COVID-19 Classification and Heatmap Generation Using Deep Learning

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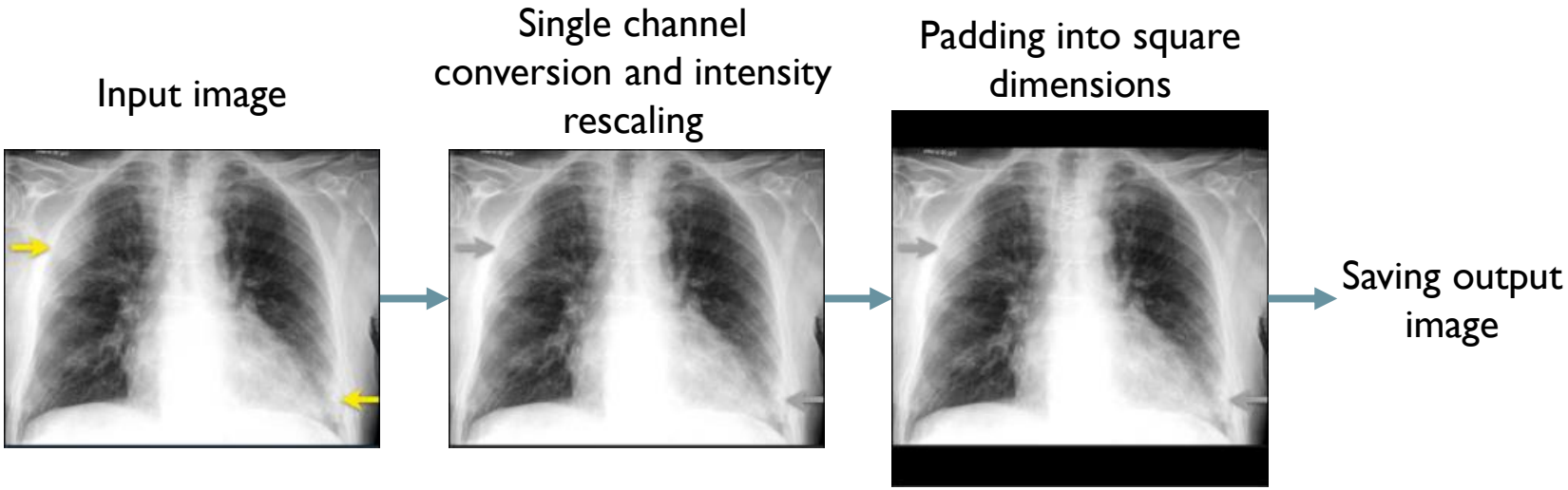
Pre-processing



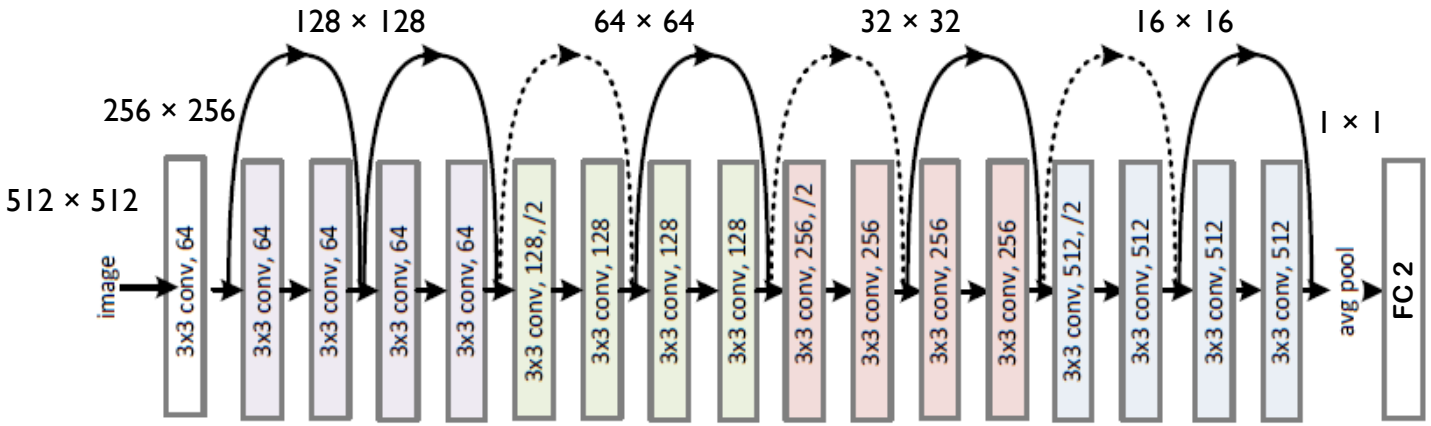
Dataset Splitting and Augmentation

- Dataset splitting:
  - Normal: 200
  - Abnormal: 184
- Transformation:
  - Training (augmentation)
    - Resize (512, 512) px
    - Random rotation 30 degrees
  - Validation
    - Resize (512, 512) px
- Mean-std intensity normalization.

	Training	**Validation**
Normal	175	25
Abnormal	161	23
Total	336	48

Network Model

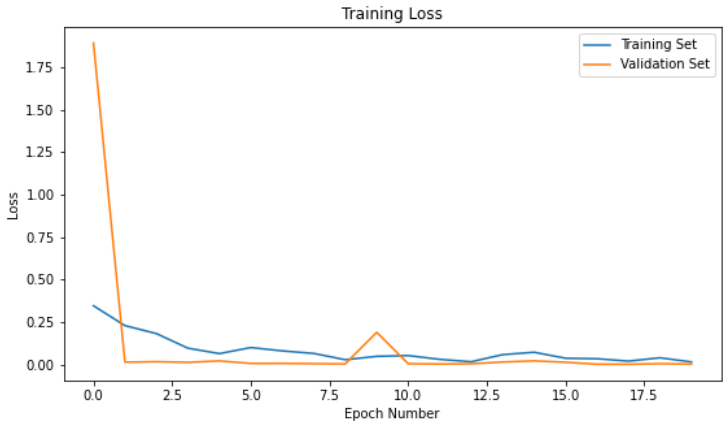
- Resnet18

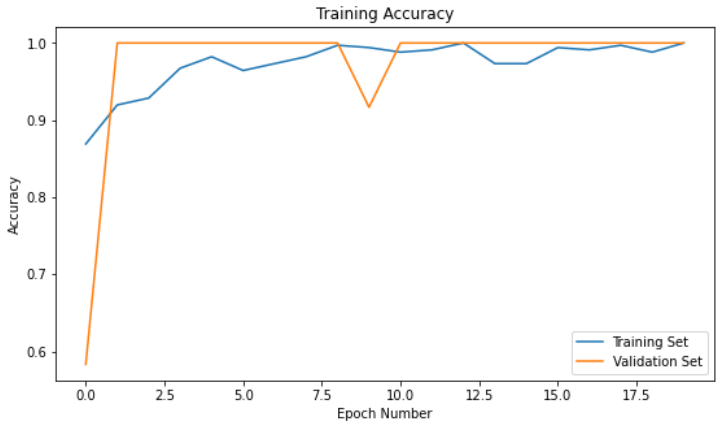


- Adam optimizer (learning rate = 0.0001).
- Weighted cross entropy loss function:
  - Normal weight = $1 - \frac{175}{175+161} = 0.48$
  - Abnormal weight = $1 - \frac{161}{175+161} = 0.52$

Training the Model

- Batch size = 4
- Number of epochs = 20

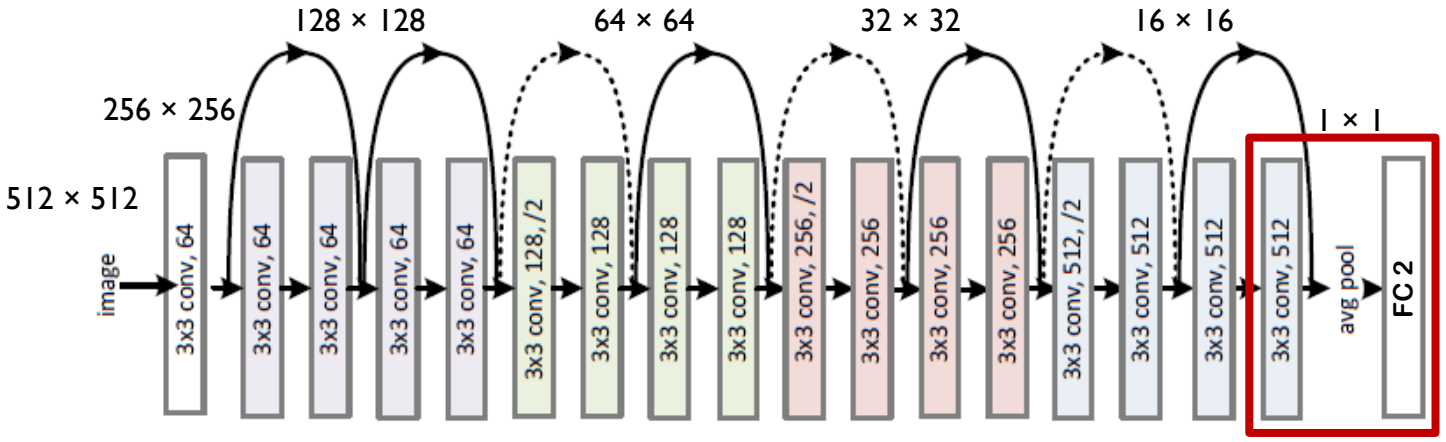




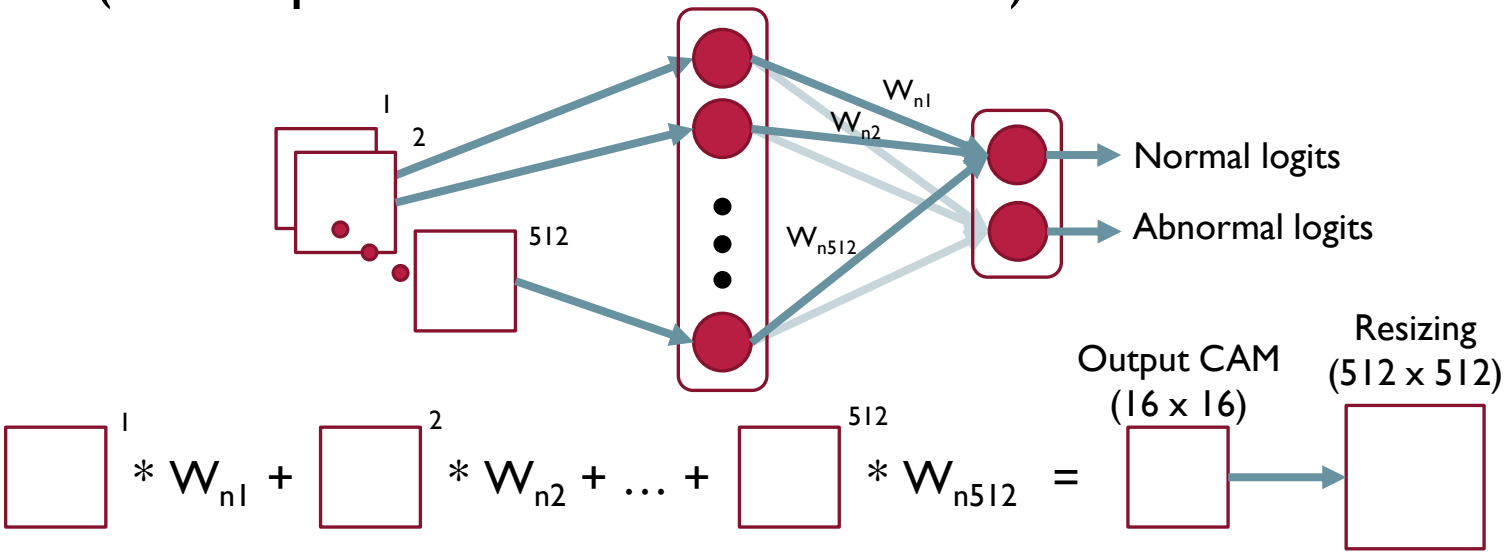
- Saving the best model:
  - Highest validation accuracy (primarily).
  - Highest training accuracy (secondarily).

Class Activation Map (CAM)

- Resnet18



- Ex. (If the predicted class is normal):



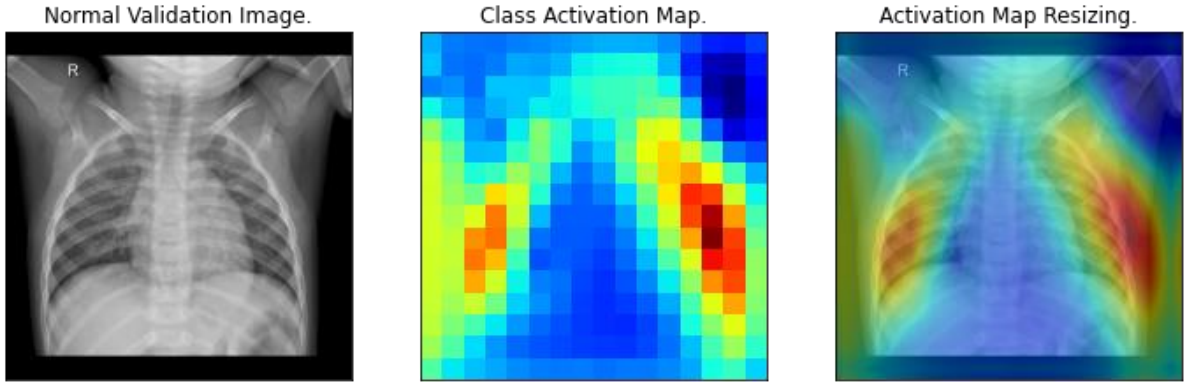
Experimental Results

	True	False
Positive (Abnormal)	23	0
Negative (Normal)	25	0

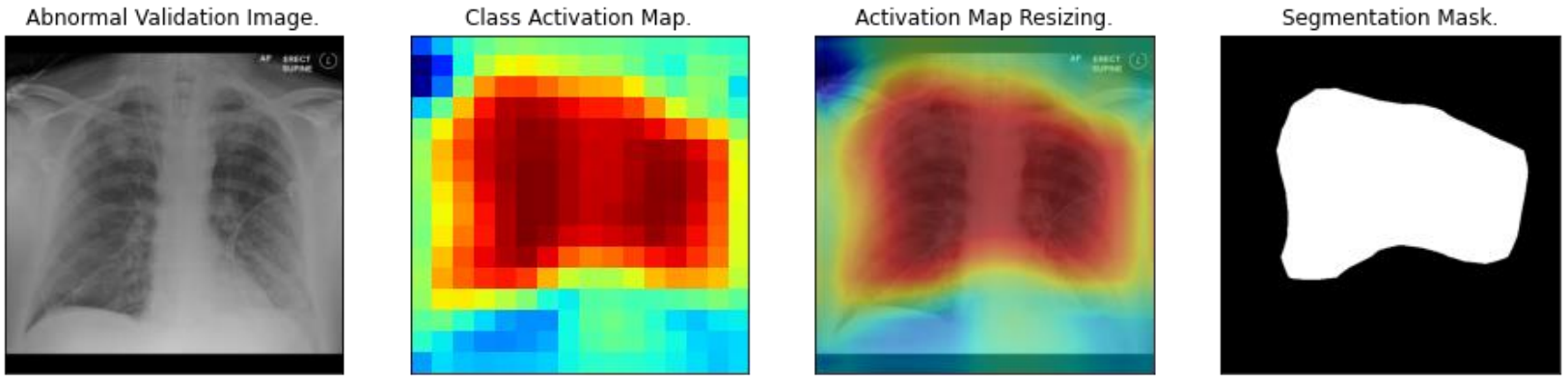
- Accuracy: 1.0
- Sensitivity(Recall): 1.0
- Specificity : 1.0

Experimental Results (cont.)

- Normal



- Abnormal (Segmentation at threshold 0.85)



Conclusion

- The Resnet model provides high classification results using limited numbers of scans.
- N-fold cross validation can be applied for better evaluation.
- The proposed solution requires testing set to avoid validation overfitting.
- The abnormal regions cannot be segmented precisely using activation maps.

Thank you.