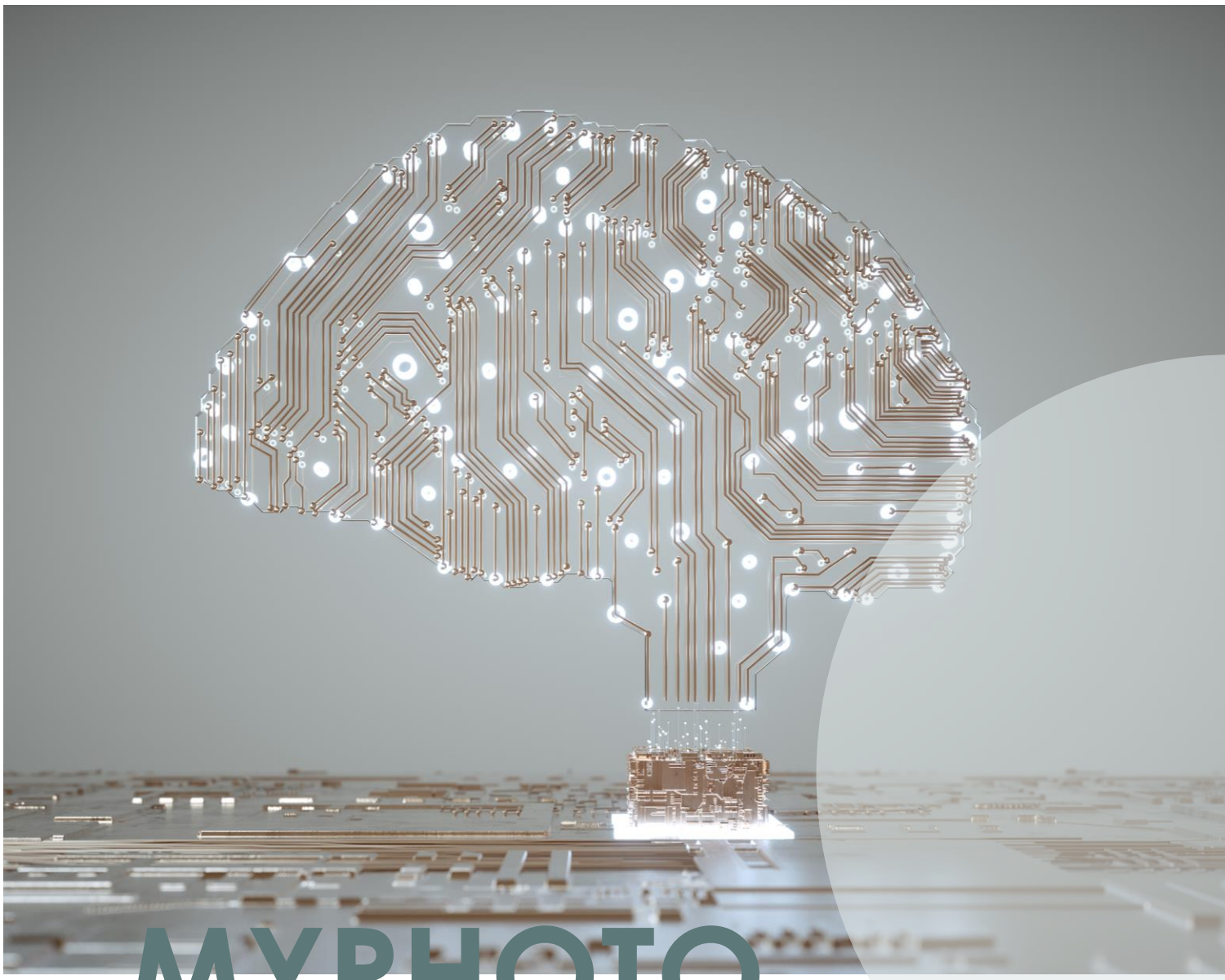


MYPHOTO WIZARD

By Shelby Lovejoy

OneSchoolhouse
Design Seminar

Artificial Intelligence

ABSTRACT

This document is a detailed report on my project for the OneSchoolhouse Design Seminar for my Artificial Intelligence class.

This project was a full-semester design project following learning material during Fall Semester. For my project, I decided to focus on building a machine learning image classification model. My goal was to create an algorithm flow that could take a batch of images and sort them into categories.

My main motivation for this project idea is that I have an exceptionally large number of photos that are constantly taunting me to be organized. (To put this in perspective, I currently have over 35,000 images sitting in my camera roll!)

For this project, I used a variety of different programs and tools to build my model, which are detailed in this report. Among these are Tensorflow, CustomVision, Tkinter, and other applications.

Overall, this project has taught me a variety of skills and information regarding machine learning and AI models. I have enjoyed this project and I hope you enjoy reading this report!

TABLE OF CONTENTS

MATERIALS

- Visual Studio Code application
- Python 3.10.6
- Tensorflow 2.12.0
- Microsoft Azure subscription

METHODOLOGY

During this project, I focused on following the design process to manage a project of this scope. In this section is the design brief, decision matrix, task action plan, weekly status reports, and excerpts from user feedback and testing. Each of these elements assisted in my design process and how I progressed from start to finish. The design brief helped me realize what project capabilities I valued, and the decision matrix helped me find the best solution to produce the outcomes I wanted. The task action plan not only gave me week-by-week to-do lists but also made the project seem slightly more manageable since I could obviously see the progression of steps to the final goal. The weekly status reports kept me on track and the user interviews gave me great feedback and ideas to implement into my project. Overall, following this methodology of the design process allowed me to produce a high-quality project in an organized manner.

DESIGN BRIEF

The Problem Statement

Daily device users need an effective way to organize and manage their photo collections due to the difficulties of photo tagging and album sorting.

Target Users

Individuals who get overwhelmed by photo management and need a more effective way to manage albums

Existing Products

Many existing algorithms are laptop-based and do not function well/efficiently for mobile device use.

Design Requirements

- User-friendly
- Connections to major photo storing systems
- Reliable & wide variety of applications

DECISION MATRIX

	Ease of Use	Reliability	Support	Skills Required	Aesthetics	Customization	Total
Clarifai	3	3	2.5	2	3	3	16.5
Tensorflow	2	3	2.5	2	2.5	3	15
Google Vision	2	2.5	2	2	2.5	2	13

My decision matrix includes three different image recognition tools that I found online. I went through each and explored their different properties. Overall, they were fairly similar, but I found Clarifai to be the most promising. It looks like it has a very easy-to-use interface that is easy to understand. Tensorflow was a close second and had many properties of typical Python programs, which I also liked. For my project, I am going to pursue Clarifai but keep Tensorflow as a backup in case a change is necessary.

As my project progressed, I ended up having to switch to Tensorflow as an export after using Clarifai for some time. Clarifai did exactly what I wanted it to, but it did not have the export capabilities that I was looking for. After realizing this, I did more research and stumbled upon Microsoft Azure's CustomVision, which is an image recognition tool that can be combined with Tensorflow.

TASK ACTION PLAN

Week 22	3/7 – 3/11	Apply: Execute Your Plan!
Finalize API selection & begin data collection (image recognition data)		
Week 23	3/14 – 3/18	First Status Report
Finish data collection & tag images		
Week 24	3/21 – 3/25	Biggest Challenge
Create algorithm/flow for data & test		
Week 25	3/28 – 4/1	Status Report
Retrain data/add in more images & retest		
Week 26	4/4 – 4/8	User Testing
Extend application of images & build app interface		
Week 27	4/11 – 4/15	Finishing Up Your Project
API integration into app & testing		
Week 28	4/18 – 4/22	Final Status Report
Build user data insertion for testing & get peer feedback		
Week 29	4/25 – 4/29	Submit Final Report
Fix bugs & submit!		

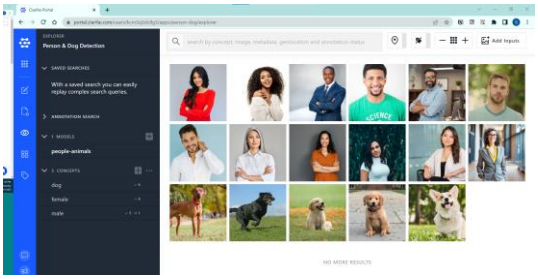
This was my original project plan. Although I had to stray off course slightly, as inevitable in a project of this size and scope, I was able to mostly follow the same progression of steps.

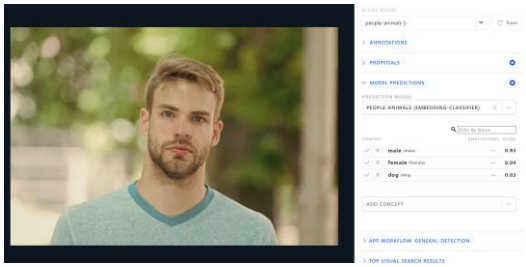
WEEKLY STATUS REPORTS

Weekly updates to stay on track with the project.

April 1, 2023

- **Project name:** no finalized name yet but... My Photo Wizard?
- **Project vision:** My vision for my project is an app that can take a large number of images as inputs and then produce them into suggested albums/groups that can be easily saved
- **Project progress:** So far, I have begun working with my application-of-choice, Clarifai. This is an online service that works with machine learning. It was pretty difficult to learn how to use it and definitely took me quite a while to get the very basics down. So far, I have put in input data so that I can understand how the program works before I start to input the complicated data that I am going for.
- **Project health:** I am feeling okay about my project. I'm definitely stressed about deadlines due to Clarifai's learning curve, but I think that Clarifai will be a really great tool and I'm very happy with how it is going.



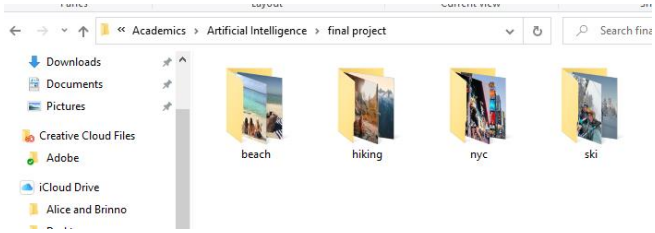


April 6, 2023

- **Project name:** My Photo Wizard
- **Project vision:** My vision for my project is an app that can take a large number of images as inputs and then produce them into suggested albums/groups that can be easily saved
- **Project progress:** For this checkpoint, I had to completely switch around my project since my initial idea with Clarifai did not work. I spent half of the week trying to figure out how to build my model and workflow using Clarifai, as well as how to integrate my API key, but that

did not end up working for a number of reasons. So... I decided to shift my focus to using Microsoft's CustomVision tool and training my model there instead. We will see what happens!

- **Project health:** I am not feeling great about my project at the moment. I hit a lot of roadblocks before getting to this step and definitely took double the amount of time to do everything. I am hoping that CustomVision will be a better platform for me and that I will be able to continue working.
- **Video update:** https://shorturl.at/eKMY4



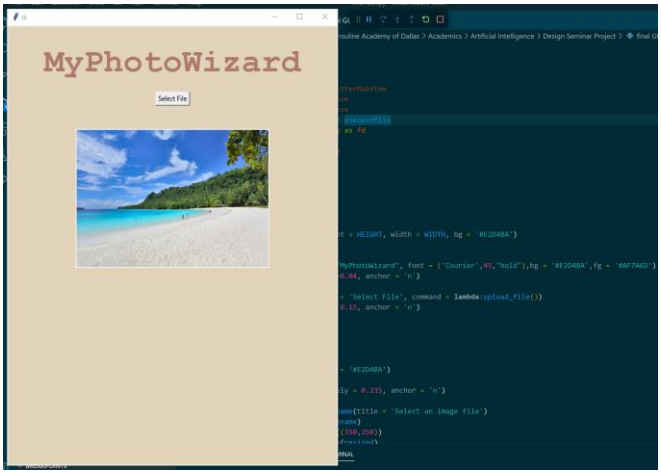
April 7, 2023

- **Project name:** My Photo Wizard
- **Project vision:** My vision for my project is an app that can take a large number of images as inputs and then produce them into suggested albums/groups that can be easily saved
- **Project progress:** This week I focused on building my actual app and working on getting file uploads to be integrated into it. I was able to get a full tkinter application running and allow files to be uploaded!
- **Project health:** I am doing okay with my project! This week definitely went a lot better than last week and I am feeling hopeful about what I can accomplish now! I am starting to see a vision for my final goal.

```
from tkintermapview import TkinterMapView
from tkinter.ttk import Combobox
from tkinter.ttk import Combobox
from tkinter.filedialog import askopenfile
from tkinter import filedialog as fd
import os
from PIL import ImageTk, Image

HEIGHT = 800
WIDTH = 600

root = tk.Tk()

# setting up opening page
canvas = tk.Canvas(root, height = HEIGHT, width = WIDTH, bg = '#E2D4BA')
canvas.pack()

title = Label(canvas, text = "MyPhotoWizard", font = ('Courier',45,"bold"),bg = '#E2D4BA',fg = '#AF7A6D')
title.place(relx = 0.5, rely =0.04, anchor = 'n')

button = tk.Button(root, text = 'Select File', command = lambda:upload_file())
button.place(relx=0.5, rely = 0.15, anchor = 'n')


# function for accessing file
def upload_file():
    filename = fd.askopenfilename(
        title = 'Select an image file'
    )
    os.startfile(os.path.abspath(filename))

    photo = PhotoImage(filename)
    canvas.create_image(10,10,anchor=NW,image=photo)
```

April 14, 2023

- **Project name:** My Photo Wizard
- **Project vision:** My vision for my project is an app that can take a large number of images as inputs and then produce them into suggested albums/groups that can be easily saved
- **Project progress:** This week I focused on two main objectives. First, I worked on touch ups to my tkinter app so that the uploaded image could easily display on the screen. Secondly, I worked on putting my CustomVision model into my tkinter app. I did have some problems with this since I couldn't find the best way to export data. So, I decided to rewrite my model as code rather than building it in the web app.
- **Project health:** I'm feeling okay! I definitely felt a bit overwhelmed at the beginning but I am starting to see a vision, especially now that I have decided to basically rebuild my model directly in VS Code rather than figuring out how to upload it. I was having a lot of trouble with that before but it is relieving that I have a solution now.
- **Video update:** https://shorturl.at/lszV6



April 21, 2023

- **Project name:** My Photo Wizard
- **Project vision:** My vision for my project is an app that can take a large number of images as inputs and then produce them into suggested albums/groups that can be easily saved
- **Project progress:** This week I focused on getting my CustomVision model integration with my python project. I originally tried to write my model training into Python manually, but I wasn't able to get my resource codes working correctly so that plan kind of backfired. Then, I had to readjust and try exporting with Tensorflow, which I've had a lot more success with. I'm still getting errors, but it is obvious that my model is connected to my Python project, which is a big win!

- **Project health:** This project is definitely nowhere near how I had originally planned (i.e. using Clarifai) , but I am proud of how far I have come considering how many errors I encountered! I'm looking forward to working on my report and hopefully getting whatever I can done.
- **Video update:** https://shorturl.at/efklm

USER INTERVIEW & TESTING

April 7, 2023

I asked my mom to observe my AI model for me. I pulled up the program on my computer and just gave a general overview of the functionality of the app. Before demoing, her first question was whether or not the app could be transferred from laptop (which it is on now) to mobile phone. I really liked that idea because it would be optimal for my project, and I want to look into it in the future.

As she worked through the app (uploading the image, having the image returned to her, etc), she was asking me about the parameters of the app. Specifically, she was wondering what the grouping categories were and if there were ways to expand them. As she was commenting, I realized that I could group photos by location and time taken so that they are more accurately placed into albums.

Overall, she liked the flow of the app and the prediction results idea. I am very grateful for her comments, and I look forward to implementing them!

April 14, 2023

"This is such a cool idea! Does the user get to choose the categories of the photos or is it predetermined? It might be cool to let the user make the groups for the bot to sort!" – Paulina D, classmate

April 22, 2023

"I love your app! It is such a cool idea and I can really tell that you put time and thought into the efficiency and reliability of the program. I do have one question... I'm wondering if your AI can take different formats of photos (.heic, jpg, .png), because that would be so so amazing!" – Eni Egedigwe, classmate

PROJECT ARTIFACTS

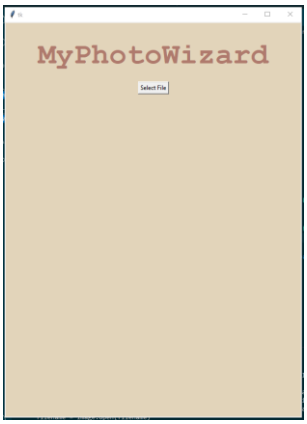
This section includes screenshots and descriptions of the main outcome of my project. There are two main sections: the tkinter app and the CustomVision model

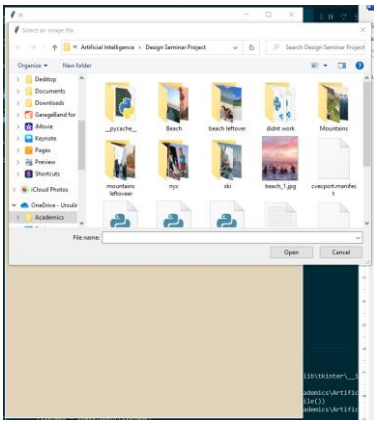
TKINTER GUI

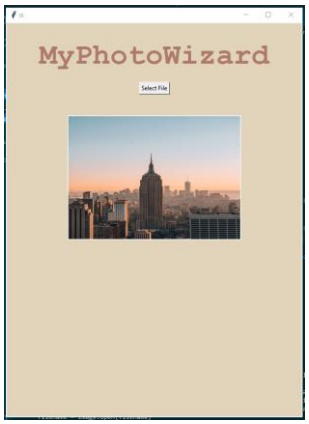
The following screenshot is from my Python project for my tkinter app.

```
import tkinter as tk
from tkinter import font
from tkinter import *
import requests
from tkintermapview import TkinterMapView
from tkinter.ttk import Combobox
from tkinter.ttk import Combobox
from tkinter.filedialog import askopenfile
from tkinter import filedialog as fd
from PIL import ImageTk, Image

HEIGHT = 800
WIDTH = 600

root = tk.Tk()

# setting up opening page
canvas = tk.Canvas(root, height = HEIGHT, width = WIDTH, bg = '#E2D4BA')
canvas.pack()

title = Label(canvas, text = "MyPhotoWizard", font = ('Courier',45,"bold"),bg = '#E2D4BA',fg = '#AF7A6D')
title.place(relx = 0.5, rely =0.04, anchor = 'n')

button = tk.Button(root, text = 'Select File', command = lambda:upload_file())
button.place(relx=0.5, rely = 0.15, anchor = 'n')

# function for accessing file
def upload_file():
    frame = tk.Frame(root, bg = '#E2D4BA')
    frame.pack()
    frame.place(relx = 0.5, rely = 0.235, anchor = 'n')

    filename = fd.askopenfilename(title = 'Select an image file')
    filename = Image.open(filename)
    resized = filename.resize((350,250))
    photo = ImageTk.PhotoImage(resized)

    label = tk.Label(frame, image = photo)
    label.pack()

    root.mainloop()


root.mainloop()
```

This code produced the following GUI page progression.



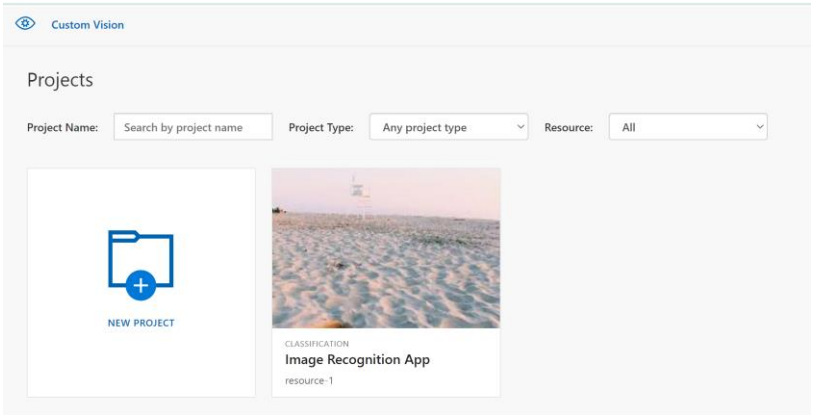




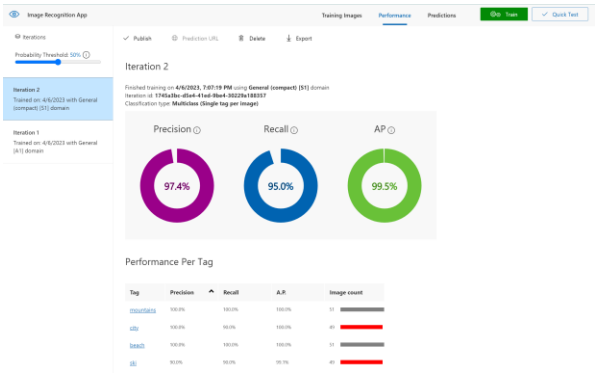
CUSTOMVISION MODEL

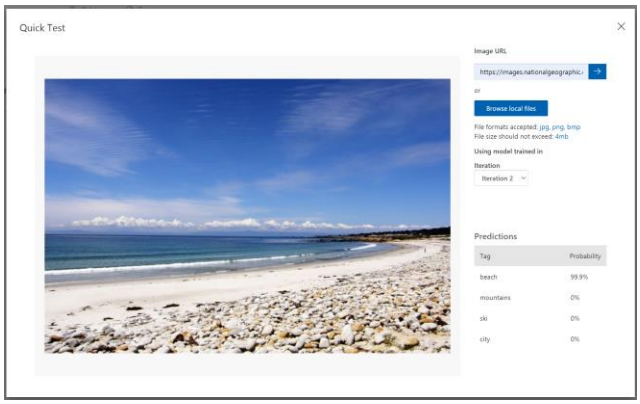
The following screenshots and excerpts are from my CustomVision model.

I used CustomVision to train my model. CustomVision is a tool by Microsoft Azure specifically made for machine learning.



In my model, I uploaded around 200 images and trained them according to different categories that I set. Then, I ran the algorithm and added more data as necessary.





After training my model, I focused on putting my exported model into my Python project. This is where I had the most issues. I had to troubleshoot different export types and tried many, many methods to approach the issue. Eventually, I decided to export using Tensorflow. I followed an instructions page (listed in Resources) to use my exported model. The following images are from both the instructions page and my code.

The following screenshots are the beginning instructions and my code for how to export.

Load your model and tags

The downloaded *.zip* file contains a *model.pb* and a *labels.txt* file. These files represent the trained model and the classification labels. The first step is to load the model into your project. Add the following code to a new Python script.

Python Copy

```python
import tensorflow as tf
import os

graph_def = tf.compat.v1.GraphDef()
labels = []

# These are set to the default names from exported models, update as needed.
filename = "model.pb"
labels_filename = "labels.txt"

# Import the TF graph
with tf.io.gfile.GFile(filename, 'rb') as f:
    graph_def.ParseFromString(f.read())
    tf.import_graph_def(graph_def, name='')

# Create a list of labels.
with open(labels_filename, 'rt') as lf:
    for l in lf:
        labels.append(l.strip())
```

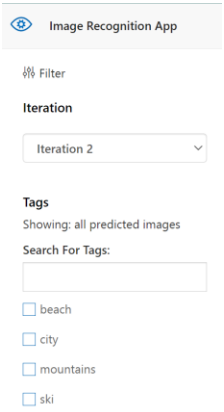
```python
import tensorflow as tf
import os

graph_def = tf.compat.v1.GraphDef()
labels = []

# These are set to the default names from exported models, update as needed.
model_filename = "model.pb"
labels_filename = "labels.txt"


# Import the TF graph
with tf.io.gfile.GFile(model_filename, 'rb') as f:
    graph_def = tf.compat.v1.GraphDef()
    graph_def.ParseFromString(f.read())
    tf.import_graph_def(graph_def, name='')

# Get the default graph
graph = tf.compat.v1.get_default_graph()

# Create a list of labels.
with open(labels_filename, 'rt') as lf:
    for l in lf:
        labels.append(l.strip())

```

The following screenshots are evidence that the model that I created online was connected to my Python project. I asked the code for the labels, and it printed out the four labels that I had coded online.

```python
# Create a list of labels.
with open(labels_filename, 'rt') as lf:
    for l in lf:
        labels.append(l.strip())


print(labels)
```

PROBLEMS 6 OUTPUT DEBUG CONSOLE TERMINAL

```
done
PS C:\SQLite3>  c:; cd 'c:\SQLite3'; & 'C:\Users\2024_S
ython.python-2023.6.1\pythonFiles\lib\python\debugpy\ad
done
PS C:\SQLite3>  c:; cd 'c:\Users\2024_ShelbyLovejoy\One
Lovejoy\AppData\Local\Programs\Python\Python310\python.
/../..\debugpy\launcher' '62669' '--' 'C:\Users\2024_Sh
ect.py'
['beach', 'city', 'mountains', 'ski']
```



Unfortunately, I was not able to fix the final error of my code that would have fulfilled my intended purpose of complete integration between my model and my code. My original goal was to have the user enter a picture and the prediction appear underneath it. However, I encountered many errors with the exported Tensorflow model and exhausted all of my resources for help – forums, friends, AI teacher, Python teacher, etc. – but unfortunately, I still encountered the same error. Despite this, I was still able to successfully build my model on CustomVision and create a link between the two platforms, even if it was not the one that I had originally intended.

CONCLUSION

What was the outcome?

Not only did I produce a functioning machine learning model during this project, but I also got to work on an intensive project that taught me many things about myself, my work goals, my interests, and, last but not least, artificial intelligence!

Did the results meet the original goals of the project?

The results were similar to what I was expecting at the start of the project. Going in, I didn't know exactly what my project was going to be versus what it was going to look like, so it is difficult to compare my current version to my goal version. However, I am very satisfied by how the project turned out and with the capabilities of the program. I also learned a lot about artificial intelligence models which I think is equally as valuable as a finished product.

Are you going to continue working on this project?

I will likely continue to work on this project in some form next year during my STEM Independent Research class. Although it may not be the exact same project, my work will definitely utilize the research knowledge that I have gained this semester and the project skills that I will take away.

What are areas of success?

During this project, I have learned a lot about problem solving and troubleshooting which was especially important when I was working on parts of my project that basically no one had ever heard of before. I'm very pleased with how I have worked through some of the issues I have encountered and produced a project that I am proud of. Another area of success is simply taking on a project like this when I have never done any technical work into artificial intelligence before!

What are the areas of improvement?

The areas of improvement on my project are some of the project capabilities. I wish that I had more knowledge of different AI models in order to enhance the abilities of my model. If I were to do this project over again, I would have liked

to ensure that my model training tool was the perfect one before I committed time to it

What advice would you give someone if they were to pick up where you left off?

If I were to advise someone on this project, I would start by instructing them to do a lot of preliminary research into Tensorflow and AI models before starting. My lack of knowledge regarding these subjects made some elements of the project unnecessarily difficult. Then, I would advise them to do work on enhancing the capabilities of the project and turning it into a full application for many uses. Finally, I would wish them good luck and tell them to just have fun with it!

RESOURCES

93, Pragyan. “Python - TensorFlow ValueError: Cannot Feed Value of Shape (64, 64, 3) for Tensor U’Placeholder:0’, Which Has Shape “(?, 64, 64, 3).”” *Stack Overflow*, 2017, stackoverflow.com/questions/40430186/tensorflow-valueerror-cannot-feed-value-of-shape-64-64-3-for-tensor-uplace. Accessed 25 Apr. 2023.

Azure, Microsoft. “Python - How to Fix “ComputerVisionErrorException: Operation Returned an Invalid Status Code “PermissionDenied.”””” *Stack Overflow*, 2019, stackoverflow.com/questions/55857062/how-to-fix-computervisionerrorexception-operation-returned-an-invalid-status-c.

Beyer, Wolfgang. “How to Build a Simple Image Recognition System with TensorFlow (Part 1).” *FreeCodeCamp.org*, 2 Jan. 2017, www.freecodecamp.org/news/how-to-build-a-simple-image-recognition-system-with-tensorflow-part-1-d6a775ef75d/.

“Cloud Computing Services | Microsoft Azure.” *Azure.microsoft.com*, azure.microsoft.com/en-us.

Docker. “Docker Overview.” *Docker Documentation*, 9 Apr. 2020, docs.docker.com/get-started/overview/.

Google. “TensorFlow.” *TensorFlow*, Google, 2019, www.tensorflow.org/.

H22, Julia . “AttributeError: Module “Tensorflow” Has No Attribute “Compat” · Issue #40422 · Tensorflow/Tensorflow.” *GitHub*, 12 June 2020, github.com/tensorflow/tensorflow/issues/40422. Accessed 25 Apr. 2023.

Lovejoy, Shelby. “CustomVision.” *Customvision.ai*, Microsoft Azure, 2023, www.customvision.ai/projects. Accessed 25 Apr. 2023.

Melo, Emilio. “Consuming and Exporting Models - Implementing Image Classification by Using the Azure Custom Vision Service Course.” *Cloud Academy*, cloudacademy.com/course/implementing-image-classification-using-azure-custom-vision-service-1719/consuming-and-exporting-models/. Accessed 25 Apr. 2023.

Patrick Farley. “Export Your Model to Mobile - Custom Vision Service - Azure Cognitive Services.” *Learn.microsoft.com*, 5 July 2022, learn.microsoft.com/en-us/azure/cognitive-services/custom-vision-service/export-your-model. Accessed 25 Apr. 2023.

---. “Quickstart: Build an Image Classification Model with the Custom Vision Portal - Azure Cognitive Services.” *Learn.microsoft.com*, 3 Nov. 2022,

learn.microsoft.com/en-us/azure/cognitive-services/Custom-Vision-Service/getting-started-build-a-classifier. Accessed 25 Apr. 2023.

---. “Quickstart: Image Classification with Custom Vision Client Library or REST API - Azure Cognitive Services.” *Learn.microsoft.com*, 3 Nov. 2022, learn.microsoft.com/en-us/azure/cognitive-services/custom-vision-service/quickstarts/image-classification?tabs=visual-studio&pivots=programming-language-python#code-examples.

---. “Tutorial: Run TensorFlow Model in Python - Custom Vision Service - Azure Cognitive Services.” *Learn.microsoft.com*, 5 July 2022, learn.microsoft.com/en-us/azure/cognitive-services/Custom-Vision-Service/export-model-python.

---. “Use Prediction Endpoint to Programmatically Test Images with Classifier - Custom Vision - Azure Cognitive Services.” *Learn.microsoft.com*, 6 Jan. 2023, learn.microsoft.com/en-us/azure/cognitive-services/custom-vision-service/use-prediction-api?source=recommendations. Accessed 25 Apr. 2023.

RO, GameZone. “Load Tensorflow Model from CustomVision in Python.” *Stack Overflow*, 2019, stackoverflow.com/questions/55084006/load-tensorflow-model-from-customvision-in-python. Accessed 25 Apr. 2023.

Samples, Azure. “Custom Vision IOS Sample Applications.” *GitHub*, 27 Mar. 2023, github.com/Azure-Samples/cognitive-services-ios-customvision-sample/blob/master/CVS_ClassifierSample_Swift/README.md.

Savvidou, Foteini. “Use a TensorFlow Model Exported from Azure Custom Vision.” *Foteini Savvidou - Blog*, 18 July 2022, sfoteini.github.io/blog/use-a-tensorflow-model-exported-from-azure-custom-vision/.

YAO. “Difference between Tensorflow’s Graph and GraphDef.” *Stack Overflow*, 2018, stackoverflow.com/questions/47059848/difference-between-tensorflows-graph-and-graphdef.