



# Build a Classification Model with Azure Custom Vision

Open Lab | Digital Summit 2018

## Miracle Innovation Labs

Miracle Software Systems, Inc.

## Build a Classification Model with Azure Custom Vision

### Introduction

This document contains a step-by-step process of creating a model with Microsoft Custom Vision which classifies the species of the animals. This model is integrated with a web application using Python Flask.

This guide was prepared by [Miracle's Innovation Labs](#)

### Pre-Requisites

All attendees must have their workstation (with Internet) to participate in the lab (Both PC and MAC are compatible). The following prerequisites will help you to make the Hands-on Lab experience easier.

- Active email ID for registering with the Microsoft Custom Vision
- Download Python 3.6
- Text Editor such as Visual Studio (or) Notepad++

### Technology Involved

- Microsoft Custom Vision
- Python 3.6

## Labs Steps

**So, let us get started!**

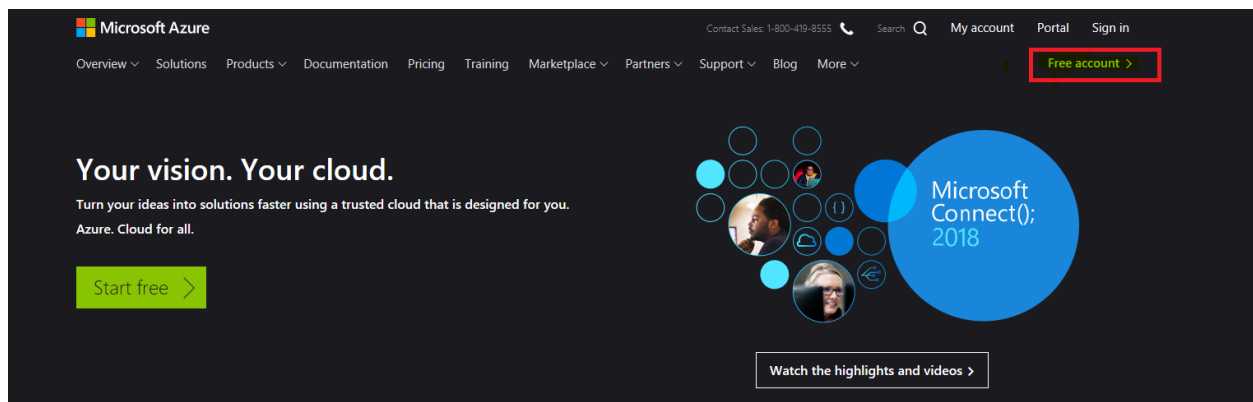
The following steps will describe how to build a model with the Microsoft Custom Vision that performs animal classification and integrate it with Web Application. The user interacts with the web application and can directly give the input image of an animal and the resultant species name will be displayed on the output page.

### Step #1 | Create a Microsoft Account

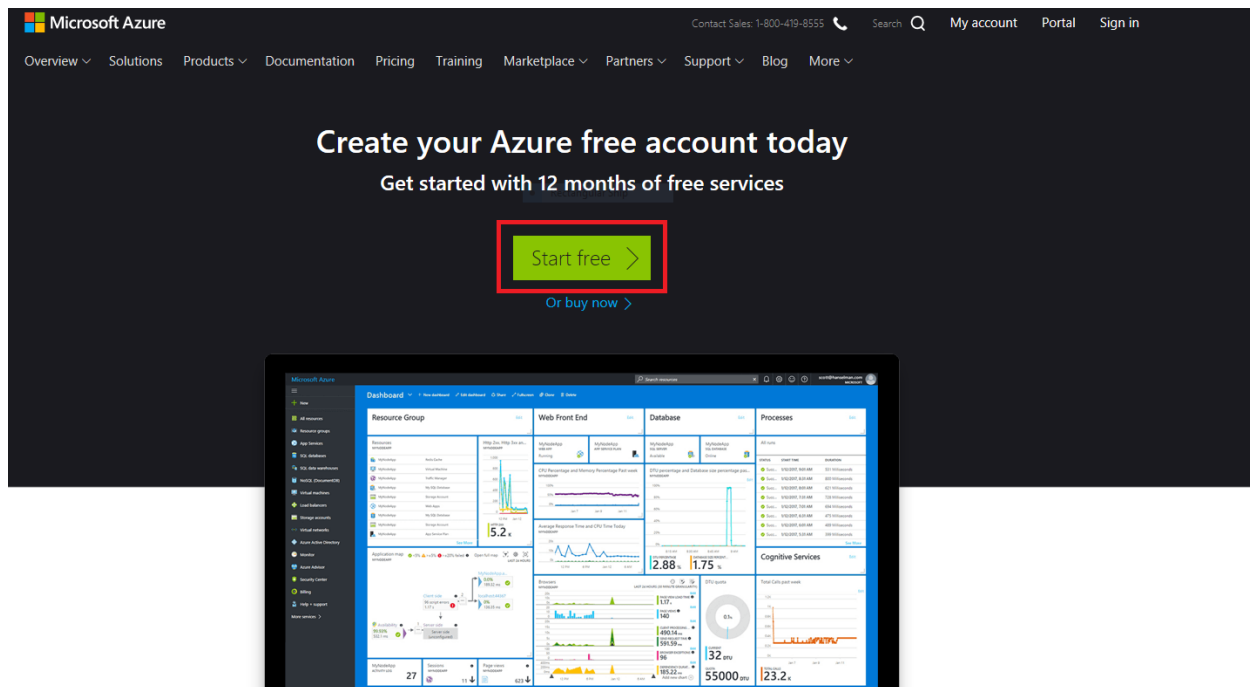
A valid Microsoft account or an Azure Active Directory OrgID ("work or school account") should exist so, that you can sign into <https://www.customvision.ai/> (customvision.ai) and get started.

If you don't have a Microsoft Account you can sign-up using the following link <https://signup.live.com/>

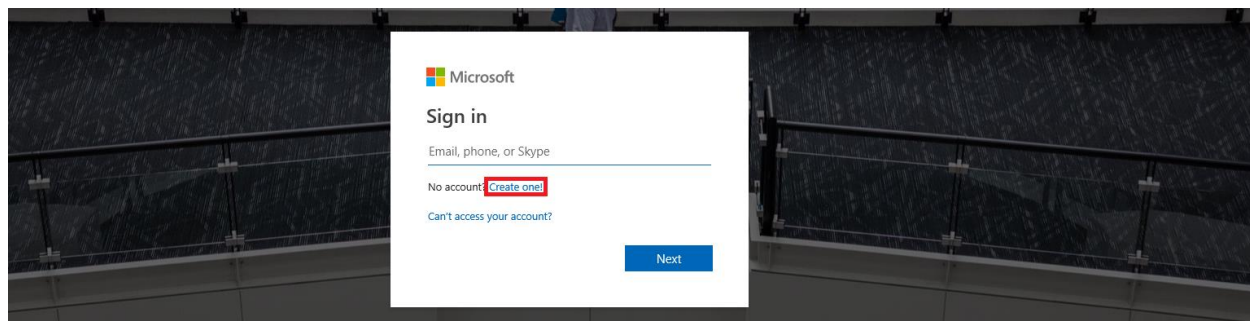
To create an account you need to have a valid phone number or an email id. Please enter this link <https://azure.microsoft.com/> and click on **free account**.



You will be redirected to the next page as shown below.

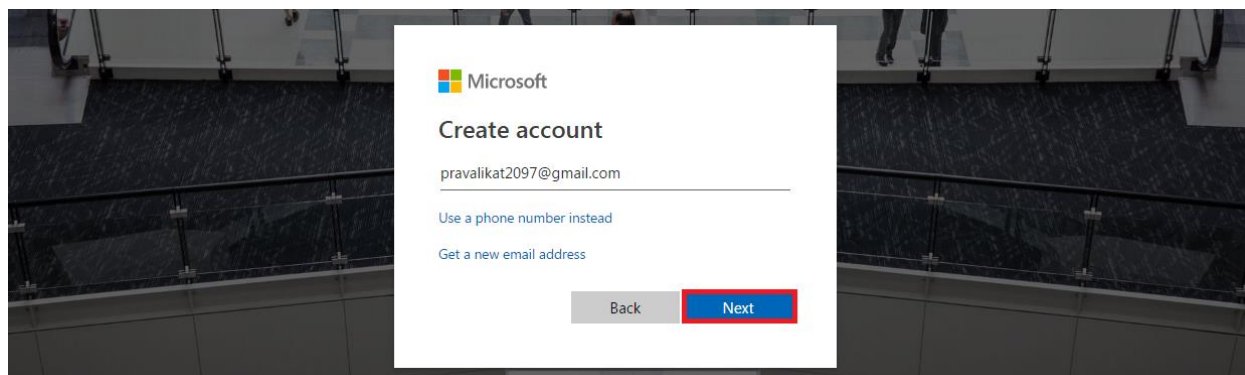


Now, click on **Start free** option and then you will be redirected to the sign in page.

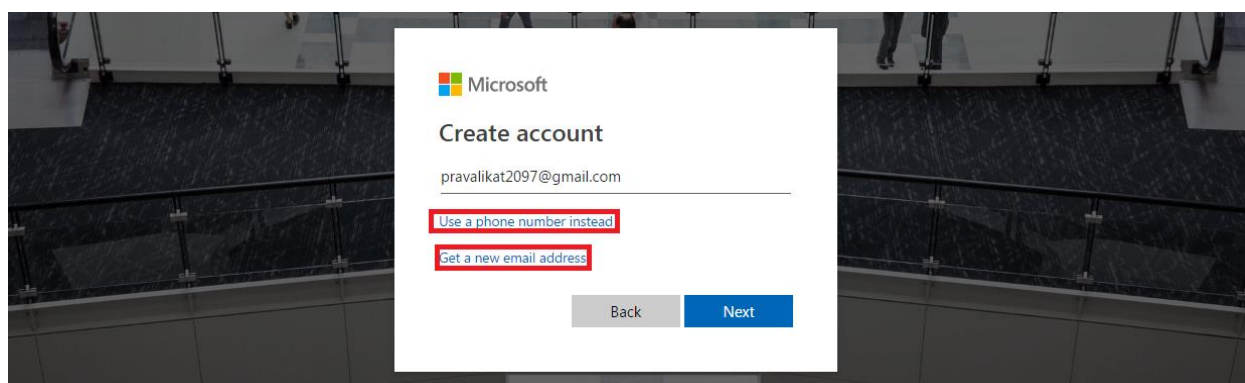


If you already have a Microsoft Account then just login with your credentials.

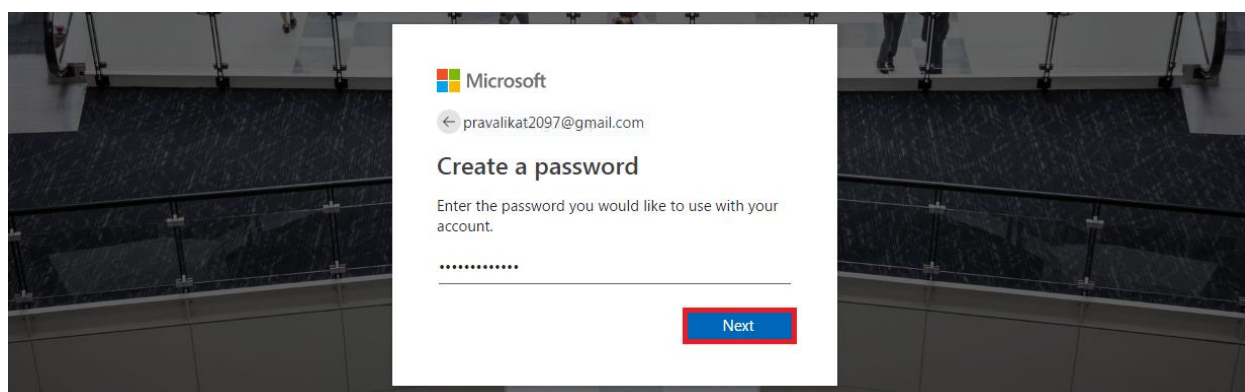
If you do not have an account, click on **Create new** option. Then, you will be redirected to the signup page <https://signup.live.com/>



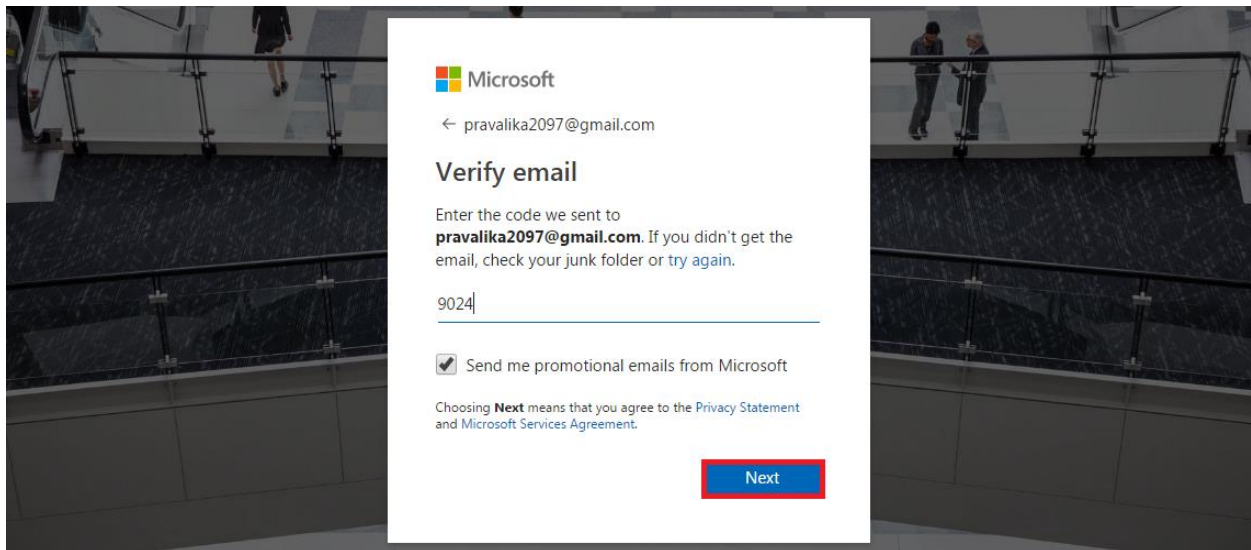
Enter your valid mail id or phone number by clicking on **Use a phone number instead** or you can also get a new email by clicking **Get a new email address**. Now, click on **Next** button (**Note** - Prefer using an existing email id like Gmail, Yahoo or use a phone number to create an account).



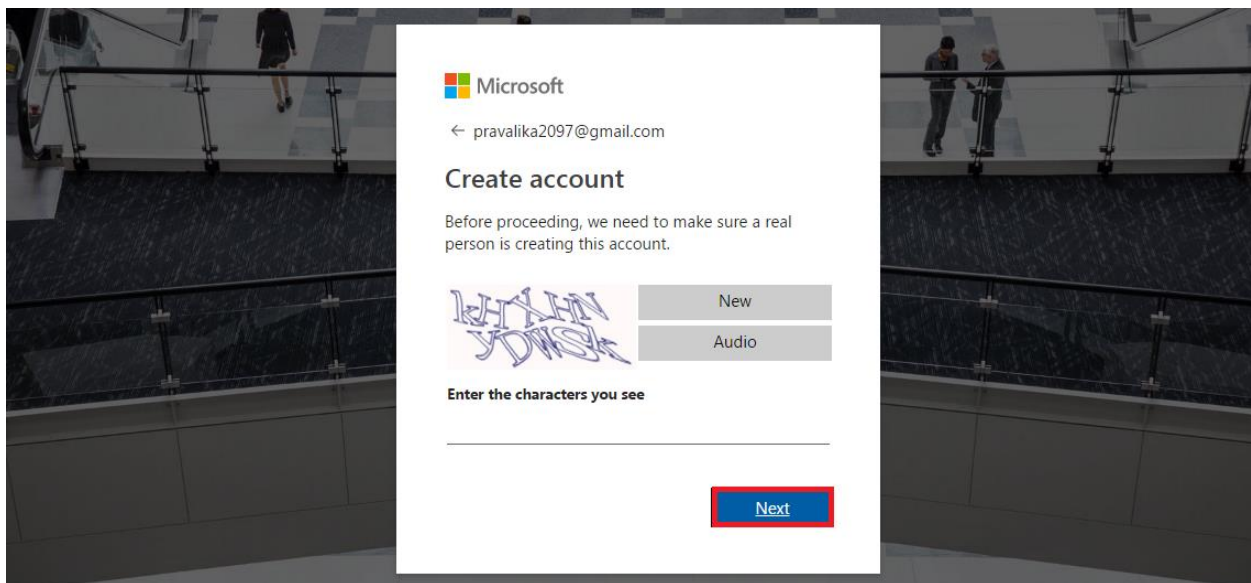
Next you have to setup your new password.



After entering the password, click on **Next** button for the verification.



Now, you will receive a verification code to your registered email id. Enter the code and then click on **Next** button.



Now enter the captcha code and click on **Next** button.

After clicking the next button you will be redirected to the following page.

Microsoft Azure

pravalika2097@gmail.com Sign out

## Azure free account sign up

Start with a ₹13,300 credit for 30 days, and keep going for free

### 1 About you

Country/Region ⓘ Rectangular Snip

India

First name

Last name

Email address ⓘ

Phone

Example: 81234-56789

Organization

PAN ID ⓘ

Here, the user need not provide any personal details. As it is a free account, you can now **Sign Out**.

Microsoft Azure

pravalika2097@gmail.com **Sign out**

## Azure free account sign up

Start with a ₹13,300 credit for 30 days, and keep going for free

After logging out, again open a new window and go to custom vision sign in page, <https://www.customvision.ai/>. Provide all the credentials that you have created previously and click on **Sign in**.

You will get a pop regarding **Terms of Service**, click on the check box and then click on **I agree** button.

Create your first project!

NEW PROJECT

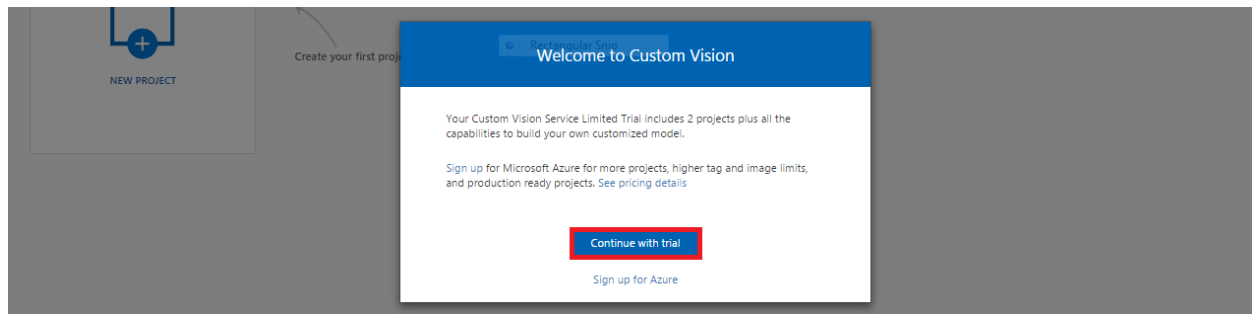
### Terms of Service

☒ I agree that my use of this service is governed by the Microsoft Online Subscription Agreement, which incorporates the Online Services Terms.

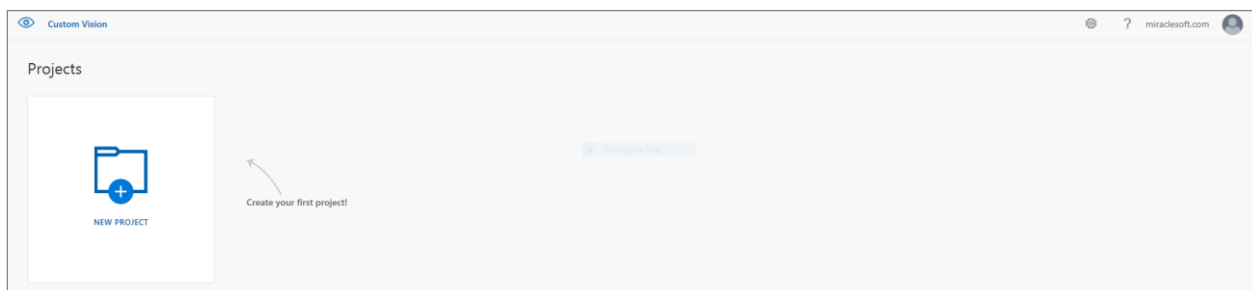
**I agree**



Again you will see another pop asking if you want to continue with the free trial account or sign up for azure. Click on **Continue with azure**.



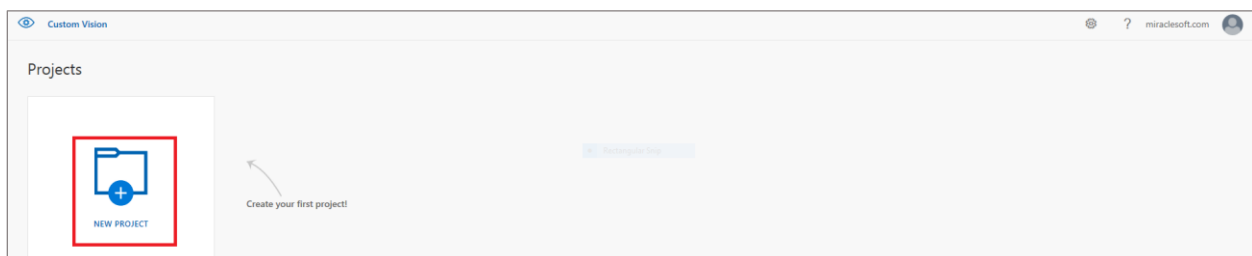
Your custom vision page will now look like this.



This is the process to sign up for **Custom vision service**.

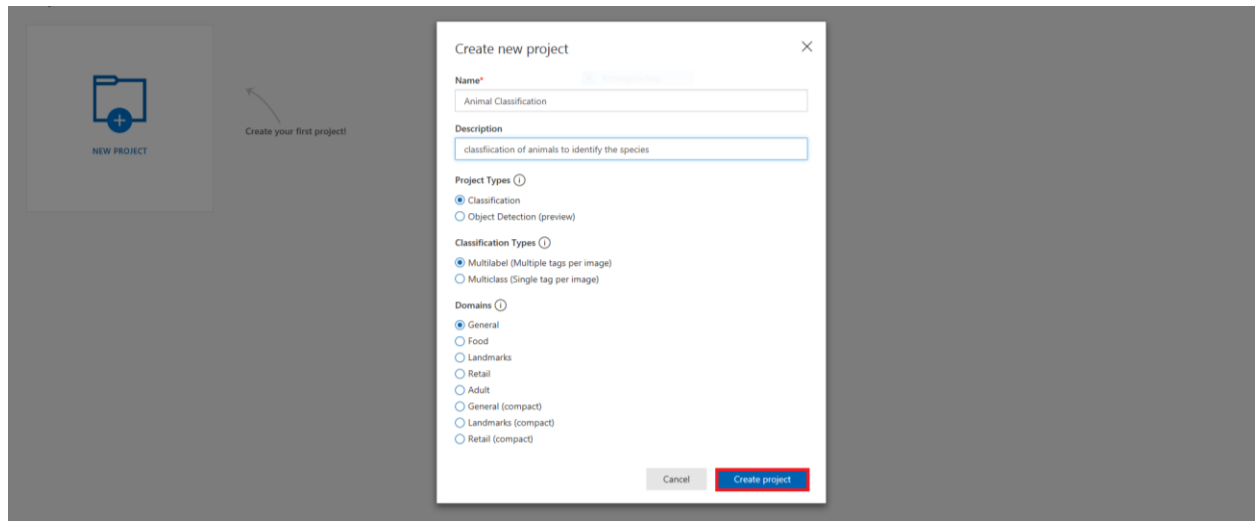
## Step #2 | Build a Model in the Microsoft Custom Vision

In the custom vision page <https://www.customvision.ai/projects> click on **NEW PROJECT**.

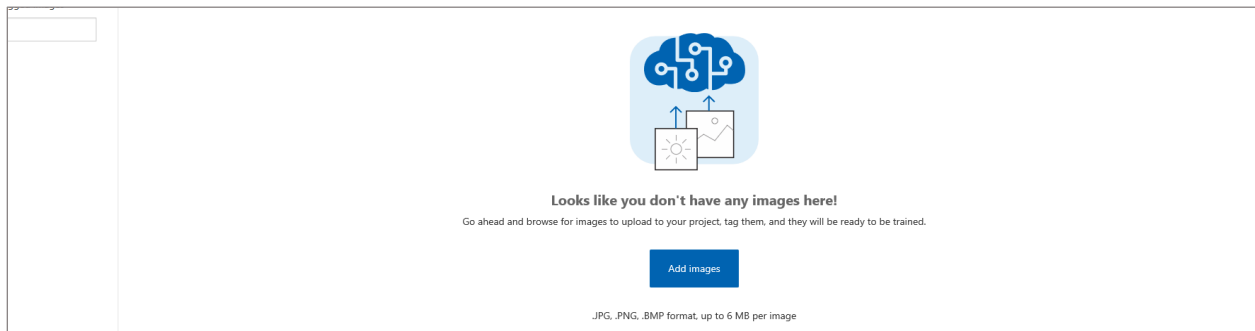


You will see a pop up for creating a new project as shown below.

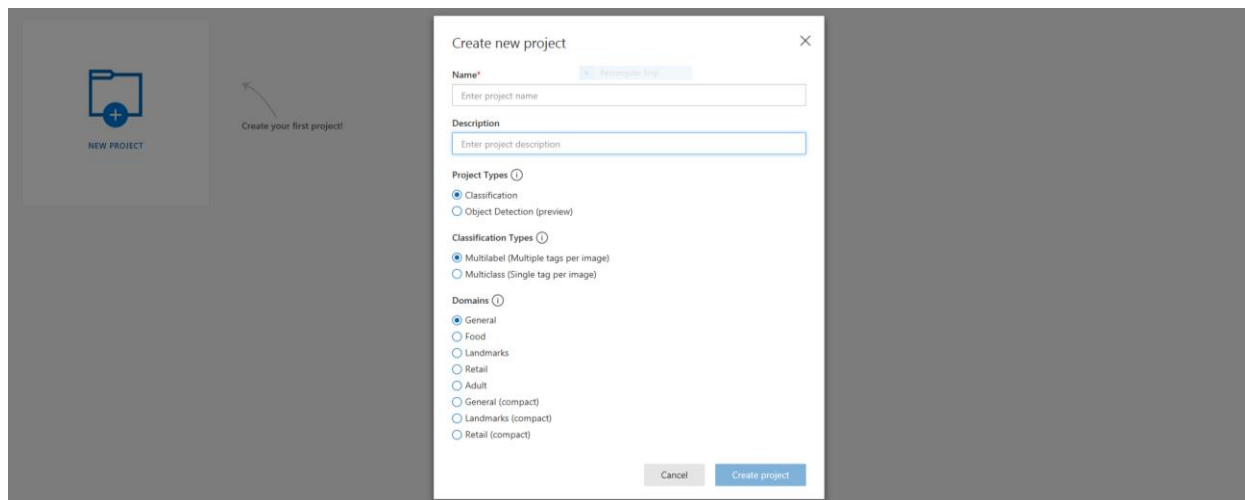




Click on **Create project** button, your project is created and will redirect to your project page as shown below.



Click on **Add images** to add the dataset that is present in the folder.



Create new project

Name\* Required field

Enter project name

Description

Enter project description

Project Types

- ☒ Classification
- ☐ Object Detection (preview)

Classification Types

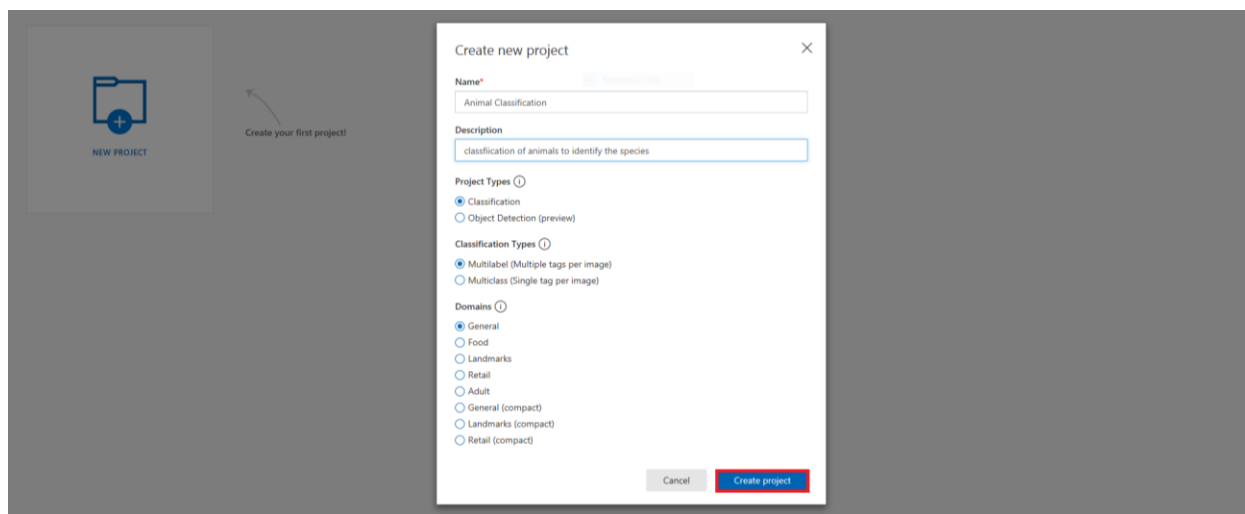
- ☒ Multilabel (Multiple tags per image)
- ☐ Multiclass (Single tag per image)

Domains

- ☒ General
- ☐ Food
- ☐ Landmarks
- ☐ Retail
- ☐ Adult
- ☐ General (compact)
- ☐ Landmarks (compact)
- ☐ Retail (compact)

Cancel Create project

Now enter only the name and description of the project as shown.



Create new project

Name\* Required field

Animal Classification

Description

classification of animals to identify the species

Project Types

- ☒ Classification
- ☐ Object Detection (preview)

Classification Types

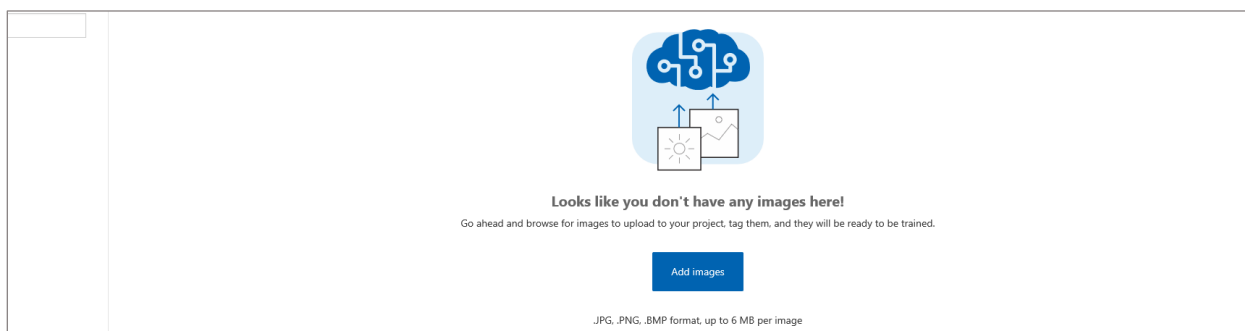
- ☒ Multilabel (Multiple tags per image)
- ☐ Multiclass (Single tag per image)

Domains

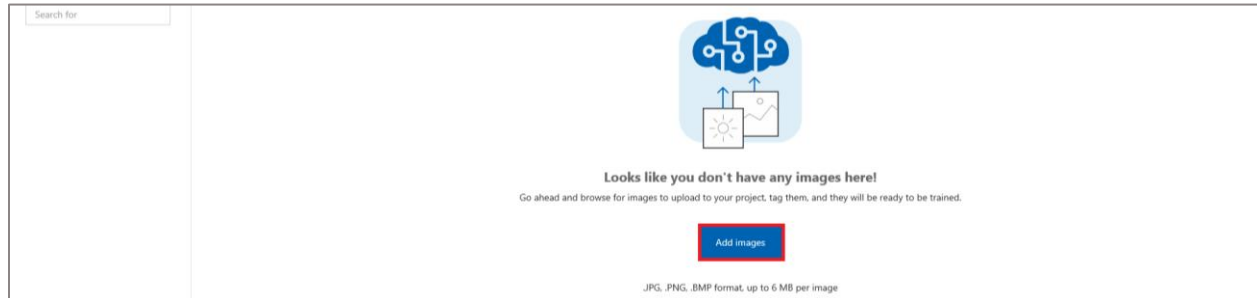
- ☒ General
- ☐ Food
- ☐ Landmarks
- ☐ Retail
- ☐ Adult
- ☐ General (compact)
- ☐ Landmarks (compact)
- ☐ Retail (compact)

Cancel Create project

Click on **Create project** button, your project will be created and will be redirected to your project page as shown.

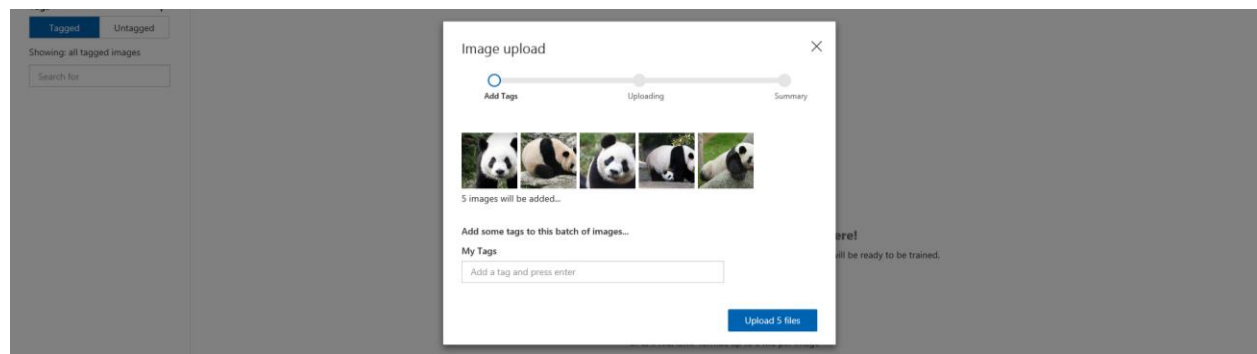


Click on **Add images** to add the dataset that is present in the folder.

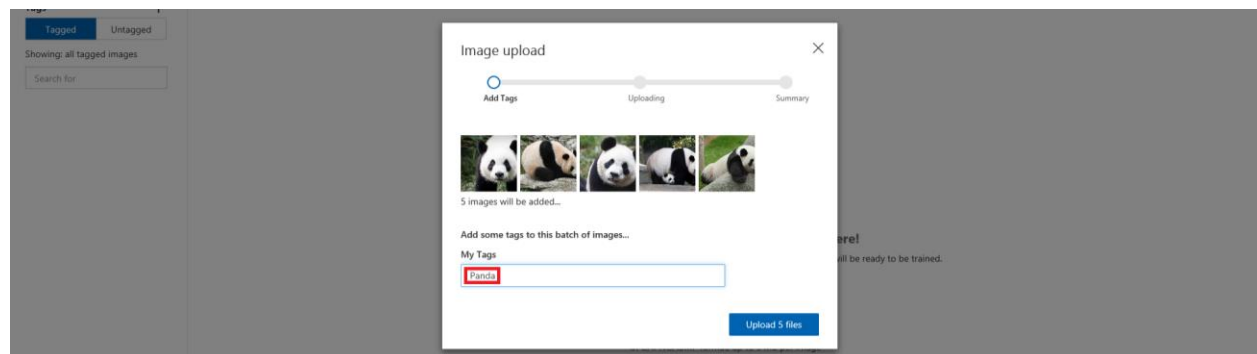


The added dataset contains 15 species and each species has 80-140 images.

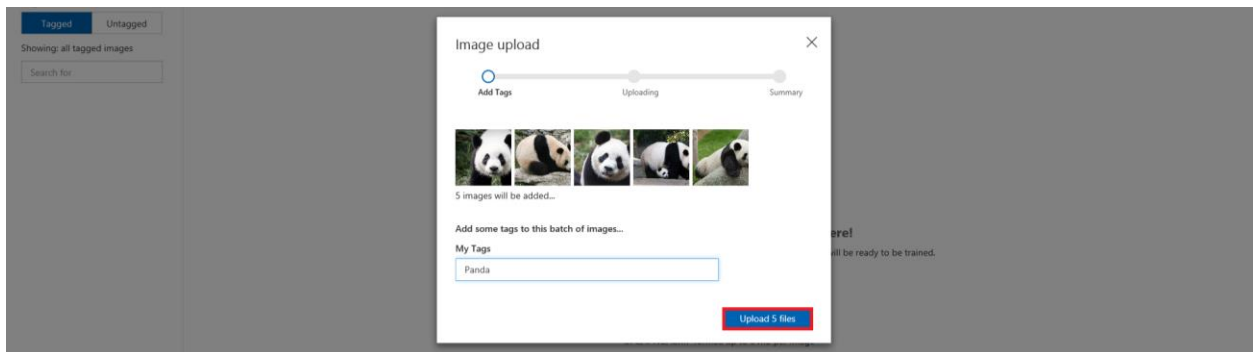
Now select the images of a particular species and provide a tag name (name of the animal such as, Panda).



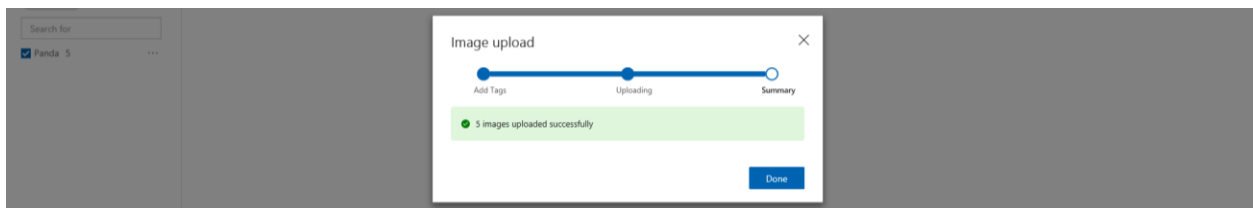
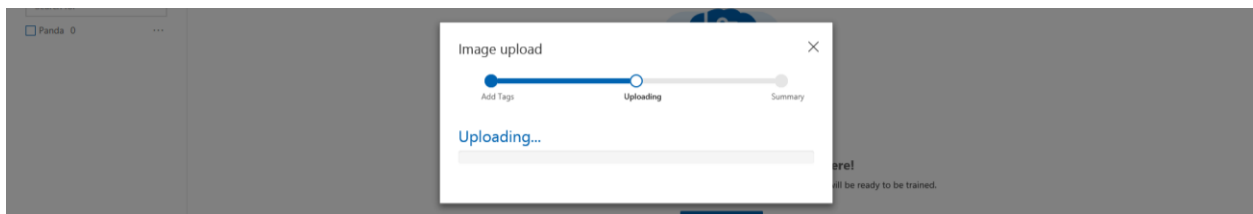
Give the tag name (name of the animal) in the text box.



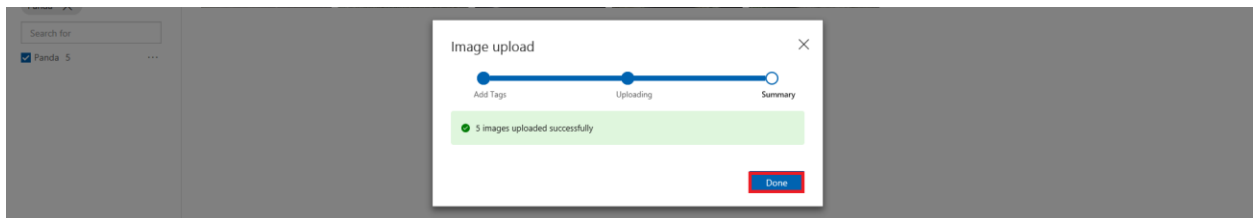
Click on **Upload files** button.



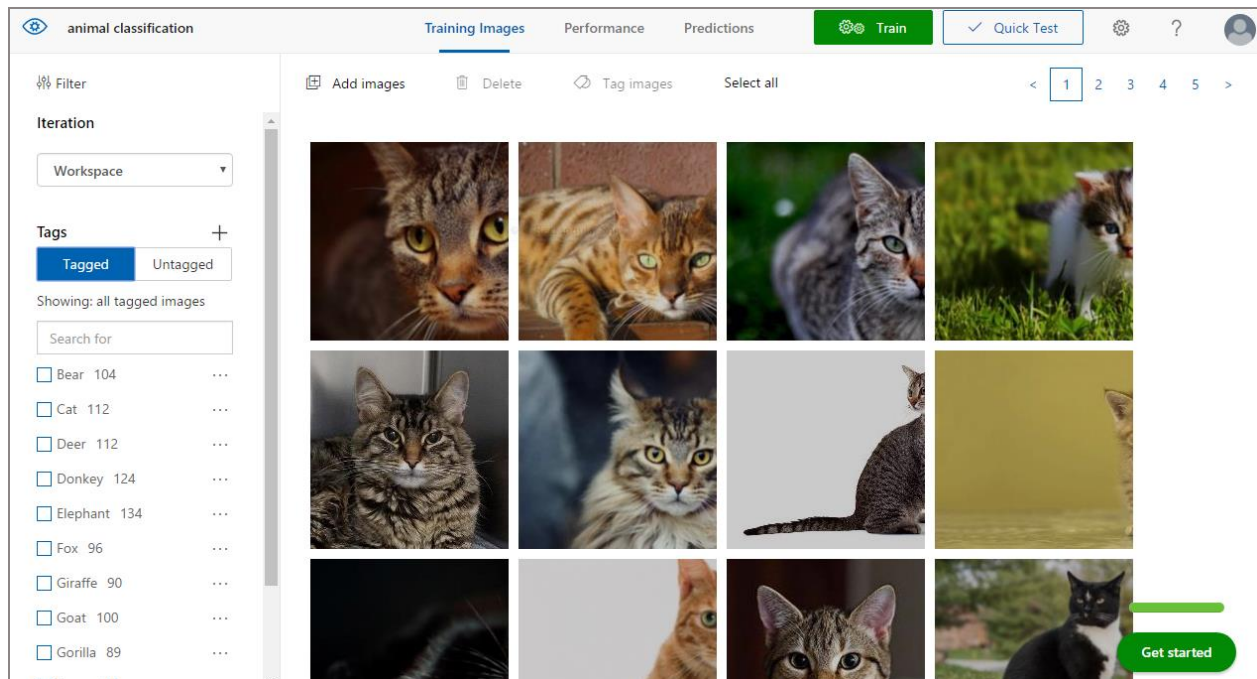
The images will be uploading now.



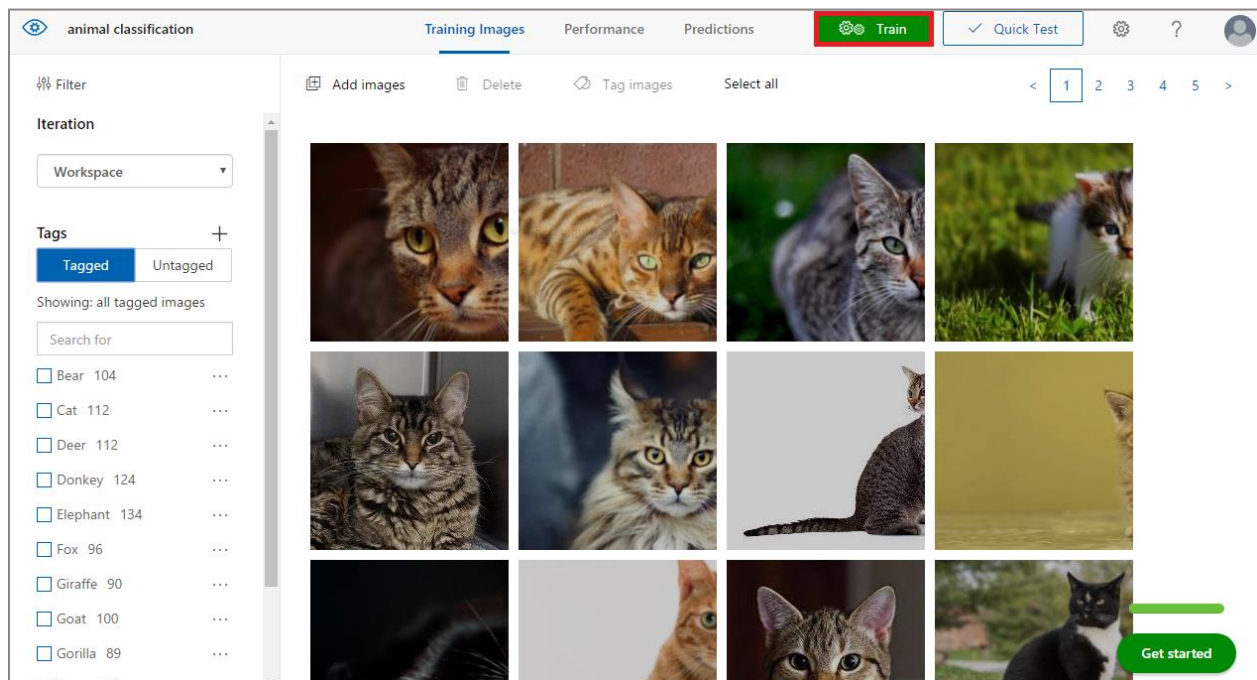
Click on **Done** button.



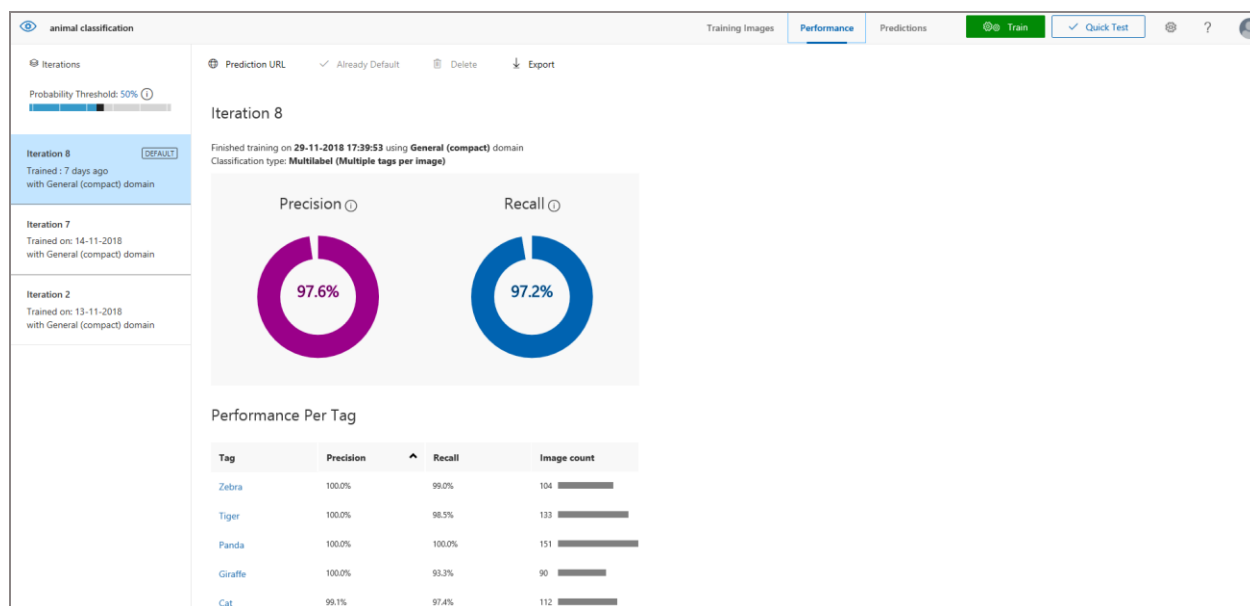
Continue this process to add all the images of the dataset. Once all the images are uploaded your project page will look like shown in the image.



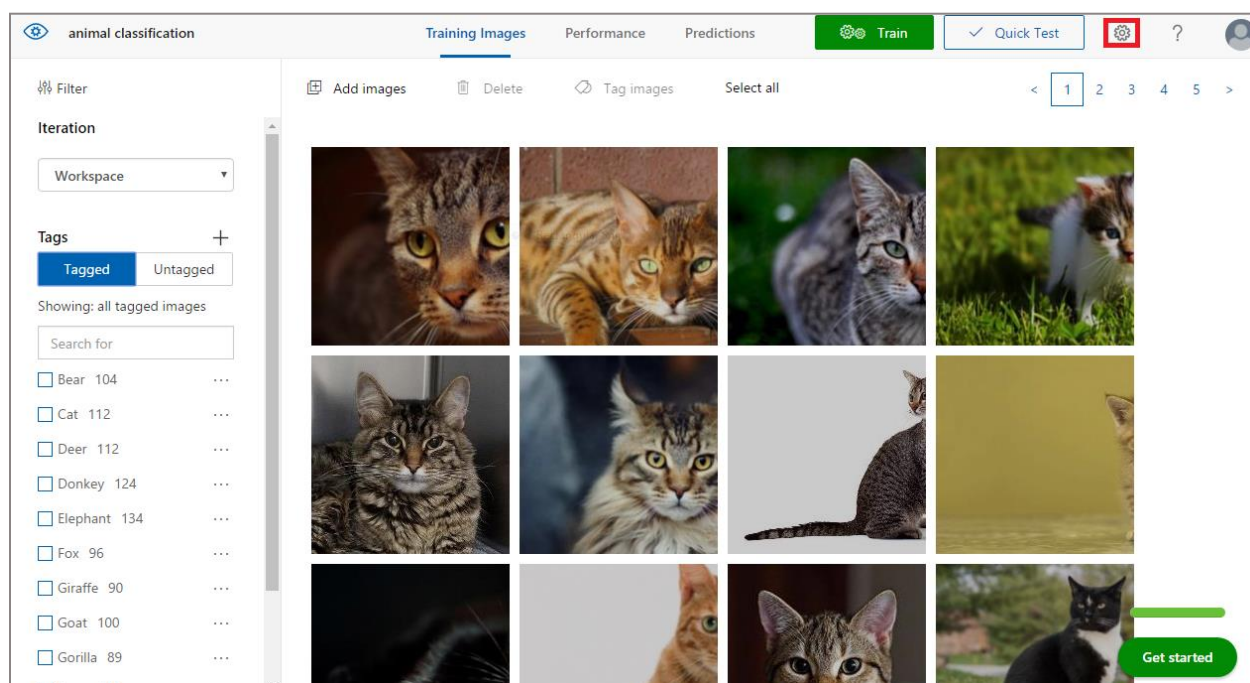
Click on **Train** button.



The model will now be trained and can be viewed in **Performance** page.



There will be 10 iterations available for one free account. Your first iteration will be trained in the **General Domain**. To change the domain, click on the settings icon shown in image.



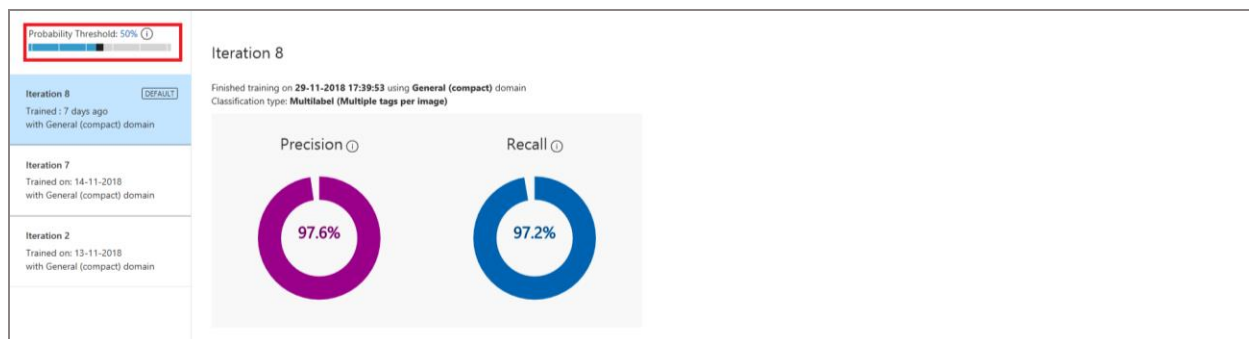
As we have to integrate the model with web application, we need to export the model. We have to change the domain to General (Compact) in settings.

The settings page will open.

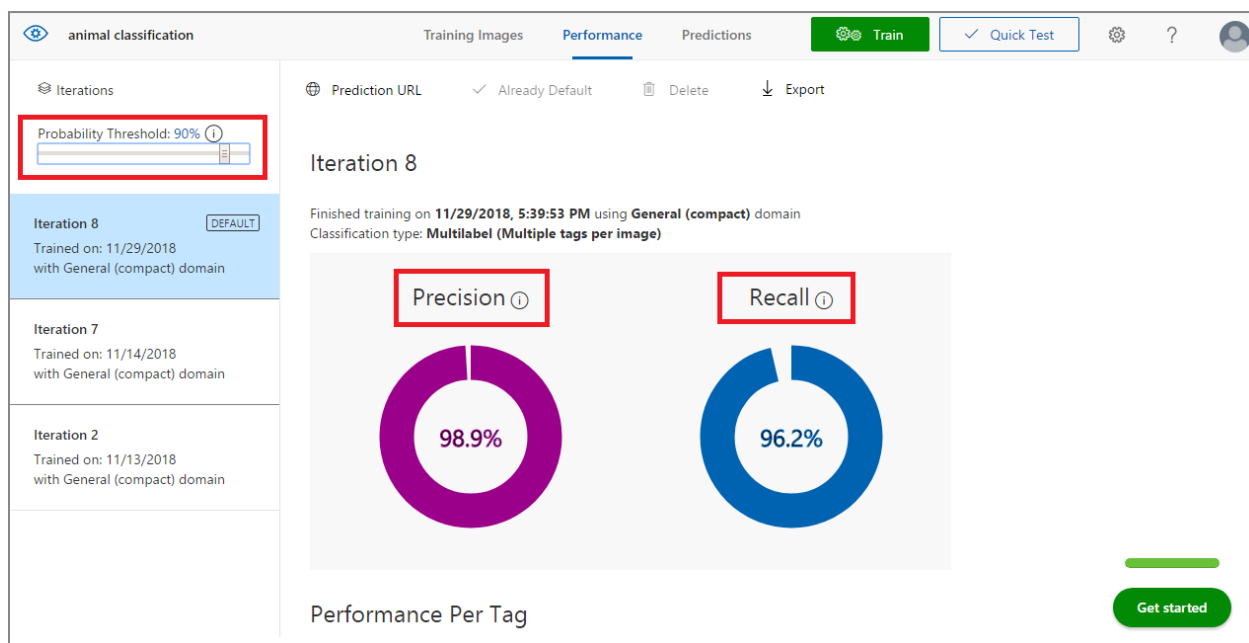
Here, go to Domains and change the domain to **General (Compact)**.

Go back to the performance page and then change the **Probability Threshold** from **50%** to **90%** to get better results.





Click on **Train** to train the model again. Once the model is trained you will get the **Precision** and **Recall** values for the model.



You can even view the performance for each tag.

<b>Iteration 8</b> <small>Trained : 7 days ago with General (compact) domain</small>	<b>Performance Per Tag</b>			
<b>Iteration 7</b> <small>Trained on: 14-11-2018 with General (compact) domain</small>	<b>Tag</b>	<b>Precision</b>	<b>Recall</b>	<b>Image count</b>
<b>Iteration 2</b> <small>Trained on: 13-11-2018 with General (compact) domain</small>	Zebra	100.0%	99.0%	104
	Tiger	100.0%	98.5%	133
	Panda	100.0%	100.0%	151
	Giraffe	100.0%	93.3%	90
	Cat	99.1%	97.4%	112
	Fox	99.0%	100.0%	96
	Gorilla	98.9%	97.8%	89
	Bear	98.1%	96.1%	104
	Elephant	97.9%	100.0%	134
	Goat	97.8%	90.0%	100
	Lion	97.8%	95.1%	130
	Deer	97.3%	97.3%	112
	Monkey	96.2%	99.0%	94
	Horse	92.5%	92.6%	80
	Donkey	90.3%	97.6%	124

If the Precision and Recall values are above **95%**, you need not train the model again. If it is less than **95%**, then you have to retrain the model.

You can also view the performance for each tag, where you can view **Precision**, **Recall** and **Image count** for each tag. If the values Precision and Recall are above **95%** you need not change otherwise you have to improve your dataset. The Image count for every tag must be uniform.

If all the values are satisfied, the Model is now Ready!!

## Step #3 | Export the Model

The model is now ready to export. To export the model, make the particular iteration as **default**, by clicking on **Make Default**.

animal classification Training Images Performance Predictions Train Quick Test

Iterations

Probability Threshold: 90%

Iteration 8  
Trained on: 11/29/2018  
with General (compact) domain

Iteration 7  
Trained on: 11/14/2018  
with General (compact) domain

Iteration 2  
Trained on: 11/13/2018  
with General (compact) domain

Prediction URL **Make default** Delete Export

### Performance Per Tag

Tag	Precision	Recall	Image count
Zebra	100.0%	99.0%	104
Tiger	100.0%	98.5%	133
Panda	100.0%	100.0%	151
Gorilla	100.0%	95.5%	89
Giraffe	100.0%	92.2%	90
Fox	100.0%	100.0%	96
Elephant	99.3%	100.0%	134
Lion	99.3%	96.1%	130
Deer	99.1%	94.6%	112

Get started

Once the iteration is marked as default you will see it as **Already Default**.

animal classification Training Images Performance Predictions Train Quick Test

Iterations

Probability Threshold: 90%

Iteration 8  
Trained on: 11/29/2018  
with General (compact) domain

Iteration 7  
Trained on: 11/14/2018  
with General (compact) domain

Iteration 2  
Trained on: 11/13/2018  
with General (compact) domain

Prediction URL **Already Default** Delete Export

### Iteration 8

Finished training on 11/29/2018, 5:39:53 PM using General (compact) domain  
Classification type: Multilabel (Multiple tags per image)

Precision ①

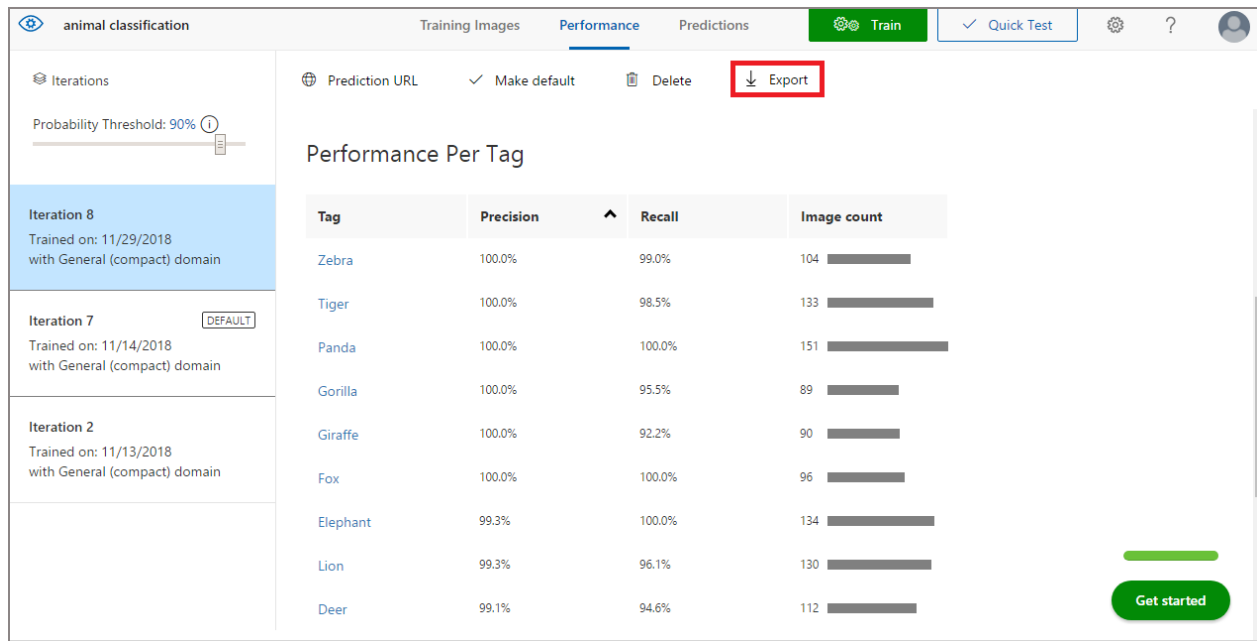
98.9%

Recall ①

96.2%

### Performance Per Tag

Get started



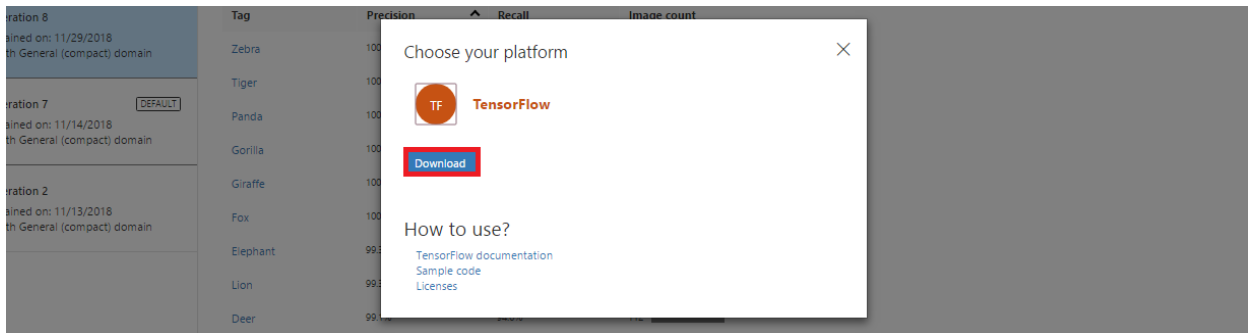
You can now view various platforms, to export like,

- Android (Tensorflow)
- iOS (CoreML)
- ONMX (Windows)
- Docker file for Azure to Edge, Azure functions, AzureML

We need Tensorflow model so, click on **Tensorflow**.



The following pop up will be displayed. Click on **Download** button.



The exported model is now downloaded. You can view the model in your local file system in downloads folder. Unzip to use it.

## Step #4 | Integrating the Model with Web Application

Now we have the model ready with us. We have to integrate the model with the UI for a proper web application to work. For integration we have to follow few steps.

In the main folder, we will have folders such as, templates and static: Files like model.pb, labels.txt, requirements.txt and app.py.

- **Model.pb** and **labels.txt** is the model file which we have exported
- Templates folder consists of all the UI code and **static** folder consists of style sheets
- **Requirements.txt** is the file which has all the dependencies that we have to install

Go to the project directory and open command prompt. For all the dependencies to install just provide the command as, **pip install -r requirements.txt**

```
Microsoft Windows [Version 10.0.17134.407]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\k sujan paul\Desktop\animal-classification>pip install -r requirements.txt_
```

Click on **ENTER**.

```
89kB)
100% |████████████████████| 890kB 442kB/s
Collecting hyperlink==18.0.0 (from -r requirements.txt (line 21))
  Downloading https://files.pythonhosted.org/packages/a7/b6/84d0c863ff81e8e7de87cff3bd8fd8f1054c227ce09af1b
e-any.whl
Collecting idna==2.7 (from -r requirements.txt (line 22))
  Downloading https://files.pythonhosted.org/packages/4b/2a/0276479a4b3caeb8a8c1af2f8e4355746a97fab05a372e4
l (58kB)
100% |████████████████████| 61kB 1.4MB/s
Collecting incremental==17.5.0 (from -r requirements.txt (line 23))
  Downloading https://files.pythonhosted.org/packages/f5/1d/c98a587dc06e107115cf4a58b49de20b19222c83d75335a
one-any.whl
Collecting isodate==0.6.0 (from -r requirements.txt (line 24))
  Using cached https://files.pythonhosted.org/packages/9b/9f/b36f7774ff5ea8e428fdcf4bb332c39ee5b9362ddd3d4
any.whl
Collecting Keras==2.1.4 (from -r requirements.txt (line 25))
  Downloading https://files.pythonhosted.org/packages/86/45/a273fe3f8fe931a11da34fba1cb74013cfc70dcf93e5d8c
.whl (322kB)
100% |████████████████████| 327kB 489kB/s
Collecting keyring==13.2.1 (from -r requirements.txt (line 26))
  Downloading https://files.pythonhosted.org/packages/88/a8/341fa4686e98bf10289eb4eaea89e8176b93c1e38de52e3
any.whl
Collecting lxml==4.2.3 (from -r requirements.txt (line 27))
  Downloading https://files.pythonhosted.org/packages/3c/06/d8db111411e4ad0677d72985af1d45ead6f1d0e8d09d80b
d64.whl (3.6MB)
100% |████████████████████| 3.6MB 201kB/s
```

All the dependencies are installed successfully.

**app.py** is the file which contains all the integration code. It is basically a python server which is written using python flask. We have to run this in order to operate the web application. In the app.py, we will initialize the model.pb and labels.txt files as follows,

**#initializing the model and labels**

**filename = "./model.pb"**

**labels\_filename = "./labels.txt"**

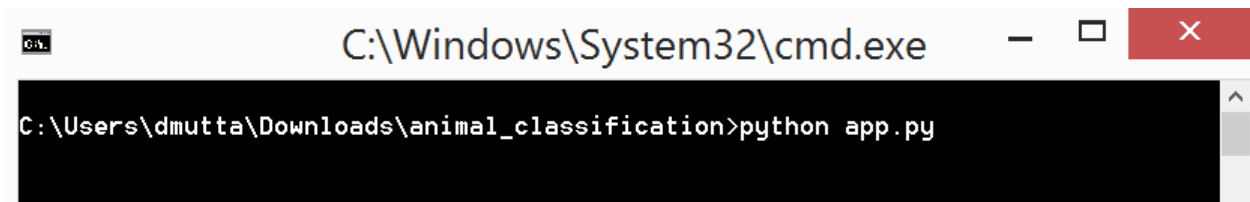
This is present in line number 22

For integrating the only thing we have to do is replace the model.pb and labels.txt present in the folder with the model.pb and labels.txt files that are obtained on exporting your own model.

So, now the integration is done and you can run your application.

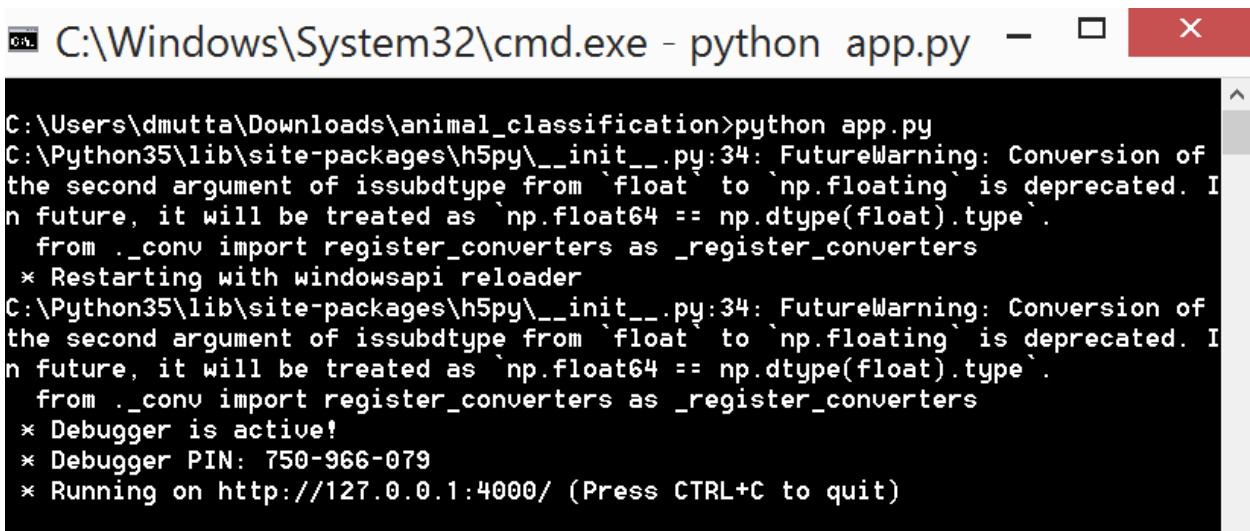
## Step #5 | Running the Web Application

Go to **Command Prompt**, provide the command as,  
**python3 app.py**



```
C:\Windows\System32\cmd.exe  
C:\Users\dmutta\Downloads\animal_classification>python app.py
```

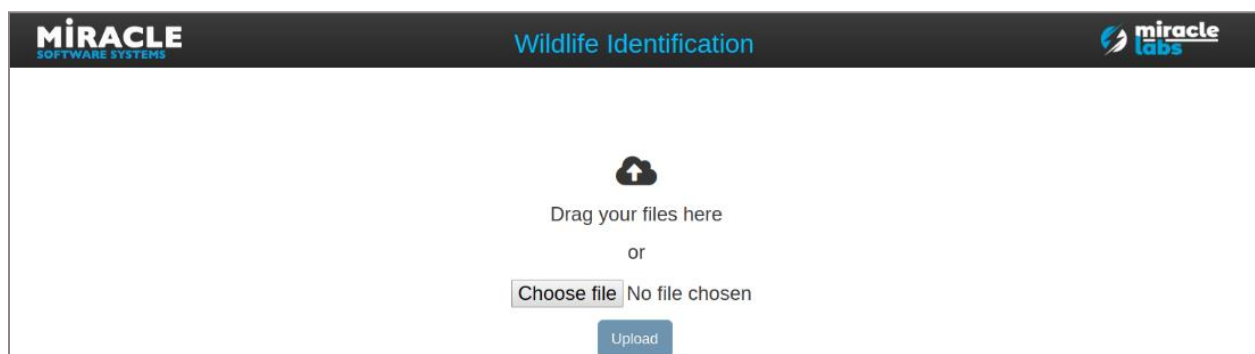
After giving the command click on **ENTER**.



```
C:\Windows\System32\cmd.exe - python app.py  
C:\Users\dmutta\Downloads\animal_classification>python app.py  
C:\Python35\lib\site-packages\h5py\__init__.py:34: FutureWarning: Conversion of  
the second argument of issubdtype from `float` to `np.floating` is deprecated. In  
future, it will be treated as `np.float64 == np.dtype(float).type`.  
  from ._conv import register_converters as _register_converters  
* Restarting with windowsapi reloader  
C:\Python35\lib\site-packages\h5py\__init__.py:34: FutureWarning: Conversion of  
the second argument of issubdtype from `float` to `np.floating` is deprecated. In  
future, it will be treated as `np.float64 == np.dtype(float).type`.  
  from ._conv import register_converters as _register_converters  
* Debugger is active!  
* Debugger PIN: 750-966-079  
* Running on http://127.0.0.1:4000/ (Press CTRL+C to quit)
```

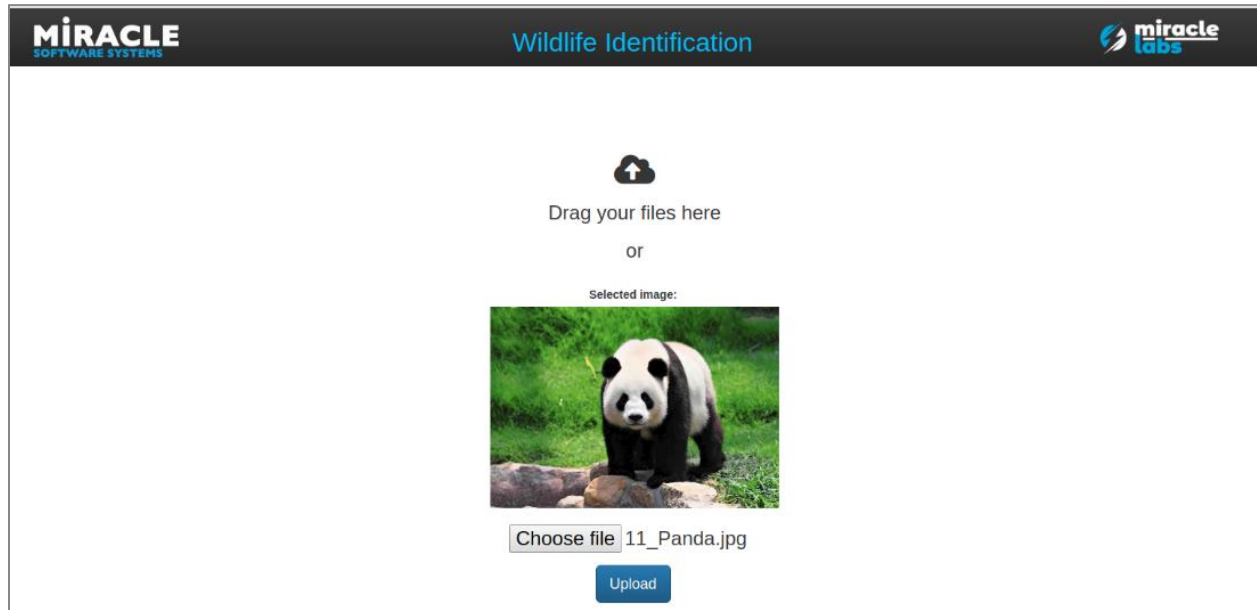
The server is now running on <https://127.0.0.1:4000/>

Now open the link in any browser and you can see your web application. The basic web application will look as shown below,

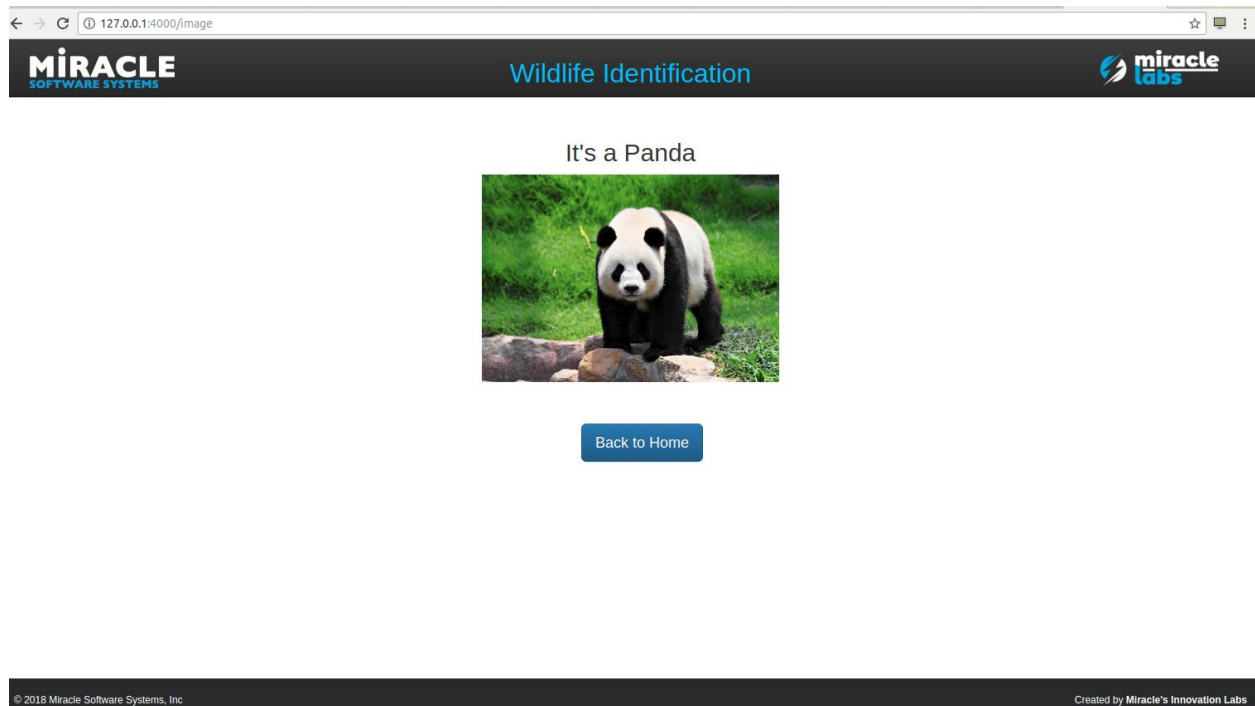




Click on the button **Choose file** to select any image of an animal.



After giving the image of any animal, click on **Upload** button and you can now view the result in the **Result Page** as Panda.



If you want to try with another image, click on **Back to Home** and repeat the same process.

Hurrah!! With this lab you were able to build a model with **Azure Custom Vision** and integrate with Web Application.

For any questions regarding the lab please feel free to reach out to [innovation@miraclesoft.com](mailto:innovation@miraclesoft.com). We hope you enjoyed creating Machine Learning models with us.