E-waste classification Using Machine Learning

Model: EfficientNetV2B2, ResNet50

```
import tensorflow as tf
from tensorflow.keras import layers, models, optimizers, callbacks
from tensorflow.keras.models import Sequential, load_model
from tensorflow.keras.applications import EfficientNetV2B0
from tensorflow.keras.applications.efficientnet import
preprocess_input
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix, classification_report
from tensorflow.keras.applications import EfficientNetV2B2,
MobileNetV2, ResNet50
import os
from PIL import Image
```

Dataset Analysis

```
dataset_path = r"C:\Users\Kanishk Pareek\Downloads\archive\modified-
dataset"
train_path = r"C:\Users\Kanishk Pareek\Downloads\archive\modified-
dataset\train"
test_path = r"C:\Users\Kanishk Pareek\Downloads\archive\modified-
dataset\test"
val_path = r"C:\Users\Kanishk Pareek\Downloads\archive\modified-
dataset\val"

# Retrieve the names of all folders in the Train dataset
garbage_types = os.listdir(train_path)
for garbage_type in garbage_types:
    folder_path = os.path.join(train_path, garbage_type)
    if os.path.isdir(folder_path):
        image_files = [f for f in os.listdir(folder_path) if
f.endswith(('jpg', 'jpeg'))]
        # For displaying the count of images in the current folder
        num_images = len(image_files)
        print(f"{garbage_type} folder contains {num_images} images.")

print("-" * 40)

# Retrieve the names of all folders in the Test dataset
garbage_types = os.listdir(test_path)
for garbage_type in garbage_types:
    folder_path = os.path.join(test_path, garbage_type)
    if os.path.isdir(folder_path):
```

```
        image_files = [f for f in os.listdir(folder_path) if
f.endswith(('jpg', 'jpeg'))]
        # For displaying the count of images in the current folder
        num_images = len(image_files)
        print(f"{garbage_type} folder contains {num_images} images.")

print("-" * 40)

# Retrieve the names of all folders in the val dataset
garbage_types = os.listdir(val_path)
for garbage_type in garbage_types:
    folder_path = os.path.join(val_path, garbage_type)
    if os.path.isdir(folder_path):
        image_files = [f for f in os.listdir(folder_path) if
f.endswith(('jpg', 'jpeg'))]
        # For displaying the count of images in the current folder
        num_images = len(image_files)
        print(f"{garbage_type} folder contains {num_images} images.")
```

```
Battery folder contains 240 images.
Keyboard folder contains 240 images.
Microwave folder contains 240 images.
Mobile folder contains 240 images.
Mouse folder contains 240 images.
PCB folder contains 240 images.
Player folder contains 240 images.
Printer folder contains 240 images.
Television folder contains 240 images.
Washing Machine folder contains 240 images.
----------------------------------------
Battery folder contains 30 images.
Keyboard folder contains 30 images.
Microwave folder contains 30 images.
Mobile folder contains 30 images.
Mouse folder contains 30 images.
PCB folder contains 30 images.
Player folder contains 30 images.
Printer folder contains 30 images.
Television folder contains 30 images.
Washing Machine folder contains 30 images.
----------------------------------------
Battery folder contains 30 images.
Keyboard folder contains 30 images.
Microwave folder contains 30 images.
Mobile folder contains 30 images.
Mouse folder contains 30 images.
PCB folder contains 30 images.
Player folder contains 30 images.
Printer folder contains 30 images.
```

```
Television folder contains 30 images.
Washing Machine folder contains 30 images.
```

```
datatrain=
tf.keras.utils.image_dataset_from_directory(train_path,shuffle = True,
image_size = (128,128), batch_size = 32, validation_split= False)
```

```
Found 2400 files belonging to 10 classes.
```

```
datatest=tf.keras.utils.image_dataset_from_directory(test_path,shuffle
= False, image_size = (128,128), batch_size = 32, validation_split=
False)
```

```
Found 300 files belonging to 10 classes.
```

```
datavalid =
tf.keras.utils.image_dataset_from_directory(val_path,shuffle = True,
image_size = (128,128), batch_size = 32, validation_split= False)
```

```
Found 300 files belonging to 10 classes.
```

```
# Retrieve all folders (categories) in the train dataset
garbage_types = os.listdir(train_path)

# Displaying 3 sample images from each class
for garbage_type in garbage_types:
    folder_path = os.path.join(train_path, garbage_type)
    if os.path.isdir(folder_path):
        image_files = [f for f in os.listdir(folder_path) if
f.endswith(('jpg', 'jpeg', 'png'))]
        num_images = len(image_files)
        print(f"{garbage_type} folder contains {num_images} images.")

        # Display up to 3 images from each class
        sample_images = image_files[:3]

        plt.figure(figsize=(12, 4))
        for i, image_file in enumerate(sample_images):
            img_path = os.path.join(folder_path, image_file)
            img = Image.open(img_path)
            plt.subplot(1, 3, i + 1)
            plt.imshow(img)
            plt.title(garbage_type)
            plt.axis('off')
        plt.suptitle(f"Sample Images from '{garbage_type}' Class",
fontsize=14)
        plt.show()
```

```
Battery folder contains 240 images.
```

Sample Images from 'Battery' Class


```
Keyboard folder contains 240 images.
```

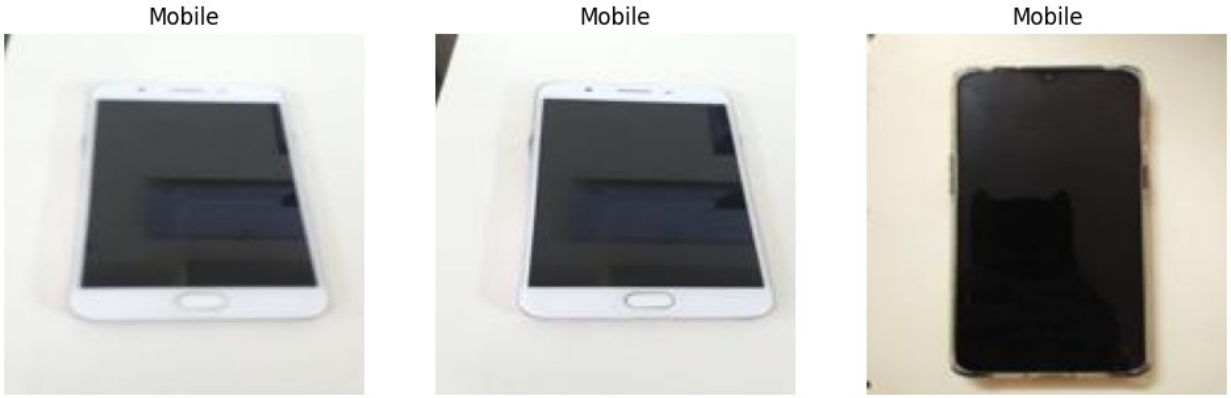
Sample Images from 'Keyboard' Class


```
Microwave folder contains 240 images.
```

Sample Images from 'Microwave' Class


```
Mobile folder contains 240 images.
```

Sample Images from 'Mobile' Class




```
Mouse folder contains 240 images.
```

Sample Images from 'Mouse' Class


```
PCB folder contains 240 images.
```

Sample Images from 'PCB' Class


```
Player folder contains 240 images.
```

Sample Images from 'Player' Class


```
Printer folder contains 240 images.
```

Sample Images from 'Printer' Class


```
Television folder contains 240 images.
```

Sample Images from 'Television' Class


```
Washing Machine folder contains 240 images.
```

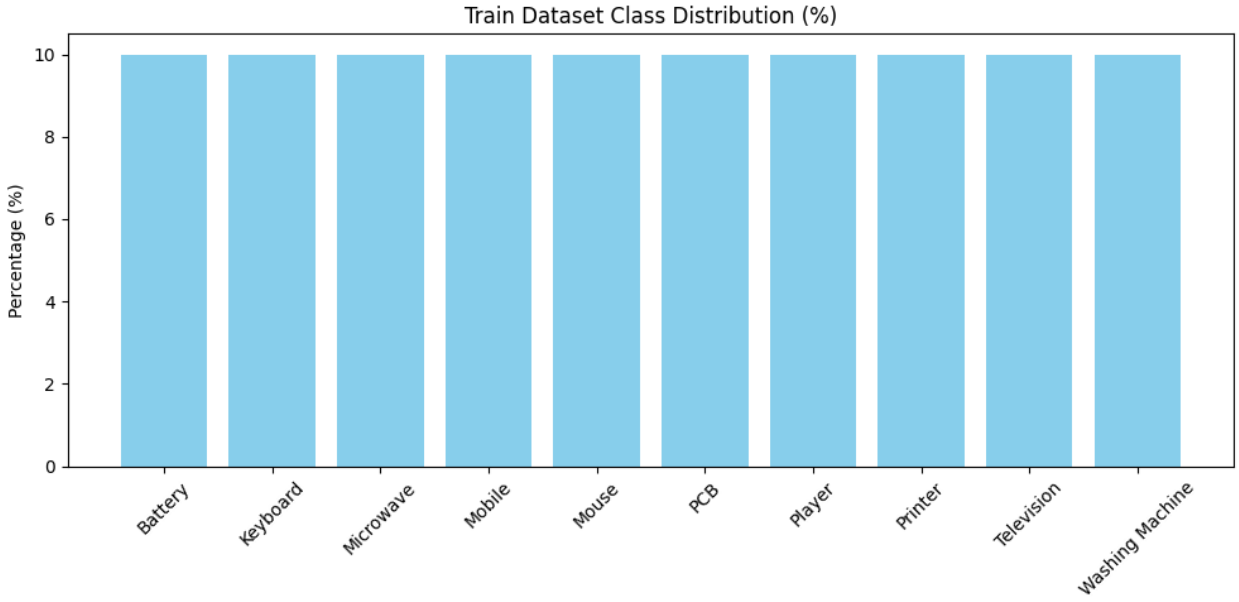

```python
import os

def get_class_distribution_percent(data_path):
    """
    Calculates the percentage distribution of image classes in a given dataset split.

    Args:
        data_path (str): Path to dataset split (e.g., train_path, test_path, val_path)

    Returns:
        dict: {class_name: percentage of total images (rounded to 2 decimals)}
    """
    class_counts = {}
    total_images = 0

    # Loop through each class folder
    for class_name in os.listdir(data_path):
        folder_path = os.path.join(data_path, class_name)
        if os.path.isdir(folder_path):
            image_files = [f for f in os.listdir(folder_path) if f.lower().endswith(('jpg', 'jpeg'))]
            count = len(image_files)
            class_counts[class_name] = count
            total_images += count

    # Convert counts to percentages
    class_percentages = {
        class_name: round((count / total_images) * 100, 2)
        for class_name, count in class_counts.items()
    }

    return class_percentages
```

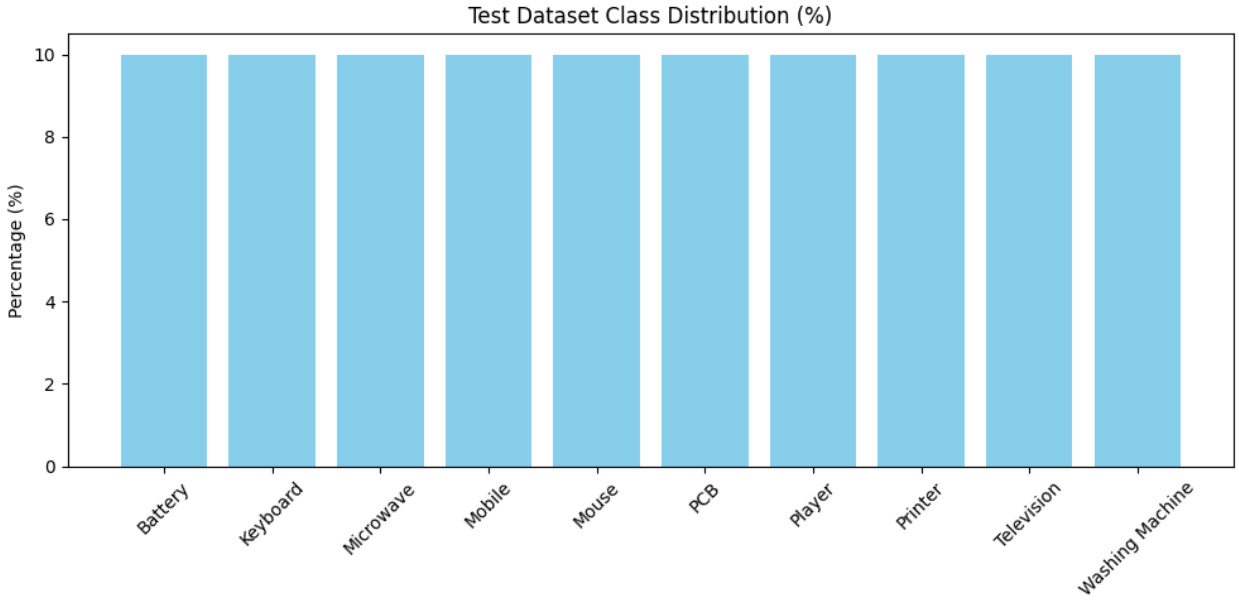
```
train_percent = get_class_distribution_percent(train_path)
test_percent = get_class_distribution_percent(test_path)
val_percent = get_class_distribution_percent(val_path)

print("Train Class Distribution (%):")
print(train_percent)
print("-" * 40)

print("Test Class Distribution (%):")
print(test_percent)
print("-" * 40)

print("Validation Class Distribution (%):")
print(val_percent)
```

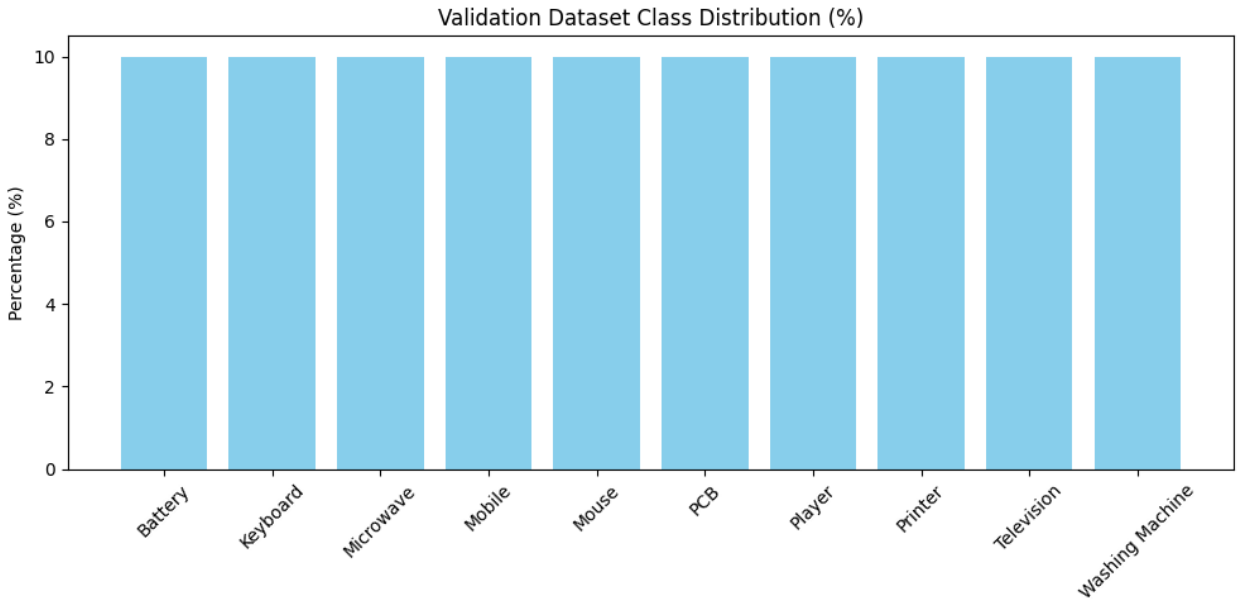
```
Train Class Distribution (%):
{'Battery': 10.0, 'Keyboard': 10.0, 'Microwave': 10.0, 'Mobile': 10.0,
'Mouse': 10.0, 'PCB': 10.0, 'Player': 10.0, 'Printer': 10.0,
'Television': 10.0, 'Washing Machine': 10.0}
----------------------------------------
Test Class Distribution (%):
{'Battery': 10.0, 'Keyboard': 10.0, 'Microwave': 10.0, 'Mobile': 10.0,
'Mouse': 10.0, 'PCB': 10.0, 'Player': 10.0, 'Printer': 10.0,
'Television': 10.0, 'Washing Machine': 10.0}
----------------------------------------
Validation Class Distribution (%):
{'Battery': 10.0, 'Keyboard': 10.0, 'Microwave': 10.0, 'Mobile': 10.0,
'Mouse': 10.0, 'PCB': 10.0, 'Player': 10.0, 'Printer': 10.0,
'Television': 10.0, 'Washing Machine': 10.0}
```

```
def plot_class_distribution(percent_dict, title="Class Distribution
(%)"):
    """
    Plots a bar chart of class distribution percentages.

    Args:
        percent_dict (dict): class_name -> percentage
        title (str): Title of the plot
    """
    labels = list(percent_dict.keys())
    percentages = list(percent_dict.values())

    plt.figure(figsize=(10, 5))
    plt.bar(labels, percentages, color='skyblue')
    plt.ylabel("Percentage (%)")
    plt.title(title)
    plt.xticks(rotation=45)
    plt.tight_layout()
    plt.show()
```

```
plot_class_distribution(train_percent, "Train Dataset Class
Distribution (%)")
plot_class_distribution(test_percent, "Test Dataset Class Distribution
(%)")
plot_class_distribution(val_percent, "Validation Dataset Class
Distribution (%)")
```







Data Augmetation

```
data_augmentation = tf.keras.Sequential([
    tf.keras.layers.RandomFlip("horizontal"),
    tf.keras.layers.RandomRotation(0.1),
    tf.keras.layers.RandomZoom(0.1),
])
```

Model Training(EfficientNetV2B2)

```
base_model = tf.keras.applications.EfficientNetV2B2(
    input_shape=(128, 128, 3),
    include_top=False,
    weights='imagenet'
)
base_model.trainable = True
for layer in base_model.layers[:100]:
    layer.trainable = False

model = tf.keras.Sequential([
    tf.keras.layers.Input(shape=(128, 128, 3)),
    data_augmentation,
    base_model,
    tf.keras.layers.GlobalAveragePooling2D(),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(10, activation='softmax')
])
model.compile(optimizer=tf.keras.optimizers.Adam(learning_rate=0.0001)
,loss = tf.keras.losses.SparseCategoricalCrossentropy(),
metrics=['Accuracy'])
```

```
# Define an EarlyStopping callback to stop training when validation
loss stops improving
early = tf.keras.callbacks.EarlyStopping(
    monitor='val_loss',            # Metric to monitor (validation
loss here)
    patience=3,                   # Stop training if there's no
improvement after this 3 epochs
    restore_best_weights=True     # After stopping, restore the model
weights from the epoch with the best val_loss
)

# Set the number of epochs
epochs = 20

# Train the model on the training dataset 'datatrain'
history = model.fit(
    datatrain,                     # Training data generator or
dataset
    validation_data=datavalid,     # Validation data generator or
dataset
    epochs=epochs,                 # Number of training epochs
    batch_size=30,                # Number of samples per gradient
update
    callbacks=[early],
    verbose = 1                   # List of callbacks to apply during
training (e.g., early stopping)
)

Epoch 1/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 64s 535ms/step - Accuracy: 0.2535 - loss:
2.1132 - val_Accuracy: 0.8333 - val_loss: 1.0403
Epoch 2/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 542ms/step - Accuracy: 0.8082 - loss:
0.9550 - val_Accuracy: 0.9167 - val_loss: 0.4449
Epoch 3/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 39s 514ms/step - Accuracy: 0.8839 - loss:
0.4577 - val_Accuracy: 0.9367 - val_loss: 0.2626
Epoch 4/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 39s 526ms/step - Accuracy: 0.9048 - loss:
0.3233 - val_Accuracy: 0.9467 - val_loss: 0.1993
Epoch 5/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 40s 529ms/step - Accuracy: 0.9397 - loss:
0.2333 - val_Accuracy: 0.9533 - val_loss: 0.1673
Epoch 6/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 552ms/step - Accuracy: 0.9546 - loss:
0.1583 - val_Accuracy: 0.9533 - val_loss: 0.1545
Epoch 7/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 544ms/step - Accuracy: 0.9610 - loss:
0.1378 - val_Accuracy: 0.9633 - val_loss: 0.1542
Epoch 8/20
```

```
75/75 ━━━━━━━━━━━━━━━━━━━━ 45s 594ms/step - Accuracy: 0.9786 - loss:
0.0879 - val_Accuracy: 0.9600 - val_loss: 0.1424
Epoch 9/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 58s 770ms/step - Accuracy: 0.9726 - loss:
0.0922 - val_Accuracy: 0.9633 - val_loss: 0.1392
Epoch 10/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 70s 928ms/step - Accuracy: 0.9826 - loss:
0.0716 - val_Accuracy: 0.9600 - val_loss: 0.1382
Epoch 11/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 71s 945ms/step - Accuracy: 0.9851 - loss:
0.0589 - val_Accuracy: 0.9600 - val_loss: 0.1520
Epoch 12/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 68s 912ms/step - Accuracy: 0.9893 - loss:
0.0477 - val_Accuracy: 0.9700 - val_loss: 0.1339
Epoch 13/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 70s 933ms/step - Accuracy: 0.9870 - loss:
0.0466 - val_Accuracy: 0.9667 - val_loss: 0.1409
Epoch 14/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 65s 868ms/step - Accuracy: 0.9883 - loss:
0.0431 - val_Accuracy: 0.9700 - val_loss: 0.1365
Epoch 15/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 65s 872ms/step - Accuracy: 0.9897 - loss:
0.0399 - val_Accuracy: 0.9633 - val_loss: 0.1293
Epoch 16/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 63s 844ms/step - Accuracy: 0.9850 - loss:
0.0476 - val_Accuracy: 0.9700 - val_loss: 0.1303
Epoch 17/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 62s 831ms/step - Accuracy: 0.9814 - loss:
0.0478 - val_Accuracy: 0.9633 - val_loss: 0.1275
Epoch 18/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 66s 875ms/step - Accuracy: 0.9939 - loss:
0.0231 - val_Accuracy: 0.9600 - val_loss: 0.1342
Epoch 19/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 65s 868ms/step - Accuracy: 0.9945 - loss:
0.0261 - val_Accuracy: 0.9633 - val_loss: 0.1326
Epoch 20/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 69s 916ms/step - Accuracy: 0.9926 - loss:
0.0283 - val_Accuracy: 0.9700 - val_loss: 0.1302

model.summary()

Model: "sequential_1"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━
┓
┃ Layer (type)                         ┃ Output Shape                ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━
┩
│ sequential (Sequential)              │ (None, 128, 128, 3)         │
```

```
0 │
├─────────────────────────────────┼────────────────────────┼─────────
───────┤
│ efficientnetv2-b2 (Functional)  │ (None, 4, 4, 1408)     │
8,769,374 │
├─────────────────────────────────┼────────────────────────┼─────────
───────┤
│ global_average_pooling2d        │ (None, 1408)           │
0 │
│ (GlobalAveragePooling2D)        │                        │
│
├─────────────────────────────────┼────────────────────────┼─────────
───────┤
│ dropout (Dropout)               │ (None, 1408)           │
0 │
├─────────────────────────────────┼────────────────────────┼─────────
───────┤
│ dense (Dense)                   │ (None, 10)             │
14,090 │
└─────────────────────────────────┴────────────────────────┴─────────
───────┘

 Total params: 24,744,022 (94.39 MB)

 Trainable params: 7,980,278 (30.44 MB)

 Non-trainable params: 803,186 (3.06 MB)

 Optimizer params: 15,960,558 (60.88 MB)
```

```
base_model.summary()
```

```
Model: "efficientnetv2-b2"

┏━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━┳━━━━━━━━━━━━━━
━━━━━┓
┃ Layer (type)        ┃ Output Shape      ┃    Param # ┃ Connected to
┃
┡━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━╇━━━━━━━━━━━━━━
━━━━━┩
│ input_layer         │ (None, 128, 128,  │          0 │ -
│ (InputLayer)        │ 3)                │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
─────┤
│ rescaling           │ (None, 128, 128,  │          0 │
input_layer[0][0] │
│ (Rescaling)         │ 3)                │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
```

```
──────┤
│ normalization        │ (None, 128, 128,  │           0 │ rescaling[0]
[0]   │
│ (Normalization)      │ 3)                │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ stem_conv (Conv2D)   │ (None, 64, 64,    │         864 │
normalization[0]… │
│                      │ 32)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ stem_bn              │ (None, 64, 64,    │         128 │ stem_conv[0]
[0]   │
│ (BatchNormalizatio… │ 32)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ stem_activation      │ (None, 64, 64,    │           0 │ stem_bn[0][0]
│
│ (Activation)         │ 32)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block1a_project_co… │ (None, 64, 64,    │       4,608 │
stem_activation[… │
│ (Conv2D)             │ 16)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block1a_project_bn   │ (None, 64, 64,    │          64 │
block1a_project_… │
│ (BatchNormalizatio… │ 16)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block1a_project_ac… │ (None, 64, 64,    │           0 │
block1a_project_… │
│ (Activation)         │ 16)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block1b_project_co… │ (None, 64, 64,    │       2,304 │
block1a_project_… │
│ (Conv2D)             │ 16)               │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
```

```
| block1b_project_bn  | (None, 64, 64,     |          64 |
block1b_project_… |
| (BatchNormalizatio… | 16)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block1b_project_ac… | (None, 64, 64,     |           0 |
block1b_project_… |
| (Activation)        | 16)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block1b_drop        | (None, 64, 64,     |           0 |
block1b_project_… |
| (Dropout)           | 16)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block1b_add (Add)   | (None, 64, 64,     |           0 |
block1b_drop[0][… |
|                     | 16)                |             |
block1a_project_… |
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block2a_expand_conv | (None, 32, 32,     |       9,216 |
block1b_add[0][0] |
| (Conv2D)            | 64)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block2a_expand_bn   | (None, 32, 32,     |         256 |
block2a_expand_c… |
| (BatchNormalizatio… | 64)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block2a_expand_act… | (None, 32, 32,     |           0 |
block2a_expand_b… |
| (Activation)        | 64)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block2a_project_co… | (None, 32, 32,     |       2,048 |
block2a_expand_a… |
| (Conv2D)            | 32)                |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block2a_project_bn  | (None, 32, 32,     |         128 |
```

```
block2a_project_… │
│ (BatchNormalizatio… │ 32)                │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_expand_conv │ (None, 32, 32,     │     36,864 │
block2a_project_… │
│ (Conv2D)            │ 128)               │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_expand_bn   │ (None, 32, 32,     │        512 │
block2b_expand_c… │
│ (BatchNormalizatio… │ 128)               │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_expand_act… │ (None, 32, 32,     │          0 │
block2b_expand_b… │
│ (Activation)        │ 128)               │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_project_co… │ (None, 32, 32,     │      4,096 │
block2b_expand_a… │
│ (Conv2D)            │ 32)                │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_project_bn  │ (None, 32, 32,     │        128 │
block2b_project_… │
│ (BatchNormalizatio… │ 32)                │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_drop        │ (None, 32, 32,     │          0 │
block2b_project_… │
│ (Dropout)           │ 32)                │            │
│
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2b_add (Add)   │ (None, 32, 32,     │          0 │
block2b_drop[0][… │
│                     │ 32)                │            │
block2a_project_… │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block2c_expand_conv │ (None, 32, 32,     │     36,864 │
block2b_add[0][0] │
```

```
│ (Conv2D)              │ 128)              │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block2c_expand_bn     │ (None, 32, 32,    │        512 │
block2c_expand_c… │
│ (BatchNormalizatio… │ 128)              │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block2c_expand_act… │ (None, 32, 32,    │          0 │
block2c_expand_b… │
│ (Activation)          │ 128)              │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block2c_project_co… │ (None, 32, 32,    │      4,096 │
block2c_expand_a… │
│ (Conv2D)              │ 32)               │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block2c_project_bn    │ (None, 32, 32,    │        128 │
block2c_project_… │
│ (BatchNormalizatio… │ 32)               │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block2c_drop          │ (None, 32, 32,    │          0 │
block2c_project_… │
│ (Dropout)             │ 32)               │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block2c_add (Add)     │ (None, 32, 32,    │          0 │
block2c_drop[0][… │
│                       │ 32)               │            │
block2b_add[0][0] │
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block3a_expand_conv │ (None, 16, 16,    │     36,864 │
block2c_add[0][0] │
│ (Conv2D)              │ 128)              │            │
│
├───────────────────────┼───────────────────┼────────────┼──────────────
──────┤
│ block3a_expand_bn     │ (None, 16, 16,    │        512 │
block3a_expand_c… │
│ (BatchNormalizatio… │ 128)              │            │
```

```
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3a_expand_act… │ (None, 16, 16,     │           0 │
block3a_expand_b… │
│ (Activation)         │ 128)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3a_project_co… │ (None, 16, 16,     │       7,168 │
block3a_expand_a… │
│ (Conv2D)             │ 56)                  │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3a_project_bn   │ (None, 16, 16,     │         224 │
block3a_project_… │
│ (BatchNormalizatio… │ 56)                  │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3b_expand_conv │ (None, 16, 16,     │     112,896 │
block3a_project_… │
│ (Conv2D)             │ 224)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3b_expand_bn    │ (None, 16, 16,     │         896 │
block3b_expand_c… │
│ (BatchNormalizatio… │ 224)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3b_expand_act… │ (None, 16, 16,     │           0 │
block3b_expand_b… │
│ (Activation)         │ 224)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3b_project_co… │ (None, 16, 16,     │      12,544 │
block3b_expand_a… │
│ (Conv2D)             │ 56)                  │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ block3b_project_bn   │ (None, 16, 16,     │         224 │
block3b_project_… │
│ (BatchNormalizatio… │ 56)                  │             │
│
```

```
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3b_drop          │ (None, 16, 16,     │           0 │
block3b_project_… │
│ (Dropout)             │ 56)                │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3b_add (Add)     │ (None, 16, 16,     │           0 │
block3b_drop[0][… │
│                       │ 56)                │             │
block3a_project_… │
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3c_expand_conv   │ (None, 16, 16,     │     112,896 │
block3b_add[0][0] │
│ (Conv2D)              │ 224)               │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3c_expand_bn     │ (None, 16, 16,     │         896 │
block3c_expand_c… │
│ (BatchNormalizatio…   │ 224)               │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3c_expand_act…   │ (None, 16, 16,     │           0 │
block3c_expand_b… │
│ (Activation)          │ 224)               │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3c_project_co…   │ (None, 16, 16,     │      12,544 │
block3c_expand_a… │
│ (Conv2D)              │ 56)                │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3c_project_bn    │ (None, 16, 16,     │         224 │
block3c_project_… │
│ (BatchNormalizatio…   │ 56)                │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
────────┤
│ block3c_drop          │ (None, 16, 16,     │           0 │
block3c_project_… │
│ (Dropout)             │ 56)                │             │
│
├───────────────────────┼────────────────────┼─────────────┼──────────────
```

```
──────┤
| block3c_add (Add)    | (None, 16, 16,     |           0 |
block3c_drop[0][… |
|                      | 56)                |             |
block3b_add[0][0] |
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_expand_conv | (None, 16, 16,     |      12,544 |
block3c_add[0][0] |
| (Conv2D)             | 224)               |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_expand_bn    | (None, 16, 16,     |         896 |
block4a_expand_c… |
| (BatchNormalizatio… | 224)               |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_expand_act… | (None, 16, 16,     |           0 |
block4a_expand_b… |
| (Activation)         | 224)               |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_dwconv2      | (None, 8, 8, 224) |       2,016 |
block4a_expand_a… |
| (DepthwiseConv2D)    |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_bn           | (None, 8, 8, 224) |         896 |
block4a_dwconv2[… |
| (BatchNormalizatio… |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_activation   | (None, 8, 8, 224) |           0 | block4a_bn[0]
[0]  |
| (Activation)         |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
| block4a_se_squeeze   | (None, 224)        |           0 |
block4a_activati… |
| (GlobalAveragePool… |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
```

```
| block4a_se_reshape  | (None, 1, 1, 224) |          0 |
block4a_se_squee… |
| (Reshape)           |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4a_se_reduce   | (None, 1, 1, 14)  |      3,150 |
block4a_se_resha… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4a_se_expand   | (None, 1, 1, 224) |      3,360 |
block4a_se_reduc… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4a_se_excite   | (None, 8, 8, 224) |          0 |
block4a_activati… |
| (Multiply)          |                   |            |
block4a_se_expan… |
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4a_project_co… | (None, 8, 8, 104) |     23,296 |
block4a_se_excit… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4a_project_bn  | (None, 8, 8, 104) |        416 |
block4a_project_… |
| (BatchNormalizatio… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4b_expand_conv | (None, 8, 8, 416) |     43,264 |
block4a_project_… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4b_expand_bn   | (None, 8, 8, 416) |      1,664 |
block4b_expand_c… |
| (BatchNormalizatio… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4b_expand_act… | (None, 8, 8, 416) |          0 |
```

```
block4b_expand_b… │
│ (Activation)           │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_dwconv2        │ (None, 8, 8, 416)   │        3,744 │
block4b_expand_a… │
│ (DepthwiseConv2D)      │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_bn             │ (None, 8, 8, 416)   │        1,664 │
block4b_dwconv2[… │
│ (BatchNormalizatio…    │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_activation     │ (None, 8, 8, 416)   │            0 │ block4b_bn[0]
[0]   │
│ (Activation)           │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_se_squeeze     │ (None, 416)         │            0 │
block4b_activati… │
│ (GlobalAveragePool…    │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_se_reshape     │ (None, 1, 1, 416)   │            0 │
block4b_se_squee… │
│ (Reshape)              │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_se_reduce      │ (None, 1, 1, 26)    │       10,842 │
block4b_se_resha… │
│ (Conv2D)               │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_se_expand      │ (None, 1, 1, 416)   │       11,232 │
block4b_se_reduc… │
│ (Conv2D)               │                     │              │
│
├────────────────────────┼─────────────────────┼──────────────┼──────────────
───────┤
│ block4b_se_excite      │ (None, 8, 8, 416)   │            0 │
block4b_activati… │
```

```
| (Multiply)           |                     |             |
block4b_se_expan… |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4b_project_co… | (None, 8, 8, 104) |     43,264 |
block4b_se_excit… |
| (Conv2D)             |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4b_project_bn   | (None, 8, 8, 104) |        416 |
block4b_project_… |
| (BatchNormalizatio… |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4b_drop         | (None, 8, 8, 104) |          0 |
block4b_project_… |
| (Dropout)            |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4b_add (Add)    | (None, 8, 8, 104) |          0 |
block4b_drop[0][… |
|                      |                     |             |
block4a_project_… |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4c_expand_conv | (None, 8, 8, 416) |     43,264 |
block4b_add[0][0] |
| (Conv2D)             |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4c_expand_bn    | (None, 8, 8, 416) |      1,664 |
block4c_expand_c… |
| (BatchNormalizatio… |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4c_expand_act… | (None, 8, 8, 416) |          0 |
block4c_expand_b… |
| (Activation)         |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| block4c_dwconv2      | (None, 8, 8, 416) |      3,744 |
block4c_expand_a… |
| (DepthwiseConv2D)    |                     |             |
|
```

```
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_bn          │ (None, 8, 8, 416)   │       1,664 │
block4c_dwconv2[… │
│ (BatchNormalizatio… │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_activation  │ (None, 8, 8, 416)   │           0 │ block4c_bn[0]
[0]   │
│ (Activation)        │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_se_squeeze  │ (None, 416)         │           0 │
block4c_activati… │
│ (GlobalAveragePool… │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_se_reshape  │ (None, 1, 1, 416)   │           0 │
block4c_se_squee… │
│ (Reshape)           │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_se_reduce   │ (None, 1, 1, 26)    │      10,842 │
block4c_se_resha… │
│ (Conv2D)            │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_se_expand   │ (None, 1, 1, 416)   │      11,232 │
block4c_se_reduc… │
│ (Conv2D)            │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_se_excite   │ (None, 8, 8, 416)   │           0 │
block4c_activati… │
│ (Multiply)          │                     │             │
block4c_se_expan… │
├─────────────────────┼─────────────────────┼─────────────┼──────────────
───────┤
│ block4c_project_co… │ (None, 8, 8, 104)   │      43,264 │
block4c_se_excit… │
│ (Conv2D)            │                     │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────
```

```
──────┤
│ block4c_project_bn  │ (None, 8, 8, 104) │         416 │
block4c_project_… │
│ (BatchNormalizatio… │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4c_drop        │ (None, 8, 8, 104) │           0 │
block4c_project_… │
│ (Dropout)           │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4c_add (Add)   │ (None, 8, 8, 104) │           0 │
block4c_drop[0][… │
│                     │                   │             │
block4b_add[0][0] │
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4d_expand_conv │ (None, 8, 8, 416) │     43,264 │
block4c_add[0][0] │
│ (Conv2D)            │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4d_expand_bn   │ (None, 8, 8, 416) │      1,664 │
block4d_expand_c… │
│ (BatchNormalizatio… │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4d_expand_act… │ (None, 8, 8, 416) │           0 │
block4d_expand_b… │
│ (Activation)        │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4d_dwconv2     │ (None, 8, 8, 416) │      3,744 │
block4d_expand_a… │
│ (DepthwiseConv2D)   │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
│ block4d_bn          │ (None, 8, 8, 416) │      1,664 │
block4d_dwconv2[… │
│ (BatchNormalizatio… │                   │             │
│
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
```

```
| block4d_activation  | (None, 8, 8, 416) |          0 | block4d_bn[0]
[0]  |
| (Activation)        |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_se_squeeze  | (None, 416)       |          0 |
block4d_activati… |
| (GlobalAveragePool… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_se_reshape  | (None, 1, 1, 416) |          0 |
block4d_se_squee… |
| (Reshape)           |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_se_reduce   | (None, 1, 1, 26)  |     10,842 |
block4d_se_resha… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_se_expand   | (None, 1, 1, 416) |     11,232 |
block4d_se_reduc… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_se_excite   | (None, 8, 8, 416) |          0 |
block4d_activati… |
| (Multiply)          |                   |            |
block4d_se_expan… |
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_project_co… | (None, 8, 8, 104) |     43,264 |
block4d_se_excit… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_project_bn  | (None, 8, 8, 104) |        416 |
block4d_project_… |
| (BatchNormalizatio… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block4d_drop        | (None, 8, 8, 104) |          0 |
```

```
block4d_project_… |
| (Dropout)            |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block4d_add (Add)    | (None, 8, 8, 104) |          0 |
block4d_drop[0][… |
|                      |                     |             |
block4c_add[0][0] |
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_expand_conv | (None, 8, 8, 624) |     64,896 |
block4d_add[0][0] |
| (Conv2D)             |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_expand_bn    | (None, 8, 8, 624) |      2,496 |
block5a_expand_c… |
| (BatchNormalizatio… |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_expand_act… | (None, 8, 8, 624) |          0 |
block5a_expand_b… |
| (Activation)         |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_dwconv2      | (None, 8, 8, 624) |      5,616 |
block5a_expand_a… |
| (DepthwiseConv2D)    |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_bn           | (None, 8, 8, 624) |      2,496 |
block5a_dwconv2[… |
| (BatchNormalizatio… |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_activation   | (None, 8, 8, 624) |          0 | block5a_bn[0]
[0]  |
| (Activation)         |                     |             |
|
├──────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5a_se_squeeze   | (None, 624)       |          0 |
block5a_activati… |
```

(GlobalAveragePool…			
block5a_se_reshape (Reshape)	(None, 1, 1, 624)	0	block5a_se_squee…
block5a_se_reduce (Conv2D)	(None, 1, 1, 26)	16,250	block5a_se_resha…
block5a_se_expand (Conv2D)	(None, 1, 1, 624)	16,848	block5a_se_reduc…
block5a_se_excite (Multiply)	(None, 8, 8, 624)	0	block5a_activati… block5a_se_expan…
block5a_project_co… (Conv2D)	(None, 8, 8, 120)	74,880	block5a_se_excit…
block5a_project_bn (BatchNormalizatio…	(None, 8, 8, 120)	480	block5a_project_…
block5b_expand_conv (Conv2D)	(None, 8, 8, 720)	86,400	block5a_project_…
block5b_expand_bn (BatchNormalizatio…	(None, 8, 8, 720)	2,880	block5b_expand_c…

```
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_expand_act… │ (None, 8, 8, 720) │             0 │
block5b_expand_b… │
│ (Activation)            │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_dwconv2         │ (None, 8, 8, 720) │         6,480 │
block5b_expand_a… │
│ (DepthwiseConv2D)       │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_bn              │ (None, 8, 8, 720) │         2,880 │
block5b_dwconv2[… │
│ (BatchNormalizatio… │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_activation      │ (None, 8, 8, 720) │             0 │ block5b_bn[0]
[0]   │
│ (Activation)            │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_se_squeeze      │ (None, 720)            │             0 │
block5b_activati… │
│ (GlobalAveragePool… │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_se_reshape      │ (None, 1, 1, 720) │             0 │
block5b_se_squee… │
│ (Reshape)               │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_se_reduce       │ (None, 1, 1, 30)  │        21,630 │
block5b_se_resha… │
│ (Conv2D)                │                        │               │
│
├─────────────────────────┼────────────────────────┼───────────────┼───────────────
──────┤
│ block5b_se_expand       │ (None, 1, 1, 720) │        22,320 │
block5b_se_reduc… │
│ (Conv2D)                │                        │               │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5b_se_excite    │ (None, 8, 8, 720)    │            0 │
block5b_activati… │
│ (Multiply)           │                      │              │
block5b_se_expan… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5b_project_co… │ (None, 8, 8, 120)    │      86,400 │
block5b_se_excit… │
│ (Conv2D)             │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5b_project_bn   │ (None, 8, 8, 120)    │          480 │
block5b_project_… │
│ (BatchNormalizatio… │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5b_drop         │ (None, 8, 8, 120)    │            0 │
block5b_project_… │
│ (Dropout)            │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5b_add (Add)    │ (None, 8, 8, 120)    │            0 │
block5b_drop[0][… │
│                      │                      │              │
block5a_project_… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5c_expand_conv │ (None, 8, 8, 720)    │      86,400 │
block5b_add[0][0] │
│ (Conv2D)             │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5c_expand_bn    │ (None, 8, 8, 720)    │       2,880 │
block5c_expand_c… │
│ (BatchNormalizatio… │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ block5c_expand_act… │ (None, 8, 8, 720)    │            0 │
block5c_expand_b… │
│ (Activation)         │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
```

```
──────┤
│ block5c_dwconv2     │ (None, 8, 8, 720) │      6,480 │
block5c_expand_a… │
│ (DepthwiseConv2D)   │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_bn          │ (None, 8, 8, 720) │      2,880 │
block5c_dwconv2[… │
│ (BatchNormalizatio… │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_activation  │ (None, 8, 8, 720) │          0 │ block5c_bn[0]
[0]  │
│ (Activation)        │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_se_squeeze  │ (None, 720)       │          0 │
block5c_activati… │
│ (GlobalAveragePool… │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_se_reshape  │ (None, 1, 1, 720) │          0 │
block5c_se_squee… │
│ (Reshape)           │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_se_reduce   │ (None, 1, 1, 30)  │     21,630 │
block5c_se_resha… │
│ (Conv2D)            │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_se_expand   │ (None, 1, 1, 720) │     22,320 │
block5c_se_reduc… │
│ (Conv2D)            │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5c_se_excite   │ (None, 8, 8, 720) │          0 │
block5c_activati… │
│ (Multiply)          │                   │            │
block5c_se_expan… │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
```

```
| block5c_project_co… | (None, 8, 8, 120) |     86,400 |
block5c_se_excit… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5c_project_bn  | (None, 8, 8, 120) |        480 |
block5c_project_… |
| (BatchNormalizatio… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5c_drop        | (None, 8, 8, 120) |          0 |
block5c_project_… |
| (Dropout)           |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5c_add (Add)   | (None, 8, 8, 120) |          0 |
block5c_drop[0][… |
|                     |                   |            |
block5b_add[0][0] |
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5d_expand_conv | (None, 8, 8, 720) |     86,400 |
block5c_add[0][0] |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5d_expand_bn   | (None, 8, 8, 720) |      2,880 |
block5d_expand_c… |
| (BatchNormalizatio… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5d_expand_act… | (None, 8, 8, 720) |          0 |
block5d_expand_b… |
| (Activation)        |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5d_dwconv2     | (None, 8, 8, 720) |      6,480 |
block5d_expand_a… |
| (DepthwiseConv2D)   |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────
──────┤
| block5d_bn          | (None, 8, 8, 720) |      2,880 |
```

```
block5d_dwconv2[… │
│ (BatchNormalizatio… │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_activation  │ (None, 8, 8, 720) │          0 │ block5d_bn[0]
[0]   │
│ (Activation)        │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_se_squeeze  │ (None, 720)       │          0 │
block5d_activati… │
│ (GlobalAveragePool… │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_se_reshape  │ (None, 1, 1, 720) │          0 │
block5d_se_squee… │
│ (Reshape)           │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_se_reduce   │ (None, 1, 1, 30)  │     21,630 │
block5d_se_resha… │
│ (Conv2D)            │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_se_expand   │ (None, 1, 1, 720) │     22,320 │
block5d_se_reduc… │
│ (Conv2D)            │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_se_excite   │ (None, 8, 8, 720) │          0 │
block5d_activati… │
│ (Multiply)          │                   │            │
block5d_se_expan… │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_project_co… │ (None, 8, 8, 120) │     86,400 │
block5d_se_excit… │
│ (Conv2D)            │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block5d_project_bn  │ (None, 8, 8, 120) │        480 │
block5d_project_… │
```

```
| (BatchNormalizatio… |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5d_drop        | (None, 8, 8, 120) |           0 |
block5d_project_… |
| (Dropout)           |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5d_add (Add)   | (None, 8, 8, 120) |           0 |
block5d_drop[0][… |
|                     |                     |             |
block5c_add[0][0] |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5e_expand_conv | (None, 8, 8, 720) |      86,400 |
block5d_add[0][0] |
| (Conv2D)            |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5e_expand_bn   | (None, 8, 8, 720) |       2,880 |
block5e_expand_c… |
| (BatchNormalizatio… |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5e_expand_act… | (None, 8, 8, 720) |           0 |
block5e_expand_b… |
| (Activation)        |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5e_dwconv2     | (None, 8, 8, 720) |       6,480 |
block5e_expand_a… |
| (DepthwiseConv2D)   |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5e_bn          | (None, 8, 8, 720) |       2,880 |
block5e_dwconv2[… |
| (BatchNormalizatio… |                     |             |
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
| block5e_activation  | (None, 8, 8, 720) |           0 | block5e_bn[0]
[0]  |
| (Activation)        |                     |             |
|
```

```
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_se_squeeze  │ (None, 720)       │          0 │
block5e_activati… │
│ (GlobalAveragePool… │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_se_reshape  │ (None, 1, 1, 720) │          0 │
block5e_se_squee… │
│ (Reshape)           │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_se_reduce   │ (None, 1, 1, 30)  │     21,630 │
block5e_se_resha… │
│ (Conv2D)            │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_se_expand   │ (None, 1, 1, 720) │     22,320 │
block5e_se_reduc… │
│ (Conv2D)            │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_se_excite   │ (None, 8, 8, 720) │          0 │
block5e_activati… │
│ (Multiply)          │                   │            │
block5e_se_expan… │
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_project_co… │ (None, 8, 8, 120) │     86,400 │
block5e_se_excit… │
│ (Conv2D)            │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_project_bn  │ (None, 8, 8, 120) │        480 │
block5e_project_… │
│ (BatchNormalizatio… │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block5e_drop        │ (None, 8, 8, 120) │          0 │
block5e_project_… │
│ (Dropout)           │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
```

```
──────┤
| block5e_add (Add)    | (None, 8, 8, 120) |           0 |
block5e_drop[0][… |
|                      |                   |             |
block5d_add[0][0] |
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_expand_conv | (None, 8, 8, 720) |     86,400 |
block5e_add[0][0] |
| (Conv2D)             |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_expand_bn    | (None, 8, 8, 720) |      2,880 |
block5f_expand_c… |
| (BatchNormalizatio… |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_expand_act… | (None, 8, 8, 720) |           0 |
block5f_expand_b… |
| (Activation)         |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_dwconv2      | (None, 8, 8, 720) |      6,480 |
block5f_expand_a… |
| (DepthwiseConv2D)    |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_bn           | (None, 8, 8, 720) |      2,880 |
block5f_dwconv2[… |
| (BatchNormalizatio… |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_activation   | (None, 8, 8, 720) |           0 | block5f_bn[0]
[0]  |
| (Activation)         |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block5f_se_squeeze   | (None, 720)       |           0 |
block5f_activati… |
| (GlobalAveragePool… |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
```

```
| block5f_se_reshape  | (None, 1, 1, 720) |          0 |
block5f_se_squee… |
| (Reshape)           |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_se_reduce   | (None, 1, 1, 30)  |     21,630 |
block5f_se_resha… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_se_expand   | (None, 1, 1, 720) |     22,320 |
block5f_se_reduc… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_se_excite   | (None, 8, 8, 720) |          0 |
block5f_activati… |
| (Multiply)          |                   |            |
block5f_se_expan… |
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_project_co… | (None, 8, 8, 120) |     86,400 |
block5f_se_excit… |
| (Conv2D)            |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_project_bn  | (None, 8, 8, 120) |        480 |
block5f_project_… |
| (BatchNormalizatio… |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_drop        | (None, 8, 8, 120) |          0 |
block5f_project_… |
| (Dropout)           |                   |            |
|
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block5f_add (Add)   | (None, 8, 8, 120) |          0 |
block5f_drop[0][… |
|                     |                   |            |
block5e_add[0][0] |
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
| block6a_expand_conv | (None, 8, 8, 720) |     86,400 |
```

```
block5f_add[0][0] │
│ (Conv2D)             │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_expand_bn    │ (None, 8, 8, 720)  │        2,880 │
block6a_expand_c… │
│ (BatchNormalizatio… │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_expand_act… │ (None, 8, 8, 720)  │            0 │
block6a_expand_b… │
│ (Activation)         │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_dwconv2      │ (None, 4, 4, 720)  │        6,480 │
block6a_expand_a… │
│ (DepthwiseConv2D)    │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_bn           │ (None, 4, 4, 720)  │        2,880 │
block6a_dwconv2[… │
│ (BatchNormalizatio… │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_activation   │ (None, 4, 4, 720)  │            0 │ block6a_bn[0]
[0]   │
│ (Activation)         │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_se_squeeze   │ (None, 720)        │            0 │
block6a_activati… │
│ (GlobalAveragePool… │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_se_reshape   │ (None, 1, 1, 720)  │            0 │
block6a_se_squee… │
│ (Reshape)            │                    │              │
│
├──────────────────────┼────────────────────┼──────────────┼──────────────
──────┤
│ block6a_se_reduce    │ (None, 1, 1, 30)   │       21,630 │
block6a_se_resha… │
```

(Conv2D)			
block6a_se_expand (Conv2D)	(None, 1, 1, 720)	22,320	block6a_se_reduc…
block6a_se_excite (Multiply)	(None, 4, 4, 720)	0	block6a_activati… block6a_se_expan…
block6a_project_co… (Conv2D)	(None, 4, 4, 208)	149,760	block6a_se_excit…
block6a_project_bn (BatchNormalizatio…	(None, 4, 4, 208)	832	block6a_project_…
block6b_expand_conv (Conv2D)	(None, 4, 4, 1248)	259,584	block6a_project_…
block6b_expand_bn (BatchNormalizatio…	(None, 4, 4, 1248)	4,992	block6b_expand_c…
block6b_expand_act… (Activation)	(None, 4, 4, 1248)	0	block6b_expand_b…
block6b_dwconv2 (DepthwiseConv2D)	(None, 4, 4, 1248)	11,232	block6b_expand_a…

```
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_bn            │ (None, 4, 4,        │      4,992 │
block6b_dwconv2[… │
│ (BatchNormalizatio… │ 1248)               │            │
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_activation    │ (None, 4, 4,        │          0 │ block6b_bn[0]
[0]   │
│ (Activation)          │ 1248)               │            │
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_se_squeeze    │ (None, 1248)        │          0 │
block6b_activati… │
│ (GlobalAveragePool… │                     │            │
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_se_reshape    │ (None, 1, 1,        │          0 │
block6b_se_squee… │
│ (Reshape)             │ 1248)               │            │
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_se_reduce     │ (None, 1, 1, 52)    │     64,948 │
block6b_se_resha… │
│ (Conv2D)              │                     │            │
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_se_expand     │ (None, 1, 1,        │     66,144 │
block6b_se_reduc… │
│ (Conv2D)              │ 1248)               │            │
│
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_se_excite     │ (None, 4, 4,        │          0 │
block6b_activati… │
│ (Multiply)            │ 1248)               │            │
block6b_se_expan… │
├───────────────────────┼─────────────────────┼────────────┼──────────────
───────┤
│ block6b_project_co… │ (None, 4, 4, 208) │    259,584 │
block6b_se_excit… │
│ (Conv2D)              │                     │            │
│
```

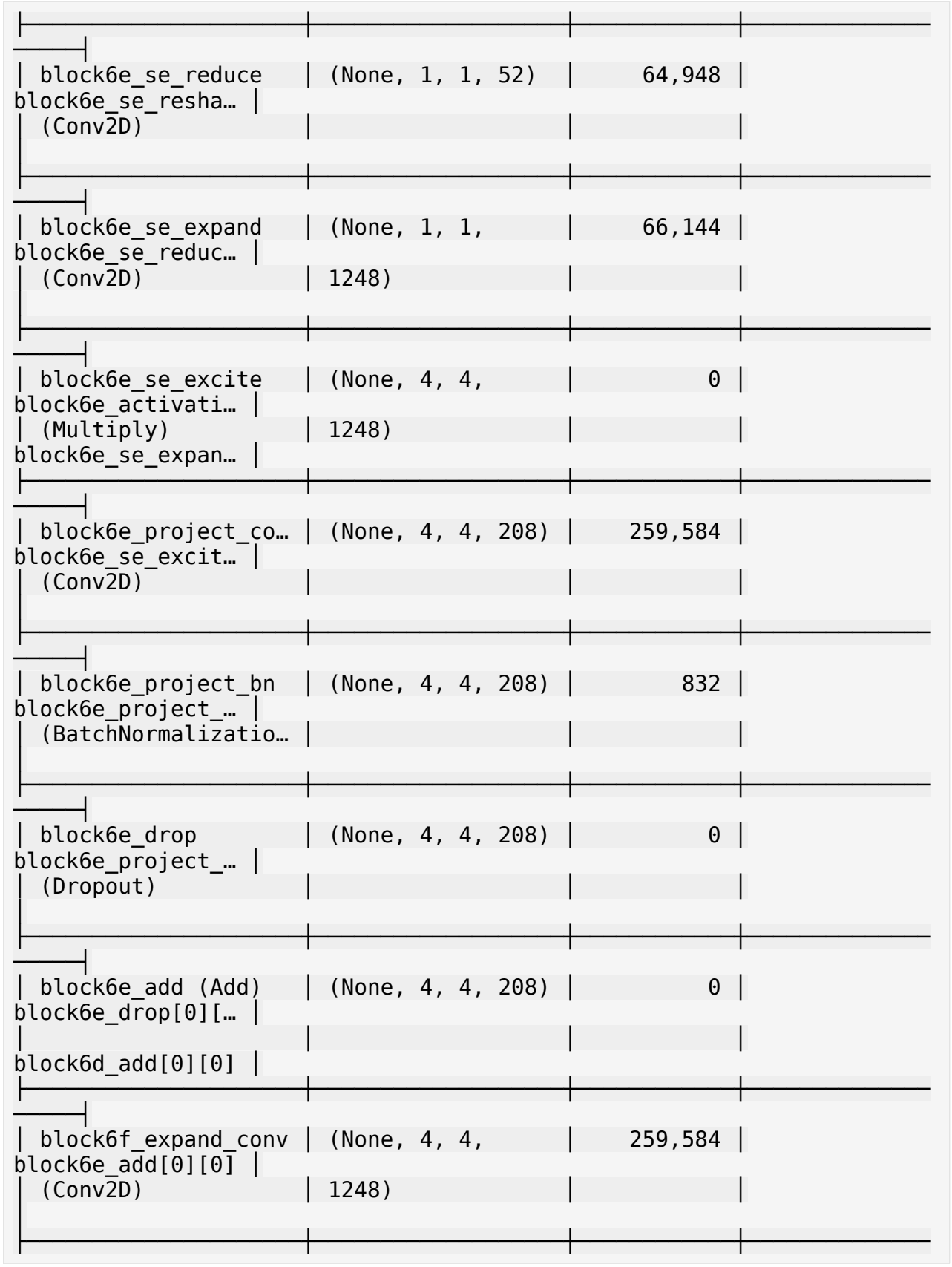
```
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6b_project_bn  │ (None, 4, 4, 208) │        832 │
block6b_project_… │
│ (BatchNormalizatio… │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6b_drop        │ (None, 4, 4, 208) │          0 │
block6b_project_… │
│ (Dropout)           │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6b_add (Add)   │ (None, 4, 4, 208) │          0 │
block6b_drop[0][… │
│                     │                   │            │
block6a_project_… │
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6c_expand_conv │ (None, 4, 4,      │    259,584 │
block6b_add[0][0] │
│ (Conv2D)            │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6c_expand_bn   │ (None, 4, 4,      │      4,992 │
block6c_expand_c… │
│ (BatchNormalizatio… │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6c_expand_act… │ (None, 4, 4,      │          0 │
block6c_expand_b… │
│ (Activation)        │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6c_dwconv2     │ (None, 4, 4,      │     11,232 │
block6c_expand_a… │
│ (DepthwiseConv2D)   │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
───────┤
│ block6c_bn          │ (None, 4, 4,      │      4,992 │
block6c_dwconv2[… │
│ (BatchNormalizatio… │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────
```

```
──────┤
| block6c_activation  | (None, 4, 4,       |          0 | block6c_bn[0]
[0]  |
| (Activation)        | 1248)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_se_squeeze  | (None, 1248)       |          0 |
block6c_activati… |
| (GlobalAveragePool… |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_se_reshape  | (None, 1, 1,       |          0 |
block6c_se_squee… |
| (Reshape)           | 1248)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_se_reduce   | (None, 1, 1, 52)   |     64,948 |
block6c_se_resha… |
| (Conv2D)            |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_se_expand   | (None, 1, 1,       |     66,144 |
block6c_se_reduc… |
| (Conv2D)            | 1248)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_se_excite   | (None, 4, 4,       |          0 |
block6c_activati… |
| (Multiply)          | 1248)              |            |
block6c_se_expan… |
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_project_co… | (None, 4, 4, 208)  |    259,584 |
block6c_se_excit… |
| (Conv2D)            |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6c_project_bn  | (None, 4, 4, 208)  |        832 |
block6c_project_… |
| (BatchNormalizatio… |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
```

```
| block6c_drop         | (None, 4, 4, 208) |           0 |
block6c_project_… |
| (Dropout)            |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6c_add (Add)    | (None, 4, 4, 208) |           0 |
block6c_drop[0][… |
|                      |                   |             |
block6b_add[0][0] |
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_expand_conv | (None, 4, 4,      |     259,584 |
block6c_add[0][0] |
| (Conv2D)             | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_expand_bn    | (None, 4, 4,      |       4,992 |
block6d_expand_c… |
| (BatchNormalizatio… | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_expand_act… | (None, 4, 4,      |           0 |
block6d_expand_b… |
| (Activation)         | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_dwconv2      | (None, 4, 4,      |      11,232 |
block6d_expand_a… |
| (DepthwiseConv2D)    | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_bn           | (None, 4, 4,      |       4,992 |
block6d_dwconv2[… |
| (BatchNormalizatio… | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_activation   | (None, 4, 4,      |           0 | block6d_bn[0]
[0]   |
| (Activation)         | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6d_se_squeeze   | (None, 1248)      |           0 |
```

```
block6d_activati… │
│ (GlobalAveragePool… │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_se_reshape  │ (None, 1, 1,         │            0 │
block6d_se_squee… │
│ (Reshape)           │ 1248)                │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_se_reduce   │ (None, 1, 1, 52)     │       64,948 │
block6d_se_resha… │
│ (Conv2D)            │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_se_expand   │ (None, 1, 1,         │       66,144 │
block6d_se_reduc… │
│ (Conv2D)            │ 1248)                │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_se_excite   │ (None, 4, 4,         │            0 │
block6d_activati… │
│ (Multiply)          │ 1248)                │              │
block6d_se_expan… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_project_co… │ (None, 4, 4, 208)    │      259,584 │
block6d_se_excit… │
│ (Conv2D)            │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_project_bn  │ (None, 4, 4, 208)    │          832 │
block6d_project_… │
│ (BatchNormalizatio… │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_drop        │ (None, 4, 4, 208)    │            0 │
block6d_project_… │
│ (Dropout)           │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ block6d_add (Add)   │ (None, 4, 4, 208)    │            0 │
block6d_drop[0][… │
```

```
|                      |                      |             |
block6c_add[0][0] |
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_expand_conv | (None, 4, 4,       |    259,584 |
block6d_add[0][0] |
| (Conv2D)             | 1248)              |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_expand_bn   | (None, 4, 4,       |      4,992 |
block6e_expand_c… |
| (BatchNormalizatio… | 1248)              |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_expand_act… | (None, 4, 4,       |          0 |
block6e_expand_b… |
| (Activation)         | 1248)              |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_dwconv2      | (None, 4, 4,       |     11,232 |
block6e_expand_a… |
| (DepthwiseConv2D)    | 1248)              |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_bn           | (None, 4, 4,       |      4,992 |
block6e_dwconv2[… |
| (BatchNormalizatio… | 1248)              |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_activation   | (None, 4, 4,       |          0 | block6e_bn[0]
[0]  |
| (Activation)         | 1248)              |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_se_squeeze   | (None, 1248)       |          0 |
block6e_activati… |
| (GlobalAveragePool… |                      |             |
|
├──────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| block6e_se_reshape   | (None, 1, 1,       |          0 |
block6e_se_squee… |
| (Reshape)            | 1248)              |             |
|
```


block6e_se_reduce (Conv2D) (None, 1, 1, 52) 64,948 block6e_se_resha…
block6e_se_expand (Conv2D) (None, 1, 1, 1248) 66,144 block6e_se_reduc…
block6e_se_excite (Multiply) (None, 4, 4, 1248) 0 block6e_activati… block6e_se_expan…
block6e_project_co… (Conv2D) (None, 4, 4, 208) 259,584 block6e_se_excit…
block6e_project_bn (BatchNormalizatio… (None, 4, 4, 208) 832 block6e_project_…
block6e_drop (Dropout) (None, 4, 4, 208) 0 block6e_project_…
block6e_add (Add) (None, 4, 4, 208) 0 block6e_drop[0][… block6d_add[0][0]
block6f_expand_conv (Conv2D) (None, 4, 4, 1248) 259,584 block6e_add[0][0]

```
──────┤
│ block6f_expand_bn   │ (None, 4, 4,       │      4,992 │
block6f_expand_c… │
│ (BatchNormalizatio… │ 1248)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_expand_act… │ (None, 4, 4,       │          0 │
block6f_expand_b… │
│ (Activation)        │ 1248)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_dwconv2     │ (None, 4, 4,       │     11,232 │
block6f_expand_a… │
│ (DepthwiseConv2D)   │ 1248)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_bn          │ (None, 4, 4,       │      4,992 │
block6f_dwconv2[… │
│ (BatchNormalizatio… │ 1248)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_activation  │ (None, 4, 4,       │          0 │ block6f_bn[0]
[0]  │
│ (Activation)        │ 1248)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_se_squeeze  │ (None, 1248)       │          0 │
block6f_activati… │
│ (GlobalAveragePool… │                    │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_se_reshape  │ (None, 1, 1,       │          0 │
block6f_se_squee… │
│ (Reshape)           │ 1248)              │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ block6f_se_reduce   │ (None, 1, 1, 52)   │     64,948 │
block6f_se_resha… │
│ (Conv2D)            │                    │            │
│
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
```

```
| block6f_se_expand   | (None, 1, 1,       |     66,144 |
block6f_se_reduc… |
| (Conv2D)            | 1248)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6f_se_excite   | (None, 4, 4,       |          0 |
block6f_activati… |
| (Multiply)          | 1248)              |            |
block6f_se_expan… |
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6f_project_co… | (None, 4, 4, 208) |    259,584 |
block6f_se_excit… |
| (Conv2D)            |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6f_project_bn  | (None, 4, 4, 208) |        832 |
block6f_project_… |
| (BatchNormalizatio… |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6f_drop        | (None, 4, 4, 208) |          0 |
block6f_project_… |
| (Dropout)           |                    |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6f_add (Add)   | (None, 4, 4, 208) |          0 |
block6f_drop[0][… |
|                     |                    |            |
block6e_add[0][0] |
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6g_expand_conv | (None, 4, 4,       |    259,584 |
block6f_add[0][0] |
| (Conv2D)            | 1248)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6g_expand_bn   | (None, 4, 4,       |      4,992 |
block6g_expand_c… |
| (BatchNormalizatio… | 1248)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| block6g_expand_act… | (None, 4, 4,       |          0 |
```

```
block6g_expand_b… │
│ (Activation)         │ 1248)              │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_dwconv2      │ (None, 4, 4,       │     11,232 │
block6g_expand_a… │
│ (DepthwiseConv2D)    │ 1248)              │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_bn           │ (None, 4, 4,       │      4,992 │
block6g_dwconv2[… │
│ (BatchNormalizatio… │ 1248)              │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_activation   │ (None, 4, 4,       │           0 │ block6g_bn[0]
[0]  │
│ (Activation)         │ 1248)              │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_se_squeeze   │ (None, 1248)       │           0 │
block6g_activati… │
│ (GlobalAveragePool… │                    │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_se_reshape   │ (None, 1, 1,       │           0 │
block6g_se_squee… │
│ (Reshape)            │ 1248)              │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_se_reduce    │ (None, 1, 1, 52)   │     64,948 │
block6g_se_resha… │
│ (Conv2D)             │                    │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_se_expand    │ (None, 1, 1,       │     66,144 │
block6g_se_reduc… │
│ (Conv2D)             │ 1248)              │             │
├──────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ block6g_se_excite    │ (None, 4, 4,       │           0 │
block6g_activati… │
```

```
| (Multiply)           | 1248)              |             |
block6g_se_expan… |
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6g_project_co… | (None, 4, 4, 208) |    259,584 |
block6g_se_excit… |
| (Conv2D)             |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6g_project_bn   | (None, 4, 4, 208) |        832 |
block6g_project_… |
| (BatchNormalizatio… |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6g_drop         | (None, 4, 4, 208) |          0 |
block6g_project_… |
| (Dropout)            |                    |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6g_add (Add)    | (None, 4, 4, 208) |          0 |
block6g_drop[0][… |
|                      |                    |             |
block6f_add[0][0] |
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6h_expand_conv | (None, 4, 4,       |    259,584 |
block6g_add[0][0] |
| (Conv2D)             | 1248)              |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6h_expand_bn    | (None, 4, 4,       |      4,992 |
block6h_expand_c… |
| (BatchNormalizatio… | 1248)              |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6h_expand_act… | (None, 4, 4,       |          0 |
block6h_expand_b… |
| (Activation)         | 1248)              |             |
|
├──────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6h_dwconv2      | (None, 4, 4,       |     11,232 |
block6h_expand_a… |
| (DepthwiseConv2D)    | 1248)              |             |
```

```
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_bn          │ (None, 4, 4,      │      4,992 │
block6h_dwconv2[… │
│ (BatchNormalizatio… │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_activation  │ (None, 4, 4,      │          0 │ block6h_bn[0]
[0]  │
│ (Activation)        │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_se_squeeze  │ (None, 1248)      │          0 │
block6h_activati… │
│ (GlobalAveragePool… │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_se_reshape  │ (None, 1, 1,      │          0 │
block6h_se_squee… │
│ (Reshape)           │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_se_reduce   │ (None, 1, 1, 52)  │     64,948 │
block6h_se_resha… │
│ (Conv2D)            │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_se_expand   │ (None, 1, 1,      │     66,144 │
block6h_se_reduc… │
│ (Conv2D)            │ 1248)             │            │
│
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_se_excite   │ (None, 4, 4,      │          0 │
block6h_activati… │
│ (Multiply)          │ 1248)             │            │
block6h_se_expan… │
├─────────────────────┼───────────────────┼────────────┼─────────────
───────┤
│ block6h_project_co… │ (None, 4, 4, 208) │    259,584 │
block6h_se_excit… │
│ (Conv2D)            │                   │            │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6h_project_bn   │ (None, 4, 4, 208)    │          832 │ block6h_project_…    │
│ (BatchNormalizatio…  │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6h_drop         │ (None, 4, 4, 208)    │            0 │ block6h_project_…    │
│ (Dropout)            │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6h_add (Add)    │ (None, 4, 4, 208)    │            0 │ block6h_drop[0][…    │
│                      │                      │              │ block6g_add[0][0]    │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6i_expand_conv  │ (None, 4, 4,         │      259,584 │ block6h_add[0][0]    │
│ (Conv2D)             │ 1248)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6i_expand_bn    │ (None, 4, 4,         │        4,992 │ block6i_expand_c…    │
│ (BatchNormalizatio…  │ 1248)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6i_expand_act…  │ (None, 4, 4,         │            0 │ block6i_expand_b…    │
│ (Activation)         │ 1248)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6i_dwconv2      │ (None, 4, 4,         │       11,232 │ block6i_expand_a…    │
│ (DepthwiseConv2D)    │ 1248)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ block6i_bn           │ (None, 4, 4,         │        4,992 │ block6i_dwconv2[…    │
│ (BatchNormalizatio…  │ 1248)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
```

```
──────┤
| block6i_activation  | (None, 4, 4,       |           0 | block6i_bn[0]
[0]  |
| (Activation)        | 1248)              |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_se_squeeze  | (None, 1248)       |           0 |
block6i_activati… |
| (GlobalAveragePool… |                    |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_se_reshape  | (None, 1, 1,       |           0 |
block6i_se_squee… |
| (Reshape)           | 1248)              |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_se_reduce   | (None, 1, 1, 52)   |      64,948 |
block6i_se_resha… |
| (Conv2D)            |                    |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_se_expand   | (None, 1, 1,       |      66,144 |
block6i_se_reduc… |
| (Conv2D)            | 1248)              |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_se_excite   | (None, 4, 4,       |           0 |
block6i_activati… |
| (Multiply)          | 1248)              |             |
block6i_se_expan… |
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_project_co… | (None, 4, 4, 208)  |     259,584 |
block6i_se_excit… |
| (Conv2D)            |                    |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| block6i_project_bn  | (None, 4, 4, 208)  |         832 |
block6i_project_… |
| (BatchNormalizatio… |                    |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
```

```
| block6i_drop         | (None, 4, 4, 208) |           0 |
block6i_project_… |
| (Dropout)            |                   |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6i_add (Add)    | (None, 4, 4, 208) |           0 |
block6i_drop[0][… |
|                      |                   |             |
block6h_add[0][0] |
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_expand_conv | (None, 4, 4,      |     259,584 |
block6i_add[0][0] |
| (Conv2D)             | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_expand_bn    | (None, 4, 4,      |       4,992 |
block6j_expand_c… |
| (BatchNormalizatio… | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_expand_act… | (None, 4, 4,      |           0 |
block6j_expand_b… |
| (Activation)         | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_dwconv2      | (None, 4, 4,      |      11,232 |
block6j_expand_a… |
| (DepthwiseConv2D)    | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_bn           | (None, 4, 4,      |       4,992 |
block6j_dwconv2[… |
| (BatchNormalizatio… | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_activation   | (None, 4, 4,      |           0 | block6j_bn[0]
[0]   |
| (Activation)         | 1248)             |             |
|
├──────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| block6j_se_squeeze   | (None, 1248)      |           0 |
```

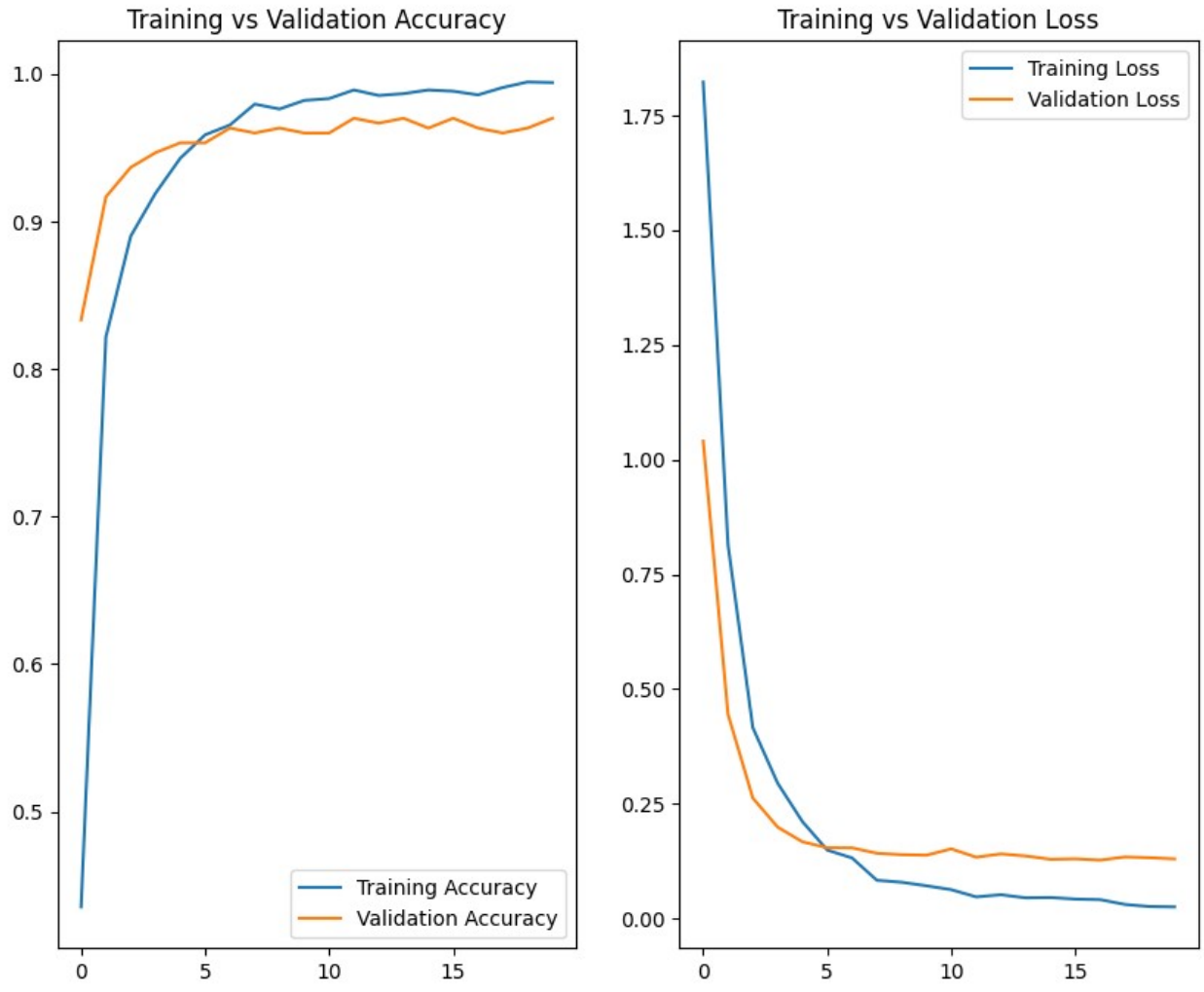
```
block6j_activati… │
│ (GlobalAveragePool… │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_se_reshape  │ (None, 1, 1,      │          0 │
block6j_se_squee… │
│ (Reshape)           │ 1248)             │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_se_reduce   │ (None, 1, 1, 52)  │     64,948 │
block6j_se_resha… │
│ (Conv2D)            │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_se_expand   │ (None, 1, 1,      │     66,144 │
block6j_se_reduc… │
│ (Conv2D)            │ 1248)             │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_se_excite   │ (None, 4, 4,      │          0 │
block6j_activati… │
│ (Multiply)          │ 1248)             │            │
block6j_se_expan… │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_project_co… │ (None, 4, 4, 208) │    259,584 │
block6j_se_excit… │
│ (Conv2D)            │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_project_bn  │ (None, 4, 4, 208) │        832 │
block6j_project_… │
│ (BatchNormalizatio… │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_drop        │ (None, 4, 4, 208) │          0 │
block6j_project_… │
│ (Dropout)           │                   │            │
│                     │                   │            │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ block6j_add (Add)   │ (None, 4, 4, 208) │          0 │
block6j_drop[0][… │
```

```
│                      │                   │             │
block6i_add[0][0] │
├──────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
│ top_conv (Conv2D)    │ (None, 4, 4,      │    292,864 │
block6j_add[0][0] │
│                      │ 1408)             │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
│ top_bn               │ (None, 4, 4,      │      5,632 │ top_conv[0]
[0]    │
│ (BatchNormalizatio… │ 1408)             │             │
│
├──────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
│ top_activation       │ (None, 4, 4,      │          0 │ top_bn[0][0]
│
│ (Activation)         │ 1408)             │             │
│
└──────────────────────┴───────────────────┴─────────────┴──────────────
──────┘

 Total params: 8,769,374 (33.45 MB)

 Trainable params: 7,966,188 (30.39 MB)

 Non-trainable params: 803,186 (3.06 MB)
```

Model Performance Visualization

```
# Plotting Training and Validation Accuracy and Loss Over Epochs

acc = history.history['Accuracy']            # Training accuracy
val_acc = history.history['val_Accuracy']    # Validation accuracy
loss = history.history['loss']               # Training loss
val_loss = history.history['val_loss']       # Validation loss

epochs_range = range(len(acc))               # X-axis range based on
number of epochs

plt.figure(figsize=(10, 8))

plt.subplot(1, 2, 1)                         # 1 row, 2 columns,
position 1
plt.plot(epochs_range, acc, label='Training Accuracy')       #
training accuracy
plt.plot(epochs_range, val_acc, label='Validation Accuracy') #
validation accuracy
plt.legend(loc='lower right')
```

```
plt.title('Training vs Validation Accuracy')

plt.subplot(1, 2, 2)                          # 1 row, 2 columns,
position 2
plt.plot(epochs_range, loss, label='Training Loss')          #
training loss
plt.plot(epochs_range, val_loss, label='Validation Loss')    #
validation loss
plt.legend(loc='upper right')
plt.title('Training vs Validation Loss')

plt.show()
```



Model Evaluation (EfficientNetV2B2)

```
loss, accuracy = model.evaluate(datatest)
print(f'Test accuracy is{accuracy:.4f}, Test loss is {loss:.4f}')
```

```
10/10 ━━━━━━━━━━━━━━━━━━━━ 5s 500ms/step - Accuracy: 0.9591 - loss:
0.1493
Test accuracy is0.9533, Test loss is 0.1532
```

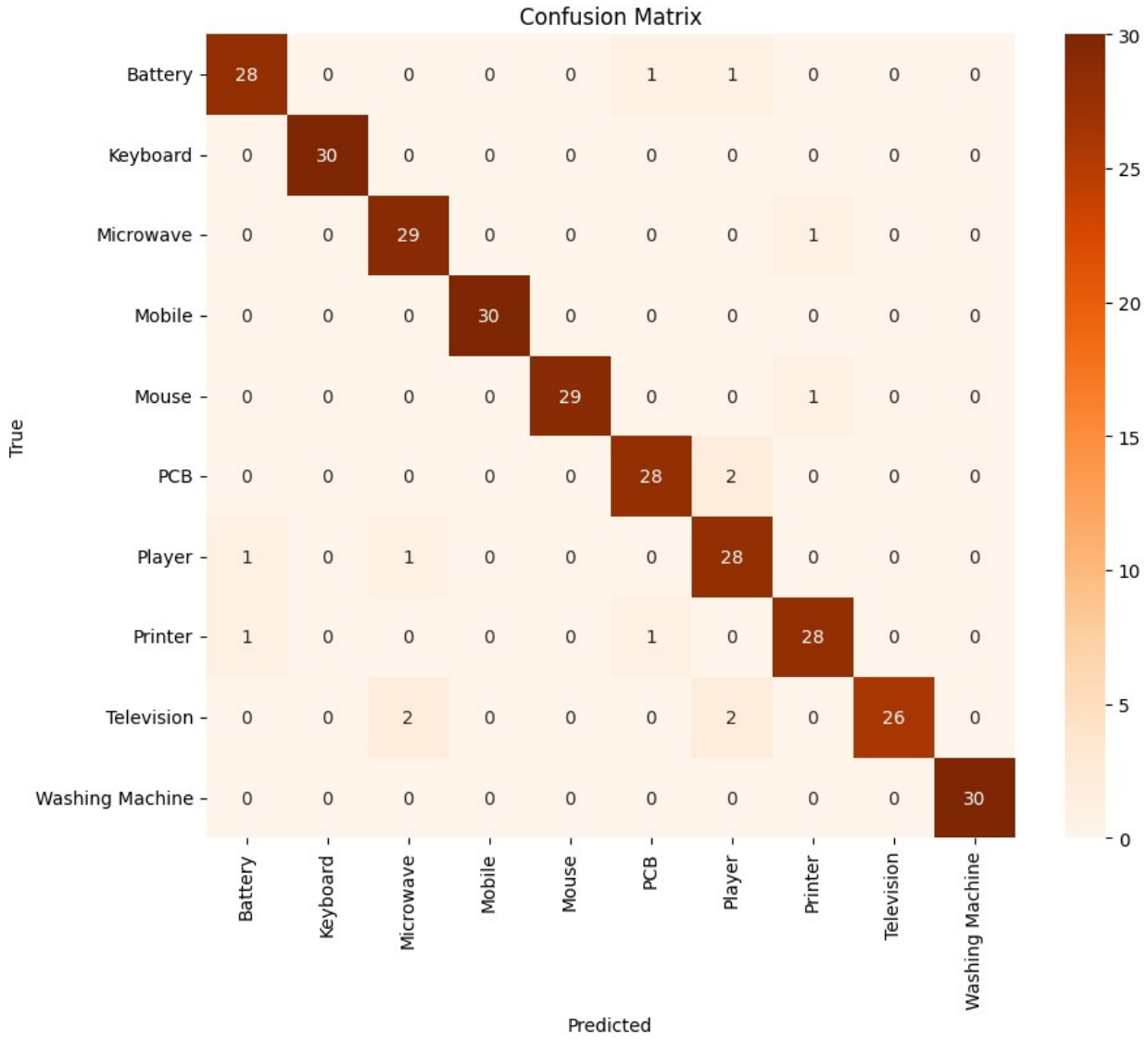
```
# Evaluate Model Performance on Test Data using Confusion Matrix and
Classification Report

# Extract true labels from all batches
y_true = np.concatenate([y.numpy() for x, y in datatest], axis=0)  #
Ground truth labels

# Get predictions as probabilities and then predicted classes
y_pred_probs = model.predict(datatest)


y_pred = np.argmax(y_pred_probs, axis=1)


print(confusion_matrix(y_true, y_pred))
print(classification_report(y_true, y_pred))
```

```
10/10 ━━━━━━━━━━━━━━━━━━━━ 10s 756ms/step
[[28  0  0  0  0  1  1  0  0  0]
 [ 0 30  0  0  0  0  0  0  0  0]
 [ 0  0 29  0  0  0  0  1  0  0]
 [ 0  0  0 30  0  0  0  0  0  0]
 [ 0  0  0  0 29  0  0  1  0  0]
 [ 0  0  0  0  0 28  2  0  0  0]
 [ 1  0  1  0  0  0 28  0  0  0]
 [ 1  0  0  0  0  1  0 28  0  0]
 [ 0  0  2  0  0  0  2  0 26  0]
 [ 0  0  0  0  0  0  0  0  0 30]]
              precision    recall  f1-score   support

           0       0.93      0.93      0.93        30
           1       1.00      1.00      1.00        30
           2       0.91      0.97      0.94        30
           3       1.00      1.00      1.00        30
           4       1.00      0.97      0.98        30
           5       0.93      0.93      0.93        30
           6       0.85      0.93      0.89        30
           7       0.93      0.93      0.93        30
           8       1.00      0.87      0.93        30
           9       1.00      1.00      1.00        30

    accuracy                           0.95       300
   macro avg       0.96      0.95      0.95       300
weighted avg       0.96      0.95      0.95       300
```

```
print(len(datatrain.class_names))
class_names = datatrain.class_names
print(class_names)
```

```
10
['Battery', 'Keyboard', 'Microwave', 'Mobile', 'Mouse', 'PCB',
'Player', 'Printer', 'Television', 'Washing Machine']
```

```
### Plot Confusion Matrix as Heatmap for Visualization

cm = confusion_matrix(y_true, y_pred)



plt.figure(figsize=(10, 8))

sns.heatmap(cm, annot=True, fmt='d',
            xticklabels=class_names,
            yticklabels=class_names,
            cmap='Oranges')


plt.xlabel('Predicted')

plt.ylabel('True')

plt.title('Confusion Matrix')

plt.show()
```

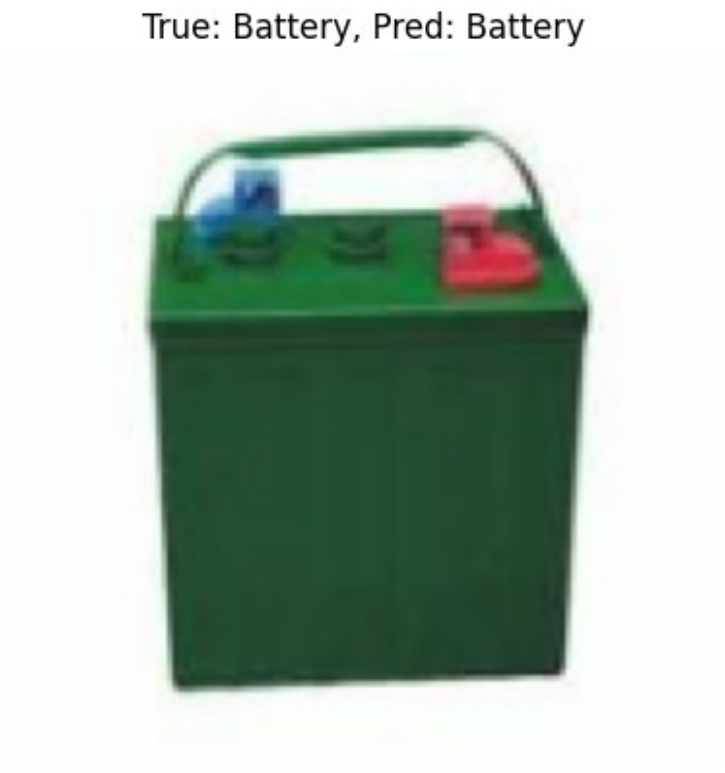


Final Testing of the Model(Predicting Images)

```
### Display Sample Predictions: True Labels vs Predicted Labels

class_names = datatest.class_names
# Get class names from test dataset

for images, labels in datatest.take(3):
# Take 2 batch from test data
    predictions = model.predict(images)
# Predicting class probabilities
    pred_labels = tf.argmax(predictions, axis=1)
# Get predicted class indices

    for i in range(3):
# Display first 3 images from batch
```

```
        plt.imshow(images[i].numpy().astype("uint8"))
# Convert tensor to image
        plt.title(f"True: {class_names[labels[i]]}, Pred:
{class_names[pred_labels[i]]}")
        plt.axis("off")

        plt.show()
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 2s 2s/step
```



True: Battery, Pred: Battery

True: Battery, Pred: Battery

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 253ms/step
```

True: Keyboard, Pred: Keyboard

True: Keyboard, Pred: Keyboard

True: Keyboard, Pred: Keyboard

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 229ms/step
```

True: Microwave, Pred: Microwave

True: Microwave, Pred: Microwave

True: Microwave, Pred: Microwave

Using Resnet50

```
Resnet50_model = tf.keras.applications.ResNet50(
    input_shape=(128, 128, 3),
    include_top=False,
    weights='imagenet'
)

base_model.trainable = True  # Allow training


for layer in Resnet50_model.layers[:100]:
    layer.trainable = False
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/resnet/
resnet50_weights_tf_dim_ordering_tf_kernels_notop.h5
94765736/94765736 ━━━━━━━━━━━━━━━━━━━━ 7s 0us/step
```

```
model_2 = tf.keras.Sequential([
    tf.keras.layers.Input(shape=(128, 128, 3)),
    base_model,
    tf.keras.layers.GlobalAveragePooling2D(),
    tf.keras.layers.Dropout(0.4),
    tf.keras.layers.Dense(10, activation='softmax')  # for 10 classes
])

model_2.compile(optimizer=tf.keras.optimizers.Adam(learning_rate=0.0001),loss = tf.keras.losses.SparseCategoricalCrossentropy(),
metrics=['Accuracy'])

early = tf.keras.callbacks.EarlyStopping(
    monitor='val_loss',
    patience=5,
    restore_best_weights=True
)

# Set the number of training epochs
epochs = 20

# Train the model using the training and validation datasets
history = model.fit(
    datatrain,                      # Training dataset
    validation_data=datavalid,      # Validation dataset to monitor performance
    epochs=epochs,                  # Train for up to 20 epochs
    batch_size=30,                  # Number of samples per training step
    callbacks=[early],              # Stop early if validation loss doesn't improve
```

```
    verbose=1                       # Print training progress
)
```

```
Epoch 1/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 37s 498ms/step - Accuracy: 0.9949 - loss:
0.0200 - val_Accuracy: 0.9633 - val_loss: 0.1378
Epoch 2/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 38s 512ms/step - Accuracy: 0.9962 - loss:
0.0190 - val_Accuracy: 0.9700 - val_loss: 0.1384
Epoch 3/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 38s 504ms/step - Accuracy: 0.9961 - loss:
0.0176 - val_Accuracy: 0.9667 - val_loss: 0.1532
Epoch 4/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 38s 513ms/step - Accuracy: 0.9947 - loss:
0.0204 - val_Accuracy: 0.9700 - val_loss: 0.1353
Epoch 5/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 39s 519ms/step - Accuracy: 0.9943 - loss:
0.0237 - val_Accuracy: 0.9667 - val_loss: 0.1397
Epoch 6/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 40s 527ms/step - Accuracy: 0.9971 - loss:
0.0140 - val_Accuracy: 0.9633 - val_loss: 0.1444
Epoch 7/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 40s 537ms/step - Accuracy: 0.9953 - loss:
0.0196 - val_Accuracy: 0.9600 - val_loss: 0.1387
Epoch 8/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 40s 536ms/step - Accuracy: 0.9934 - loss:
0.0196 - val_Accuracy: 0.9700 - val_loss: 0.1369
Epoch 9/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 541ms/step - Accuracy: 0.9942 - loss:
0.0230 - val_Accuracy: 0.9667 - val_loss: 0.1228
Epoch 10/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 540ms/step - Accuracy: 0.9970 - loss:
0.0169 - val_Accuracy: 0.9733 - val_loss: 0.1321
Epoch 11/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 548ms/step - Accuracy: 0.9963 - loss:
0.0148 - val_Accuracy: 0.9667 - val_loss: 0.1413
Epoch 12/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 41s 549ms/step - Accuracy: 0.9941 - loss:
0.0222 - val_Accuracy: 0.9633 - val_loss: 0.1352
Epoch 13/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 42s 555ms/step - Accuracy: 0.9943 - loss:
0.0167 - val_Accuracy: 0.9633 - val_loss: 0.1367
Epoch 14/20
75/75 ━━━━━━━━━━━━━━━━━━━━ 42s 557ms/step - Accuracy: 0.9968 - loss:
0.0145 - val_Accuracy: 0.9667 - val_loss: 0.1442
```

```
# Plotting Training and Validation Accuracy and Loss Over Epochs

acc = history.history['Accuracy']           # Training accuracy
val_acc = history.history['val_Accuracy']   # Validation accuracy
```

```
loss = history.history['loss']                # Training loss
val_loss = history.history['val_loss']        # Validation loss

epochs_range = range(len(acc))                # X-axis range based on
number of epochs

plt.figure(figsize=(10, 8))

plt.subplot(1, 2, 1)                          # 1 row, 2 columns,
position 1
plt.plot(epochs_range, acc, label='Training Accuracy')       #
training accuracy
plt.plot(epochs_range, val_acc, label='Validation Accuracy') #
validation accuracy
plt.legend(loc='lower right')
plt.title('Training vs Validation Accuracy')

plt.subplot(1, 2, 2)                          # 1 row, 2 columns,
position 2
plt.plot(epochs_range, loss, label='Training Loss')          #
training loss
plt.plot(epochs_range, val_loss, label='Validation Loss')    #
validation loss
plt.legend(loc='upper right')
plt.title('Training vs Validation Loss')

plt.show()
```


```
model.save('Best_model.keras')
```