Classification of pneumonia status through X-ray images
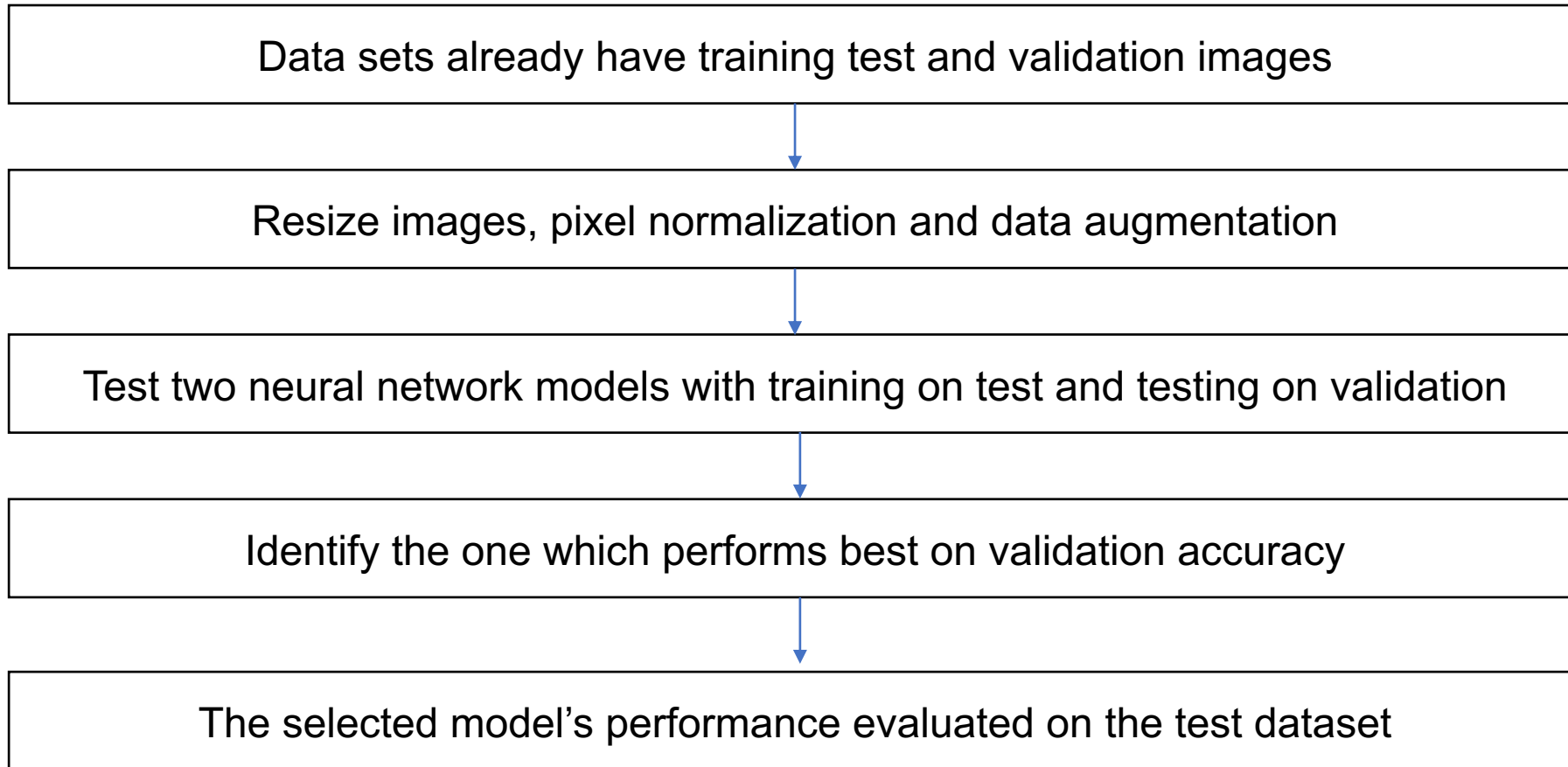
Background information

Aim: Development of method for automated detection of X ray images

- Availability of 5,863 X-ray images from 1-3 year olds divided into training, test and validation images

	Pneumonia	Normal
Training	3875	1341
Validation	8	8
Test	390	234

Strategy for development of automated detection method

Data sets already have training test and validation images

Resize images, pixel normalization and data augmentation

Test two neural network models with training on test and testing on validation

Identify the one which performs best on validation accuracy

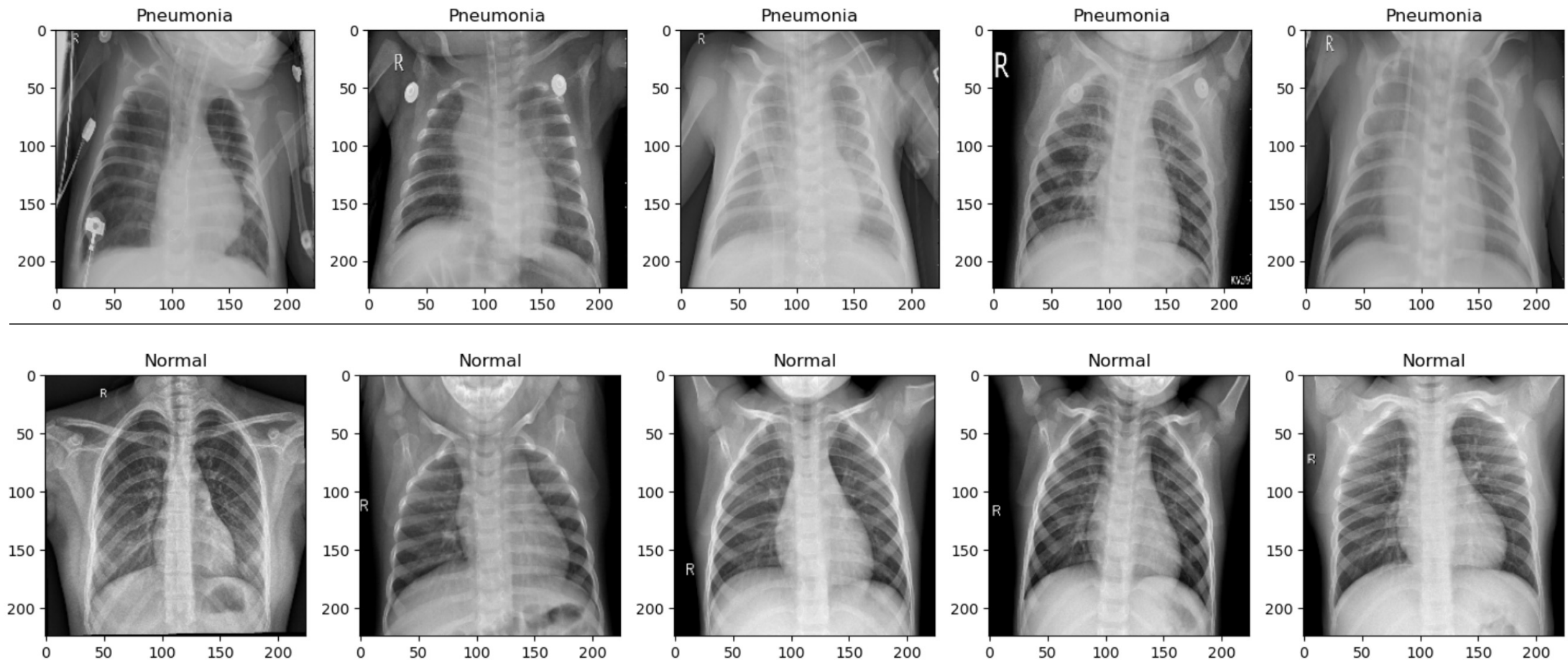The selected model's performance evaluated on the test dataset

Exploratory data analysis

- Looking at the training dataset, we can see that there is a class imbalance with the number of images in the pneumonia class 3 times that of normal.
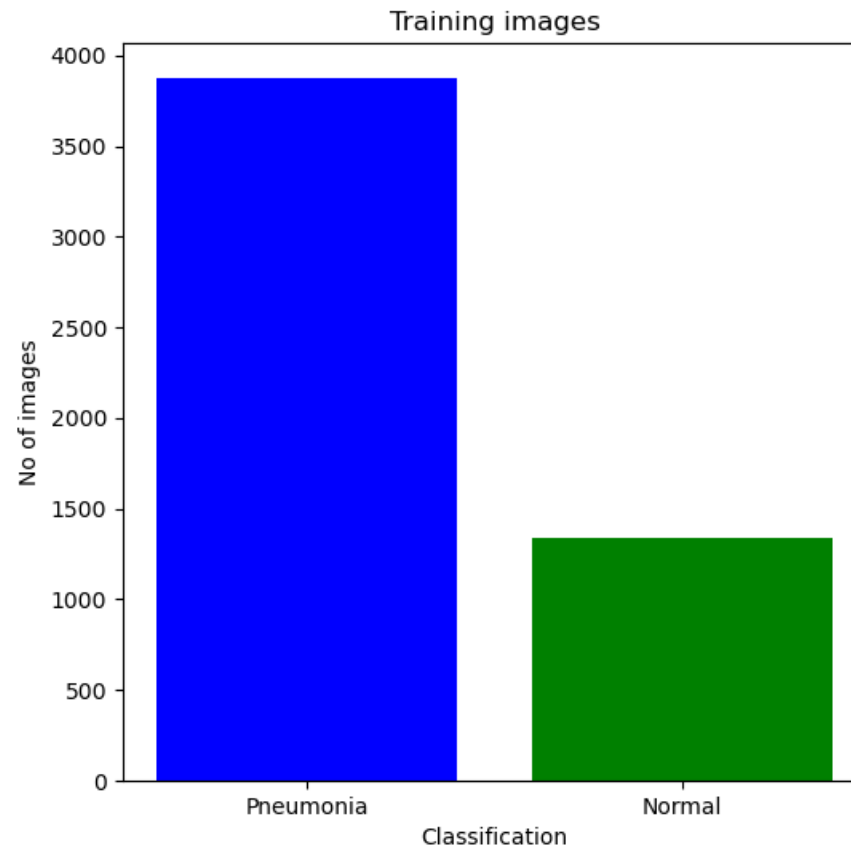
Chest X ray images

- Visualizing a few images after resizing (224x224) in the training dataset

Building neural network models for classification

- We will be testing two convolutional neural network models:

-Resnet50 model

-Custom Conventional neural network

To counter the imbalance and any overfitting:
- Used data augmentation to increase the diversity of images to be trained
-Used class weights balancing in the training which were dependent on the number of images in each class
 Loss function used: Binary cross entropy

Resnet50

- Resnet50 is a 50 layer deep model with weights for lower layers trained from Imagenet.
- Top layer was adjusted as this is a binary classification.
- Let us look at the performance based on training and validation data sets with no of epochs determined by when the validation accuracy does not further improve
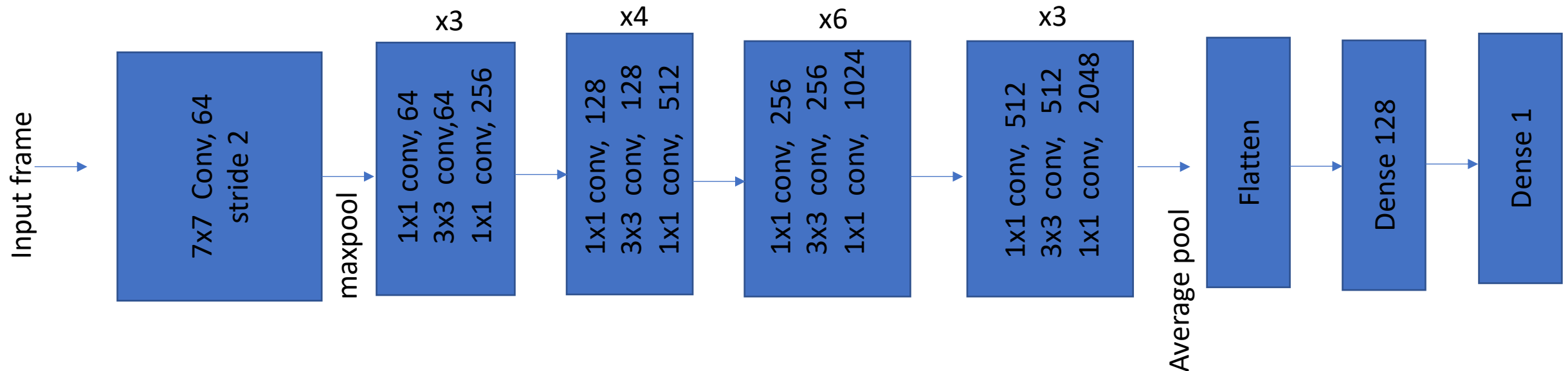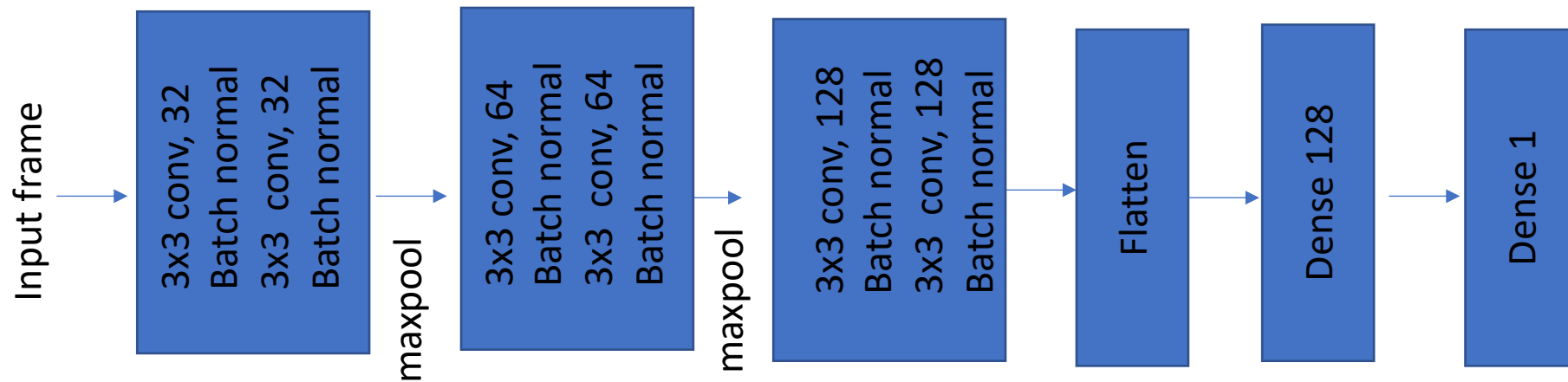
Resnet50 model evaluation

- Let us look at the performance based on training and validation data sets with no of epochs determined by when the validation accuracy does not further improve
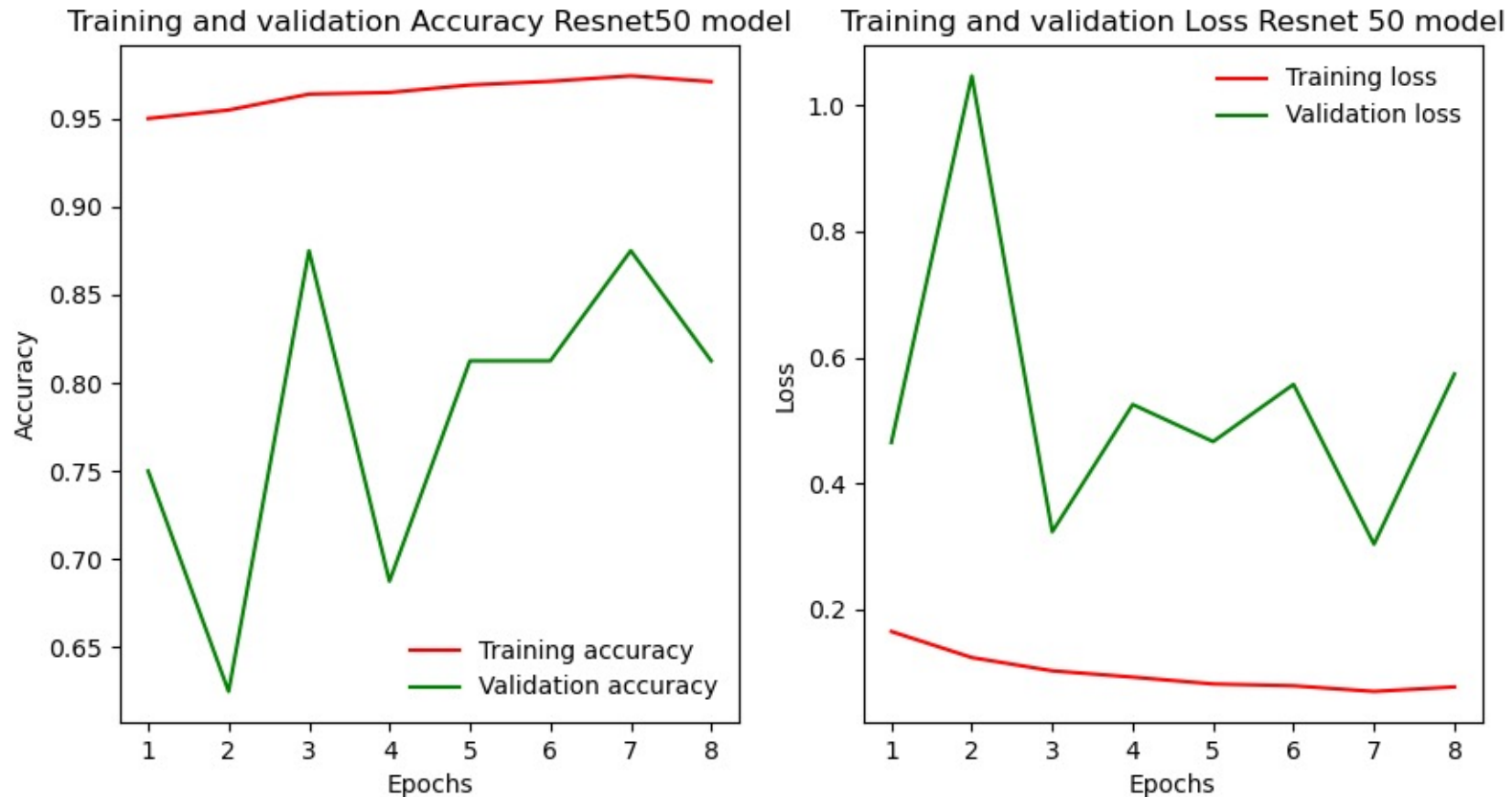
Convolutional neural network

- We used a traditional convolutional network using the following architecture

Input frame → [3x3 conv, 32 / Batch normal / 3x3 conv, 32 / Batch normal] → maxpool → [3x3 conv, 64 / Batch normal / 3x3 conv, 64 / Batch normal] → maxpool → [3x3 conv, 128 / Batch normal / 3x3 conv, 128 / Batch normal] → Flatten → Dense 128 → Dense 1

CNN model evaluation

- Let us look at the performance based on training and validation data sets with no of epochs determined by when the validation accuracy does not further improve
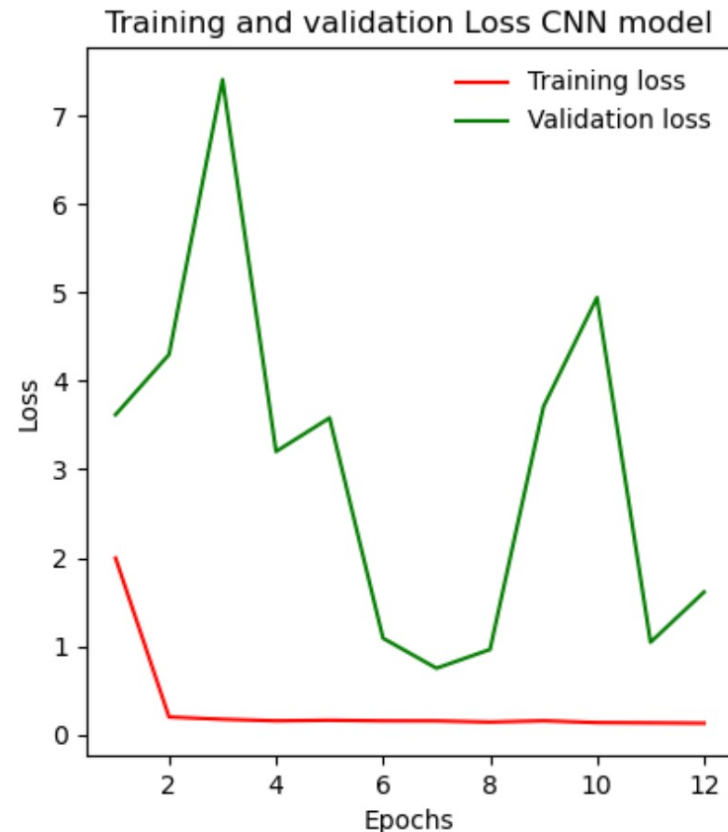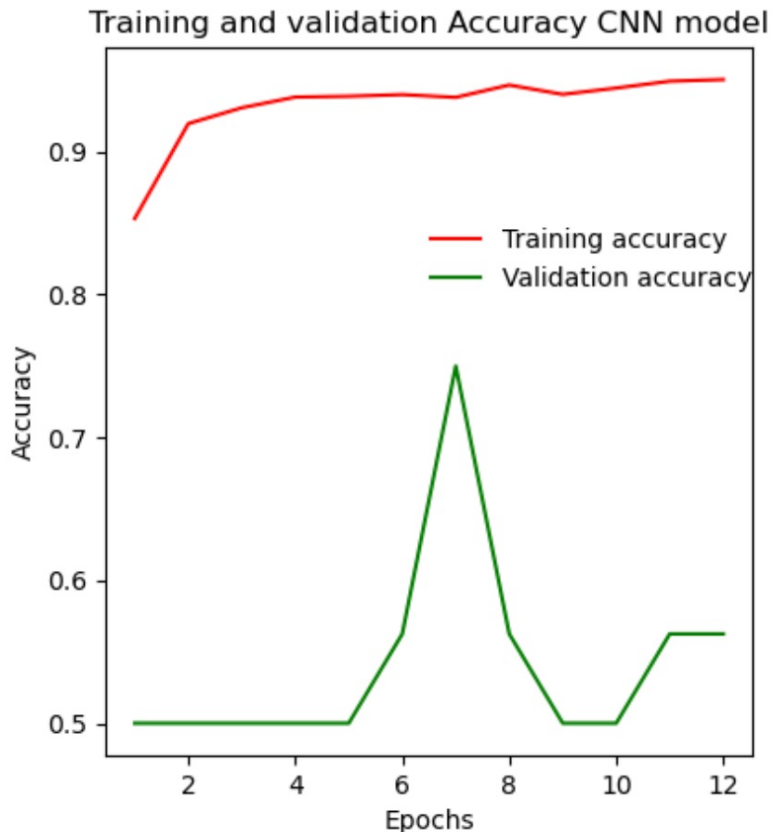

Lower accuracy on the validation compared to Resnet50 model

Test performance and conclusion

- Based on the performances for validation accuracy, Resnet50 was the better model and was evaluated in the test data set.

	Accuracy	Precision	Recall
Test	93.6%	0.94	0.94