CHAPTER 6
CONCLUSION AND FUTURE SCOPE

Brain Tumor Classification system has been developed with novel approaches for this research work. Dataset are firmed with collection of number of patients MRI Images from the Sahyog Imaging Centre, SSG Hospital, Baroda Medical College, The Maharaja Sayajirao University of the Baroda. For validation of the system dataset from the internet are also used. Different tasks; Pre-processing, Segmentation, Feature Extraction and Classification; are surveyed extensively and best approach is carried out for proposed system.

In Pre-processing task, different filters Wiener filter, Anisotropic filter, Median filter, Non-Local Means filter and Combined filters are processed and compared. Different qualitative parameters like Peak Signal to Noise Ratio, Mean Square Error, Root Mean Square Error and Universal Quality Index; are analysed. Analysis shows that combine wiener and anisotropic filter gives the better result compared to other filters implemented. With the Filtering stage conclusion, Weiner and Anisotropic filter is used for further processing and segmentation. In the Segmentation task, Multilevel thresholding Segmentation technique such as Cuckoo Search algorithm using different objective functions – Otsu's, Kapur Entropy, Tsallis Entropy, Combined Otsu's and Tsallis- are compared and analyzed to determine their effectiveness in detecting and classifying brain tumors. Cuckoo search algorithm using Combined Otsu's and Tsallis objective function gives the better result compared to other segmentation techniques. For Feature extraction task, second level decomposition Discrete Wavelet Transform was used. Feature matrix is generated using twelve different parameters. Twelve statistical parameters covered are Contrast, Correlation, Energy, Homogeneity, Mean, Standard Deviation, Entropy, Root Mean Square, Variance, Kurtosis, Skewness and Inverse Different Moment. For Feature Classification task, Support Vector Machine is used. 2×2 and 3×3 confusion matrix table is generated to check performance of classification algorithm. Statistical parameters; Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Accuracy; are calculated using 2×2 and 3×3 confusion matrix. 2×2 confusion matrix given classification of With Tumor or Without Tumor of the Brain MRI Image. 3×3 confusion matrix given classification of Benign Tumor, Malignant Tumor and Without Tumor of the Brain MRI Image.

The detection and classification of brain Tumours are essential for the early diagnosis and effective treatment of these abnormal growths of brain tissue. Medical imaging, specifically MRI is the most common non-intrusive method for assessing brain Tumours. The accuracy and efficacy of Brain Tumor detection and classification have been substantially enhanced through advances in medical imaging and machine learning.

In the future, developments are expected to concentrate on two key areas: enhancing accuracy through hybrid methods and leveraging the benefits of 3D volumetric data to increase productivity.

Researchers can develop novel hybrid methods that combine the positive aspects of various image processing and machine learning techniques to achieve higher accuracy. The detection and classification process can be optimized by combining conventional image processing algorithms, such as enhancement of images and feature extraction from 2D volumes, with cutting-edge deep learning models. This integration enables improved data variability and class imbalance management while concurrently leveraging deep learning algorithms' robust pattern recognition capabilities. A more robust, reliable, and accurate diagnosis of Brain Tumors will be facilitated by the thorough exploration and optimization of diverse hybrid methods.

Utilizing 3D volumetric data opens up new avenues for improved Brain Tumor detection efficiency. With advanced imaging technologies capable of capturing volumetric data, researchers can examine the three-dimensional characteristics of brain images in greater detail. Developing specialized 3D convolutional neural networks (CNNs) or adapting existing 2D CNN architectures to volumetric data can significantly increase the accuracy and localization of tumours. Innovative techniques focused on reducing the computational complexity of 3D CNNs while maintaining performance levels will result in quicker inference and real-time applications, making brain tumour detection more efficient and practically feasible.

The future depends upon a combination of advanced image processing and machine learning techniques. Researchers can stretch the boundaries of accuracy and efficiency in brain tumor diagnosis by developing hybrid approaches that capitalize on the strengths of each domain and effectively utilizing the wealth of information provided by 3D volumetric data. These innovations can potentially revolutionize clinical practices by allowing the early detection of brain tumors and their accurate classification, thereby improving patient outcomes and informing treatment decisions. To realize these opportunities, an interdisciplinary collaboration among medical experts, imaging specialists, and machine learning researchers is essential, as is the availability of extensive and diverse datasets to train and validate robust models. As technology continues to advance, these prospective endeavours have the potential to transform the diagnosis and classification of brain tumors, potentially preserving innumerable lives.