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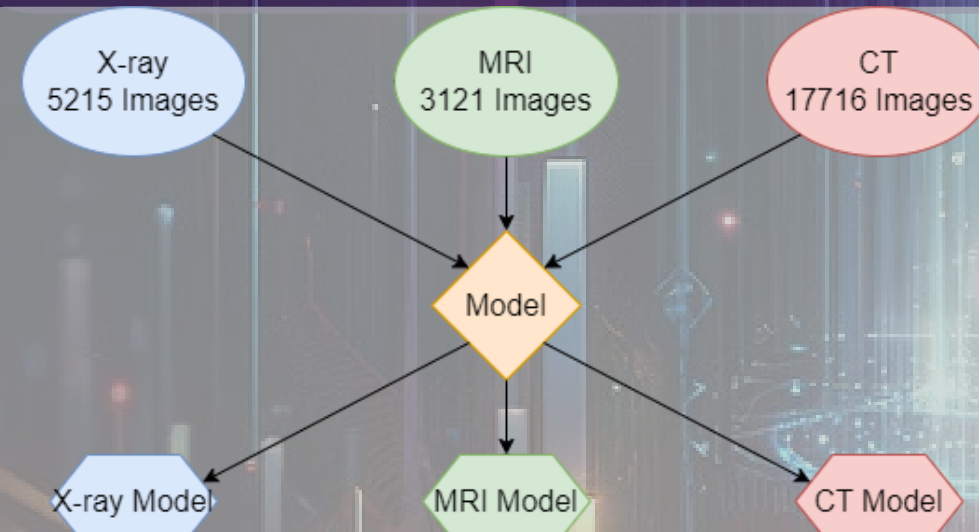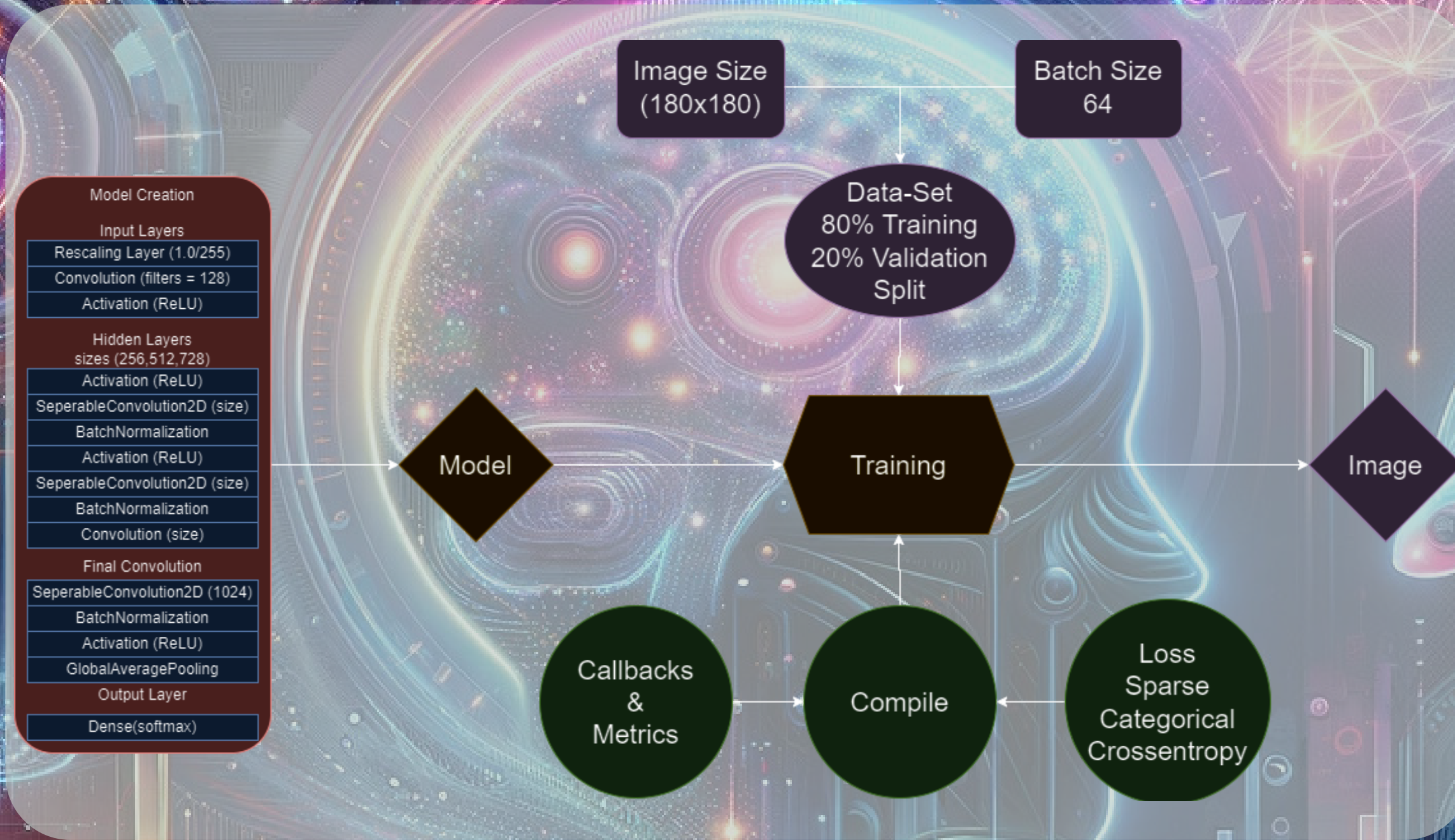an Atlantaigh

Atlantic
Technological
University

Med-AI

Overview

The objective of this project is to develop and implement medical classification technology with artificial intelligence. This will aid medical personnel like doctors in diagnosing, with precision, specific conditions from X-rays, MRIs, and CT images. By training deep learning models on big datasets of medical images, this system is able to classify images into different categories representing various health conditions (i.e., pneumonia, tumour, healthy scan). These models are deployed in a user-friendly web application where users can upload a series of images to be classified. These enable fast and accurate image categorisation, hence faster diagnoses and treatment planning, quicker and precise care; which will lead to improved patient care and medical outcomes.

Model

The Model is a smaller, more diverse sister to the Xception model developed by Google Inc. Engineer Francois Chollet. This model focuses on Separable Convolutions which allow a simple convolution to be split into two steps. This Separable convolution allows for increased performance so the model can learn faster. Xception is a powerful CNN model that allows for "computer vision" tasks. When this model is trained new images can be sent for the trained model to classify.
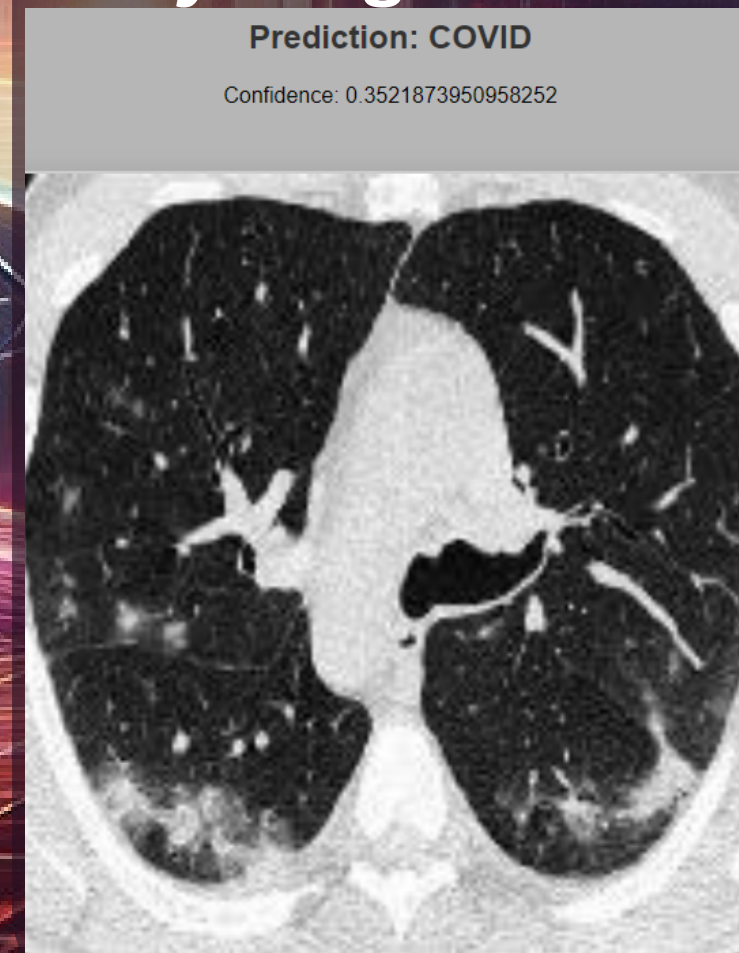
Web App

The Website incorporates 4 models. The first model classifies whether the image sent is an MRI, CT, or X-ray scan. This image data is then sent to the corresponding model which classifies it from its range of classes.
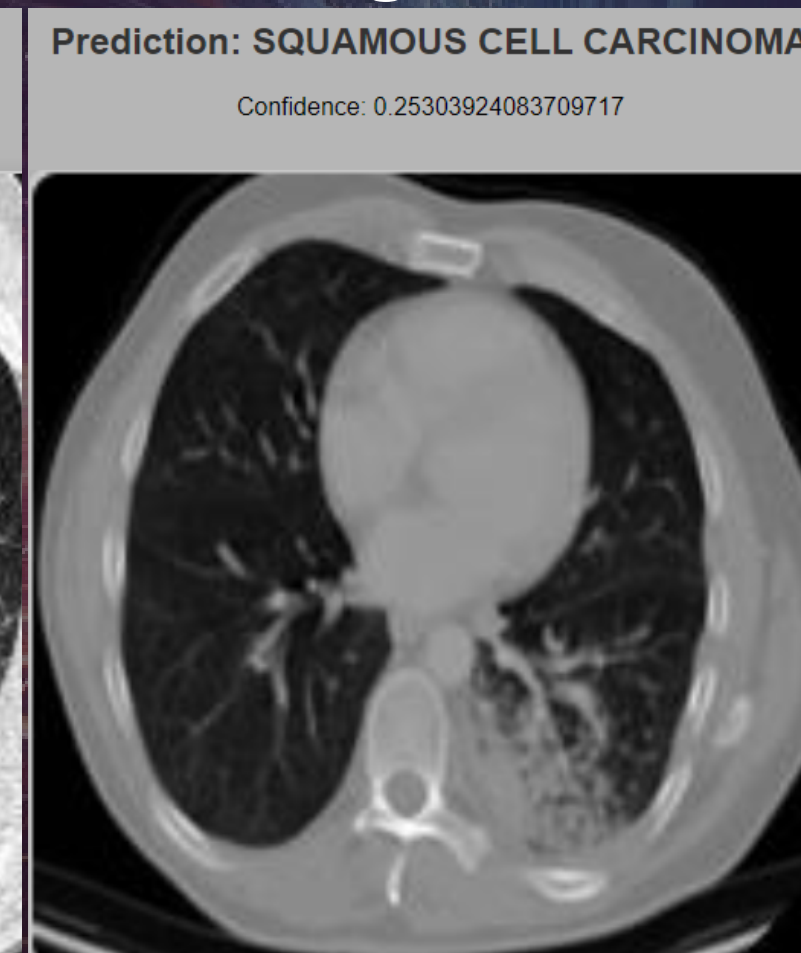
- **X-ray** - Normal, COVID.

- **MRI** - Normal, Glioma tumor, Meningioma tumor, Pituitary tumor, Tumor

- **CT** - Normal, Covid, Community-Acquired Pneumonia, Adenocarcinoma, Large Cell Carcinoma, Squamous Cell Carcinoma.
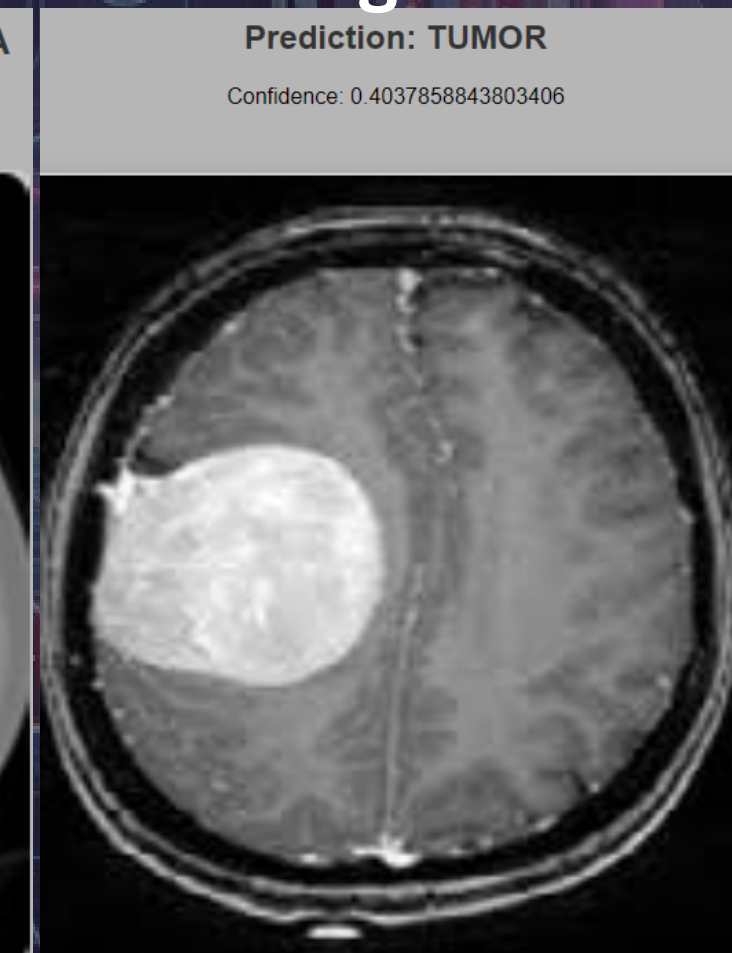
Diagram:

X-ray 5215 Images → MRI 3121 Images → CT 17716 Images → Model → X-ray Model, MRI Model, CT Model

Image Size (180x180) · Batch Size 64

Data-Set 80% Training 20% Validation Split

Model Creation
Input Layers
Rescaling Layer (1.0/255)
Convolution (filters = 128)
Activation (ReLU)
Hidden Layers sizes (256,512,728)
Activation (ReLU)
SeperableConvolution2D (size)
BatchNormalization
Activation (ReLU)
SeperableConvolution2D (size)
BatchNormalization
Convolution (size)
Final Convolution
SeperableConvolution2D (1024)
BatchNormalization
Activation (ReLU)
GlobalAveragePooling
Output Layer
Dense(softmax)

Model · Training · Image

Callbacks & Metrics → Compile → Loss Sparse Categorical Crossentropy

Skills/Tech

The project is equipped with TensorFlow and Keras as the main technologies in the development of the deep learning model. TensorFlow helps to build, train, and deploy machine learning models, while Keras provides a simple interface for the design of neural networks. While Keras provides flexibility, the deep learning framework of TensorFlow brings power. This combination allows my project to grow and train according to my medical images using cutting-edge convolutional neural networks (CNNs) for solving problems of image classification. With these two technologies, it allows me to work on my final goal which is to develop and train a reliable and trustworthy model which can help classify medical scans which can reduce the time for medical diagnosis.

Result

X-ray Image of chest
Prediction: COVID
Confidence: 0.3521873950958252

CT Image of chest
Prediction: SQUAMOUS CELL CARCINOMA
Confidence: 0.253039240883709717

MRI Image of brain
Prediction: TUMOR
Confidence: 0.4037858843803406

Data

In the pre-processing and data collection stage, the project uses different datasets of medical images from Kaggle. The included datasets provide images of previously mentioned medical issues. The pre-processing is done with care to provide the model with the highest quality image and consistent data, with many operations such as resizing, normalization, and data augmentation. This assures that the classification of medical images is done accurately to offer healthcare professionals a concrete diagnostic tool.