

Assignment 1: Image Classification:

This machine learning uses the Custom Vision API trained to perform image classification where it can differentiate between pictures with the designated tag labels: building, forest, glacier, mountain, sea, street. This is a real-world example using an Image Classification Dataset obtained from Intel where machine learning is used to appropriately determine whether an image can be described as a building, forest, glacier, mountain, sea, or street by observing certain features. Using those features, the model is trained using machine learning by observing those features from the training data. This dataset contains 25,000 images but only a subset of 136 images were used to train the model.

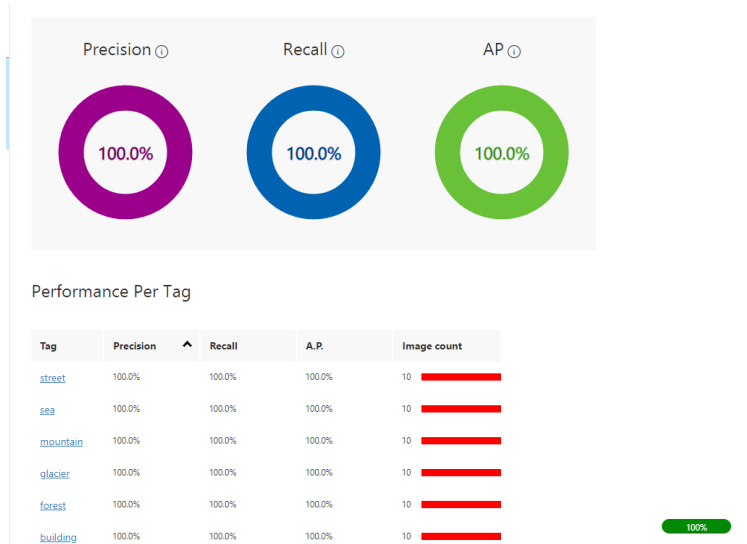
The model yielded great results on its first iteration. 100% precision, 100% recall, and 100% AP was achieved across all tags. However, >90% accuracy was achieved for all tags except for mountain and street which yielded 60-70% accuracy. This was a result of some mountains being recognized as glaciers with a significant probability. This was also the case with street images where streets were recognized as buildings with a high probability. Therefore, more images were analyzed from the public dataset provided by Intel. I gathered more images for mountains and glaciers, and streets and buildings respectively. I noticed there were some similarities in color so more images for mountains were obtained where there was some snow or a white and blue colorations. For glaciers, I gathered more images that conveyed more information of the setting so that the environmental surroundings could convey more information about where mountains and glaciers reside. Similarly, more images were gathered for both streets and buildings where images were not only collected in different angles, but we could see more of the surroundings. For streets, cars, roadways, traffic signs, and even people could be seen in some of the images gathered which would not be present for buildings. This would give additional information so that the model can infer from the test images whether the image is a street or building based on environmental features.

Unfortunately, there were issues finetuning the model. Because I only aimed for obtaining more data for specific tags, it led to a distribution that was not uniform which is not ideal when evaluating the data. Furthermore, the features gathered were not ideal for differentiating between mountains and glaciers even though the final iteration showed there were improvements made for distinguishing between buildings and streets. This is likely because there are more distinct characteristics for both streets and buildings whereas glaciers can largely resemble mountains in many instances. Keep in mind that the data gathered is a very small subset of the data Intel gathered which is likely necessary to produce accurate results.

Reference:

<https://www.kaggle.com/datasets/puneet6060/intel-image-classification?resource=download>

Model Accuracy:



Building:

Image 1	Correct	99.9	Image 6	Incorrect	25.3
Image 2	Correct	99.9	Image 7	Correct	99.9
Image 3	Correct	98.1	Image 8	Correct	99.1
Image 4	Correct	99.9	Image 9	Correct	99.8
Image 5	Correct	96.6	Image 10	Correct	98.1

Total Correctness: 9/10 or 90%

Percentage Correctness: 91.66%

Forest:

Image 1	Correct	95.9	Image 6	Incorrect	34.2
Image 2	Correct	97.8	Image 7	Correct	98.2
Image 3	Correct	98.4	Image 8	Correct	99.8
Image 4	Correct	94.3	Image 9	Correct	99.8
Image 5	Correct	96.3	Image 10	Correct	99.9

Total Correctness: 9/10 or 90%

Percentage Correctness: 91.46%

Glacier:

Image 1	Correct	99.8	Image 6	Correct	98.8
Image 2	Correct	97.8	Image 7	Correct	98.8
Image 3	Correct	99.9	Image 8	Correct	99.8
Image 4	Correct	99.2	Image 9	Correct	99.8
Image 5	Correct	99.9	Image 10	Correct	99.9

Total Correctness: 10/10 or 100%

Percentage Correctness: 99.36%

Mountain:

Image 1	Incorrect	44.5	Image 6	Incorrect	78
Image 2	Incorrect	61.2	Image 7	Incorrect	25.8
Image 3	Incorrect	63.3	Image 8	Correct	99.8
Image 4	Incorrect	84.2	Image 9	Correct	95.6
Image 5	Incorrect	0.1	Image 10	Incorrect	59.6

Total Correctness: 2/10 or 20%

Percentage Correctness: 61.21%

Sea:

Image 1	Correct	99.9	Image 6	Correct	96.7
Image 2	Correct	99.9	Image 7	Correct	99.5
Image 3	Correct	99.9	Image 8	Correct	99.3
Image 4	Correct	99.8	Image 9	Correct	99.9
Image 5	Correct	98	Image 10	Correct	99.9

Total Correctness: 10/10 or 100%

Percentage Correctness: 99.28%

Street:

Image 1	Incorrect	74.2	Image 6	Correct	99.7
Image 2	Correct	99	Image 7	Correct	99.8
Image 3	Correct	93.5	Image 8	Correct	99.3
Image 4	Incorrect	7	Image 9	Incorrect	7.7
Image 5	Incorrect	99	Image 10	Incorrect	13.7

Total Correctness: 5/10 or 50%

Percentage Correctness: 69.29%