Final Project Proposal
Early prediction of potential Lung Cancer cases based on lung scans

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Abstract— In this project we will attempt to identify lung cancer from scanned images of lungs. The data we use will be from Kaggle, as a part of their 2017 Data Science Bowl. The images are scanned images of lungs and are provided by the National Cancer Institute. Each patient has a set of images each containing a variable number of images where each image is a 2D slice of the scan. Our objective is to design, develop and train a neural network using the data set of thousands of high-resolution lung scans to accurately classify if the patient would acquire lung cancer in the next 12 months. This will dramatically reduce the false positive rate and enhances detection technology, help patients take early measures, and save radiologists' time.

1 Approach

The basis of our approach will be through using convolutional neural networks to guess whether the patient has cancer or not. We will do exploratory data analysis to determine the types of information we can pull from the dataset. Since each image data is a series of 2D slices, we will come up with an efficient way to cleverly use this 3D image data and weight the different slices. We will use histograms of the images aslo as features.

After training and evaluating VGGNet, U-Net and ResNet Convolutional Neural Networks, we will make modifications to these networks to increase performance and accuracy.

We will attempt to use two different novel convolutional neural network architectures to make use of the three-dimensional images (stacked 2D slices) provided. First, we will create new cross-sectional images by combining the same rows or columns of pixels in each image into a new cross-sectional image. For instance, the first cross-sectional image would take the first row of the top photo as the first row of the cross-sectional image, the first row of the second photo as the second row of the cross-sectional image, and so on.

The next architecture we will explore is inspired by the paper Human Pose Estimation in Space and Time using 3D CNN. In this paper, the authors use 3D kernels to create a three-dimensional CNN based on different pictures throughout time. We will do a similar method, utilizing the three-dimensional structure of our data in a new 3D CNN.

Some of our ideas are using attention, taking in outside data for segmentation, and/or incorporating prior information from outside sources in our training data.

2 Contribution

We will both contribute equally to this project and will both work equally on all tasks in the approach.

TABLE 1
Task Distribution

Task	Contributor
1.Data Pre-processing: Collecting prior information that might be useful	Gopal
2. Data Pre-processing: Preparation of 2D cross sectional images	Stephen
3. Design, Modification and Analysis of VGGNet, U-Net and ResNet CNNs.	Gopal, Stephen
4. Implementation of Finalised CNN models	Gopal, Stephen
5. Training and Testing	Gopal
6. Tweaking for improved accuracy and performance.	Stephen
7. Final Observations and Results	Gopal, Stephen

3 Milestones

TABLE 2
Milestones

Task	Tentative Deadline
1.Data Pre-processing: Collecting prior information that might be useful	10-Mar-2017
2. Data Pre-processing: Preparation of 2D cross sectional images	03-Mar-2017

3. Design, Modification and Analysis of VGGNet, U-Net and ResNet CNNs.	20-Mar-2017
4. Implementation of Finalised CNN models	07-Apr-2017
5. Training and Testing	14-Apr-2017
6. Tweaking for improved accuracy and performance.	21-Apr-2017
7. Final Observations and Results	24-Apr-2017

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