Image Classification with Deep Learning

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Self-paced

Outline

- Image Data
- Image classification via multiple models
- Conclusion

Image Data

- Data Source
  - https://www.kaggle.com/datasets/paultimothymooney/chest-xray-pneumonia
- Data Summary

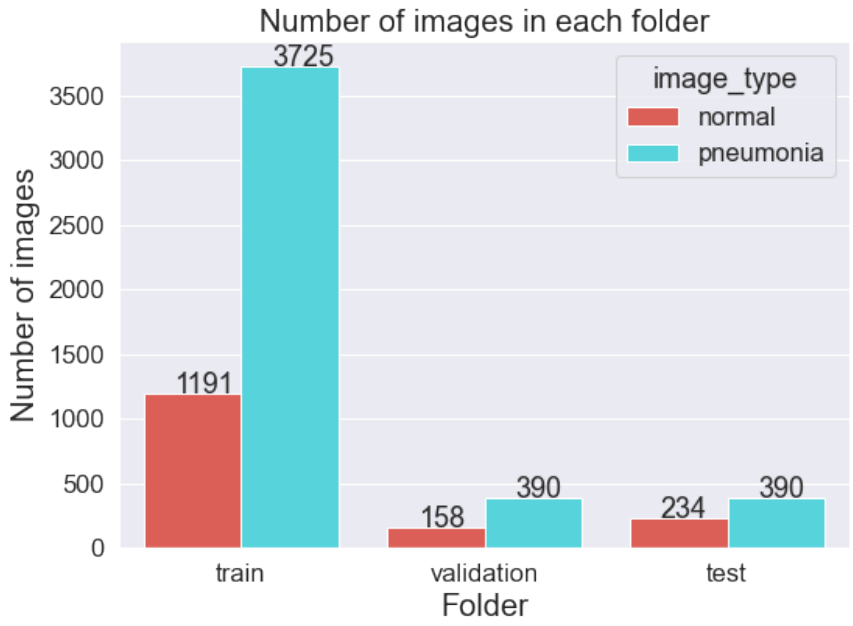


Image Examples

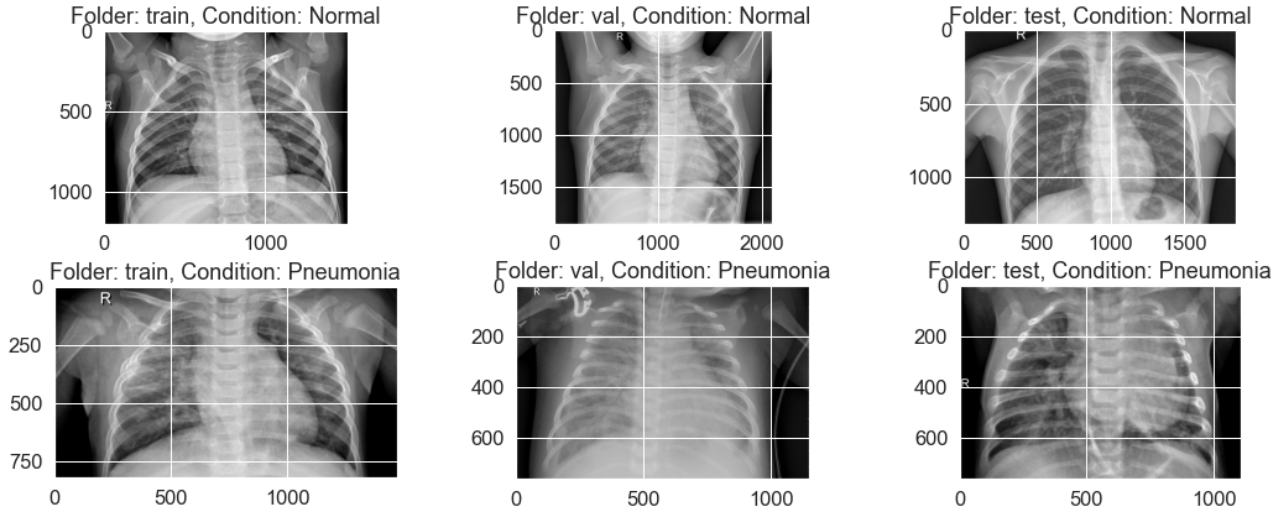


Image Classification via Multiple Models

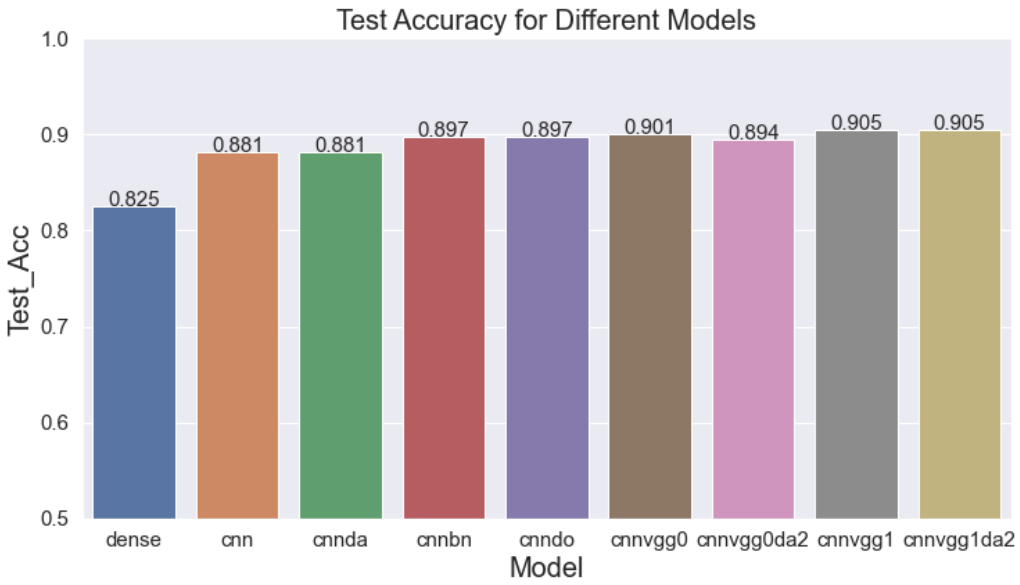
- Multiple Models
  - Dense model (dense)
  - Conventional neural network (CNN) model
    - Basic model (cnn)
    - With Data Augmentation (cnnda)
    - With Batch Normalization (cnnbn)
    - With Dropout (cnndo)
  - Pretrained model, i.e., VGG19
    - With the basic CNN model (cnnvgg0)
    - With a CNN model of more nodes (cnnvgg1)
    - With a new data augmentation (cnnvgg0da2 and cnnvgg1da2)

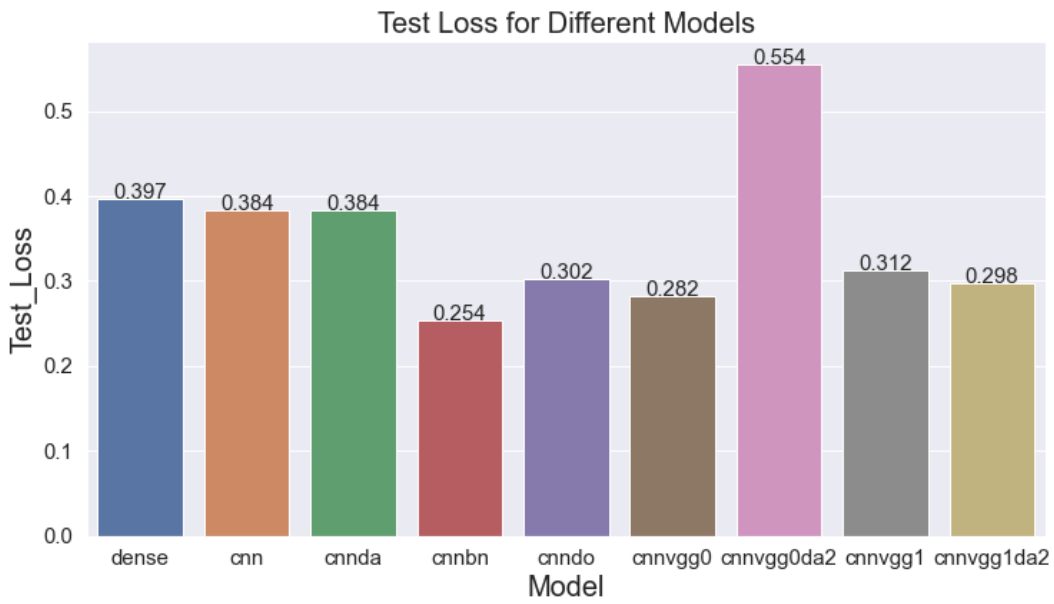
VGG19 model

Model: "vgg19"

Layer (type)	Output Shape	Param #
input_9 (InputLayer)	[(None, 150, 150, 3)]	0
block1_conv1 (Conv2D)	(None, 150, 150, 64)	1792
block1_conv2 (Conv2D)	(None, 150, 150, 64)	36928
block1_pool (MaxPooling2D)	(None, 75, 75, 64)	0
block2_conv1 (Conv2D)	(None, 75, 75, 128)	73856
block2_conv2 (Conv2D)	(None, 75, 75, 128)	147584
block2_pool (MaxPooling2D)	(None, 37, 37, 128)	0
block3_conv1 (Conv2D)	(None, 37, 37, 256)	295168
block3_conv2 (Conv2D)	(None, 37, 37, 256)	590080
block3_conv3 (Conv2D)	(None, 37, 37, 256)	590080
block3_conv4 (Conv2D)	(None, 37, 37, 256)	590080
block3_pool (MaxPooling2D)	(None, 18, 18, 256)	0
block4_conv1 (Conv2D)	(None, 18, 18, 512)	1180160
block4_conv2 (Conv2D)	(None, 18, 18, 512)	2359808
block4_conv3 (Conv2D)	(None, 18, 18, 512)	2359808
block4_conv4 (Conv2D)	(None, 18, 18, 512)	2359808
block4_pool (MaxPooling2D)	(None, 9, 9, 512)	0
block5_conv1 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv2 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv3 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv4 (Conv2D)	(None, 9, 9, 512)	2359808
block5_pool (MaxPooling2D)	(None, 4, 4, 512)	0

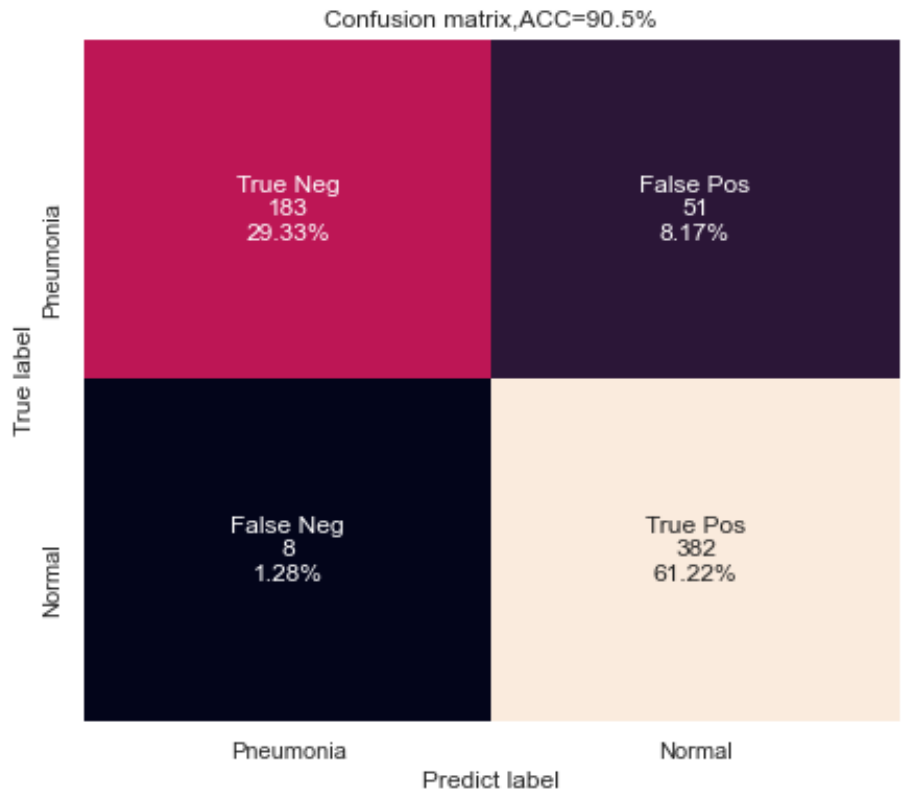
- Model Comparisons





- The basic dense model has accuracy above 80%
- The deep learning models have increased accuracy above 88%
- The deep learning models have similar performance

- Final Model Results: CNNVGG1



Layer (type)	Output Shape	Param #
vgg19 (Functional)	(None, 4, 4, 512)	20024384
flatten_82 (Flatten)	(None, 8192)	0
dense_393 (Dense)	(None, 64)	524352
dense_394 (Dense)	(None, 128)	8320
dense_395 (Dense)	(None, 256)	33024
dense_396 (Dense)	(None, 16)	4112
dense_397 (Dense)	(None, 1)	17

Total params: 20,594,209
Trainable params: 569,825
Non-trainable params: 20,024,384

Conclusion

- The deep learning model could achieve a high classification accuracy above 90%

- With more training data and further optimization of the model, much higher accuracy could be achieved

Thanks for your attention!