3D CNN for Lung nodule detection

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For the *Luna16 False Positive Reduction Track*

We are a group of research scientists who developed a CNN architecture for lung nodule detection. We would like to benchmark our model against submissions to the Luna 16 competition so that we can have a better understanding of its strengths and weaknesses.

The model that we developed works on a 32 x 32 x 32 patch of lung volume which was cropped out from the original images provided. The network has a total of 21 layers, including batch normalization, 3D convolution and pooling layers. Drop out layers were also introduced to to prevent overfitting of the data. We would like to apologise as we are unable to release exact details of the network since it is still under development. However, initial results on the test set on our end revealed to be promising, with the network achieving an F1 score of 0.87.

The dataset that was provided was heavily skewed towards the negatives. As such, we developed our own training dataset by first up-sampling the positives to a value of 65,000 and down-sampling the negatives until we achieve a P:N ratio of 1:5.

Augmentation of the positive dataset was performed in two consecutive pipelines. The data was first rotated at an angle $\theta \in \{0°, 90°, 180°, 270°\}$ and a further rotation angle φ with a uniform distribution of $-5° \; to \; 5°$. The result is then translated randomly along each axis by a value ranging from -1 to 1 voxel. Randomizing the augmentation helps ensure that we do not have any duplicates during the training process.

For further improvements, we could also consider incorporating boosting to improve network performance on the limited positive dataset size we have.