DeepASPECT - Determine Stroke Impact

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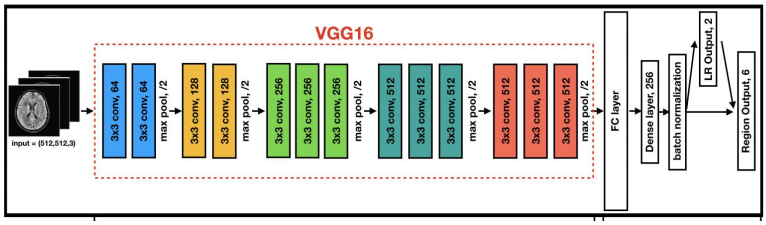
Introduction

Stroke is one of the leading causes of mortality and morbidity in USA. DeepASPECT analyzes non-contrast CT scans of a patient's brain to determine the damage that has occurred due to insufficient blood flow in the brain from a stroke by looking at parenchyma changes. The model then assigns an ASPECT score which is used to assess severity of an ischemic stroke and determine treatment options.[1]

Model Architecture

Model was created through transfer learning from VGG16[2]. It provides two sets of outputs. One output for Left vs Right and 6 for the regions.



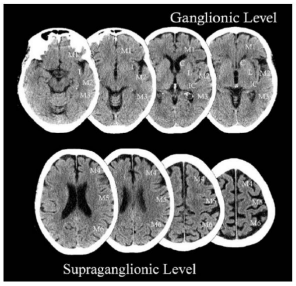
Results

Medical diagnosis requires high sensitivity and specificity. Model is performing well given the smaller data set it trained on.

Specificity	**98.11%**
Sensitivity	61.54%
Exact-match-score	**97.47%**
Hamming-loss	**2.53%**

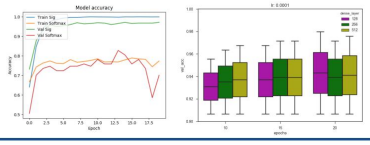
Data

For a given patient we receive ~30 horizontal slices representing 5mm each in DICOM format. Preprocessing is applied to highlight brain parenchyma. For the training set we have 20 labels each representing the presence of bleeding in a specific region of interest in the right/left side of the brain along with a few patient attributes.



Training

Model was trained on for 171 patients. Hyper parameter search was done across 6 parameters and validation accuracy of 98% was achieved.



Future Direction

Current model is tuned for 3 regions of the total 10. We will continue to work to extend it to all 10 regions. Secondly there is an opportunity to reduce noise to the model by performing a slice selection first before running the model. Our experiments with a CNN for slice selection has shown promise and we would want to continue that direction.

Acknowledgements

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References

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2.Simonyan, K., & Zisserman, A. (2014). Very deep convolutional networks for large-scale image recognition. arXiv:1409.1556.