

Model Development Phase Template

Date	19 july 2024
Team ID	SWTID1720084639
Project Title	Beneath the Waves: Unraveling Coral Mysteries through Deep Learning
Maximum Marks	10 Marks

Initial Model Training Code, Model Validation and Evaluation Report

The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

Initial Model Training Code (5 marks):

```
from keras.optimizers import Adam
#opt = Adam(lr=0.001)

vggmodel.compile(loss = 'categorical_crossentropy' , metrics=['accuracy'])

labels = ['bleached','healthy']

import numpy as np
img = '/content/drive/MyDrive/test/healthy/14307809941_27b4257449_o.jpg'
img = load_img(img, target_size=(299,299))
x = img_to_array(img)
x = preprocess_input(x)
preds = vggmodel.predict(np.array([x]))
preds

1/1 [=====] - 0s 238ms/step
array([[5.6030145e-15, 1.0000000e+00]], dtype=float32)

labels[np.argmax(preds)]

'healthy'
```

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics																		
VGG16	<table> <thead> <tr> <th>Layer (type)</th><th>Output Shape</th><th>Param #</th></tr> </thead> <tbody> <tr> <td>vgg16 (Functional)</td><td>(None, 9, 9, 512)</td><td>14714688</td></tr> <tr> <td>flatten (Flatten)</td><td>(None, 41472)</td><td>0</td></tr> <tr> <td>dense (Dense)</td><td>(None, 256)</td><td>10617088</td></tr> <tr> <td>dropout (Dropout)</td><td>(None, 256)</td><td>0</td></tr> <tr> <td>dense_1 (Dense)</td><td>(None, 2)</td><td>514</td></tr> </tbody> </table> <p> Total params: 25332290 (96.64 MB) Trainable params: 10617602 (40.50 MB) Non-trainable params: 14714688 (56.13 MB) </p>	Layer (type)	Output Shape	Param #	vgg16 (Functional)	(None, 9, 9, 512)	14714688	flatten (Flatten)	(None, 41472)	0	dense (Dense)	(None, 256)	10617088	dropout (Dropout)	(None, 256)	0	dense_1 (Dense)	(None, 2)	514	<pre> Epoch 1/10: 22% 121/512 - loss: 1.8300 - accuracy: 0.3812 - val_loss: 0.5984 - val_accuracy: 0.8200 Epoch 2/10: 16% 80/512 - loss: 0.6249 - accuracy: 0.6678 - val_loss: 0.5926 - val_accuracy: 0.9075 Epoch 3/10: 17% 92/512 - loss: 0.5381 - accuracy: 0.7170 - val_loss: 0.6065 - val_accuracy: 0.9362 Epoch 4/10: 17% 90/512 - loss: 0.5431 - accuracy: 0.7111 - val_loss: 0.5734 - val_accuracy: 0.9875 Epoch 5/10: 18% 90/512 - loss: 0.5087 - accuracy: 0.7452 - val_loss: 0.5552 - val_accuracy: 0.7388 Epoch 6/10: 18% 90/512 - loss: 0.4987 - accuracy: 0.7600 - val_loss: 0.5061 - val_accuracy: 0.9875 Epoch 7/10: 18% 90/512 - loss: 0.4955 - accuracy: 0.7504 - val_loss: 0.5255 - val_accuracy: 0.9875 Epoch 8/10: 18% 90/512 - loss: 0.4838 - accuracy: 0.7780 - val_loss: 0.5164 - val_accuracy: 0.7388 Epoch 9/10: 17% 97/512 - loss: 0.4538 - accuracy: 0.8172 - val_loss: 0.5671 - val_accuracy: 0.7812 Epoch 10/10: 18% 90/512 - loss: 0.4387 - accuracy: 0.8172 - val_loss: 0.5359 - val_accuracy: 0.7388 </pre>
Layer (type)	Output Shape	Param #																		
vgg16 (Functional)	(None, 9, 9, 512)	14714688																		
flatten (Flatten)	(None, 41472)	0																		
dense (Dense)	(None, 256)	10617088																		
dropout (Dropout)	(None, 256)	0																		
dense_1 (Dense)	(None, 2)	514																		
RESNET	<table> <thead> <tr> <th>Layer (type)</th><th>Output Shape</th><th>Param #</th></tr> </thead> <tbody> <tr> <td>resnet50 (Functional)</td><td>(None, 10, 10, 2048)</td><td>23587712</td></tr> <tr> <td>flatten_1 (Flatten)</td><td>(None, 204800)</td><td>0</td></tr> <tr> <td>dense_2 (Dense)</td><td>(None, 256)</td><td>52429056</td></tr> <tr> <td>dropout_1 (Dropout)</td><td>(None, 256)</td><td>0</td></tr> <tr> <td>dense_3 (Dense)</td><td>(None, 2)</td><td>514</td></tr> </tbody> </table> <p> Total params: 76017282 (289.98 MB) Trainable params: 52429570 (200.00 MB) Non-trainable params: 23587712 (89.98 MB) </p>	Layer (type)	Output Shape	Param #	resnet50 (Functional)	(None, 10, 10, 2048)	23587712	flatten_1 (Flatten)	(None, 204800)	0	dense_2 (Dense)	(None, 256)	52429056	dropout_1 (Dropout)	(None, 256)	0	dense_3 (Dense)	(None, 2)	514	<pre> Epoch 1/10: 27% 141/512 - loss: 10.8580 - accuracy: 0.5836 - val_loss: 0.8487 - val_accuracy: 0.5312 Epoch 2/10: 17% 97/512 - loss: 1.8581 - accuracy: 0.5272 - val_loss: 0.6931 - val_accuracy: 0.5888 Epoch 3/10: 16% 87/512 - loss: 0.7763 - accuracy: 0.5200 - val_loss: 0.6928 - val_accuracy: 0.6256 Epoch 4/10: 16% 88/512 - loss: 0.6931 - accuracy: 0.5312 - val_loss: 0.6938 - val_accuracy: 0.5625 Epoch 5/10: 17% 93/512 - loss: 0.6931 - accuracy: 0.5302 - val_loss: 0.6929 - val_accuracy: 0.5625 Epoch 6/10: 16% 91/512 - loss: 0.6931 - accuracy: 0.5302 - val_loss: 0.6929 - val_accuracy: 0.5312 Epoch 7/10: 17% 97/512 - loss: 0.6938 - accuracy: 0.5282 - val_loss: 0.6926 - val_accuracy: 0.5625 Epoch 8/10: 17% 97/512 - loss: 0.6929 - accuracy: 0.5282 - val_loss: 0.6932 - val_accuracy: 0.5888 Epoch 9/10: 16% 89/512 - loss: 0.8887 - accuracy: 0.5228 - val_loss: 0.6921 - val_accuracy: 0.5625 Epoch 10/10: 16% 89/512 - loss: 0.8887 - accuracy: 0.5228 - val_loss: 0.6921 - val_accuracy: 0.5625 </pre>
Layer (type)	Output Shape	Param #																		
resnet50 (Functional)	(None, 10, 10, 2048)	23587712																		
flatten_1 (Flatten)	(None, 204800)	0																		
dense_2 (Dense)	(None, 256)	52429056																		
dropout_1 (Dropout)	(None, 256)	0																		
dense_3 (Dense)	(None, 2)	514																		

INCEPTION

Layer (type)	Output Shape	Param #
inception_v3 (Functional)	(None, 8, 8, 2048)	21802784
global_average_pooling2d (GlobalAveragePooling2D)	(None, 2048)	0
dense_4 (Dense)	(None, 256)	524544
dropout_2 (Dropout)	(None, 256)	0
dense_5 (Dense)	(None, 2)	514
Total params: 22327842 (85.17 MB)		
Trainable params: 525058 (2.00 MB)		
Non-trainable params: 21802784 (83.17 MB)		

```
Epoch 17/18: 100% (1/1) - loss: 0.7225 - accuracy: 0.5052 - val_loss: 0.5530 - val_accuracy: 0.7500
Epoch 18/18: 100% (1/1) - loss: 0.5871 - accuracy: 0.6766 - val_loss: 0.5065 - val_accuracy: 0.7500
Epoch 19/18: 100% (1/1) - loss: 0.5099 - accuracy: 0.7276 - val_loss: 0.5026 - val_accuracy: 0.7500
Epoch 20/18: 100% (1/1) - loss: 0.5290 - accuracy: 0.7392 - val_loss: 0.5076 - val_accuracy: 0.7500
Epoch 21/18: 100% (1/1) - loss: 0.5238 - accuracy: 0.7346 - val_loss: 0.5100 - val_accuracy: 0.6562
Epoch 22/18: 100% (1/1) - loss: 0.5226 - accuracy: 0.7315 - val_loss: 0.4757 - val_accuracy: 0.6818
Epoch 23/18: 100% (1/1) - loss: 0.4835 - accuracy: 0.7605 - val_loss: 0.4888 - val_accuracy: 0.7012
Epoch 24/18: 100% (1/1) - loss: 0.5064 - accuracy: 0.7469 - val_loss: 0.5067 - val_accuracy: 0.7108
Epoch 25/18: 100% (1/1) - loss: 0.5018 - accuracy: 0.7487 - val_loss: 0.5024 - val_accuracy: 0.6875
Epoch 26/18: 100% (1/1) - loss: 0.4888 - accuracy: 0.7417 - val_loss: 0.4842 - val_accuracy: 0.6818
```

DENSENET

Layer (type)	Output Shape	Param #
densenet121 (Functional)	(None, 9, 9, 1024)	7037504
global_average_pooling2d_1 (GlobalAveragePooling2D)	(None, 1024)	0
dense_6 (Dense)	(None, 256)	262400
dropout_3 (Dropout)	(None, 256)	0
dense_7 (Dense)	(None, 2)	514
Total params: 7300418 (27.85 MB)		
Trainable params: 262914 (1.00 MB)		
Non-trainable params: 7037504 (26.85 MB)		

```
Epoch 17/18: 100% (1/1) - loss: 0.6889 - accuracy: 0.6553 - val_loss: 0.4188 - val_accuracy: 0.8562
Epoch 18/18: 100% (1/1) - loss: 0.5518 - accuracy: 0.7258 - val_loss: 0.5677 - val_accuracy: 0.7500
Epoch 19/18: 100% (1/1) - loss: 0.4954 - accuracy: 0.7618 - val_loss: 0.5721 - val_accuracy: 0.6875
Epoch 20/18: 100% (1/1) - loss: 0.4935 - accuracy: 0.8137 - val_loss: 0.4976 - val_accuracy: 0.7108
Epoch 21/18: 100% (1/1) - loss: 0.4449 - accuracy: 0.7768 - val_loss: 0.5479 - val_accuracy: 0.8125
Epoch 22/18: 100% (1/1) - loss: 0.4266 - accuracy: 0.7956 - val_loss: 0.5805 - val_accuracy: 0.7108
Epoch 23/18: 100% (1/1) - loss: 0.4236 - accuracy: 0.7871 - val_loss: 0.5262 - val_accuracy: 0.7108
Epoch 24/18: 100% (1/1) - loss: 0.3985 - accuracy: 0.8025 - val_loss: 0.4691 - val_accuracy: 0.7500
Epoch 25/18: 100% (1/1) - loss: 0.3888 - accuracy: 0.8032 - val_loss: 0.4638 - val_accuracy: 0.7012
Epoch 26/18: 100% (1/1) - loss: 0.3871 - accuracy: 0.8241 - val_loss: 0.5481 - val_accuracy: 0.7500
```

XCEPTION

Layer (type)	Output Shape	Param #
xception (Functional)	(None, 10, 10, 2048)	20861480
global_average_pooling2d_2 (GlobalAveragePooling2D)	(None, 2048)	0
dense_8 (Dense)	(None, 256)	524544
dropout_4 (Dropout)	(None, 256)	0
dense_9 (Dense)	(None, 2)	514
Total params: 21386538 (81.58 MB)		
Trainable params: 525058 (2.00 MB)		
Non-trainable params: 20861480 (79.58 MB)		

```
Epoch 17/18: 100% (1/1) - loss: 0.6393 - accuracy: 0.6412 - val_loss: 0.6444 - val_accuracy: 0.5938
Epoch 18/18: 100% (1/1) - loss: 0.5279 - accuracy: 0.7223 - val_loss: 0.6838 - val_accuracy: 0.6562
Epoch 19/18: 100% (1/1) - loss: 0.5242 - accuracy: 0.7522 - val_loss: 0.7086 - val_accuracy: 0.6250
Epoch 20/18: 100% (1/1) - loss: 0.4871 - accuracy: 0.7715 - val_loss: 0.6889 - val_accuracy: 0.6562
Epoch 21/18: 100% (1/1) - loss: 0.4782 - accuracy: 0.7801 - val_loss: 0.7219 - val_accuracy: 0.5938
Epoch 22/18: 100% (1/1) - loss: 0.4019 - accuracy: 0.7708 - val_loss: 0.6722 - val_accuracy: 0.6562
Epoch 23/18: 100% (1/1) - loss: 0.4266 - accuracy: 0.8128 - val_loss: 0.5425 - val_accuracy: 0.7108
Epoch 24/18: 100% (1/1) - loss: 0.4251 - accuracy: 0.8084 - val_loss: 0.5780 - val_accuracy: 0.6250
Epoch 25/18: 100% (1/1) - loss: 0.3955 - accuracy: 0.8198 - val_loss: 0.5975 - val_accuracy: 0.6562
Epoch 26/18: 100% (1/1) - loss: 0.4082 - accuracy: 0.8325 - val_loss: 0.6815 - val_accuracy: 0.6562
```