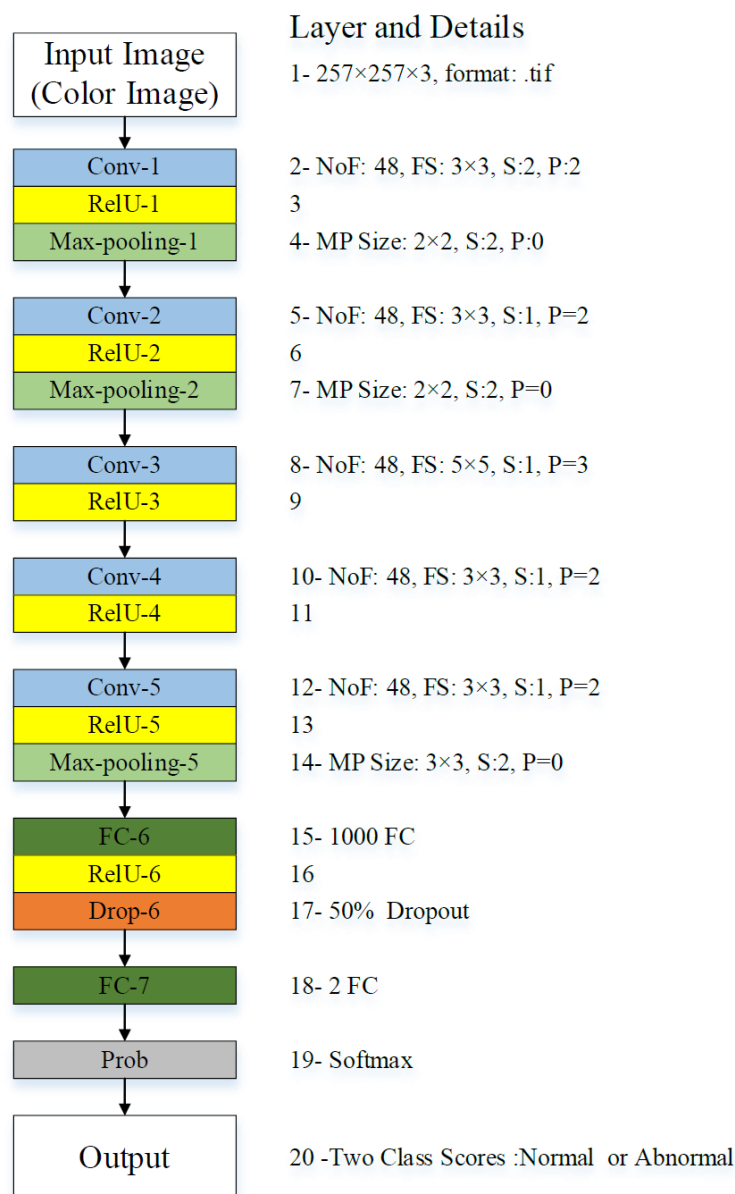


**Note:** You must use the keras library to solve this exercise.

- 1- Create artificial images with data augmentation including (flipping, histogram equalization, rotation, translation, shearing and etc.) and add them in the dataset.
- 2- Display the total number of dataset color images after the data augmentation step and separate 80% of the dataset for training dataset and 20% for test dataset.
- 3- Create a Convolutional Neural Network (CNN) according to the following structure:



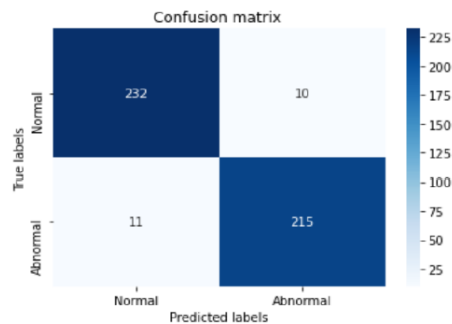
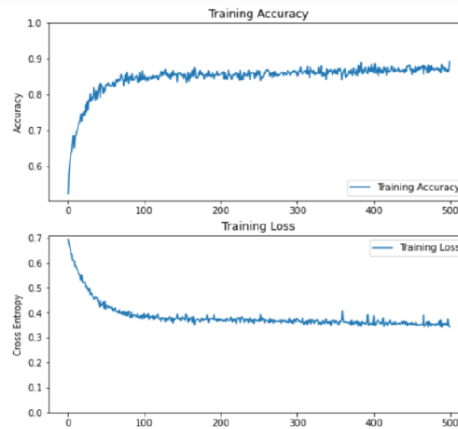
**Guide:**

FS: Filter Size  
 MP Size: Size of Max-pooling  
 NoF: Number of Filters  
 P: Padding  
 S: Stride

- 4- Training the model with the following parameters on the dataset:

Batch size	100
Number of epochs	500
Learning rate	0.0001
Loss function	Binary Cross Entropy

- 5- Display variation of each epoch in training accuracy and loss function.
- 6- Display model performance metrics including: confusion matrix, loss, accuracy, precision, recall and specificity.
- 7- You can achieve better performance metrics than following performance metrics by changing the network structure.



```
loss: 0.10124388337135315
accuracy: 0.9551281929016113
percision: 0.9536033868789673
recall: 0.945164680480957
```

---

Write a report with description to solve this exercise. The report includes the steps to answer each question and screenshot of their output.

Attach the code.

Make HW3.zip

Upload it in elearn system.