IDENTIFICATION OF BIOMARKERS FOR BRAIN CANCER:

INTEGRATING BIOINFORMATICS AND DEEP LEARNING

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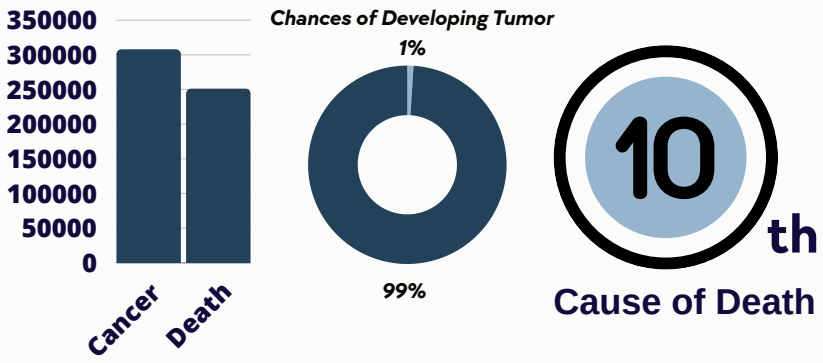
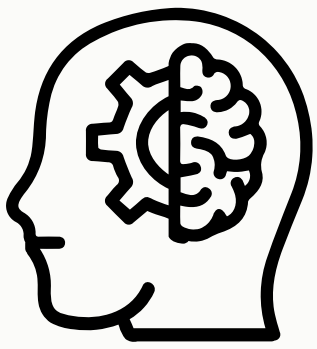
INTRODUCTION

Brain cancer is a significant global health burden, with 308,102 people diagnosed and 251,329 deaths in 2020. Early and accurate diagnosis using MRI is crucial for effective treatment planning and improved patient outcomes. However, manual MRI analysis is time-consuming and prone to subjectivity. This study aims to develop an automated deep learning model that integrates brain tumor segmentation, classification, and grading in a unified end-to-end system.

BRAIN TUMORS DATA



METHODS



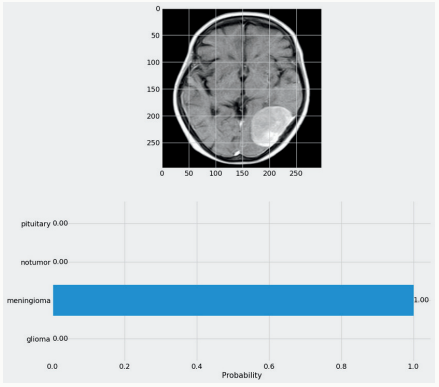
The dataset consists of 7023 brain MRI scans from Kaggle, split into training, validation, and testing subsets. Data preprocessing includes creating Pandas DataFrames, visualizing class distributions with Seaborn countplots, and applying data augmentation techniques using Keras ImageDataGenerator.

The model uses pre-trained Xception on ImageNet as the base, with additional layers like Flatten, Dropout, and Dense with ReLU and Softmax activations. It is compiled with Adamax optimizer, categorical cross-entropy loss, and evaluation metrics like accuracy, precision, and recall. The model is trained for 10 epochs, and training metrics are visualized over epochs.

RESULTS

Table 2. Classification Report

	Precision	Recall	F_1 Score	Support
Glioma	0.98	0.96	0.97	150
Meningioma	0.97	0.95	0.96	153
No Tumor	1.00	1.00	1.00	203
Pituitary	0.97	1.00	0.98	150
Accuracy			0.98	656
Macro Average	0.98	0.98	0.98	656
Weighted Average	0.98	0.98	0.98	656



ACCURACY

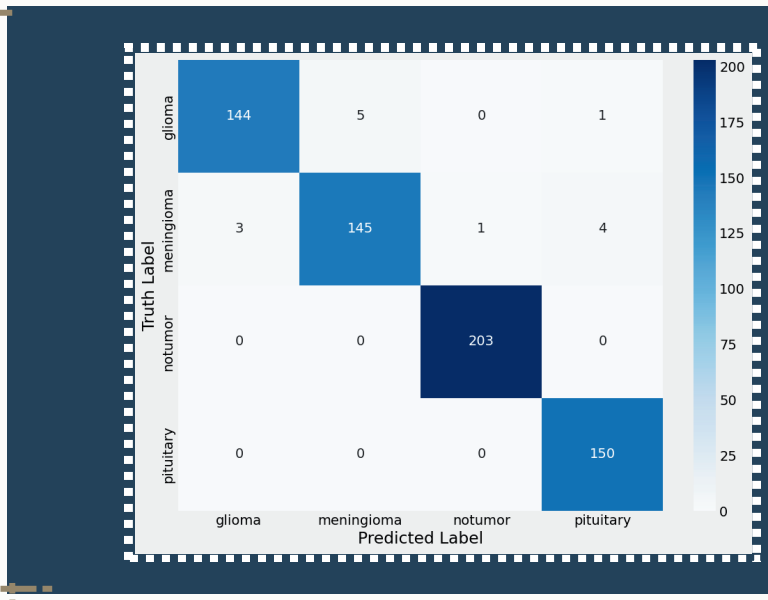
The model achieves 97.87% accuracy on the testing set, with high precision and recall scores across all tumor types.

PREDICTION

The "prediction" function loads and preprocesses MRI images, generates predictions, and displays probability distributions.

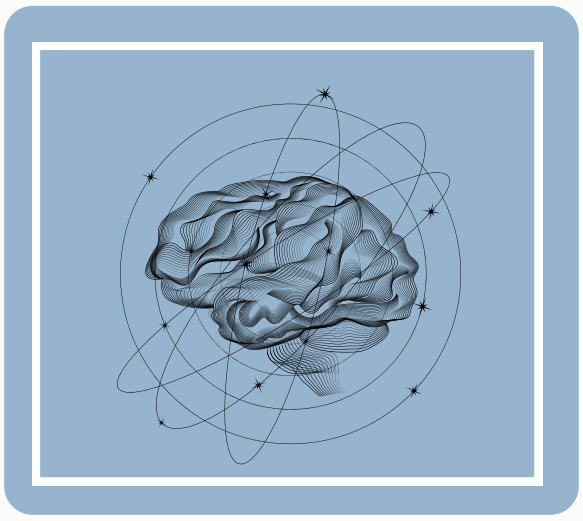
DESCRIPTION

The "description" function provides detailed information about the predicted tumor type.



CONCLUSIONS

The proposed deep learning model based on Xception CNN effectively identifies and classifies brain tumors from MRI scans with high accuracy. By integrating bioinformatics techniques and deep learning algorithms, this approach has the potential to support treatment planning and surgical decision-making, ultimately contributing to improved patient outcomes in neuro-oncology.



FUTURE WORKS

Future work includes integrating additional imaging modalities, incorporating multi-omics data to identify molecular biomarkers, and validating the model's performance using diverse datasets to ensure generalizability across different clinical settings.

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