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Brain Tumor Detection in Medical Images Using HOG Feature Extraction and Machine Learning Algorithms

[1]Mrs.N.Sulakshna,[2]Kunapareddy Dinkle Manikanta, [3]Ramanadham Tevo Pavani, [4]Priyanka Gujjarlapudi, [5]Gattu Lakshmi Prasanna

[1]Associate Professor, Computer Science and Engineering, St. Ann's College of Engineering and Technology, Nayunipalli (V), Vetapalem (M), Chirala, Bapatla Dist, Andhra Pradesh – 523187, India
[2,3,4,5] U. G Student, Dept Computer Science and Engineering, St. Ann's College of Engineering and Technology, Nayunipalli (V), Vetapalem (M), Chirala, Bapatla Dist, Andhra Pradesh – 523187, India

ABSTRACT

Brain tumor detection is a critical task in medical image analysis. Early and accurate diagnosis helps improve patient survival rates. Medical imaging techniques such as MRI are commonly used. Manual analysis of MRI images is time-consuming. It also depends heavily on expert radiologists. Automated systems can assist in diagnosis. This project proposes a machine learning-based approach. Histogram of Oriented Gradients (HOG) is used for feature extraction. HOG captures important texture and shape features. Extracted features are used for classification. Machine learning algorithms analyse these features. The system classifies images as tumor or non-tumor. Preprocessing improves image quality. Noise reduction enhances feature extraction. The approach reduces human effort. It improves diagnostic accuracy. The system is cost-effective. It supports faster decision-making. The model is scalable. The results show promising performance.

KEY WORDS

Brain Tumor Detection, Medical Image Processing, HOG Features, Machine Learning, MRI Images

INTRODUCTION

Brain tumors are abnormal growths in brain tissue. They can be benign or malignant. Early detection is essential for treatment. MRI is widely used for brain imaging. MRI provides high-resolution images. Manual examination requires expert knowledge. Human errors may occur during diagnosis. Automated detection systems help radiologists. Image processing techniques enhance images. Feature extraction plays a key role. HOG extracts edge and gradient information. Machine learning enables automated classification. The system reduces diagnostic time. It improves accuracy and consistency. Computer-aided diagnosis is gaining popularity. Machine learning models learn from data. The approach supports large datasets. It reduces workload for doctors. The system is reliable. This project focuses on automated brain tumor detection.

LITERATURE SURVEY

Several studies focus on brain tumor detection. Traditional methods rely on manual segmentation. Image processing techniques are widely used. Feature extraction improves classification. Researchers have used texture features. Wavelet-based features are common. Statistical features are also applied. HOG features capture spatial information. Machine learning models show good performance. SVM is widely used for classification. KNN is simple and effective. Decision trees are used in some studies. Neural networks improve accuracy. Hybrid models show better results. Preprocessing enhances detection accuracy. Noise removal improves feature quality. Feature selection reduces dimensionality. Classification accuracy varies across methods. Recent research focuses on automation. Literature confirms machine learning effectiveness.

RELATED WORK

Many researchers proposed MRI-based detection systems. CNN-based models show high accuracy. However, they require large datasets. Traditional ML models work with small datasets. HOG features are used in object detection. HOG improves shape

representation. SVM combined with HOG gives good results. Some systems use GLCM features. Hybrid feature extraction improves performance. KNN is used for similarity matching. Naive Bayes is used for probabilistic classification. Deep learning requires high computation. ML models are computationally efficient. Edge detection improves segmentation. Thresholding methods are also used. Accuracy varies with dataset size. Performance depends on preprocessing. Related work highlights feature importance. Comparative studies show HOG efficiency. Existing research supports ML-based approaches.

EXISTING SYSTEM

Existing systems rely on manual diagnosis. Radiologists visually inspect MRI scans. This process is time-consuming. Accuracy depends on expertise. Manual systems are subjective. Errors may occur due to fatigue. Traditional systems lack automation. Simple threshold-based methods are used. They are sensitive to noise. Feature extraction is limited. Low accuracy is observed. Scalability is poor. Processing large datasets is difficult. Results vary across users. Existing systems require high effort. They are not cost-effective. Automation is minimal. Decision-making is slow. System reliability is limited. Existing systems lack intelligence.

PROPOSED SYSTEM

The proposed system automates brain tumor detection. MRI images are used as input. Image preprocessing enhances quality. Noise reduction improves clarity. HOG features are extracted. HOG captures edge and gradient patterns. Features are used for classification. Machine learning algorithms are applied. SVM classifies tumor and non-tumor images. KNN compares feature similarity. The system improves accuracy. Processing time is reduced. Human effort is minimized. The system is scalable. It handles large datasets. Results are consistent. The model is cost-effective. The system supports early diagnosis. Performance is improved. The proposed approach is efficient.

SYSTEM ARCHITECTURE

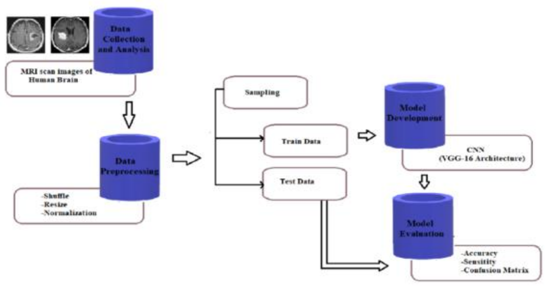

Fig 1: System Architecture

METHODOLOGY DESCRIPTION

MRI images are collected from datasets. Images are resized uniformly. Preprocessing removes noise. Contrast enhancement is applied. HOG feature extraction is performed. Gradient orientations are calculated. Feature vectors are generated. Dataset is divided into training and testing. Machine learning models are trained. SVM classifier is implemented. KNN classifier is also used. Models learn from training data. Testing data evaluates performance. Accuracy is calculated. Precision and recall are measured. Confusion matrix is generated. Results are analysed. Best model is selected. System performance is evaluated. Final output is tumor detection.

RESULTS AND DISCUSSION

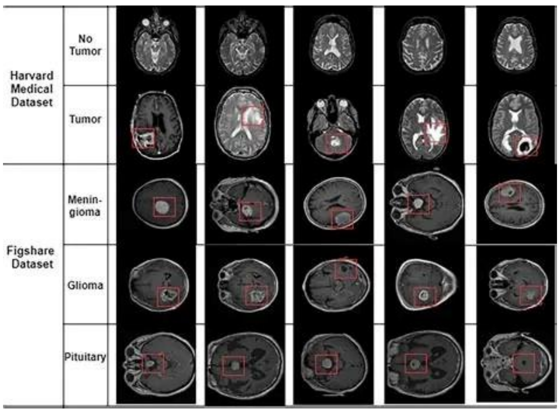

Fig 2: Home Page

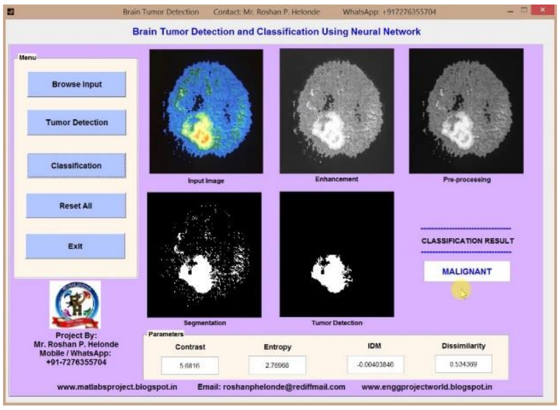

Fig 3: Detection Page

CONCLUSION

The proposed system successfully detects brain tumors. HOG features effectively represent image characteristics. Machine learning models classify images accurately. The system reduces manual diagnosis effort. It improves detection accuracy. Processing time is minimized. The approach is cost-effective. It supports early tumor detection. The system is reliable and efficient. SVM performs better than other models. HOG improves feature representation. The system handles medical images well. It can be extended further. Deep learning can be integrated. Real-time detection is possible. The system supports medical diagnosis. Automation improves consistency. It assists radiologists effectively. The project meets its objectives. Future enhancements are possible.

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