Image Classification on Diseased Plants

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CS3120

Models Used

- AlexNet
- ZFNet
- Inception V3

AlexNet

- Developed in 2012 by Alex Krizhevsky, Ilya Sutskever and Geoffrey E. Hinton
- CNN architecture that won the 2012 ImageNet challenge

Layer (type)	Output Shape	Param #
rescaling (Rescaling)	(None, 224, 224, 3)	0
conv2d (Conv2D)	(None, 56, 56, 96)	34944
lambda (Lambda)	(None, 56, 56, 96)	0
max_pooling2d (MaxPooling2D)	(None, 27, 27, 96)	0
conv2d_1 (Conv2D)	(None, 27, 27, 256)	614656
lambda_1 (Lambda)	(None, 27, 27, 256)	0
max_pooling2d_1 (MaxPooling2	(None, 13, 13, 256)	0
conv2d_2 (Conv2D)	(None, 13, 13, 384)	885120
conv2d_3 (Conv2D)	(None, 13, 13, 384)	1327488
conv2d_4 (Conv2D)	(None, 13, 13, 256)	884992
flatten (Flatten)	(None, 43264)	0
dense (Dense)	(None, 4096)	177213440
dropout (Dropout)	(None, 4096)	0
dense_1 (Dense)	(None, 4096)	16781312
dropout_1 (Dropout)	(None, 4096)	0
dense_2 (Dense)	(None, 38)	155686

Total params: 197,897,638
Trainable params: 197,897,638
Non-trainable params: 0

ZFNet

- Developed in 2013 by Matthew Zeiler and Rob Fergus
- CNN architecture that improves upon AlexNet and won the 2014 ImageNet challenge

Layer (type)	Output Shape	Param #
rescaling (Rescaling)	(None, 224, 224, 3)	0
conv2d (Conv2D)	(None, 112, 112, 96)	14208
lambda (Lambda)	(None, 112, 112, 96)	0
max_pooling2d (MaxPooling2D)	(None, 55, 55, 96)	0
conv2d_1 (Conv2D)	(None, 28, 28, 256)	614656
lambda_1 (Lambda)	(None, 28, 28, 256)	0
max_pooling2d_1 (MaxPooling2	(None, 13, 13, 256)	0
conv2d_2 (Conv2D)	(None, 13, 13, 512)	1180160
conv2d_3 (Conv2D)	(None, 13, 13, 1024)	4719616
conv2d_4 (Conv2D)	(None, 13, 13, 512)	4719104
flatten (Flatten)	(None, 86528)	0
dense (Dense)	(None, 4096)	354422784
dropout (Dropout)	(None, 4096)	0
dense_1 (Dense)	(None, 4096)	16781312
dropout_1 (Dropout)	(None, 4096)	0
dense_2 (Dense)	(None, 38)	155686

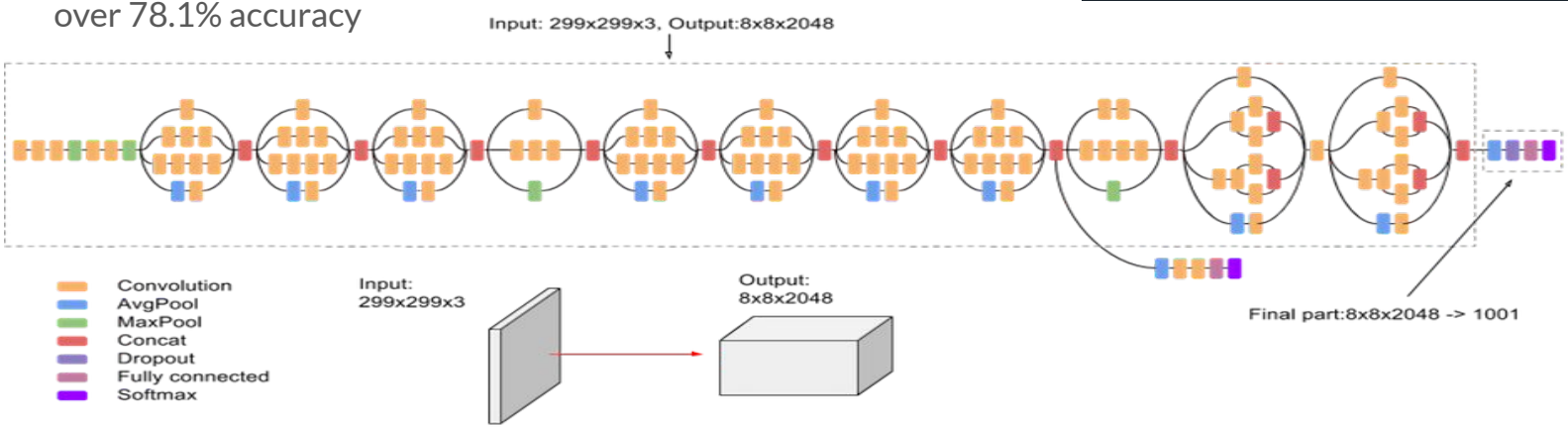
Total params: 382,607,526
Trainable params: 382,607,526
Non-trainable params: 0

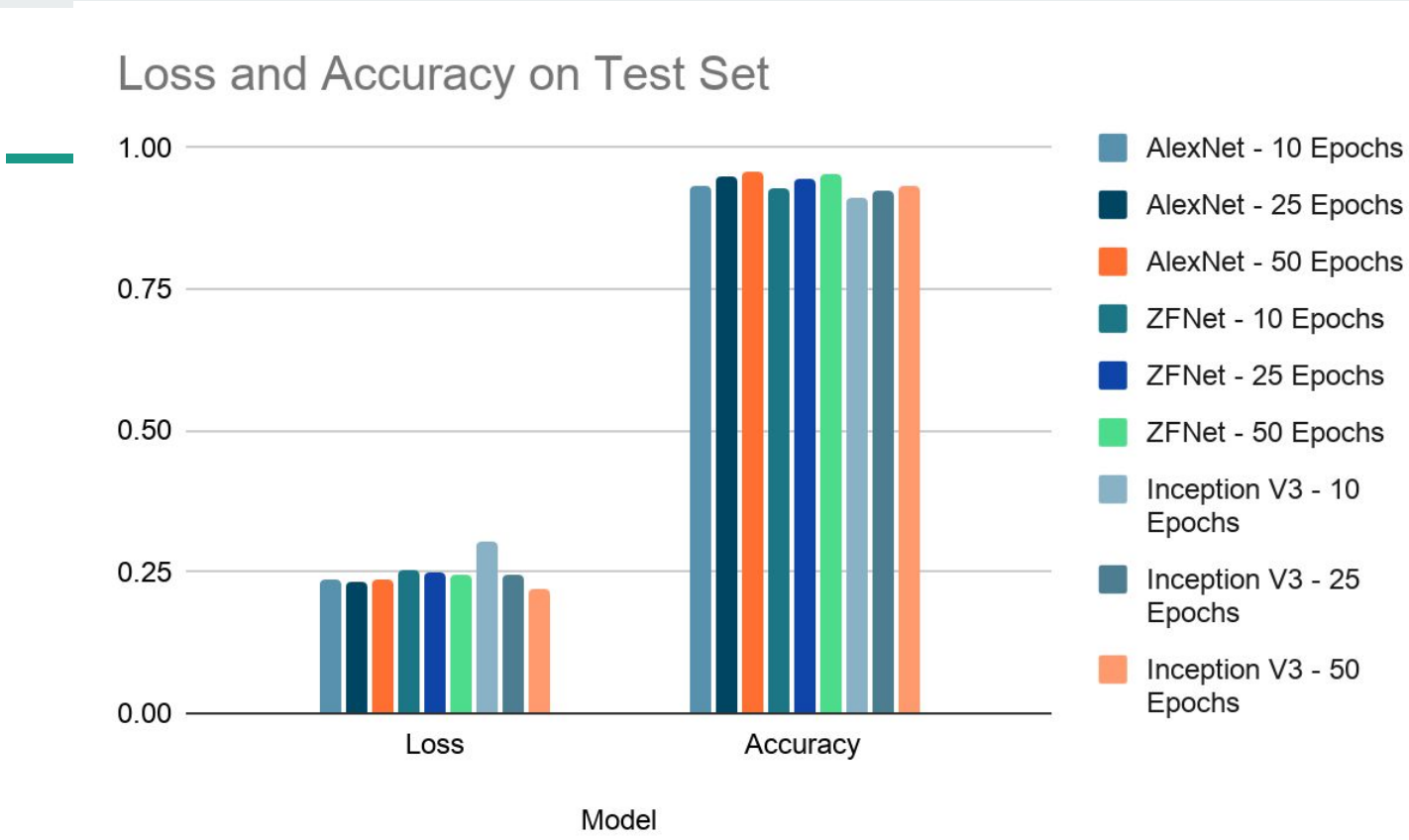
Inception V3

- The third version of Google's Inception net, introduced in 2015
- Developed by Christian Szegedy, Vincent Vanhoucke, Sergey Ioffe, Jonathon Shlens, & Zbigniew Wojna
- Pretrained model
- Trained on the ImageNet dataset where it has achieved over 78.1% accuracy

Layer (type)	Output Shape	Param #
input_2 (InputLayer)	[(None, 224, 224, 3)]	0
tf.math.truediv (TFOpLambda)	(None, 224, 224, 3)	0
tf.math.subtract (TFOpLambda	(None, 224, 224, 3)	0
inception_v3 (Functional)	(None, 5, 5, 2048)	21802784
global_average_pooling2d (Gl	(None, 2048)	0
dropout (Dropout)	(None, 2048)	0
dense (Dense)	(None, 38)	77862

Total params: 21,880,646
Trainable params: 77,862
Non-trainable params: 21,802,784




Loss and Accuracy on Test Set
1.00
0.75
0.50
0.25
0.00
Loss
Accuracy
Model
AlexNet - 10 Epochs
AlexNet - 25 Epochs
AlexNet - 50 Epochs
ZFNet - 10 Epochs
ZFNet - 25 Epochs
ZFNet - 50 Epochs
Inception V3 - 10 Epochs
Inception V3 - 25 Epochs
Inception V3 - 50 Epochs

Sources

- Hughes, D. P., & Salathé, M. PlantVillage Dataset - Images of Healthy and Diseased plants. https://www.kaggle.com/abdallahalidev/plantvillage-dataset.
- Krizhevsky, A., Sutskever, I., & Hinton, G.E. (2012). ImageNet classification with deep convolutional neural networks. Communications of the ACM, 60, 84 - 90.
- Christian Szegedy, Vincent Vanhoucke, Sergey Ioffe, Jonathon Shlens, & Zbigniew Wojna. (2015). Rethinking the Inception Architecture for Computer Vision.
- Matthew D Zeiler, & Rob Fergus. (2013). Visualizing and Understanding Convolutional Networks.