

# CarStyle

October 2, 2024

```
[1]: import tensorflow as tf
import os
import cv2
import math
import json
import numpy as np
from matplotlib import pyplot as plt
from keras.applications import EfficientNetV2B3
from keras.models import Model
from keras.layers import Dense, GlobalAveragePooling2D
from keras.metrics import Precision, Recall, SparseCategoricalAccuracy

[2]: print("Num GPUs Available: ", len(tf.config.list_physical_devices('GPU')))
gpus = tf.config.experimental.list_physical_devices('GPU')
if gpus:
    try:
        for gpu in gpus:
            tf.config.experimental.set_memory_growth(gpu, True)
        logical_gpus = tf.config.experimental.list_logical_devices('GPU')
        print(len(gpus), "Physical GPUs,", len(logical_gpus), "Logical GPUs")
    except RuntimeError as e:
        print(e)
```

```
Num GPUs Available:  1
1 Physical GPUs, 1 Logical GPUs
```

```
[3]: base_dir = 'Styles'
train_dir = os.path.join(base_dir, 'train')
val_dir = os.path.join(base_dir, 'valid')
test_dir = os.path.join(base_dir, 'test')

img_size = (224, 224)
batch_size = 32

train_data = tf.keras.utils.image_dataset_from_directory(
    train_dir,
    image_size=img_size,
    batch_size=batch_size,
```

```

        label_mode='int',
        interpolation='bilinear'
    )

    val_data = tf.keras.utils.image_dataset_from_directory(
        val_dir,
        image_size=img_size,
        batch_size=batch_size,
        label_mode='int',
        interpolation='bilinear'
    )

    test_data = tf.keras.utils.image_dataset_from_directory(
        test_dir,
        image_size=img_size,
        batch_size=batch_size,
        label_mode='int',
        interpolation='bilinear'
    )

```

Found 5350 files belonging to 7 classes.  
 Found 1397 files belonging to 7 classes.  
 Found 802 files belonging to 7 classes.

```

[4]: class_names = train_data.class_names
    print("Class names test:", class_names)

    with open('CarStyle map.json', 'w') as f:
        json.dump(class_names, f)

    data_iterator = train_data.as_numpy_iterator()

```

Class names test: ['Convertible', 'Coupe', 'Hatchback', 'Pick-Up', 'SUV', 'Sedan', 'VAN']

```

[5]: batch = data_iterator.next()
    num_classes = len(class_names)

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[6]: ncols = 4
    nrows = math.ceil(num_classes / ncols)
    fig, ax = plt.subplots(nrows=nrows, ncols=ncols, figsize=(20, 20))

    if nrows == 1:
        ax = ax.flatten()
    elif ncols == 1:
        ax = ax.flatten()

    plotted = set()

```

```

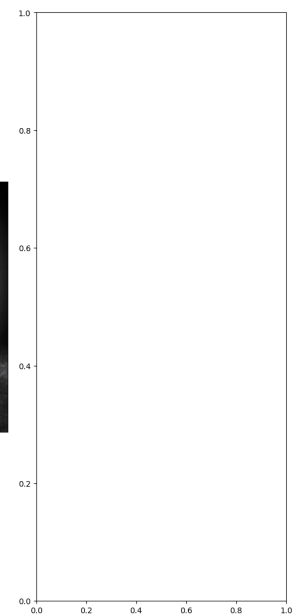
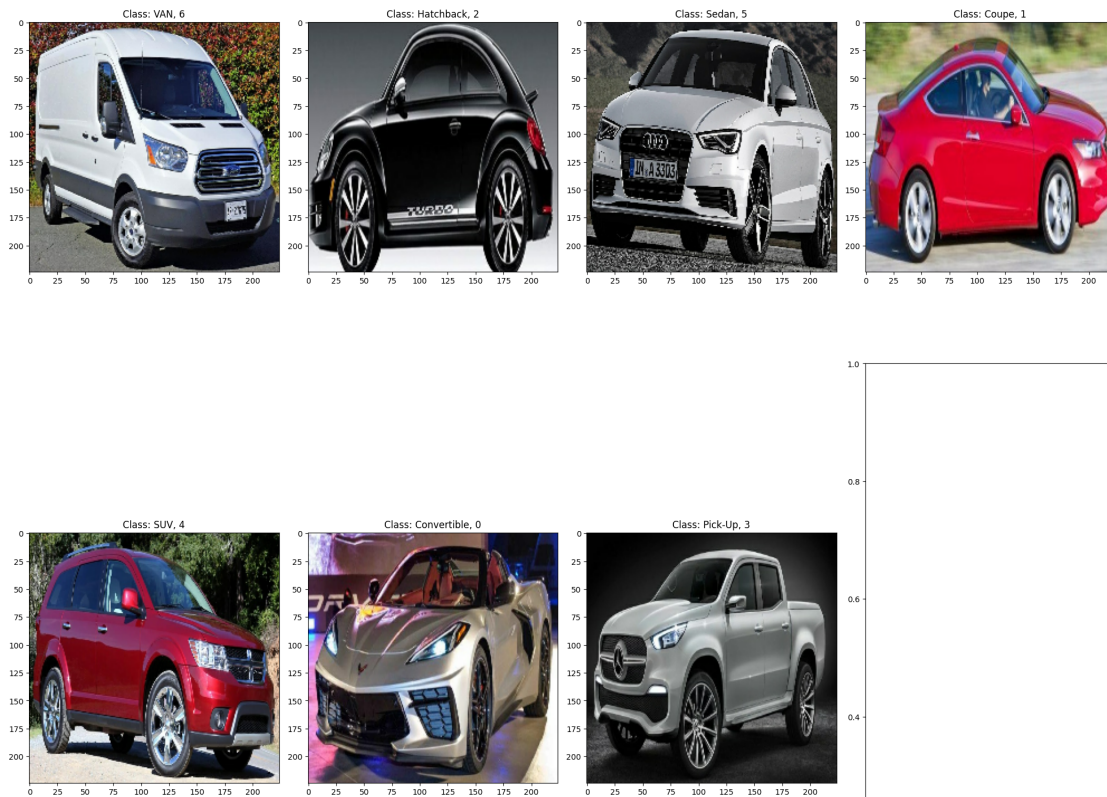
count = 0
while count < num_classes:
    batch = next(data_iterator)

    for idx, img in enumerate(batch[0]):
        label = batch[1][idx]
        if label not in plotted:
            ax_idx = count if nrows == 1 or ncols == 1 else (count // ncols,
↪count % ncols)
            ax[ax_idx].imshow(img.astype(int))
            ax[ax_idx].title.set_text(f"Class: {class_names[label]}, {label}")
            plotted.add(label)
            count += 1

    if count == num_classes:
        break

plt.tight_layout()
plt.show()

```



```
[7]: base_model = EfficientNetV2B3(
      weights='imagenet',
      include_top=False,
      input_shape=(224, 224, 3)
    )
    base_model.summary()
```

Downloading data from [https://storage.googleapis.com/tensorflow/keras-applications/efficientnet\\_v2/efficientnetv2-b3\\_notop.h5](https://storage.googleapis.com/tensorflow/keras-applications/efficientnet_v2/efficientnetv2-b3_notop.h5)  
 52606240/52606240 [=====] - 1s 0us/step  
 Model: "efficientnetv2-b3"

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	[(None, 224, 224, 3)]	0	[]
rescaling (Rescaling) ['input_1[0][0]']	(None, 224, 224, 3)	0	
normalization (Normalization) ['rescaling[0][0]']	(None, 224, 224, 3)	0	
stem_conv (Conv2D) ['normalization[0][0]']	(None, 112, 112, 40)	1080	
stem_bn (BatchNormalization) ['stem_conv[0][0]']	(None, 112, 112, 40)	160	
stem_activation (Activation) ['stem_bn[0][0]']	(None, 112, 112, 40)	0	
block1a_project_conv (Conv2D) ['stem_activation[0][0]']	(None, 112, 112, 16)	5760	
block1a_project_bn (BatchNormalization) ['block1a_project_conv[0][0]']	(None, 112, 112, 16)	64	

```

    block1a_project_activation (Ac (None, 112, 112, 16 0
['block1a_project_bn[0][0]']
tivation)
)

    block1b_project_conv (Conv2D) (None, 112, 112, 16 2304
['block1a_project_activation[0][0]
)
]']

    block1b_project_bn (BatchNorma (None, 112, 112, 16 64
['block1b_project_conv[0][0]']
lization)
)

    block1b_project_activation (Ac (None, 112, 112, 16 0
['block1b_project_bn[0][0]']
tivation)
)

    block1b_drop (Dropout) (None, 112, 112, 16 0
['block1b_project_activation[0][0]
)
]']

    block1b_add (Add) (None, 112, 112, 16 0
['block1b_drop[0][0]',
)
'block1a_project_activation[0][0]
]']

    block2a_expand_conv (Conv2D) (None, 56, 56, 64) 9216
['block1b_add[0][0]']

    block2a_expand_bn (BatchNormal (None, 56, 56, 64) 256
['block2a_expand_conv[0][0]']
ization)

    block2a_expand_activation (Act (None, 56, 56, 64) 0
['block2a_expand_bn[0][0]']
ivation)

    block2a_project_conv (Conv2D) (None, 56, 56, 40) 2560
['block2a_expand_activation[0][0]
']

    block2a_project_bn (BatchNorma (None, 56, 56, 40) 160
['block2a_project_conv[0][0]']
lization)

    block2b_expand_conv (Conv2D) (None, 56, 56, 160) 57600
['block2a_project_bn[0][0]']

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    block2b_expand_bn (BatchNormal (None, 56, 56, 160) 640
['block2b_expand_conv[0][0] ']
    ization)

    block2b_expand_activation (Act (None, 56, 56, 160) 0
['block2b_expand_bn[0][0] ']
    ivation)

    block2b_project_conv (Conv2D) (None, 56, 56, 40) 6400
['block2b_expand_activation[0][0]

    ']

    block2b_project_bn (BatchNorma (None, 56, 56, 40) 160
['block2b_project_conv[0][0] ']
    lization)

    block2b_drop (Dropout) (None, 56, 56, 40) 0
['block2b_project_bn[0][0] ']

    block2b_add (Add) (None, 56, 56, 40) 0
['block2b_drop[0][0] ',
'block2a_project_bn[0][0] ']

    block2c_expand_conv (Conv2D) (None, 56, 56, 160) 57600
['block2b_add[0][0] ']

    block2c_expand_bn (BatchNormal (None, 56, 56, 160) 640
['block2c_expand_conv[0][0] ']
    ization)

    block2c_expand_activation (Act (None, 56, 56, 160) 0
['block2c_expand_bn[0][0] ']
    ivation)

    block2c_project_conv (Conv2D) (None, 56, 56, 40) 6400
['block2c_expand_activation[0][0]

    ']

    block2c_project_bn (BatchNorma (None, 56, 56, 40) 160
['block2c_project_conv[0][0] ']
    lization)

    block2c_drop (Dropout) (None, 56, 56, 40) 0
['block2c_project_bn[0][0] ']

    block2c_add (Add) (None, 56, 56, 40) 0
['block2c_drop[0][0] ',
'block2b_add[0][0] ']

```

block3a\_expand\_conv (Conv2D) (None, 28, 28, 160) 57600  
['block2c\_add[0][0]']

block3a\_expand\_bn (BatchNormal (None, 28, 28, 160) 640  
['block3a\_expand\_conv[0][0]']  
ization)

block3a\_expand\_activation (Act (None, 28, 28, 160) 0  
['block3a\_expand\_bn[0][0]']  
ivation)

block3a\_project\_conv (Conv2D) (None, 28, 28, 56) 8960  
['block3a\_expand\_activation[0][0]

']

block3a\_project\_bn (BatchNorma (None, 28, 28, 56) 224  
['block3a\_project\_conv[0][0]']  
lization)

block3b\_expand\_conv (Conv2D) (None, 28, 28, 224) 112896  
['block3a\_project\_bn[0][0]']

block3b\_expand\_bn (BatchNormal (None, 28, 28, 224) 896  
['block3b\_expand\_conv[0][0]']  
ization)

block3b\_expand\_activation (Act (None, 28, 28, 224) 0  
['block3b\_expand\_bn[0][0]']  
ivation)

block3b\_project\_conv (Conv2D) (None, 28, 28, 56) 12544  
['block3b\_expand\_activation[0][0]

']

block3b\_project\_bn (BatchNorma (None, 28, 28, 56) 224  
['block3b\_project\_conv[0][0]']  
lization)

block3b\_drop (Dropout) (None, 28, 28, 56) 0  
['block3b\_project\_bn[0][0]']

block3b\_add (Add) (None, 28, 28, 56) 0  
['block3b\_drop[0][0]',  
'block3a\_project\_bn[0][0]']

block3c\_expand\_conv (Conv2D) (None, 28, 28, 224) 112896  
['block3b\_add[0][0]']

```

block3c_expand_bn (BatchNormal (None, 28, 28, 224) 896
['block3c_expand_conv[0][0] '
ization)

block3c_expand_activation (Act (None, 28, 28, 224) 0
['block3c_expand_bn[0][0] '
ivation)

block3c_project_conv (Conv2D) (None, 28, 28, 56) 12544
['block3c_expand_activation[0][0]

']

block3c_project_bn (BatchNorma (None, 28, 28, 56) 224
['block3c_project_conv[0][0] '
lization)

block3c_drop (Dropout) (None, 28, 28, 56) 0
['block3c_project_bn[0][0] '

block3c_add (Add) (None, 28, 28, 56) 0
['block3c_drop[0][0] ',
'block3b_add[0][0] '

block4a_expand_conv (Conv2D) (None, 28, 28, 224) 12544
['block3c_add[0][0] '

block4a_expand_bn (BatchNormal (None, 28, 28, 224) 896
['block4a_expand_conv[0][0] '
ization)

block4a_expand_activation (Act (None, 28, 28, 224) 0
['block4a_expand_bn[0][0] '
ivation)

block4a_dwconv2 (DepthwiseConv (None, 14, 14, 224) 2016
['block4a_expand_activation[0][0]
2D)

']

block4a_bn (BatchNormalization (None, 14, 14, 224) 896
['block4a_dwconv2[0][0] '
)

block4a_activation (Activation (None, 14, 14, 224) 0
['block4a_bn[0][0] '
)

block4a_se_squeeze (GlobalAver (None, 224) 0

```



```

['block4a_activation[0][0]']
agePooling2D)

block4a_se_reshape (Reshape) (None, 1, 1, 224) 0
['block4a_se_squeeze[0][0]']

block4a_se_reduce (Conv2D) (None, 1, 1, 14) 3150
['block4a_se_reshape[0][0]']

block4a_se_expand (Conv2D) (None, 1, 1, 224) 3360
['block4a_se_reduce[0][0]']

block4a_se_excite (Multiply) (None, 14, 14, 224) 0
['block4a_activation[0][0]',
'block4a_se_expand[0][0]']

block4a_project_conv (Conv2D) (None, 14, 14, 112) 25088
['block4a_se_excite[0][0]']

block4a_project_bn (BatchNormal (None, 14, 14, 112) 448
['block4a_project_conv[0][0]']
ization)

block4b_expand_conv (Conv2D) (None, 14, 14, 448) 50176
['block4a_project_bn[0][0]']

block4b_expand_bn (BatchNormal (None, 14, 14, 448) 1792
['block4b_expand_conv[0][0]']
ization)

block4b_expand_activation (Act (None, 14, 14, 448) 0
['block4b_expand_bn[0][0]']
ivation)

block4b_dwconv2 (DepthwiseConv (None, 14, 14, 448) 4032
['block4b_expand_activation[0][0]
2D)

block4b_bn (BatchNormalization (None, 14, 14, 448) 1792
['block4b_dwconv2[0][0]']
)

block4b_activation (Activation (None, 14, 14, 448) 0
['block4b_bn[0][0]']
)

block4b_se_squeeze (GlobalAver (None, 448) 0
['block4b_activation[0][0]']

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```

agePooling2D)

block4b_se_reshape (Reshape)      (None, 1, 1, 448)      0
['block4b_se_squeeze[0][0]']

block4b_se_reduce (Conv2D)        (None, 1, 1, 28)      12572
['block4b_se_reshape[0][0]']

block4b_se_expand (Conv2D)        (None, 1, 1, 448)      12992
['block4b_se_reduce[0][0]']

block4b_se_excite (Multiply)      (None, 14, 14, 448)    0
['block4b_activation[0][0]',
'block4b_se_expand[0][0]']

block4b_project_conv (Conv2D)     (None, 14, 14, 112)    50176
['block4b_se_excite[0][0]']

block4b_project_bn (BatchNormaliza (None, 14, 14, 112)    448
['block4b_project_conv[0][0]']
lization)

block4b_drop (Dropout)            (None, 14, 14, 112)    0
['block4b_project_bn[0][0]']

block4b_add (Add)                 (None, 14, 14, 112)    0
['block4b_drop[0][0]',
'block4a_project_bn[0][0]']

block4c_expand_conv (Conv2D)      (None, 14, 14, 448)    50176
['block4b_add[0][0]']

block4c_expand_bn (BatchNormaliza (None, 14, 14, 448)    1792
['block4c_expand_conv[0][0]']
lization)

block4c_expand_activation (Activa (None, 14, 14, 448)    0
['block4c_expand_bn[0][0]']
tion)

block4c_dwconv2 (DepthwiseConv2D) (None, 14, 14, 448)    4032
['block4c_expand_activation[0][0]
2D)

block4c_bn (BatchNormalization)    (None, 14, 14, 448)    1792
['block4c_dwconv2[0][0]']
)

```

```

    block4c_activation (Activation (None, 14, 14, 448) 0
['block4c_bn[0][0]']
)

    block4c_se_squeeze (GlobalAveragePooling2D) (None, 448) 0
['block4c_activation[0][0]']

    block4c_se_reshape (Reshape) (None, 1, 1, 448) 0
['block4c_se_squeeze[0][0]']

    block4c_se_reduce (Conv2D) (None, 1, 1, 28) 12572
['block4c_se_reshape[0][0]']

    block4c_se_expand (Conv2D) (None, 1, 1, 448) 12992
['block4c_se_reduce[0][0]']

    block4c_se_excite (Multiply) (None, 14, 14, 448) 0
['block4c_activation[0][0]',
'block4c_se_expand[0][0]']

    block4c_project_conv (Conv2D) (None, 14, 14, 112) 50176
['block4c_se_excite[0][0]']

    block4c_project_bn (BatchNormalization) (None, 14, 14, 112) 448
['block4c_project_conv[0][0]']

    block4c_drop (Dropout) (None, 14, 14, 112) 0
['block4c_project_bn[0][0]']

    block4c_add (Add) (None, 14, 14, 112) 0
['block4c_drop[0][0]',
'block4b_add[0][0]']

    block4d_expand_conv (Conv2D) (None, 14, 14, 448) 50176
['block4c_add[0][0]']

    block4d_expand_bn (BatchNormalization) (None, 14, 14, 448) 1792
['block4d_expand_conv[0][0]']

    block4d_expand_activation (Activation) (None, 14, 14, 448) 0
['block4d_expand_bn[0][0]']

    block4d_dwconv2 (DepthwiseConv2D) (None, 14, 14, 448) 4032
['block4d_expand_activation[0][0]']

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2D)

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block4d\_bn (BatchNormalization (None, 14, 14, 448) 1792  
['block4d\_dwconv2[0][0]']  
)

block4d\_activation (Activation (None, 14, 14, 448) 0  
['block4d\_bn[0][0]']  
)

block4d\_se\_squeeze (GlobalAveragePooling2D) (None, 448) 0  
['block4d\_activation[0][0]']  
agePooling2D)

block4d\_se\_reshape (Reshape) (None, 1, 1, 448) 0  
['block4d\_se\_squeeze[0][0]']

block4d\_se\_reduce (Conv2D) (None, 1, 1, 28) 12572  
['block4d\_se\_reshape[0][0]']

block4d\_se\_expand (Conv2D) (None, 1, 1, 448) 12992  
['block4d\_se\_reduce[0][0]']

block4d\_se\_excite (Multiply) (None, 14, 14, 448) 0  
['block4d\_activation[0][0]',  
'block4d\_se\_expand[0][0]']

block4d\_project\_conv (Conv2D) (None, 14, 14, 112) 50176  
['block4d\_se\_excite[0][0]']

block4d\_project\_bn (BatchNormalization) (None, 14, 14, 112) 448  
['block4d\_project\_conv[0][0]']  
lization)

block4d\_drop (Dropout) (None, 14, 14, 112) 0  
['block4d\_project\_bn[0][0]']

block4d\_add (Add) (None, 14, 14, 112) 0  
['block4d\_drop[0][0]',  
'block4c\_add[0][0]']

block4e\_expand\_conv (Conv2D) (None, 14, 14, 448) 50176  
['block4d\_add[0][0]']

block4e\_expand\_bn (BatchNormalization) (None, 14, 14, 448) 1792  
['block4e\_expand\_conv[0][0]']  
ization)

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    block4e_expand_activation (Activation (None, 14, 14, 448) 0
['block4e_expand_bn[0][0]']
    ivation)

    block4e_dwconv2 (DepthwiseConv (None, 14, 14, 448) 4032
['block4e_expand_activation[0][0]
    2D)

    block4e_bn (BatchNormalization (None, 14, 14, 448) 1792
['block4e_dwconv2[0][0]']
    )

    block4e_activation (Activation (None, 14, 14, 448) 0
['block4e_bn[0][0]']
    )

    block4e_se_squeeze (GlobalAveragePooling2D (None, 448) 0
['block4e_activation[0][0]']
    agePooling2D)

    block4e_se_reshape (Reshape (None, 1, 1, 448) 0
['block4e_se_squeeze[0][0]']
    )

    block4e_se_reduce (Conv2D (None, 1, 1, 28) 12572
['block4e_se_reshape[0][0]']
    )

    block4e_se_expand (Conv2D (None, 1, 1, 448) 12992
['block4e_se_reduce[0][0]']
    )

    block4e_se_excite (Multiply (None, 14, 14, 448) 0
['block4e_activation[0][0]',
'block4e_se_expand[0][0]']
    )

    block4e_project_conv (Conv2D (None, 14, 14, 112) 50176
['block4e_se_excite[0][0]']
    )

    block4e_project_bn (BatchNormalization (None, 14, 14, 112) 448
['block4e_project_conv[0][0]']
    ization)

    block4e_drop (Dropout (None, 14, 14, 112) 0
['block4e_project_bn[0][0]']
    )

    block4e_add (Add (None, 14, 14, 112) 0
['block4e_drop[0][0]',
'block4d_add[0][0]']
    )

    block5a_expand_conv (Conv2D (None, 14, 14, 672) 75264

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```

['block4e_add[0][0]']

block5a_expand_bn (BatchNormal (None, 14, 14, 672) 2688
['block5a_expand_conv[0][0]']
ization)

block5a_expand_activation (Act (None, 14, 14, 672) 0
['block5a_expand_bn[0][0]']
ivation)

block5a_dwconv2 (DepthwiseConv (None, 14, 14, 672) 6048
['block5a_expand_activation[0][0]
2D)

block5a_bn (BatchNormalization (None, 14, 14, 672) 2688
['block5a_dwconv2[0][0]']
)

block5a_activation (Activation (None, 14, 14, 672) 0
['block5a_bn[0][0]']
)

block5a_se_squeeze (GlobalAver (None, 672) 0
['block5a_activation[0][0]']
agePooling2D)

block5a_se_reshape (Reshape) (None, 1, 1, 672) 0
['block5a_se_squeeze[0][0]']

block5a_se_reduce (Conv2D) (None, 1, 1, 28) 18844
['block5a_se_reshape[0][0]']

block5a_se_expand (Conv2D) (None, 1, 1, 672) 19488
['block5a_se_reduce[0][0]']

block5a_se_excite (Multiply) (None, 14, 14, 672) 0
['block5a_activation[0][0]',
'block5a_se_expand[0][0]']

block5a_project_conv (Conv2D) (None, 14, 14, 136) 91392
['block5a_se_excite[0][0]']

block5a_project_bn (BatchNorma (None, 14, 14, 136) 544
['block5a_project_conv[0][0]']
lization)

block5b_expand_conv (Conv2D) (None, 14, 14, 816) 110976
['block5a_project_bn[0][0]']

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block5b_expand_bn (BatchNormal (None, 14, 14, 816) 3264
['block5b_expand_conv[0][0]']
ization)

block5b_expand_activation (Act (None, 14, 14, 816) 0
['block5b_expand_bn[0][0]']
ivation)

block5b_dwconv2 (DepthwiseConv (None, 14, 14, 816) 7344
['block5b_expand_activation[0][0]
2D)

block5b_bn (BatchNormalization (None, 14, 14, 816) 3264
['block5b_dwconv2[0][0]']
)

block5b_activation (Activation (None, 14, 14, 816) 0
['block5b_bn[0][0]']
)

block5b_se_squeeze (GlobalAver (None, 816) 0
['block5b_activation[0][0]']
agePooling2D)

block5b_se_reshape (Reshape) (None, 1, 1, 816) 0
['block5b_se_squeeze[0][0]']

block5b_se_reduce (Conv2D) (None, 1, 1, 34) 27778
['block5b_se_reshape[0][0]']

block5b_se_expand (Conv2D) (None, 1, 1, 816) 28560
['block5b_se_reduce[0][0]']

block5b_se_excite (Multiply) (None, 14, 14, 816) 0
['block5b_activation[0][0]',
'block5b_se_expand[0][0]']

block5b_project_conv (Conv2D) (None, 14, 14, 136) 110976
['block5b_se_excite[0][0]']

block5b_project_bn (BatchNorma (None, 14, 14, 136) 544
['block5b_project_conv[0][0]']
lization)

block5b_drop (Dropout) (None, 14, 14, 136) 0
['block5b_project_bn[0][0]']

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```

    block5b_add (Add) (None, 14, 14, 136) 0
['block5b_drop[0][0]',
'block5a_project_bn[0][0]']

    block5c_expand_conv (Conv2D) (None, 14, 14, 816) 110976
['block5b_add[0][0]']

    block5c_expand_bn (BatchNormal (None, 14, 14, 816) 3264
['block5c_expand_conv[0][0]']
ization)

    block5c_expand_activation (Act (None, 14, 14, 816) 0
['block5c_expand_bn[0][0]']
ivation)

    block5c_dwconv2 (DepthwiseConv (None, 14, 14, 816) 7344
['block5c_expand_activation[0][0]
2D)

    block5c_bn (BatchNormalization (None, 14, 14, 816) 3264
['block5c_dwconv2[0][0]']
)

    block5c_activation (Activation (None, 14, 14, 816) 0
['block5c_bn[0][0]']
)

    block5c_se_squeeze (GlobalAver (None, 816) 0
['block5c_activation[0][0]']
agePooling2D)

    block5c_se_reshape (Reshape) (None, 1, 1, 816) 0
['block5c_se_squeeze[0][0]']

    block5c_se_reduce (Conv2D) (None, 1, 1, 34) 27778
['block5c_se_reshape[0][0]']

    block5c_se_expand (Conv2D) (None, 1, 1, 816) 28560
['block5c_se_reduce[0][0]']

    block5c_se_excite (Multiply) (None, 14, 14, 816) 0
['block5c_activation[0][0]',
'block5c_se_expand[0][0]']

    block5c_project_conv (Conv2D) (None, 14, 14, 136) 110976
['block5c_se_excite[0][0]']

    block5c_project_bn (BatchNorma (None, 14, 14, 136) 544

```



```

['block5c_project_conv[0][0]']
lization)

block5c_drop (Dropout)          (None, 14, 14, 136) 0
['block5c_project_bn[0][0]']

block5c_add (Add)                (None, 14, 14, 136) 0
['block5c_drop[0][0]',
'block5b_add[0][0]']

block5d_expand_conv (Conv2D)     (None, 14, 14, 816) 110976
['block5c_add[0][0]']

block5d_expand_bn (BatchNormal   (None, 14, 14, 816) 3264
['block5d_expand_conv[0][0]']
ization)

block5d_expand_activation (Act   (None, 14, 14, 816) 0
['block5d_expand_bn[0][0]']
ivation)

block5d_dwconv2 (DepthwiseConv   (None, 14, 14, 816) 7344
['block5d_expand_activation[0][0]
2D)

block5d_bn (BatchNormalization   (None, 14, 14, 816) 3264
['block5d_dwconv2[0][0]']
)

block5d_activation (Activation   (None, 14, 14, 816) 0
['block5d_bn[0][0]']
)

block5d_se_squeeze (GlobalAver   (None, 816) 0
['block5d_activation[0][0]']
agePooling2D)

block5d_se_reshape (Reshape)     (None, 1, 1, 816) 0
['block5d_se_squeeze[0][0]']

block5d_se_reduce (Conv2D)       (None, 1, 1, 34) 27778
['block5d_se_reshape[0][0]']

block5d_se_expand (Conv2D)       (None, 1, 1, 816) 28560
['block5d_se_reduce[0][0]']

block5d_se_excite (Multiply)     (None, 14, 14, 816) 0
['block5d_activation[0][0]',

```

```

'block5d_se_expand[0][0]']

block5d_project_conv (Conv2D) (None, 14, 14, 136) 110976
['block5d_se_excite[0][0]']

block5d_project_bn (BatchNormal (None, 14, 14, 136) 544
['block5d_project_conv[0][0]']
ization)

block5d_drop (Dropout) (None, 14, 14, 136) 0
['block5d_project_bn[0][0]']

block5d_add (Add) (None, 14, 14, 136) 0
['block5d_drop[0][0]',
'block5c_add[0][0]']

block5e_expand_conv (Conv2D) (None, 14, 14, 816) 110976
['block5d_add[0][0]']

block5e_expand_bn (BatchNormal (None, 14, 14, 816) 3264
['block5e_expand_conv[0][0]']
ization)

block5e_expand_activation (Act (None, 14, 14, 816) 0
['block5e_expand_bn[0][0]']
ivation)

block5e_dwconv2 (DepthwiseConv (None, 14, 14, 816) 7344
['block5e_expand_activation[0][0]
2D)

block5e_bn (BatchNormalization (None, 14, 14, 816) 3264
['block5e_dwconv2[0][0]']
)

block5e_activation (Activation (None, 14, 14, 816) 0
['block5e_bn[0][0]']
)

block5e_se_squeeze (GlobalAver (None, 816) 0
['block5e_activation[0][0]']
agePooling2D)

block5e_se_reshape (Reshape) (None, 1, 1, 816) 0
['block5e_se_squeeze[0][0]']

block5e_se_reduce (Conv2D) (None, 1, 1, 34) 27778
['block5e_se_reshape[0][0]']

```

```

    block5e_se_expand (Conv2D)      (None, 1, 1, 816)    28560
['block5e_se_reduce[0][0]']

    block5e_se_excite (Multiply)    (None, 14, 14, 816)  0
['block5e_activation[0][0]',
'block5e_se_expand[0][0]']

    block5e_project_conv (Conv2D)   (None, 14, 14, 136)  110976
['block5e_se_excite[0][0]']

    block5e_project_bn (BatchNorma  (None, 14, 14, 136)  544
['block5e_project_conv[0][0]']
lization)

    block5e_drop (Dropout)          (None, 14, 14, 136)  0
['block5e_project_bn[0][0]']

    block5e_add (Add)               (None, 14, 14, 136)  0
['block5e_drop[0][0]',
'block5d_add[0][0]']

    block5f_expand_conv (Conv2D)    (None, 14, 14, 816)  110976
['block5e_add[0][0]']

    block5f_expand_bn (BatchNormal  (None, 14, 14, 816)  3264
['block5f_expand_conv[0][0]']
lization)

    block5f_expand_activation (Act  (None, 14, 14, 816)  0
['block5f_expand_bn[0][0]']
ivation)

    block5f_dwconv2 (DepthwiseConv  (None, 14, 14, 816)  7344
['block5f_expand_activation[0][0]
2D)

    block5f_bn (BatchNormalization  (None, 14, 14, 816)  3264
['block5f_dwconv2[0][0]']
)

    block5f_activation (Activation  (None, 14, 14, 816)  0
['block5f_bn[0][0]']
)

    block5f_se_squeeze (GlobalAver  (None, 816)          0
['block5f_activation[0][0]']
agePooling2D)

```

```

    block5f_se_reshape (Reshape)      (None, 1, 1, 816)      0
['block5f_se_squeeze[0][0]']

    block5f_se_reduce (Conv2D)        (None, 1, 1, 34)      27778
['block5f_se_reshape[0][0]']

    block5f_se_expand (Conv2D)        (None, 1, 1, 816)      28560
['block5f_se_reduce[0][0]']

    block5f_se_excite (Multiply)      (None, 14, 14, 816)   0
['block5f_activation[0][0]',
'block5f_se_expand[0][0]']

    block5f_project_conv (Conv2D)     (None, 14, 14, 136)   110976
['block5f_se_excite[0][0]']

    block5f_project_bn (BatchNormal   (None, 14, 14, 136)   544
['block5f_project_conv[0][0]',
lization)

    block5f_drop (Dropout)            (None, 14, 14, 136)   0
['block5f_project_bn[0][0]']

    block5f_add (Add)                 (None, 14, 14, 136)   0
['block5f_drop[0][0]',
'block5e_add[0][0]']

    block5g_expand_conv (Conv2D)      (None, 14, 14, 816)   110976
['block5f_add[0][0]']

    block5g_expand_bn (BatchNormal    (None, 14, 14, 816)   3264
['block5g_expand_conv[0][0]',
lization)

    block5g_expand_activation (Act     (None, 14, 14, 816)   0
['block5g_expand_bn[0][0]',
ivation)

    block5g_dwconv2 (DepthwiseConv    (None, 14, 14, 816)   7344
['block5g_expand_activation[0][0]',
2D)

    block5g_bn (BatchNormalization    (None, 14, 14, 816)   3264
['block5g_dwconv2[0][0]',
)

    block5g_activation (Activation     (None, 14, 14, 816)   0

```

```

['block5g_bn[0][0]']
)

block5g_se_squeeze (GlobalAveragePooling2D) (None, 816) 0
['block5g_activation[0][0]']

block5g_se_reshape (Reshape) (None, 1, 1, 816) 0
['block5g_se_squeeze[0][0]']

block5g_se_reduce (Conv2D) (None, 1, 1, 34) 27778
['block5g_se_reshape[0][0]']

block5g_se_expand (Conv2D) (None, 1, 1, 816) 28560
['block5g_se_reduce[0][0]']

block5g_se_excite (Multiply) (None, 14, 14, 816) 0
['block5g_activation[0][0]',
'block5g_se_expand[0][0]']

block5g_project_conv (Conv2D) (None, 14, 14, 136) 110976
['block5g_se_excite[0][0]']

block5g_project_bn (BatchNormalization) (None, 14, 14, 136) 544
['block5g_project_conv[0][0]']

block5g_drop (Dropout) (None, 14, 14, 136) 0
['block5g_project_bn[0][0]']

block5g_add (Add) (None, 14, 14, 136) 0
['block5g_drop[0][0]',
'block5f_add[0][0]']

block6a_expand_conv (Conv2D) (None, 14, 14, 816) 110976
['block5g_add[0][0]']

block6a_expand_bn (BatchNormalization) (None, 14, 14, 816) 3264
['block6a_expand_conv[0][0]']

block6a_expand_activation (Activation) (None, 14, 14, 816) 0
['block6a_expand_bn[0][0]']

block6a_dwconv2 (DepthwiseConv2D) (None, 7, 7, 816) 7344
['block6a_expand_activation[0][0]']
2D)
']

```

```

    block6a_bn (BatchNormalization (None, 7, 7, 816) 3264
['block6a_dwconv2[0][0]']
)

    block6a_activation (Activation (None, 7, 7, 816) 0
['block6a_bn[0][0]']
)

    block6a_se_squeeze (GlobalAveragePooling2D) (None, 816) 0
['block6a_activation[0][0]']

    block6a_se_reshape (Reshape) (None, 1, 1, 816) 0
['block6a_se_squeeze[0][0]']

    block6a_se_reduce (Conv2D) (None, 1, 1, 34) 27778
['block6a_se_reshape[0][0]']

    block6a_se_expand (Conv2D) (None, 1, 1, 816) 28560
['block6a_se_reduce[0][0]']

    block6a_se_excite (Multiply) (None, 7, 7, 816) 0
['block6a_activation[0][0]',
'block6a_se_expand[0][0]']

    block6a_project_conv (Conv2D) (None, 7, 7, 232) 189312
['block6a_se_excite[0][0]']

    block6a_project_bn (BatchNormalization) (None, 7, 7, 232) 928
['block6a_project_conv[0][0]']

    block6b_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6a_project_bn[0][0]']

    block6b_expand_bn (BatchNormalization) (None, 7, 7, 1392) 5568
['block6b_expand_conv[0][0]']

    block6b_expand_activation (Activation) (None, 7, 7, 1392) 0
['block6b_expand_bn[0][0]']

    block6b_dwconv2 (DepthwiseConv2D) (None, 7, 7, 1392) 12528
['block6b_expand_activation[0][0]']

```

```

    block6b_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6b_dwconv2[0][0]']
)

    block6b_activation (Activation (None, 7, 7, 1392) 0
['block6b_bn[0][0]']
)

    block6b_se_squeeze (GlobalAveragePooling2D) (None, 1392) 0
['block6b_activation[0][0]']

    block6b_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6b_se_squeeze[0][0]']

    block6b_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6b_se_reshape[0][0]']

    block6b_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6b_se_reduce[0][0]']

    block6b_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6b_activation[0][0]',
'block6b_se_expand[0][0]']

    block6b_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6b_se_excite[0][0]']

    block6b_project_bn (BatchNormalization) (None, 7, 7, 232) 928
['block6b_project_conv[0][0]']

    block6b_drop (Dropout) (None, 7, 7, 232) 0
['block6b_project_bn[0][0]']

    block6b_add (Add) (None, 7, 7, 232) 0
['block6b_drop[0][0]',
'block6a_project_bn[0][0]']

    block6c_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6b_add[0][0]']

    block6c_expand_bn (BatchNormalization) (None, 7, 7, 1392) 5568
['block6c_expand_conv[0][0]']

    block6c_expand_activation (Activation) (None, 7, 7, 1392) 0
['block6c_expand_bn[0][0]']

```

```

ivation)

block6c_dwconv2 (DepthwiseConv (None, 7, 7, 1392) 12528
['block6c_expand_activation[0][0]
2D)

block6c_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6c_dwconv2[0][0]']
)

block6c_activation (Activation (None, 7, 7, 1392) 0
['block6c_bn[0][0]']
)

block6c_se_squeeze (GlobalAver (None, 1392) 0
['block6c_activation[0][0]']
agePooling2D)

block6c_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6c_se_squeeze[0][0]']

block6c_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6c_se_reshape[0][0]']

block6c_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6c_se_reduce[0][0]']

block6c_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6c_activation[0][0]',
'block6c_se_expand[0][0]']

block6c_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6c_se_excite[0][0]']

block6c_project_bn (BatchNorma (None, 7, 7, 232) 928
['block6c_project_conv[0][0]']
lization)

block6c_drop (Dropout) (None, 7, 7, 232) 0
['block6c_project_bn[0][0]']

block6c_add (Add) (None, 7, 7, 232) 0
['block6c_drop[0][0]',
'block6b_add[0][0]']

block6d_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6c_add[0][0]']

```



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    block6d_expand_bn (BatchNormal (None, 7, 7, 1392) 5568
['block6d_expand_conv[0][0]']
    ization)

    block6d_expand_activation (Act (None, 7, 7, 1392) 0
['block6d_expand_bn[0][0]']
    ivation)

    block6d_dwconv2 (DepthwiseConv (None, 7, 7, 1392) 12528
['block6d_expand_activation[0][0]
    2D)

    block6d_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6d_dwconv2[0][0]']
    )

    block6d_activation (Activation (None, 7, 7, 1392) 0
['block6d_bn[0][0]']
    )

    block6d_se_squeeze (GlobalAver (None, 1392) 0
['block6d_activation[0][0]']
    agePooling2D)

    block6d_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6d_se_squeeze[0][0]']

    block6d_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6d_se_reshape[0][0]']

    block6d_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6d_se_reduce[0][0]']

    block6d_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6d_activation[0][0]',
'block6d_se_expand[0][0]']

    block6d_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6d_se_excite[0][0]']

    block6d_project_bn (BatchNorma (None, 7, 7, 232) 928
['block6d_project_conv[0][0]']
    lization)

    block6d_drop (Dropout) (None, 7, 7, 232) 0
['block6d_project_bn[0][0]']

    block6d_add (Add) (None, 7, 7, 232) 0

```

```

['block6d_drop[0][0]',
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block6e_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6d_add[0][0]']

block6e_expand_bn (BatchNormal (None, 7, 7, 1392) 5568
['block6e_expand_conv[0][0]']
ization)

block6e_expand_activation (Act (None, 7, 7, 1392) 0
['block6e_expand_bn[0][0]']
ivation)

block6e_dwconv2 (DepthwiseConv (None, 7, 7, 1392) 12528
['block6e_expand_activation[0][0]
2D)

block6e_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6e_dwconv2[0][0]']
)

block6e_activation (Activation (None, 7, 7, 1392) 0
['block6e_bn[0][0]']
)

block6e_se_squeeze (GlobalAver (None, 1392) 0
['block6e_activation[0][0]']
agePooling2D)

block6e_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6e_se_squeeze[0][0]']

block6e_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6e_se_reshape[0][0]']

block6e_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6e_se_reduce[0][0]']

block6e_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6e_activation[0][0]',
'block6e_se_expand[0][0]']

block6e_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6e_se_excite[0][0]']

block6e_project_bn (BatchNorma (None, 7, 7, 232) 928
['block6e_project_conv[0][0]']

```

```

lization)

block6e_drop (Dropout)      (None, 7, 7, 232)    0
['block6e_project_bn[0][0]']

block6e_add (Add)           (None, 7, 7, 232)    0
['block6e_drop[0][0]',
'block6d_add[0][0]']

block6f_expand_conv (Conv2D) (None, 7, 7, 1392)  322944
['block6e_add[0][0]']

block6f_expand_bn (BatchNormal (None, 7, 7, 1392)  5568
ization)
['block6f_expand_conv[0][0]']

block6f_expand_activation (Act (None, 7, 7, 1392)  0
ivation)
['block6f_expand_bn[0][0]']

block6f_dwconv2 (DepthwiseConv (None, 7, 7, 1392)  12528
2D)
['block6f_expand_activation[0][0]']

block6f_bn (BatchNormalization (None, 7, 7, 1392)  5568
['block6f_dwconv2[0][0]']
)

block6f_activation (Activation (None, 7, 7, 1392)  0
['block6f_bn[0][0]']
)

block6f_se_squeeze (GlobalAver (None, 1392)      0
agePooling2D)
['block6f_activation[0][0]']

block6f_se_reshape (Reshape)   (None, 1, 1, 1392)  0
['block6f_se_squeeze[0][0]']

block6f_se_reduce (Conv2D)     (None, 1, 1, 58)    80794
['block6f_se_reshape[0][0]']

block6f_se_expand (Conv2D)     (None, 1, 1, 1392)  82128
['block6f_se_reduce[0][0]']

block6f_se_excite (Multiply)   (None, 7, 7, 1392)  0
['block6f_activation[0][0]',
'block6f_se_expand[0][0]']

```

block6f_project_conv (Conv2D)	(None, 7, 7, 232)	322944
['block6f_se_excite[0][0]']		
block6f_project_bn (BatchNormalization)	(None, 7, 7, 232)	928
['block6f_project_conv[0][0]']		
block6f_drop (Dropout)	(None, 7, 7, 232)	0
['block6f_project_bn[0][0]']		
block6f_add (Add)	(None, 7, 7, 232)	0
['block6f_drop[0][0]', 'block6e_add[0][0]']		
block6g_expand_conv (Conv2D)	(None, 7, 7, 1392)	322944
['block6f_add[0][0]']		
block6g_expand_bn (BatchNormalization)	(None, 7, 7, 1392)	5568
['block6g_expand_conv[0][0]']		
block6g_expand_activation (Activation)	(None, 7, 7, 1392)	0
['block6g_expand_bn[0][0]']		
block6g_dwconv2 (DepthwiseConv2D)	(None, 7, 7, 1392)	12528
['block6g_expand_activation[0][0]']		
block6g_bn (BatchNormalization)	(None, 7, 7, 1392)	5568
['block6g_dwconv2[0][0]']		
block6g_activation (Activation)	(None, 7, 7, 1392)	0
['block6g_bn[0][0]']		
block6g_se_squeeze (GlobalAveragePooling2D)	(None, 1392)	0
['block6g_activation[0][0]']		
block6g_se_reshape (Reshape)	(None, 1, 1, 1392)	0
['block6g_se_squeeze[0][0]']		
block6g_se_reduce (Conv2D)	(None, 1, 1, 58)	80794
['block6g_se_reshape[0][0]']		

block6g_se_expand (Conv2D) ['block6g_se_reduce[0][0]']	(None, 1, 1, 1392)	82128
block6g_se_excite (Multiply) ['block6g_activation[0][0]', 'block6g_se_expand[0][0]']	(None, 7, 7, 1392)	0
block6g_project_conv (Conv2D) ['block6g_se_excite[0][0]']	(None, 7, 7, 232)	322944
block6g_project_bn (BatchNormal ization)	(None, 7, 7, 232)	928
block6g_drop (Dropout) ['block6g_project_bn[0][0]']	(None, 7, 7, 232)	0
block6g_add (Add) ['block6g_drop[0][0]', 'block6f_add[0][0]']	(None, 7, 7, 232)	0
block6h_expand_conv (Conv2D) ['block6g_add[0][0]']	(None, 7, 7, 1392)	322944
block6h_expand_bn (BatchNormal ization)	(None, 7, 7, 1392)	5568
block6h_expand_activation (Act ivation)	(None, 7, 7, 1392)	0
block6h_dwconv2 (DepthwiseConv 2D)	(None, 7, 7, 1392)	12528
block6h_bn (BatchNormalization )	(None, 7, 7, 1392)	5568
block6h_activation (Activation )	(None, 7, 7, 1392)	0
block6h_se_squeeze (GlobalAver agePooling2D)	(None, 1392)	0

block6h_se_reshape (Reshape) ['block6h_se_squeeze[0][0]']	(None, 1, 1, 1392)	0
block6h_se_reduce (Conv2D) ['block6h_se_reshape[0][0]']	(None, 1, 1, 58)	80794
block6h_se_expand (Conv2D) ['block6h_se_reduce[0][0]']	(None, 1, 1, 1392)	82128
block6h_se_excite (Multiply) ['block6h_activation[0][0]', 'block6h_se_expand[0][0]']	(None, 7, 7, 1392)	0
block6h_project_conv (Conv2D) ['block6h_se_excite[0][0]']	(None, 7, 7, 232)	322944
block6h_project_bn (BatchNormal lization) ['block6h_project_conv[0][0]']	(None, 7, 7, 232)	928
block6h_drop (Dropout) ['block6h_project_bn[0][0]']	(None, 7, 7, 232)	0
block6h_add (Add) ['block6h_drop[0][0]', 'block6g_add[0][0]']	(None, 7, 7, 232)	0
block6i_expand_conv (Conv2D) ['block6h_add[0][0]']	(None, 7, 7, 1392)	322944
block6i_expand_bn (BatchNormal ization) ['block6i_expand_conv[0][0]']	(None, 7, 7, 1392)	5568
block6i_expand_activation (Act ivation) ['block6i_expand_bn[0][0]']	(None, 7, 7, 1392)	0
block6i_dwconv2 (DepthwiseConv 2D) ['block6i_expand_activation[0][0]']	(None, 7, 7, 1392)	12528
block6i_bn (BatchNormalization) ['block6i_dwconv2[0][0]'] )	(None, 7, 7, 1392)	5568
block6i_activation (Activation) ['block6i_bn[0][0]']	(None, 7, 7, 1392)	0

```

)

block6i_se_squeeze (GlobalAveragePooling2D) (None, 1392) 0
['block6i_activation[0][0]']

block6i_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6i_se_squeeze[0][0]']

block6i_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6i_se_reshape[0][0]']

block6i_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6i_se_reduce[0][0]']

block6i_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6i_activation[0][0]',
'block6i_se_expand[0][0]']

block6i_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6i_se_excite[0][0]']

block6i_project_bn (BatchNormalization) (None, 7, 7, 232) 928
['block6i_project_conv[0][0]']

block6i_drop (Dropout) (None, 7, 7, 232) 0
['block6i_project_bn[0][0]']

block6i_add (Add) (None, 7, 7, 232) 0
['block6i_drop[0][0]',
'block6h_add[0][0]']

block6j_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6i_add[0][0]']

block6j_expand_bn (BatchNormalization) (None, 7, 7, 1392) 5568
['block6j_expand_conv[0][0]']

block6j_expand_activation (Activation) (None, 7, 7, 1392) 0
['block6j_expand_bn[0][0]']

block6j_dwconv2 (DepthwiseConv2D) (None, 7, 7, 1392) 12528
['block6j_expand_activation[0][0]']
2D)
']

```

```

    block6j_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6j_dwconv2[0][0]']
)

    block6j_activation (Activation (None, 7, 7, 1392) 0
['block6j_bn[0][0]']
)

    block6j_se_squeeze (GlobalAveragePooling2D) (None, 1392) 0
['block6j_activation[0][0]']

    block6j_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6j_se_squeeze[0][0]']

    block6j_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6j_se_reshape[0][0]']

    block6j_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6j_se_reduce[0][0]']

    block6j_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6j_activation[0][0]',
'block6j_se_expand[0][0]']

    block6j_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6j_se_excite[0][0]']

    block6j_project_bn (BatchNormalization) (None, 7, 7, 232) 928
['block6j_project_conv[0][0]']

    block6j_drop (Dropout) (None, 7, 7, 232) 0
['block6j_project_bn[0][0]']

    block6j_add (Add) (None, 7, 7, 232) 0
['block6j_drop[0][0]',
'block6i_add[0][0]']

    block6k_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6j_add[0][0]']

    block6k_expand_bn (BatchNormalization) (None, 7, 7, 1392) 5568
['block6k_expand_conv[0][0]']

    block6k_expand_activation (Activation) (None, 7, 7, 1392) 0
['block6k_expand_bn[0][0]']

```



```

ivation)

block6k_dwconv2 (DepthwiseConv (None, 7, 7, 1392) 12528
['block6k_expand_activation[0][0]
2D)

block6k_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6k_dwconv2[0][0]')

block6k_activation (Activation (None, 7, 7, 1392) 0
['block6k_bn[0][0]')

block6k_se_squeeze (GlobalAveragePooling2D) (None, 1392) 0
['block6k_activation[0][0]']

block6k_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6k_se_squeeze[0][0]']

block6k_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6k_se_reshape[0][0]']

block6k_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6k_se_reduce[0][0]']

block6k_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6k_activation[0][0]',
'block6k_se_expand[0][0]']

block6k_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6k_se_excite[0][0]']

block6k_project_bn (BatchNormalization) (None, 7, 7, 232) 928
['block6k_project_conv[0][0]']

block6k_drop (Dropout) (None, 7, 7, 232) 0
['block6k_project_bn[0][0]']

block6k_add (Add) (None, 7, 7, 232) 0
['block6k_drop[0][0]',
'block6j_add[0][0]']

block6l_expand_conv (Conv2D) (None, 7, 7, 1392) 322944
['block6k_add[0][0]']

```

```

block6l_expand_bn (BatchNormal (None, 7, 7, 1392) 5568
['block6l_expand_conv[0][0]']
ization)

block6l_expand_activation (Act (None, 7, 7, 1392) 0
['block6l_expand_bn[0][0]']
ivation)

block6l_dwconv2 (DepthwiseConv (None, 7, 7, 1392) 12528
['block6l_expand_activation[0][0]
2D)

block6l_bn (BatchNormalization (None, 7, 7, 1392) 5568
['block6l_dwconv2[0][0]']
)

block6l_activation (Activation (None, 7, 7, 1392) 0
['block6l_bn[0][0]']
)

block6l_se_squeeze (GlobalAver (None, 1392) 0
['block6l_activation[0][0]']
agePooling2D)

block6l_se_reshape (Reshape) (None, 1, 1, 1392) 0
['block6l_se_squeeze[0][0]']

block6l_se_reduce (Conv2D) (None, 1, 1, 58) 80794
['block6l_se_reshape[0][0]']

block6l_se_expand (Conv2D) (None, 1, 1, 1392) 82128
['block6l_se_reduce[0][0]']

block6l_se_excite (Multiply) (None, 7, 7, 1392) 0
['block6l_activation[0][0]',
'block6l_se_expand[0][0]']

block6l_project_conv (Conv2D) (None, 7, 7, 232) 322944
['block6l_se_excite[0][0]']

block6l_project_bn (BatchNorma (None, 7, 7, 232) 928
['block6l_project_conv[0][0]']
lization)

block6l_drop (Dropout) (None, 7, 7, 232) 0
['block6l_project_bn[0][0]']

block6l_add (Add) (None, 7, 7, 232) 0

```

```
['block6l_drop[0][0]',
'block6k_add[0][0]']

top_conv (Conv2D)          (None, 7, 7, 1536)    356352
['block6l_add[0][0]']

top_bn (BatchNormalization) (None, 7, 7, 1536)    6144
['top_conv[0][0]']

top_activation (Activation) (None, 7, 7, 1536)    0
['top_bn[0][0]']
```

```
=====
Total params: 12,930,622
Trainable params: 12,821,406
Non-trainable params: 109,216
-----
```

```
[8]: x = base_model.output
      x = GlobalAveragePooling2D()(x)
      output = Dense(num_classes, activation='softmax')(x)
      model = Model(inputs=base_model.input, outputs=output)

      model.compile(optimizer='adam',
                    loss='sparse_categorical_crossentropy',
                    metrics=['accuracy'])

      tensorboard_callback = tf.keras.callbacks.TensorBoard(log_dir='logs')

      hist = model.fit(train_data, epochs=20, validation_data=val_data,
                      ↪callbacks=[tensorboard_callback])
```

```
Epoch 1/20
168/168 [=====] - 28s 110ms/step - loss: 0.5645 -
accuracy: 0.7905 - val_loss: 0.1982 - val_accuracy: 0.9313
Epoch 2/20
168/168 [=====] - 17s 102ms/step - loss: 0.2073 -
accuracy: 0.9321 - val_loss: 0.1831 - val_accuracy: 0.9341
Epoch 3/20
168/168 [=====] - 17s 101ms/step - loss: 0.1279 -
accuracy: 0.9579 - val_loss: 0.1176 - val_accuracy: 0.9578
Epoch 4/20
168/168 [=====] - 17s 102ms/step - loss: 0.0756 -
accuracy: 0.9740 - val_loss: 0.2044 - val_accuracy: 0.9363
Epoch 5/20
168/168 [=====] - 17s 102ms/step - loss: 0.1046 -
```

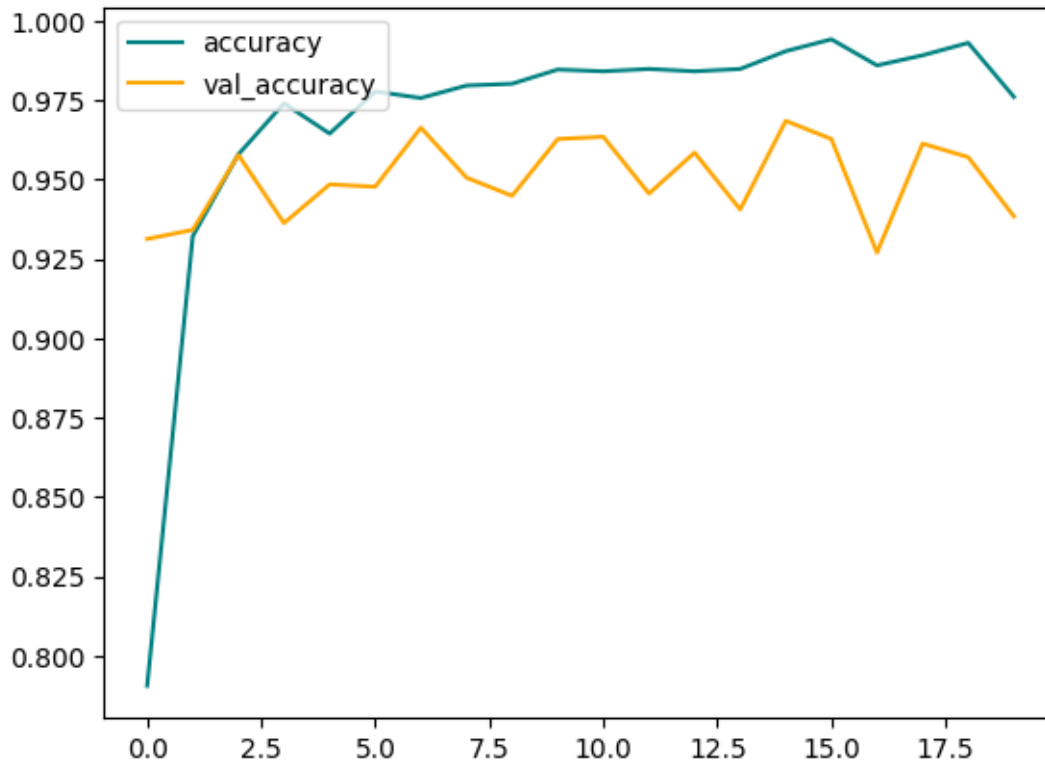
accuracy: 0.9645 - val\_loss: 0.1512 - val\_accuracy: 0.9485  
 Epoch 6/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0695 -  
 accuracy: 0.9778 - val\_loss: 0.1580 - val\_accuracy: 0.9477  
 Epoch 7/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0798 -  
 accuracy: 0.9757 - val\_loss: 0.1199 - val\_accuracy: 0.9664  
 Epoch 8/20  
 168/168 [=====] - 17s 101ms/step - loss: 0.0662 -  
 accuracy: 0.9796 - val\_loss: 0.1733 - val\_accuracy: 0.9506  
 Epoch 9/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0558 -  
 accuracy: 0.9802 - val\_loss: 0.1892 - val\_accuracy: 0.9449  
 Epoch 10/20  
 168/168 [=====] - 17s 103ms/step - loss: 0.0513 -  
 accuracy: 0.9847 - val\_loss: 0.1540 - val\_accuracy: 0.9628  
 Epoch 11/20  
 168/168 [=====] - 18s 104ms/step - loss: 0.0439 -  
 accuracy: 0.9841 - val\_loss: 0.1267 - val\_accuracy: 0.9635  
 Epoch 12/20  
 168/168 [=====] - 17s 101ms/step - loss: 0.0381 -  
 accuracy: 0.9849 - val\_loss: 0.2053 - val\_accuracy: 0.9456  
 Epoch 13/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0471 -  
 accuracy: 0.9841 - val\_loss: 0.1521 - val\_accuracy: 0.9585  
 Epoch 14/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0444 -  
 accuracy: 0.9849 - val\_loss: 0.2391 - val\_accuracy: 0.9406  
 Epoch 15/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0295 -  
 accuracy: 0.9905 - val\_loss: 0.1354 - val\_accuracy: 0.9685  
 Epoch 16/20  
 168/168 [=====] - 18s 104ms/step - loss: 0.0173 -  
 accuracy: 0.9942 - val\_loss: 0.1378 - val\_accuracy: 0.9628  
 Epoch 17/20  
 168/168 [=====] - 17s 103ms/step - loss: 0.0411 -  
 accuracy: 0.9860 - val\_loss: 0.2648 - val\_accuracy: 0.9270  
 Epoch 18/20  
 168/168 [=====] - 17s 102ms/step - loss: 0.0325 -  
 accuracy: 0.9892 - val\_loss: 0.1452 - val\_accuracy: 0.9613  
 Epoch 19/20  
 168/168 [=====] - 18s 103ms/step - loss: 0.0202 -  
 accuracy: 0.9931 - val\_loss: 0.1520 - val\_accuracy: 0.9571  
 Epoch 20/20  
 168/168 [=====] - 17s 101ms/step - loss: 0.0784 -  
 accuracy: 0.9761 - val\_loss: 0.2342 - val\_accuracy: 0.9384

```
[9]: fig = plt.figure()
plt.plot(hist.history['loss'], color='teal', label='loss')
plt.plot(hist.history['val_loss'], color='orange', label='val_loss')
fig.suptitle('Loss', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```



```
[10]: fig = plt.figure()
plt.plot(hist.history['accuracy'], color='teal', label='accuracy')
plt.plot(hist.history['val_accuracy'], color='orange', label='val_accuracy')
fig.suptitle('Accuracy', fontsize=20)
plt.legend(loc="upper left")
plt.show()
```

## Accuracy



```
[11]: pre = Precision()
      re = Recall()
      acc = SparseCategoricalAccuracy()
```

```
[ ]: for batch in test_data.as_numpy_iterator():
      X, y = batch
      yhat = model.predict(X)

      yhat_classes = tf.argmax(yhat, axis=1)

      pre.update_state(y, yhat_classes)
      re.update_state(y, yhat_classes)
      acc.update_state(y, yhat)
```

```
1/1 [=====] - 1s 1s/step
1/1 [=====] - 0s 33ms/step
1/1 [=====] - 0s 28ms/step
1/1 [=====] - 0s 26ms/step
1/1 [=====] - 0s 27ms/step
1/1 [=====] - 0s 26ms/step
```

```

1/1 [=====] - 0s 27ms/step
1/1 [=====] - 0s 29ms/step
1/1 [=====] - 0s 29ms/step
1/1 [=====] - 0s 23ms/step
1/1 [=====] - 0s 23ms/step
1/1 [=====] - 0s 22ms/step
1/1 [=====] - 0s 23ms/step
1/1 [=====] - 0s 24ms/step

```

```

[ ]: print(f"Precision: {pre.result().numpy() * 100 : .2f}%")
      print(f"Recall: {re.result().numpy() * 100 : .2f}%")
      print(f"Accuracy: {acc.result().numpy() * 100 : .2f}%")

```

```

[ ]: img = cv2.imread('Styles/test/Hatchback/8_jpg.rf.
      ↪c314c1d6777942876503fa1482c82240.jpg')

      img_resized = cv2.resize(img, img_size)
      img_expanded = np.expand_dims(img_resized, axis=0)

      yhat = model.predict(img_expanded)
      predicted_class = tf.argmax(yhat, axis=1).numpy()[0]

      plt.imshow(img)
      plt.title(f'Predicted class: {predicted_class}')
      plt.axis('off')
      plt.show()

```

```

[ ]: print(f'Predicted class is: {class_names[predicted_class]}')
      for idx, prob in enumerate(yhat[0]):
          print(f"Model probability for {class_names[idx]} is {prob * 100:.2f}%")

```

```

[ ]: model_file_name = f"CarStyle{acc.result().numpy() * 100 : .2f}%_
      ↪EfficientNetV2B3.h5"
      model.save(os.path.join('CarBackend/models/CarStyles', model_file_name))

```

```

[ ]:

```