

IDS 594 Machine Learning Deployment Project

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Objectives

- To deploy the Food Classification Model using Google Cloud Platform
- To facilitate users accessing the image classification model with the ML Application building on Streamlit.

Possible solutions for deployment project

- **Model Deployment platform**

There are many supreme cloud service platforms that could be used to deploy machine learning and deep learning models on cloud for example;

- Google Cloud Platform (GCP)
- Amazon Web Services (AWS)
- Microsoft Azure

In this project, GCP is the main platform to be focused on due to its great flexibility, speed, user friendly, compatibility with other google platforms and pricing.

- **Application/ User interface**

Similarly to the cloud platform, there are many frameworks for application development such as Shiny which focuses on data analytics with R, Voila the library that turns individual Jupyter notebooks into interactive web pages, Flask a Python web framework for building websites and apps, etc. Streamlit is another method for full dashboarding solutions with Python-based data analytics. It is a new framework which is not maturely developed yet. However, it has very high simplicity, is easy to use and very popular these days.

Pros and cons of tools using in this project

Streamlit

Benefits of using Streamlit

- Streamlit is an open source framework which helps users to create interactive apps with Python scripts
- Fast and convenient way to build and share data apps
- Streamlit supports many main Python plotting libraries i.e. Matplotlib's Pyplot library, Seaborn, Altair, Vega-Lite, Plotly, Bokeh, PyDeck (which supports 3D, and map graphing options), and GraphViz.

Downside of using Streamlit

- Lack of design flexibility and control over your application layout.
 - Speed issues due to the application flow happens with large application and/or dataset
 - The entire source code is being re-run on every new change or interaction.
 - The API is not currently comprehensive.
- Users have to give them a trust of behind to work on Streamlit applications.

Google Cloud Platform (GCP)

Benefits of using GCP

- Excellent integration with other Google services
- Facilitates easy collaboration
- Very open-source and DevOps-centric

Downside of using GCP

- Fewer features/services
- More limited range of services and doesn't command the same global spread of data centers offered by AWS and Azure.

Tools, workflow, and project methodology

Tools

1. Streamlit
2. Google Cloud Platform
3. Google Storage
4. Docker
5. Google Container Registry
6. App Engine

Project Workflow

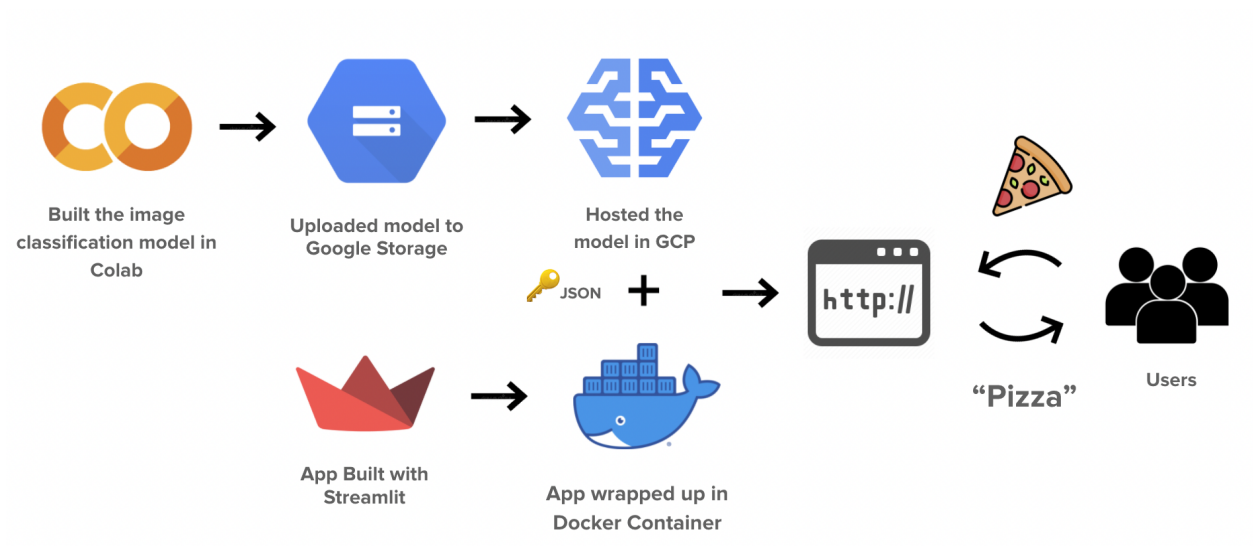


Figure 1 Project Workflow

Methodology

1. Develop food classification application locally using Streamlit (app.py)

```
### Script
import os
import json
import requests
import SessionState
import streamlit as st
import tensorflow as tf
from utils import load_and_prep_image, classes_and_models, update_logger, predict_json
```

2. Deploy food classification model in GCP
 - a. Running the model in Google Colab
 - b. Connect Google Colab with GCP
 - i. Create the bucket in GCP and connect

```
# Install and initialize the gcloud command line tool - https://cloud.google.com/sdk/docs/install
# (this will give you access to gcloud tools within Colab)
!curl https://sdk.cloud.google.com | bash && /dev/null
!gcloud init
```

```

% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
           Dload  Upload   Total     Spent    Left     Speed
100  443    100  443    0     0    840      0 --:--:-- --:--:-- --:--:--    842
##### 100.0%
which curl
curl -# -f https://dl.google.com/dl/cloudsdk/channels/rapid/google-cloud-sdk.tar.gz
##### 100.0%
mkdir -p /root
tar -C /root -zxvf /tmp/tmp.9Adb0MhwH4/google-cloud-sdk.tar.gz
/root/google-cloud-sdk/install.sh
Beginning update. This process may take several minutes.
```

3. Connect Streamlit application with GCP
 - a. Provide JSON key to Streamlit to access the model on GCP

```
# Setup environment credentials (you'll need to change these)
os.environ["GOOGLE_APPLICATION_CREDENTIALS"] = "ids594mldeployment-634c5e3e0a2d.json"
PROJECT = "ids594mldeployment" # change for your GCP project
REGION = "us-central1" # change for your GCP region (where your model is hosted)

### Streamlit code (works as a straightt-forward script) ###
st.title("Welcome to Food Vision 🍷")
st.header("Identify what's in your food photos!")
```

4. Deploy the app to App Engine
 - a. Wrap the model inside the docker and deploy on GCP

```

🐚 Dockerfile > ...
1  FROM python:3.7
2
3  ## App engine stuff
4  # Expose port you want your app on
5  EXPOSE 8080
6
7  # Upgrade pip
8  RUN pip install -U pip
9
10 COPY requirements.txt app/requirements.txt
11 RUN pip install -r app/requirements.txt
12
13 # Create a new directory for app (keep it in its own directory)
14 COPY . /app
15 WORKDIR app
16
17 # Run
18 ENTRYPOINT ["streamlit", "run", "app.py", "--server.port=8080", "--server.address=0.0.0.0"]

```

5. Access the result page

```

C:\> Command Prompt
Microsoft Windows [Version 10.0.19042.1237]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mihir>
C:\Users\mihir>cd C:\Users\mihir\IDS594-ml-deployment-project\food-vision
C:\Users\mihir\IDS594-ml-deployment-project\food-vision>en\scripts\activate.bat
(en) C:\Users\mihir\IDS594-ml-deployment-project\food-vision>streamlit run app.py

You can now view your Streamlit app in your browser.

Local URL: http://localhost:8501
Network URL: http://10.40.223.231:8501

```

Results

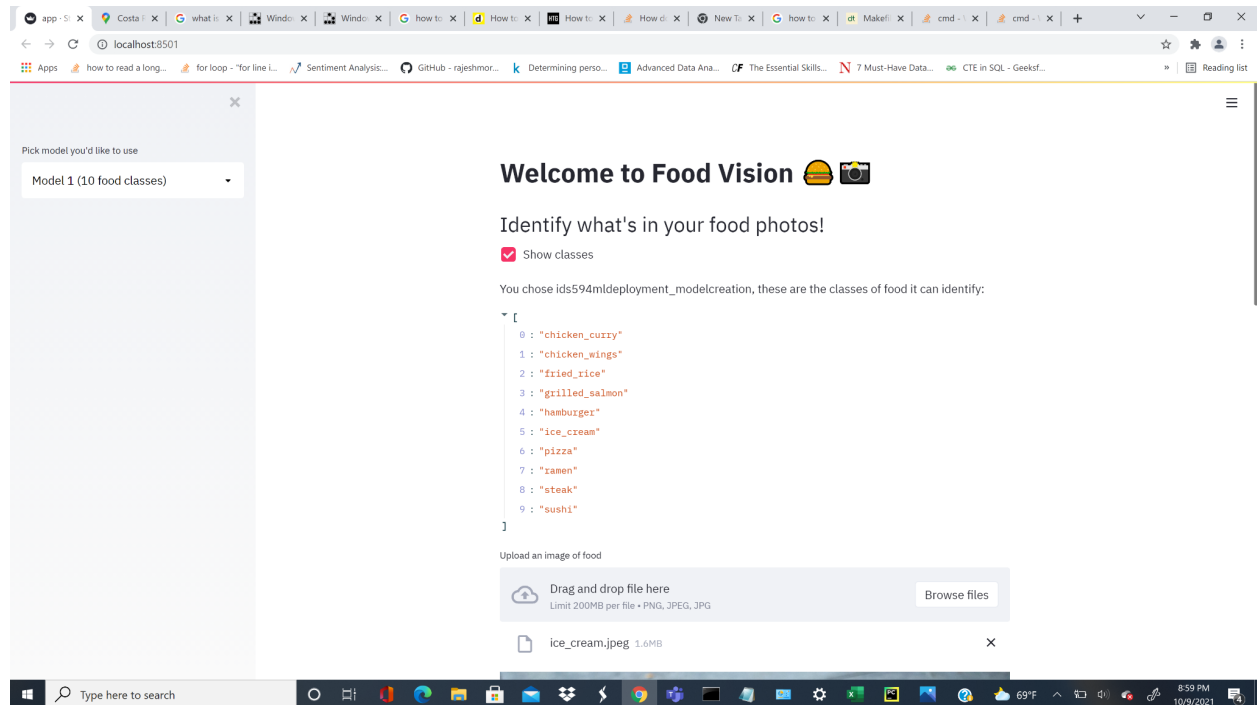


Figure 2 Application Results

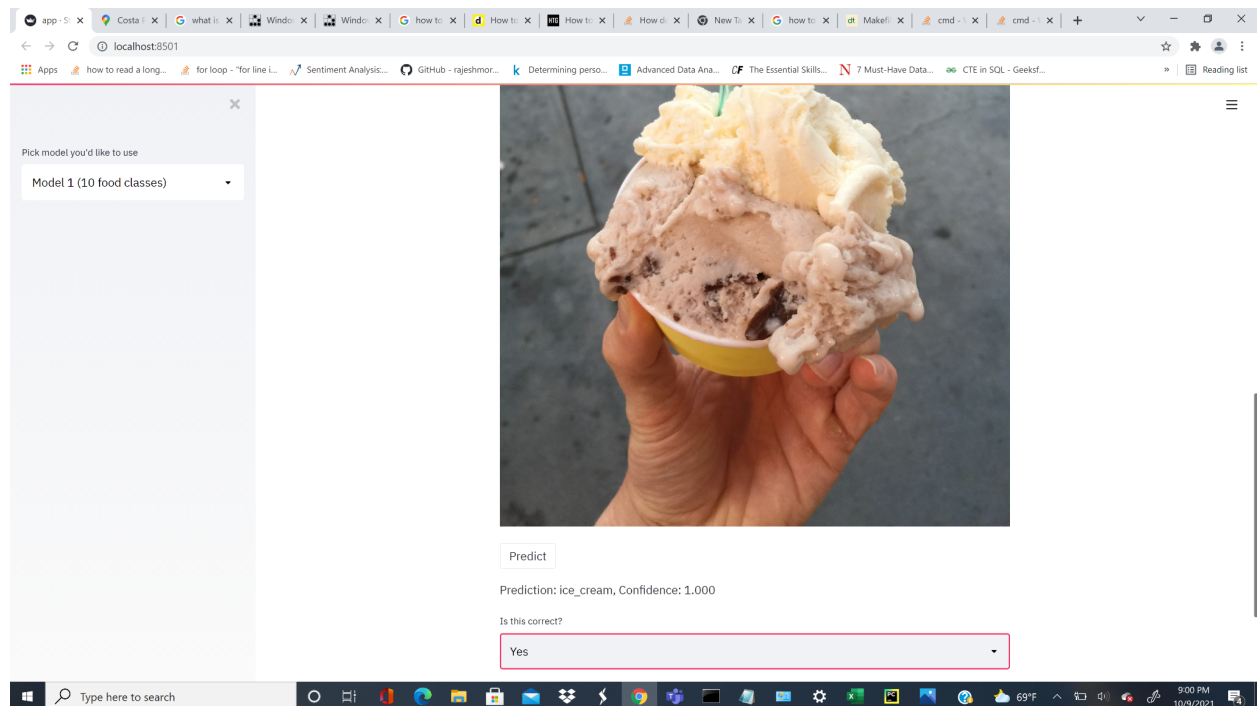


Figure 3 Application Results

Lessons learned

- Troubleshoot the command prompt to deploy the model
- Learning new technologies

Project plan

Work Stream	Strat Date	End Date
Project Brainstorm	Sep 25,2021	Sep 25,2021
Literature review / Research / DL model preparation	Sep 25,2021	Sep 25,2021
Set up the environment for deployment project	Sep 25,2021	Sep 25,2021
Run the application locally	Sep 25,2021	Oct 02,2021
Deploy the DL model in GCP	Oct 02,2021	Oct 02,2021
Connect the application with GCP	Oct 02,2021	Oct 02,2021
Test run the application	Oct 09,2021	Oct 09,2021
Prepare report and presentation slides	Oct 09,2021	Oct 09,2021

Reference

<https://github.com/mrdbourke/cs329s-ml-deployment-tutorial>