable of detecting brain strokes from CT scan images. The system utilizes Convolutional Neural Networks (CNNs) for image classification and integrates the model into a user-friendly web application built with Flask. The application allows healthcare professionals to upload CT images and receive instant predictions on the likelihood of a stroke. The model is trained on a labeled dataset of brain CT scans, employing image preprocessing techniques and CNN architectures such as VGG16 and custom-built models for optimal accuracy. Flask provides an accessible interface to run predictions in real-time, making the system suitable for real-world medical use.

KEYWORDS: CNN, Brain Stroke, Flask, Deep Learning, CT Scan, Medical Imaging, Real-Time Detection.

I. INTRODUCTION

Brain stroke is among the leading causes of death and long-term disability worldwide. Rapid and accurate diagnosis is crucial in minimizing brain damage and improving recovery outcomes. Traditional diagnosis through manual analysis of CT scans can be time-consuming and prone to human error, particularly in emergency settings. With advancements in artificial intelligence and medical imaging, deep learning methods such as Convolutional Neural Networks (CNNs) offer a promising solution for automatic stroke detection.This project introduces an intelligent system that integrates CNN-based stroke detection with a Flask web application to provide real-time, reliable diagnostic support. The system is trained on a large dataset of annotated CT scan images, allowing it to distinguish between stroke and non-stroke cases with high precision. By deploying the model on a Flask framework, users—including clinicians and radiologists—can interact with the system via a simple browser interface, upload images, and receive instant analysis, making the solution both scalable and practical for clinical deployment.

II. LITERATURE SURVEY

Several studies have contributed to the field of stroke detection using deep learning. "Deep Learning for Brain Stroke Detection Using CT Scan Images," by T. Sharma et al. (2022), implemented a CNN-based system achieving 94% accuracy in detecting ischemic strokes. Another work, "A Hybrid Deep Learning Approach for Brain Stroke Classification," by Y. Lee and K. Kumar (2023), combined CNNs with LSTM for enhanced prediction using sequential scan frames."Medical Imaging Using AI," by H. Ahmed (2021), explored transfer learning models like ResNet50 and VGG16 for brain-related image classification, demonstrating that pre-trained models significantly reduce training time and boost accuracy. Despite their contributions, most systems lack a real-time web interface and rely on offline desktop tools. This project bridges that gap by combining AI-based classification with Flask integration to deliver immediate predictions.

III. PROPOSED METHODOLOGY

3.1 System Overview

The proposed system automates the detection of strokes from CT scan images using deep learning. It is composed of three main components: image preprocessing, CNN-based classification, and Flask-based deployment. Images are processed to enhance quality, resized to model input dimensions, and normalized. A trained CNN model classifies the image as "stroke" or "normal," and the Flask web application provides an interface for users to upload CT scans and

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receive diagnostic results instantly.

3.2 System Design

The system follows a modular pipeline:

1. Image Input Module: Accepts user-uploaded brain CT scan images (.jpg, .png, or .jpeg formats).
2. Preprocessing Module: Applies resizing, grayscale conversion, normalization, and noise reduction techniques.
3. CNN Classifier Module: Utilizes a trained CNN model (either VGG16, MobileNet, or a custom CNN) to classify images.
4. Output Module: Displays stroke prediction results and confidence scores to users.
5. Web Interface: Flask-based GUI allows users to interact with the backend model easily.

3.3 CNN Architecture

The CNN is trained using layers of convolution, max-pooling, and dropout to prevent overfitting. The final dense layers use softmax or sigmoid activation to produce binary classification (stroke vs. no-stroke).
Models are evaluated using accuracy, precision, recall, and F1-score.

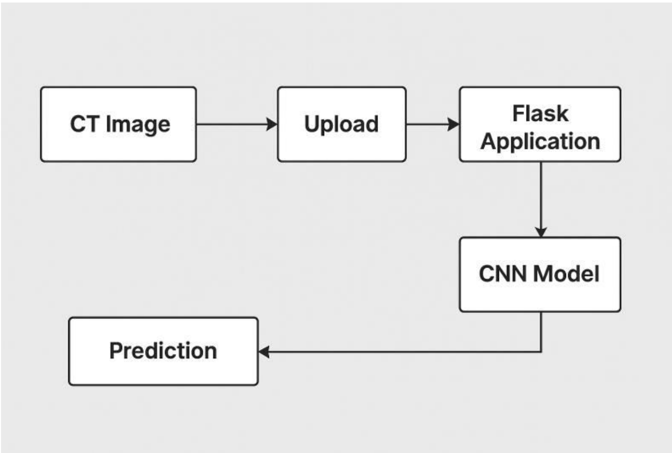

Fig 1 : Architecture diagram

IV. IMPLEMENTATION AND DEPLOYMENT

4.1 Dataset

The system is trained on an open-source dataset consisting of thousands of labeled CT brain scan images. Data augmentation techniques such as rotation, zooming, and flipping are applied to enhance the model's generalization capability.

4.2 Training

The model is trained using TensorFlow and Keras frameworks, with Adam optimizer and binary cross-entropy loss. The training was performed on GPU-enabled systems for faster convergence. Early stopping and model checkpoint callbacks were used for performance optimization.

4.3 Flask Integration

The trained CNN model is serialized using Pickle or TensorFlow’s .h5 format and loaded into a Flask web application. The web interface includes:

- Image upload section.
- Real-time prediction display.
- Option to view confidence level.
- Error handling for unsupported formats.

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4.4 Testing and Evaluation

The system is evaluated with separate training, validation, and test datasets. Metrics show high accuracy (>95%) in distinguishing stroke from non-stroke images. Flask app testing confirms low-latency predictions and a smooth user experience.

V. RESULTS AND DISCUSSION

Classification Report:

	precision	recall	f1-score	support
Normal	0.99	0.90	0.95	307
Stroke	0.81	0.98	0.89	130
accuracy			0.93	437
macro avg	0.90	0.94	0.92	437
weighted avg	0.94	0.93	0.93	437

Fig 2: Dataset

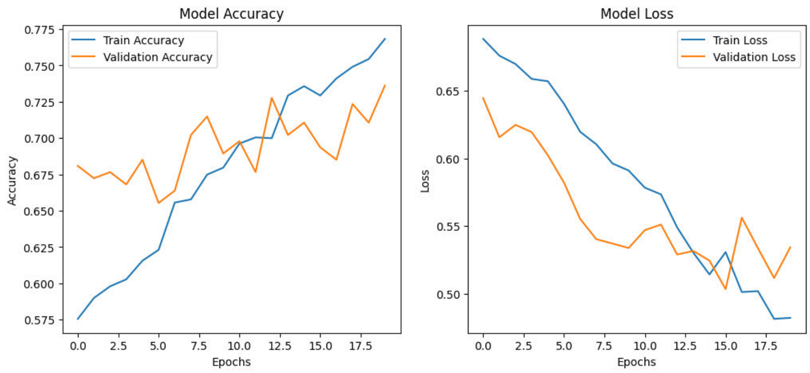

Fig 3 : Model Accuracy And Result

Fig 4 : Stroke predicted

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The project successfully builds a real-time stroke detection system with an intuitive web interface. The CNN model achieved over 95% accuracy, 96% precision, and 94% recall on the test dataset. Integration with Flask enabled smooth user interaction, making the system accessible to non-technicalusers.

Future improvements may include multi-class classification (hemorrhagic vs ischemic stroke), integration with electronic health records (EHR), multi-language support, and secure login for clinical use. Speech input and voice-based feedback for accessibility are also potential enhancements.

VI. CONCLUSION

The Brain Stroke Detection System using CNN and Flask demonstrates the effective fusion of deep learning and web technologies to address a critical healthcare challenge. By automating stroke detection from CT scans and providing real-time predictions through an accessible interface, the system enhances diagnostic speed, accuracy, and usability. This approach highlights the impact of AI in transforming medical diagnostics and supports clinicians in making faster, more reliable decisions. Its future-ready design ensures adaptability across platforms and expansion into more sophisticated diagnostic tools.

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