Airport Image Recognition System (AIRS)

ISEM IE3100M Systems Design Project
Course Coordinator: Dr Bok Shung Hwee
Module Advisors: A/Prof Chen Nan, Prof Andrew Lim
Team Members: Marcus Sim Tze Han, Shasqil Rukirsor, Thng Yue Wei, Wong Jia Jin
Industrial Supervisors: Mr Lee Hock Lye, Mr Jesse James Jalleh, Mr Syaifullah Bin Sarip, Mr Yee Zi Qiang

Company Background

- Changi Airports International (CAI) is a global aviation consultancy agency under Changi Airport Group (CAG).
- They design integrated solutions that enable its clients and partners to fulfil their potential of being world-class airports.

Project Overview

Project Motivation

1. Manual image classification is a highly time-consuming process.
2. Image search and retrieval is confusing due to inefficient organization of images.

Time Consuming | Manual | Confusing

Key Objectives

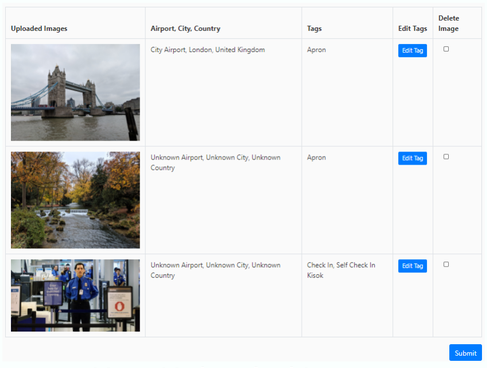
- Research & evaluate Deep Learning methodologies to determine best solution for prediction of image attributes.
- Prototype, develop and deploy a system that allows for automatic classification, systematic search & retrieval of images based on its attributes.

Methodology

Data Collection → Research CNN Architectures → Testing and Evaluation of CNN → AIRS Prototype Development → Further Testing and Development → Final Testing & Deployment

AIRS

Airport Image Recognition System (AIRS) is a system designed for CAI consultants to organise and retrieve their airport-related images more easily.



User Uploaded Images

If uploaded image is incorrectly classified by CNN Model, changes can be made with "edit tag" function.

The backend cross-references image metadata with an airport master list to return the nearest airport, city, and country that the image was taken in.

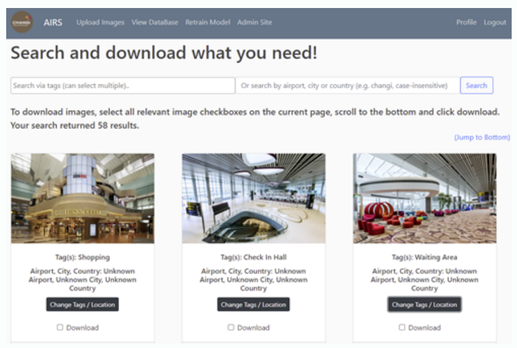
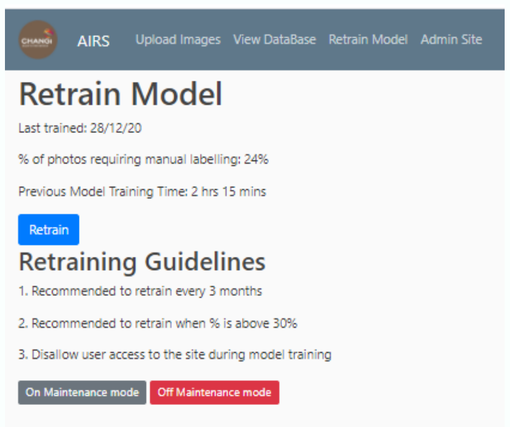


Image Database

Users can view the image database or filter images by tags or geolocation.

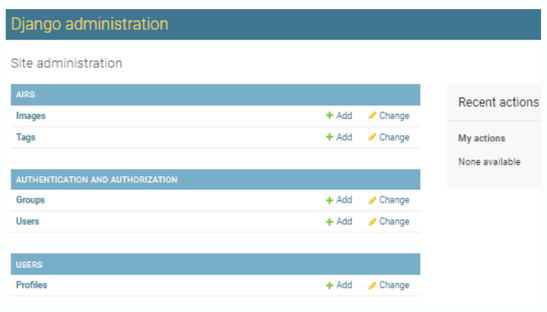
Below each image, a checkbox allows the user to select images that he/she wishes to download.



Model Retraining Page

Web Administrators can initiate retraining of the CNN if its classification performance degrades.

As users continue to upload images, retraining the CNN with the increased size and variety of the database will likely improve classification accuracy in the long run.



Admin Page

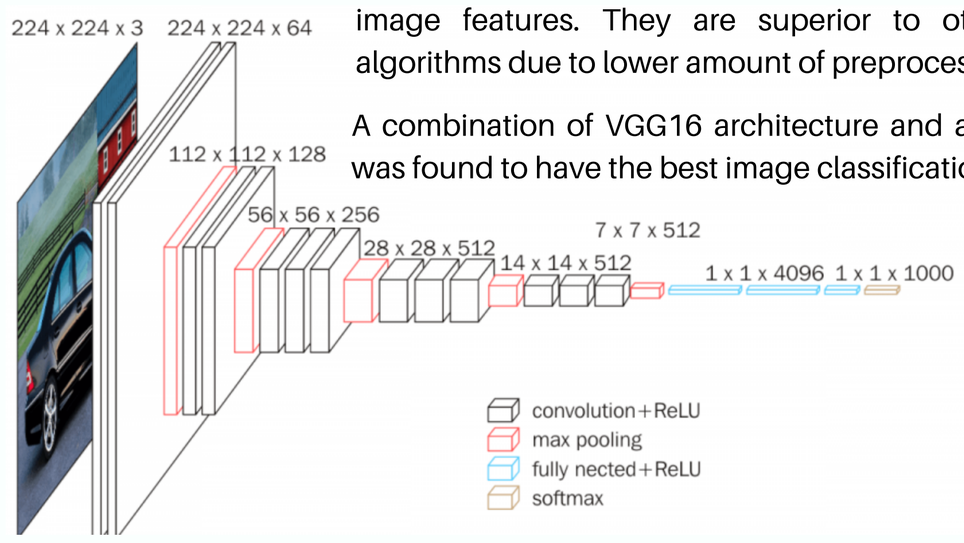
Web Administrators are able to edit image properties, list of tags, user profiles and permissions via Admin Page.

Web Administrators are also able to track user actions under the "Recent Actions" tab.

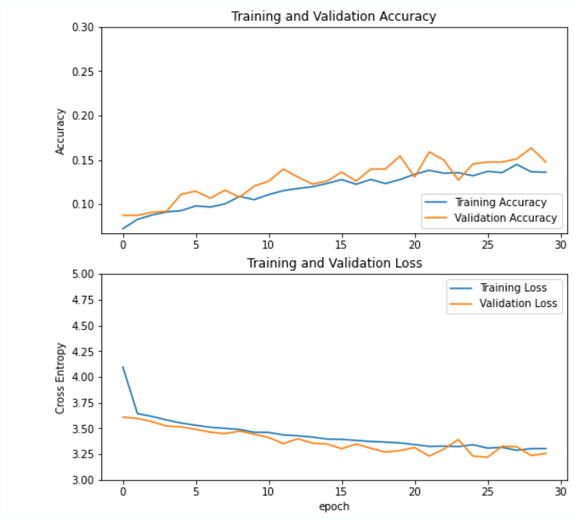
Convolutional Neural Network (CNN)

A CNN is a deep learning algorithm capable of taking in an input image and assigning local weights and biases to identify image features. They are superior to other classification algorithms due to lower amount of preprocessing required.

A combination of VGG16 architecture and a custom classifier was found to have the best image classification performance.

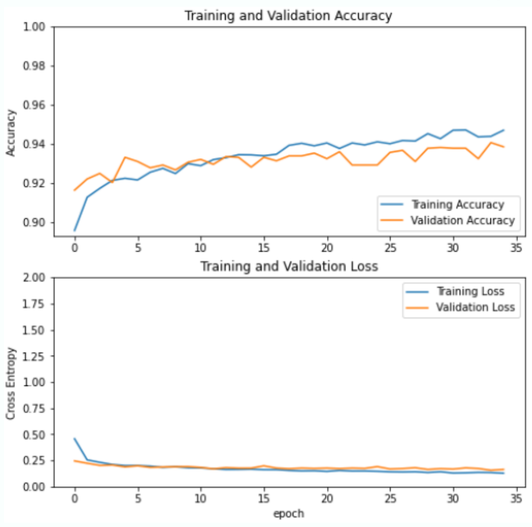


Simple CNN w/o Transfer Learning



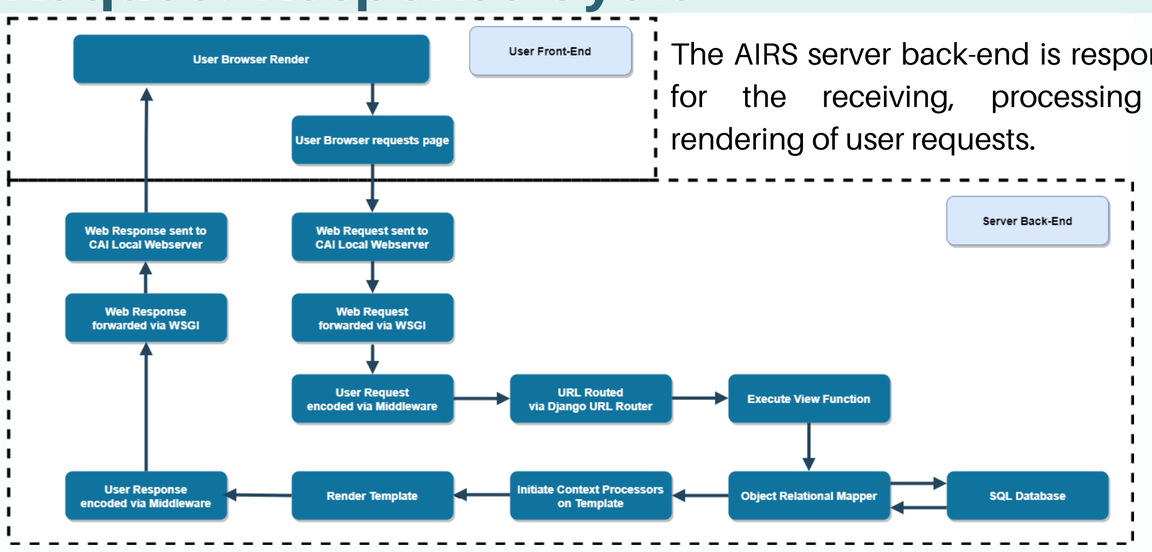
Training and validation accuracies are less than 15%. Training and validation loss rates were relatively high.

Custom VGG16 with Transfer Learning



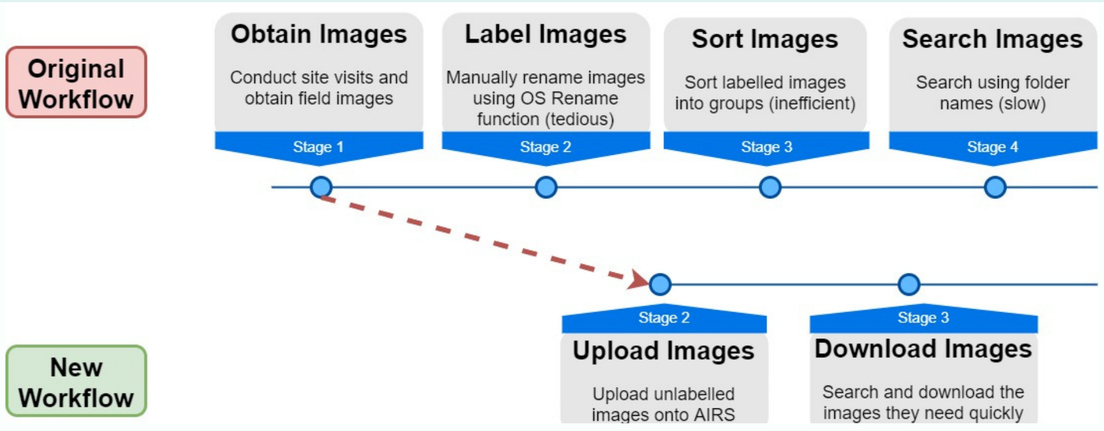
Training and validation accuracies are more than 90%. Training and validation loss rates were relatively low.

Request-Response Cycle



The AIRS server back-end is responsible for the receiving, processing and rendering of user requests.

Benefits



- Increased efficiency in workflow process
- Consolidated and Organised Database
- Intuitive User Interface

Key Skillsets Acquired

- django
- TensorFlow
- JavaScript
- HTML
- JSon
- SQL