Brain Tumor MRI Image Classification with Convolutional Neural Networks (CNN)

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https://github.com/eordog/erdos_artemis

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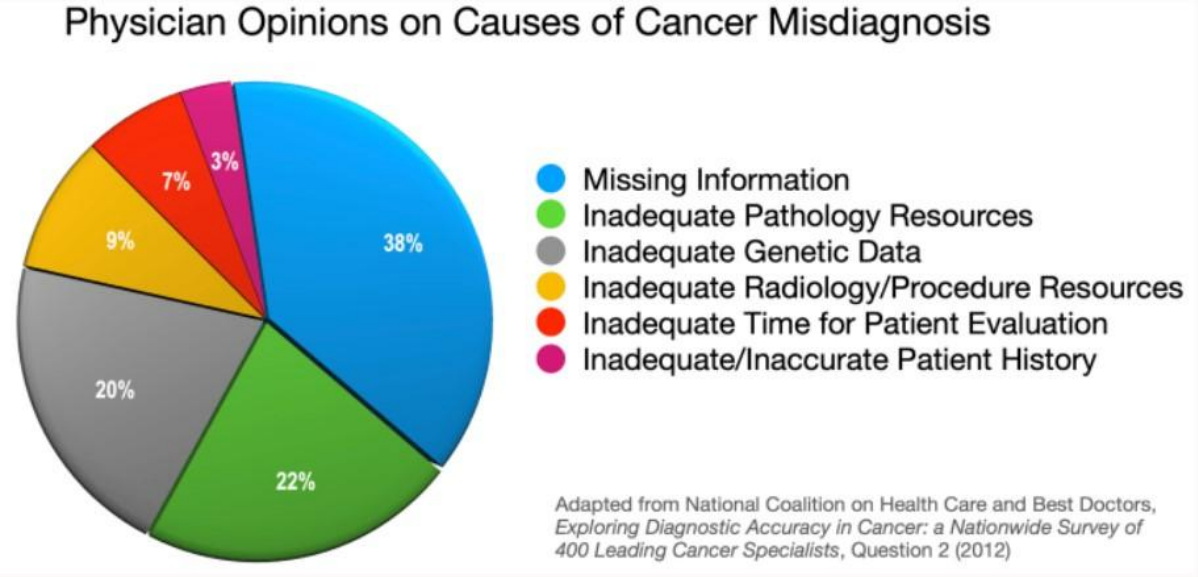
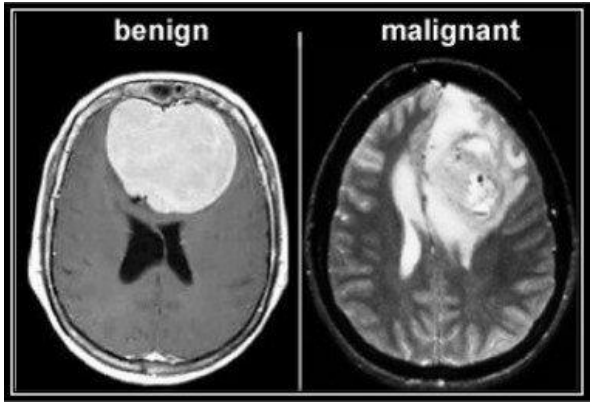
Background

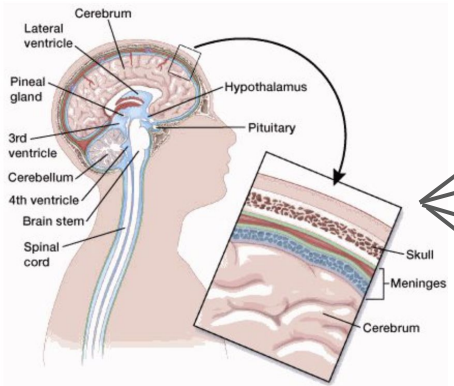
- Brain and spinal cord **tumors** are masses of abnormal cells in the brain or spinal cord that have grown out of control.

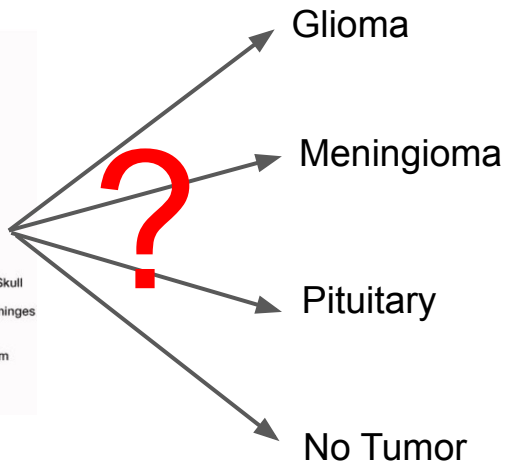


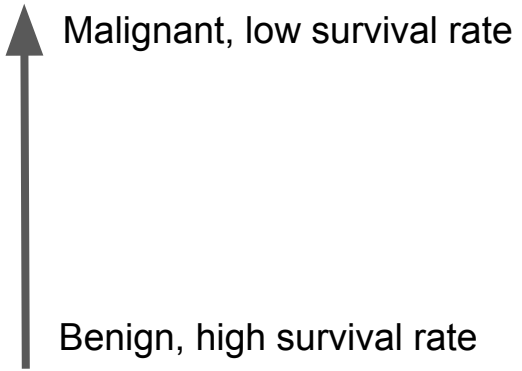


Overview

- **Problem**: Brain tumor diagnosis requires manual examination of MRI images by a radiologist. This process can be error-prone and time-consuming.
- **Goal**: To develop a machine learning algorithm to accurately and efficiently classify brain tumor types based on MRI images.
- **Stakeholders**
  - Healthcare providers: automate the diagnostic process.
  - Patients: receive faster and more accurate treatment.

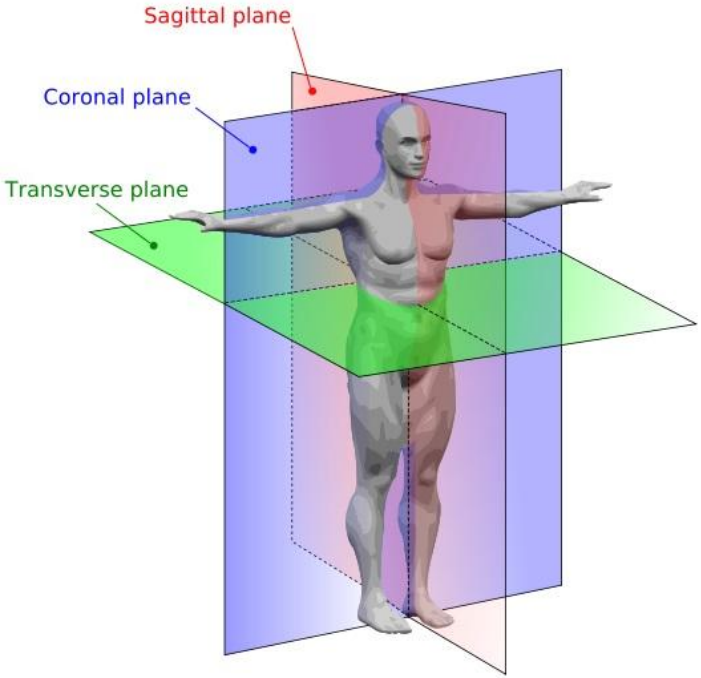


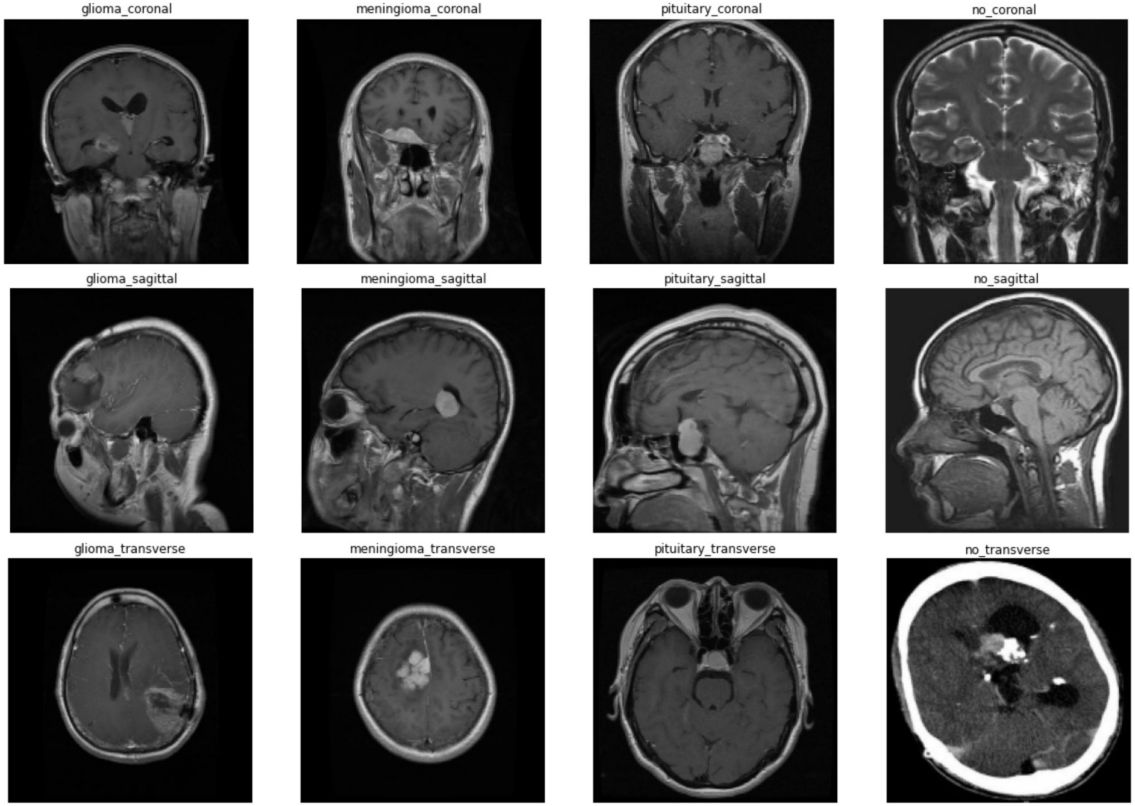




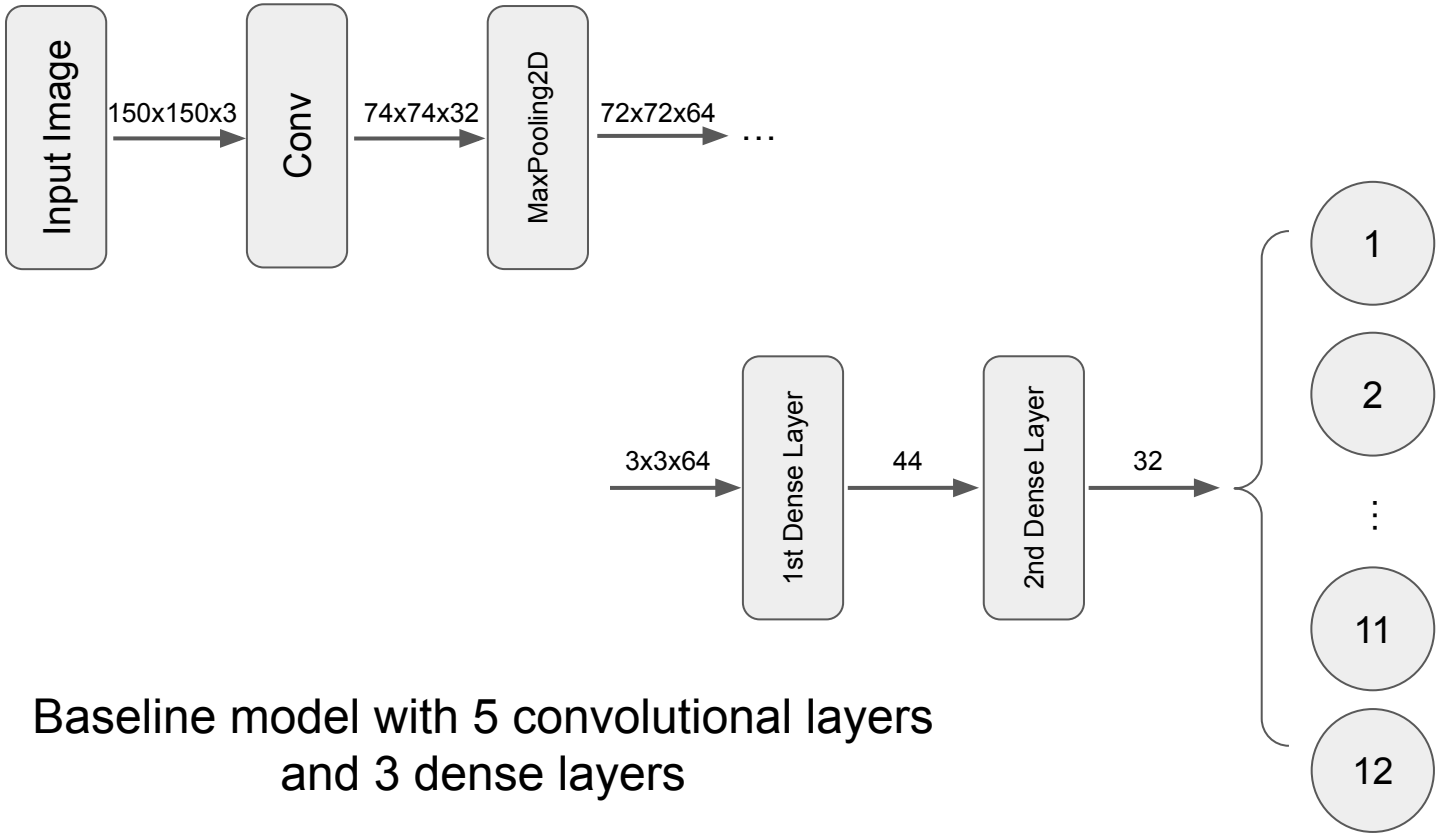
Data Selection and Pre-processing

Data Source: https://www.kaggle.com/datasets/sartajbhuvaji/brain-tumor-classification-mri



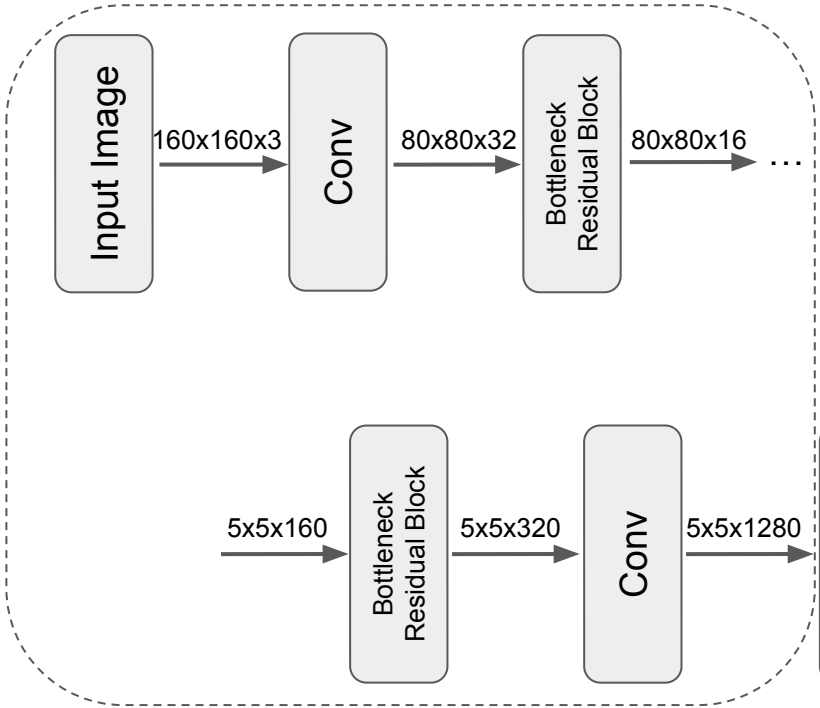


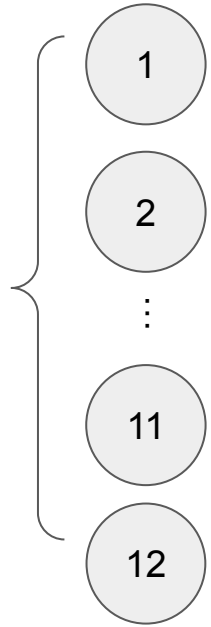
Architecture of the Baseline Model

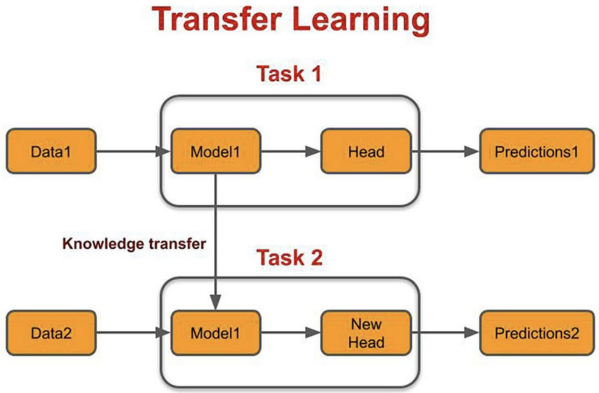


- Baseline model with 5 convolutional layers and 3 dense layers

Architecture of the CNN Built Upon MobileNetV2







- MobileNetV2 model

with pre-trained weights from ImageNet dataset (over 14 million images)

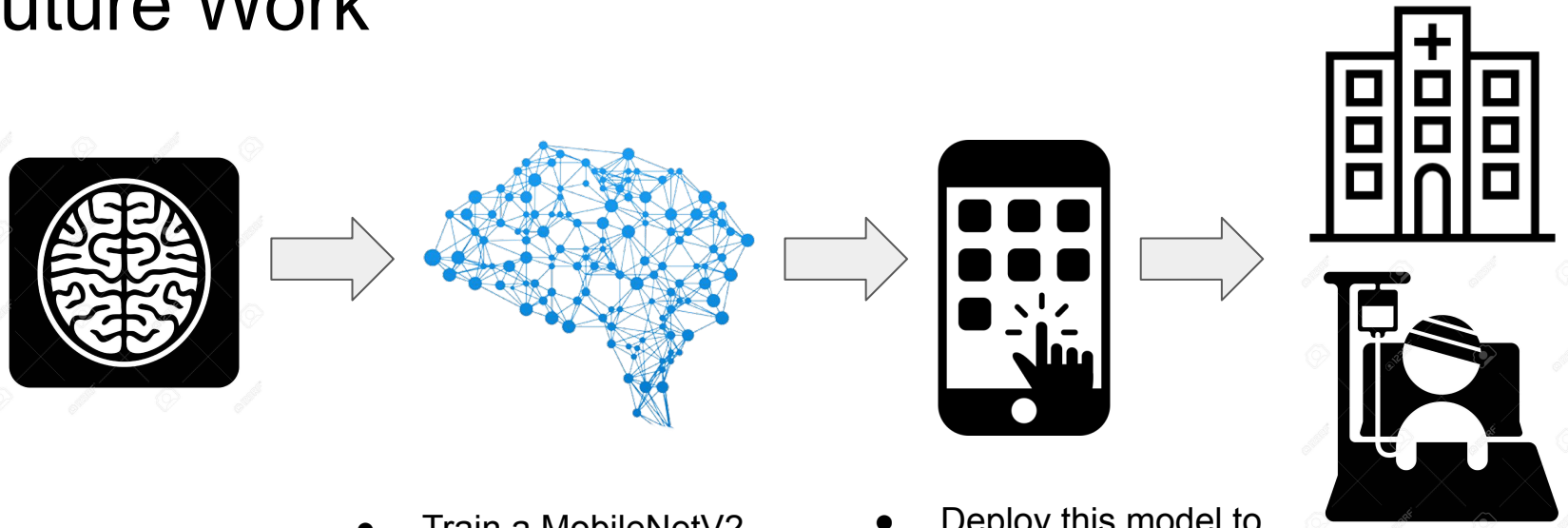
Results

Model	Accuracy
Baseline	88%
InceptionV3	94%
MobileNetV2	95%

- Aim for an overall high accuracy, a high recall for “glioma” and a high precision for “no tumor” categories

Results for MobileNetV2	Precision	Recall
glioma_coronal	1.00	0.87
meningioma_coronal	0.81	1.00
pituitary_coronal	0.96	0.96
no_coronal	0.00	0.00
glioma_sagittal	0.97	1.00
meningioma_sagittal	1.00	0.96
pituitary_sagittal	1.00	1.00
no_sagittal	1.00	0.86
glioma_transverse	1.00	0.91
meningioma_transverse	0.92	0.97
pituitary_transverse	0.97	1.00
no_transverse	1.00	0.95

Future Work



- Collect more MRI images for different types of brain tumors
- Train a MobileNetV2 model to classify all types of brain tumors
- Deploy this model to mobile devices to provide guidance for healthcare providers and patients

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