In [4]:

```
import tensorflow as tf
import numpy as np
import os
```

Testing with 0's

In [1]:

```
import time

st = time.time()
```

In [3]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 0
Total images: 2370
```

In [4]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 342ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 17ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 25ms/step
1/1 [==============================] - 0s 32ms/step
```

In [5]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

Ground Truth: 0

Classified Values:
[0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 4, 0, 0, 0, 0, 0, 1, 0, 0, 4, 4, 0, 4,
4, 0, 4, 0, 4, 4, 1, 0, 1, 0, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 6, 0, 0, 4, 0, 0, 0, 4, 0, 1, 0, 4, 0, 0, 4, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 6, 0, 0, 0, 0, 0, 4, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 1, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 4, 0, 0, 0, 4, 0, 0, 0, 0, 0, 1,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 3, 0, 6, 0, 4, 0, 2, 6, 0, 0, 2, 0, 0, 0, 0, 1, 0, 6,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 7, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0,
0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 6, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2,
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0, 6, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 6, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0,

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0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 1, 0, 0, 3, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 6, 0, 0, 0, 6, 1, 0, 0, 0, 6, 1,
0, 6, 0, 2, 7, 0, 6, 6, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 5, 0, 5, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 6, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
5, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 4, 0, 4, 4, 0, 0, 0,
4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 4, 0, 0, 0, 0, 0, 1, 0, 0, 4, 4, 0, 0, 4, 4, 0, 4, 0, 0, 4, 0, 0,
1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 6, 0,
0, 0, 4, 4, 0, 0, 4, 4, 0, 0, 4, 0, 0, 4, 4, 0, 0, 4]
```

In [6]:

```python
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 93.97%
```

In [7]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 315.91197299957275
```

Testing with 1's

In [8]:

```
import time

st = time.time()
```

In [10]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 1
Total images: 2382
```

In [11]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 63ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 16ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 55ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 40ms/step
```

In [12]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

Ground Truth: 1

Classified Values:
[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 4, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
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1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 4, 1, 1, 1, 1, 1, 1, 1,
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```

In [13]:

```
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 99.29%
```

In [14]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 253.0953562259674
```

Testing with 2's

In [15]:

```
import time

st = time.time()
```

In [17]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 2
Total images: 2384
```

In [18]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 64ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 16ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 16ms/step
1/1 [==============================] - 0s 24ms/step
```

In [19]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

Ground Truth: 2

Classified Values:
[2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
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6, 2, 2, 6, 2, 2, 4, 0, 6, 2, 2, 2, 2, 2, 2, 2, 3, 6, 1, 2, 2, 6, 6, 2,
2, 2, 6, 2, 6, 2, 1, 2, 6, 2, 0, 2, 2, 2, 2, 2, 6, 4, 4, 6, 6, 6, 2, 6,
2, 2, 1, 2, 2, 4, 2, 2]
```

In [20]:

```
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 96.22%
```

In [21]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 268.7023415565491
```

Testing with 3's

In [28]:

```
import time

st = time.time()
```

In [29]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 3
Total images: 2288
```

In [30]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 72ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
```

In [31]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

```
Ground Truth: 3

Classified Values:
[3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3,
3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 0, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 3, 3,
3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 3, 3,
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3, 3, 3, 6, 6, 3, 4, 3, 3, 3, 3, 7, 3, 6, 3, 3, 3, 3, 7, 3, 3, 3, 3, 3,
2, 3, 3, 3, 3, 7, 4, 3]
```

In [32]:

```
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 95.10%
```

In [33]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 211.69867873191833
```

Testing with 4's

In [43]:

```
import time

st = time.time()
```

In [44]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 4
Total images: 2202
```

In [45]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 72ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 32ms/step
```

In [46]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

```
Ground Truth: 4

Classified Values:
[4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 0, 4, 4,
0, 1, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
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4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4]
```

In [47]:

```
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 97.59%
```

In [48]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 227.73187136650085
```

Testing with 5's

In [49]:

```
import time

st = time.time()
```

In [50]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 5
Total images: 2160
```

In [51]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 80ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 53ms/step
1/1 [==============================] - 0s 65ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 47ms/step
```

In [52]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

Ground Truth: 5

Classified Values:
[5, 5, 5, 5, 3, 5, 5, 5, 6, 1, 4, 5, 5, 3, 7, 3, 3, 5, 0, 3, 5, 5, 0, 1,
5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,
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5, 6, 6, 5, 6, 6, 6, 5, 5, 5, 5, 5, 5, 5, 6, 6, 5, 6, 5, 5, 5, 6, 6, 5]
```

In [53]:

```
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 93.33%
```

In [54]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 226.36950182914734
```

Testing with 6's

In [55]:

```
import time

st = time.time()
```

In [56]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 6
Total images: 2169
```

In [57]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 73ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 64ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 54ms/step
1/1 [==============================] - 0s 55ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 63ms/step
1/1 [==============================] - 0s 48ms/step
```

In [58]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

Ground Truth: 6

Classified Values:
[6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
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6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
6, 2, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6,
6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 4, 6, 6, 6, 6, 6, 6, 6, 6, 6, 4, 6, 6, 6,
6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 0, 4, 6, 6, 6, 6, 6, 6, 6, 6, 6,
6, 6, 6, 6, 6, 6, 6, 6, 6]
```

In [59]:

```python
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 97.33%
```

In [60]:

```python
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 214.33196139335632
```

Testing with 7's

In [5]:

```
import time

st = time.time()
```

In [6]:

```
model = tf.keras.models.load_model("C:/Users/justi/OneDrive/Desktop/Justin/School/Colleg

image_folder = "C:/Users/justi/OneDrive/Desktop/Justin/School/College/S6/S6_Mini_Project

# Get a list of all the images in the folder
image_list = os.listdir(image_folder)

gnd_truth = int(input("Enter Ground Truth: "))

print(f"Total images: {len(image_list)}")
```

```
Enter Ground Truth: 7
Total images: 2180
```

In [7]:

```
pred = []

# Loop through all the images in the folder and classify them
for image_name in image_list:

    test_image = tf.keras.preprocessing.image.load_img(os.path.join(image_folder, image_
    test_image = np.expand_dims(test_image, axis=0) # Expand the dimensions of the image

    result = model.predict(test_image)

    predicted_value = np.argmax(result[0])

    pred.append(predicted_value)
```

```
1/1 [==============================] - 0s 172ms/step
1/1 [==============================] - 0s 55ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 58ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 16ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 40ms/step
```

In [8]:

```
print(f"Ground Truth: {gnd_truth}\n")
print(f"Classified Values:\n{pred}")
```

```
Ground Truth: 7

Classified Values:
[7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 1, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
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```

In [9]:

```
# Accuracy calculation
true_labels = [gnd_truth] * len(image_list)

correct_predictions = sum(pred[i] == true_labels[i] for i in range(len(image_list)))

accuracy = (correct_predictions / len(true_labels)) * 100

print(f"Accuracy: {accuracy:.2f}%")
```

```
Accuracy: 97.57%
```

In [10]:

```
print(f"Total time taken (in seconds): {time.time() - st}")
```

```
Total time taken (in seconds): 188.38701486587524
```

End of test