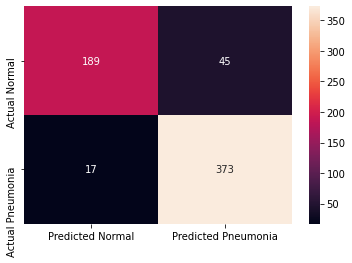
Exempel : Körning 1: Lr = 0.002 , aktivering = relu, 4 lager, optomizer = adam , loss = cross entropy, epoch = 15, KOPIERA IN HELA CNN.SEQUIENCIAL HÄR, Val\_loss, train\_loss, val\_acc, accuracy, f1 score, pasta in classification report

## Model 1:

### Original

* Lr = ReduceLROnPlateau(monitor='val\_loss', patience=2, verbose=1, factor=0.3, min\_lr=0.000001).
* Aktivering = ReLU
* 15 lager
* optimizer = adam
* loss = binary crossentropy
* epoch = 25, ended at 7 epoch = EarlyStopping(monitor='val\_loss', mode='min', patience=3)

Epoch 00006: ReduceLROnPlateau reducing learning rate to 0.0003000000142492354.

Epoch 7/25

326/326 [==============================] - 133s 408ms/step - loss: 0.1275 - accuracy: 0.9531 - val\_loss: 0.8370 - val\_accuracy: 0.6875

precision recall f1-score support

NORMAL 0.92 0.81 0.86 234

PNEUMONIA 0.89 0.96 0.92 390

accuracy 0.90 624

macro avg 0.90 0.88 0.89 624

weighted avg 0.90 0.90 0.90 624

Model: "sequential"

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Layer (type) Output Shape Param #

=================================================================

conv2d (Conv2D) (None, 500, 500, 32) 320

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max\_pooling2d (MaxPooling2D) (None, 250, 250, 32) 0

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conv2d\_1 (Conv2D) (None, 250, 250, 32) 9248

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max\_pooling2d\_1 (MaxPooling2 (None, 125, 125, 32) 0

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conv2d\_2 (Conv2D) (None, 125, 125, 32) 9248

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max\_pooling2d\_2 (MaxPooling2 (None, 62, 62, 32) 0

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conv2d\_3 (Conv2D) (None, 62, 62, 64) 18496

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max\_pooling2d\_3 (MaxPooling2 (None, 31, 31, 64) 0

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conv2d\_4 (Conv2D) (None, 31, 31, 64) 36928

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max\_pooling2d\_4 (MaxPooling2 (None, 15, 15, 64) 0

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flatten (Flatten) (None, 14400) 0

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dense (Dense) (None, 128) 1843328

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dense\_1 (Dense) (None, 64) 8256

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dense\_2 (Dense) (None, 1) 65

=================================================================

Total params: 1,925,889

Trainable params: 1,925,889

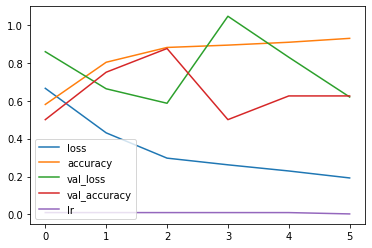
Non-trainable params: 0

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## Model 2:

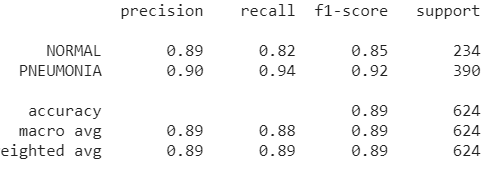
Like model 1

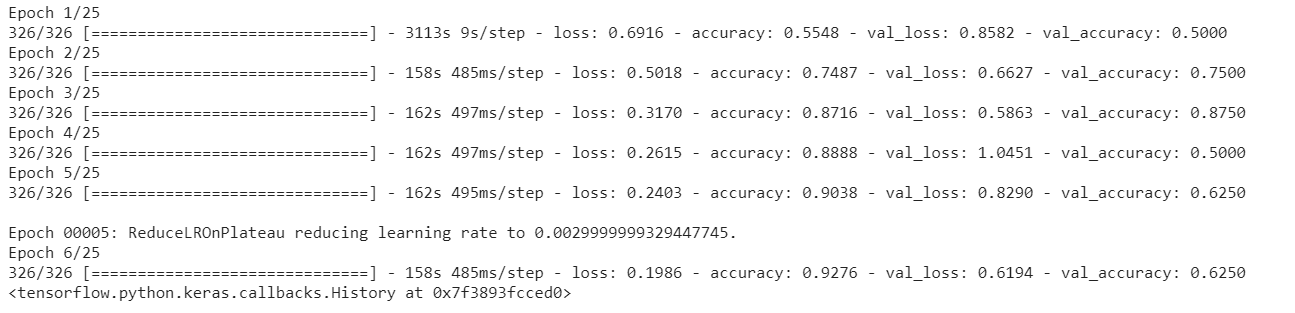
Changed optimizer to SGD:





The testing accuracy is : 89.42307829856873 %

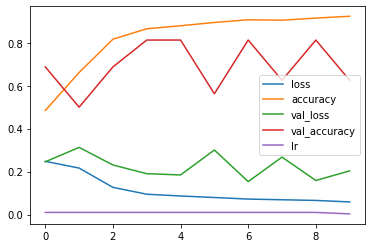


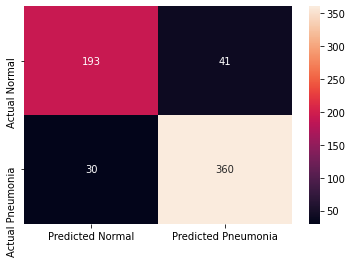


## Model 3:

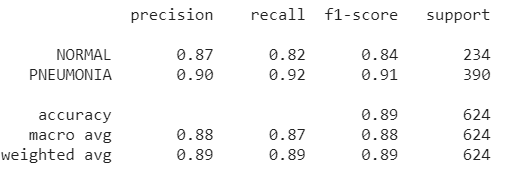
Like model 2

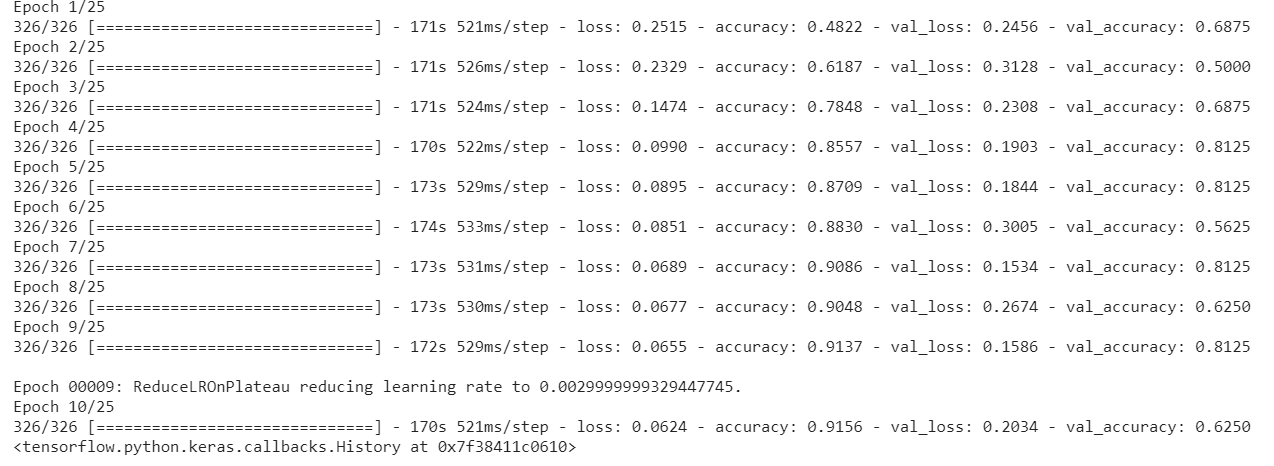
Changed lossfunction to mean squared error:





The testing accuracy is : 88.62179517745972 %

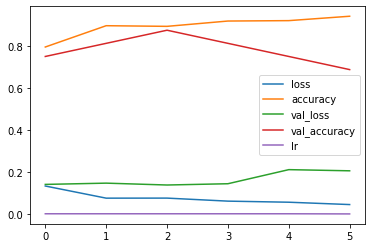


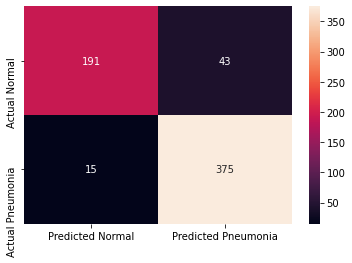


## Model 4:

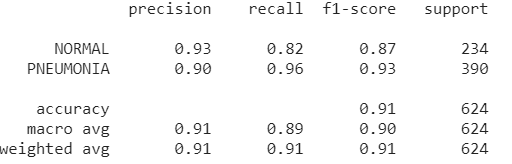
Like model 1.

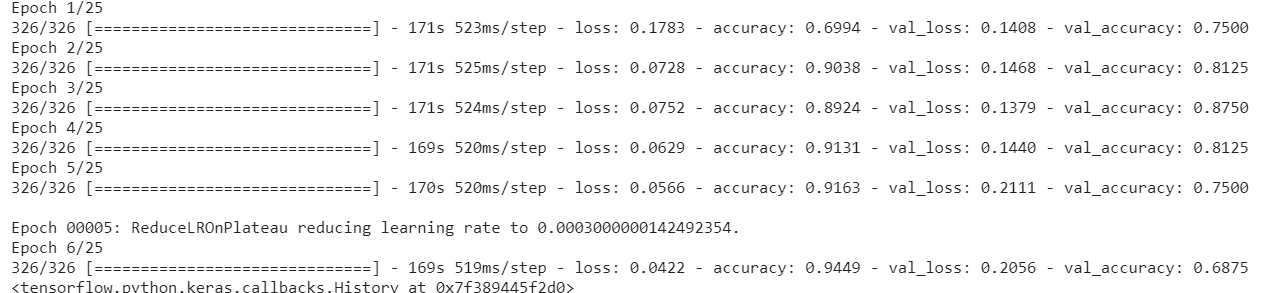
Optimizer Adam and mean squared error



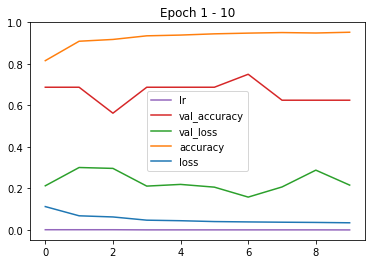


The testing accuracy is : 90.70512652397156 %

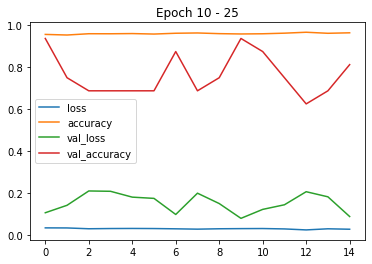




**Training plot Epoch 1-10**



**Training plot Epoch 10 - 25**



## Model 5:

Removed max pooling and added conv2d layers and a linear layer

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Layer (type) Output Shape Param #

=================================================================

conv2d\_20 (Conv2D) (None, 500, 500, 32) 320

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_21 (Conv2D) (None, 500, 500, 32) 9248

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max\_pooling2d\_12 (MaxPooling (None, 250, 250, 32) 0

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conv2d\_22 (Conv2D) (None, 250, 250, 32) 9248

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max\_pooling2d\_13 (MaxPooling (None, 125, 125, 32) 0

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conv2d\_23 (Conv2D) (None, 125, 125, 64) 18496

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conv2d\_24 (Conv2D) (None, 125, 125, 64) 36928

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conv2d\_25 (Conv2D) (None, 125, 125, 64) 36928

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conv2d\_26 (Conv2D) (None, 125, 125, 64) 36928

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max\_pooling2d\_14 (MaxPooling (None, 62, 62, 64) 0

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flatten\_4 (Flatten) (None, 246016) 0

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dense\_15 (Dense) (None, 128) 31490176

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dense\_16 (Dense) (None, 128) 16512

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dense\_17 (Dense) (None, 64) 8256

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dense\_18 (Dense) (None, 32) 2080

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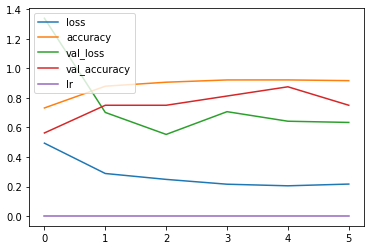
dense\_19 (Dense) (None, 1) 33

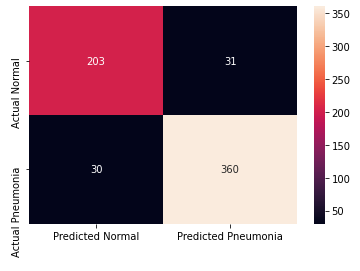
=================================================================

Total params: 31,665,153

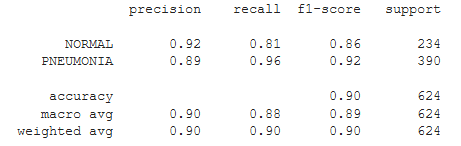
Trainable params: 31,665,153

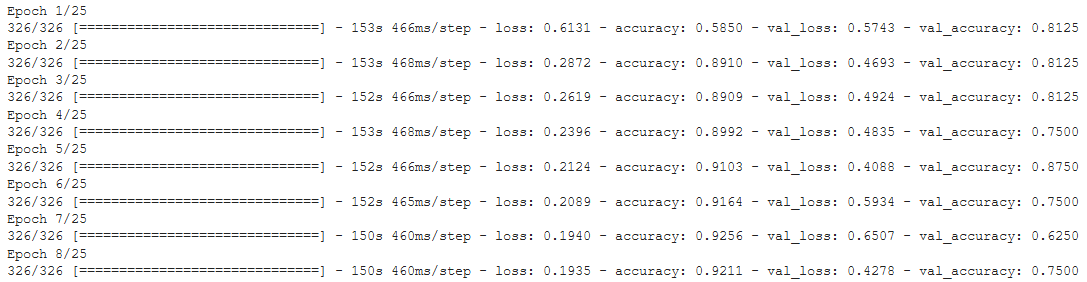
Non-trainable params: 0





The testing accuracy is : 88.78205418586731 %





## Model 6:

Like model 1.

Optimizer Adam and mean squared error

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Layer (type) Output Shape Param #

=================================================================

conv2d\_7 (Conv2D) (None, 500, 500, 32) 320

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max\_pooling2d\_3 (MaxPooling2 (None, 250, 250, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_8 (Conv2D) (None, 250, 250, 32) 9248

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max\_pooling2d\_4 (MaxPooling2 (None, 125, 125, 32) 0

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conv2d\_9 (Conv2D) (None, 125, 125, 32) 9248

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max\_pooling2d\_5 (MaxPooling2 (None, 62, 62, 32) 0

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conv2d\_10 (Conv2D) (None, 62, 62, 64) 18496

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max\_pooling2d\_6 (MaxPooling2 (None, 31, 31, 64) 0

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flatten\_1 (Flatten) (None, 61504) 0

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dense\_5 (Dense) (None, 128) 7872640

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dense\_6 (Dense) (None, 64) 8256

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dense\_7 (Dense) (None, 1) 65

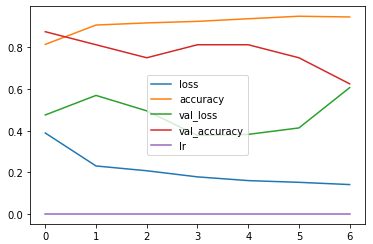
=================================================================

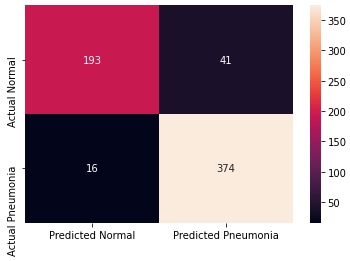
Total params: 7,918,273

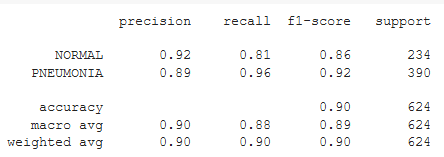
Trainable params: 7,918,273

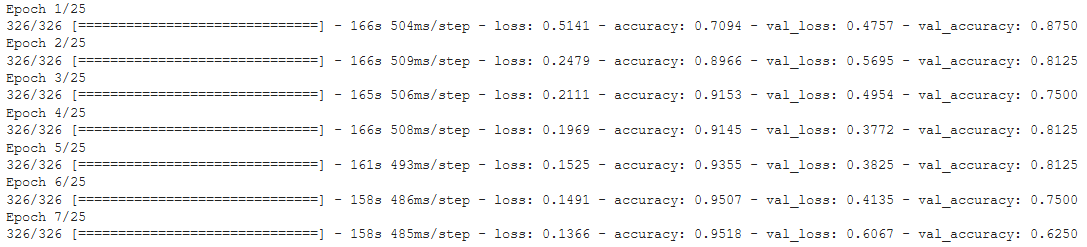
Non-trainable params: 0

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## Model 7:

Transfer learning: feature extraction on ResNet-50 (pretrained on ImageNet dataset).

Optimizer Adam with learning rate 0.003 and Binary Cross Entropy loss.

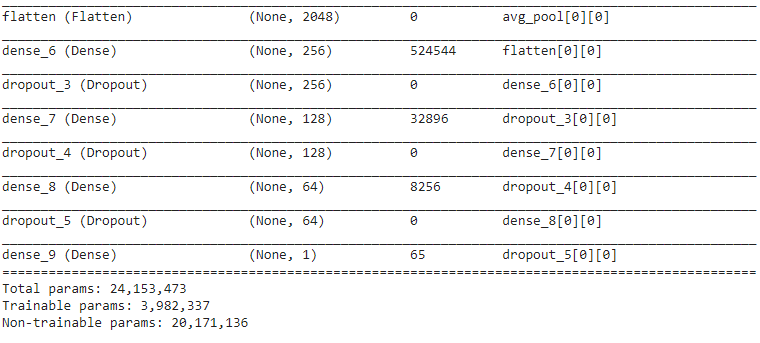
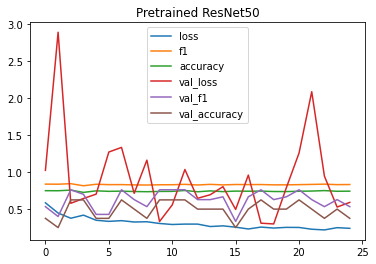
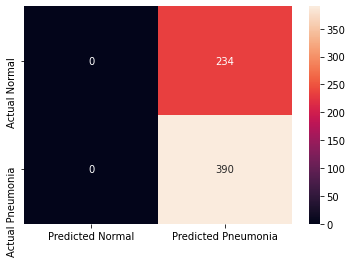


Fig.: Fully connected layer on top of the ResNet50 model.





precision recall f1-score support

NORMAL 0.00 0.00 0.00 234

PNEUMONIA 0.62 1.00 0.77 390

accuracy 0.62 624

macro avg 0.31 0.50 0.38 624

weighted avg 0.39 0.62 0.48 624