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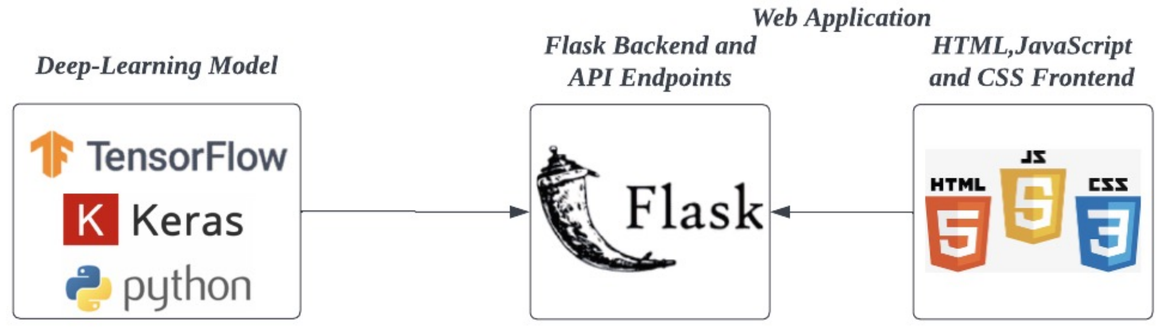
Detection of Brain Tumours using Image Processing and Machine Learning



Introduction

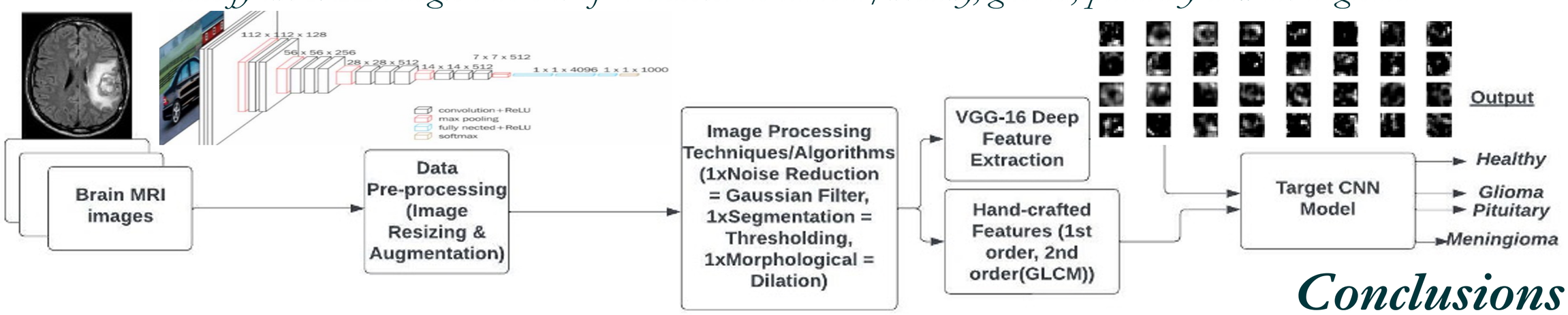
Due to the high mortality rate of brain tumours, early detection is imperative to increase treatment options and survival chances.

Aims

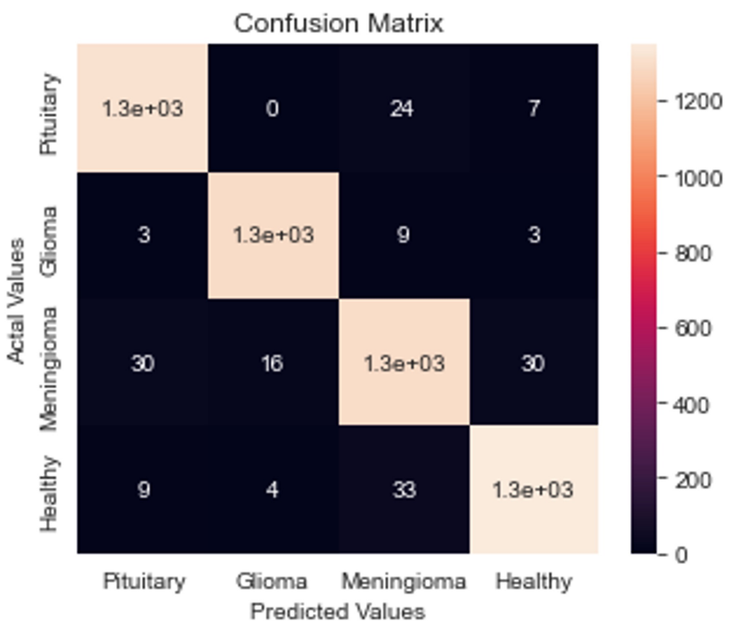
To detect the presence of Pituitary, Gliomas and Meningioma tumours in cerebral MRI images using Image Processing, GLCM features, deep features and Machine Learning/Deep Learning.

Methods

The classification system is constituted of 5 main stages that are data pre-processing, image processing, hand-crafted feature extraction, transfer-learning-based deep-feature extraction, and CNN multiclass classifier. Hand-crafted feature extraction will include first-order features and second-order texture features like energy/correlation. The second-order features were extracted using the grey-level co-occurrence matrix (GLCM) method. In the transfer-learning-based stage, the output from one of the max pooling layers of the VGG-16 CNN architecture was used as deep features. The concatenated features were used in the classification process by the target CNN model to classify the MRI images into one of 4 classes: no tumour/healthy, glioma, pituitary and meningioma.



Results

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['Healthy' 'Pituitary' 'Healthy' ... 'Meningioma' 'Pituitary' 'Glioma']
Acc: 0.9689636061333826
F1 scores: [0.97293289 0.98660543 0.94813733 0.96904248]
Recall Scores: [0.97691735 0.98849693 0.94468705 0.96695402]
Matthews correlation coefficient: 0.9586173933560784
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Conclusions

The results from this project imply that the deep-learning-based web app can precisely detect the presence and type of brain tumour present. However, after rigorous testing of the web app, it became apparent that due to the limited cerebral MRI images available for specific modalities, the web app sometimes encountered difficulties when trying to detect tumours in MRI images belonging to certain modalities like T2.