Iowa Initiative for Artificial Intelligence

Final Report

Project title:	PREDICTION OF PULMONARY EMBOLISM BY DUAL-ENERGY CT BLOOD POOL IMAGING USING AN ARTIFICIAL INTELLIGENCE ALGORITHM
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Other investigators:	
Date:	

Were specific aims fulfilled:	Y
Readiness for extramural proposal?	Y
If yes … Planned submission date	The PI left the U of Iowa
Funding agency	
Grant mechanism	
If no … Why not? What went wrong?	

Brief summary of accomplished results:

We developed and validated a 3D CNN model to automatically predict pulmonary embolism with achieved prediction accuracy of 0.81.

Research report:

Aims (provided by PI):

This proposal aims to utilize an artificial intelligence algorithm to predict the presence of pulmonary embolism based on iodine maps of the lungs obtained from dual-energy chest CTs.

Data:

At the Division of the Cardiovascular and Thoracic Imaging of the Department of Radiology we have available standard CTPA images and iodine maps of 168 patients, since the majority of the patients referred for a CTPA for suspected pulmonary embolism are scanned using a dual-energy technique. We checked each patient and this identified 39 positive exams and 129 normal controls for this pilot study.

AI/ML Approach:

A 3D CNN model [1] was implemented for image classification – each image was classified as pulmonary embolism or control . Training/validation split was 128/42.

Experimental methods, validation approach:

Data Preparation

Data preparation or pre-processing is an essential step in any machine learning study. In order to save computation time, we resized each image to the size of 128x128X64. In this project, data normalization is an important step which ensures that each input parameter (pixel) has a similar data distribution. This makes convergence faster while training the model. We normalized the image intensity to [0,255].

Image Classification

The 3D CNN is one of the most popular machine learning models for image classification. 3D convolutional neural network architecture, which consists of several modules of 3D conv, maxpool and batch normalization layers, was selected for this task. Its basic architecture is shown in Fig. 1.

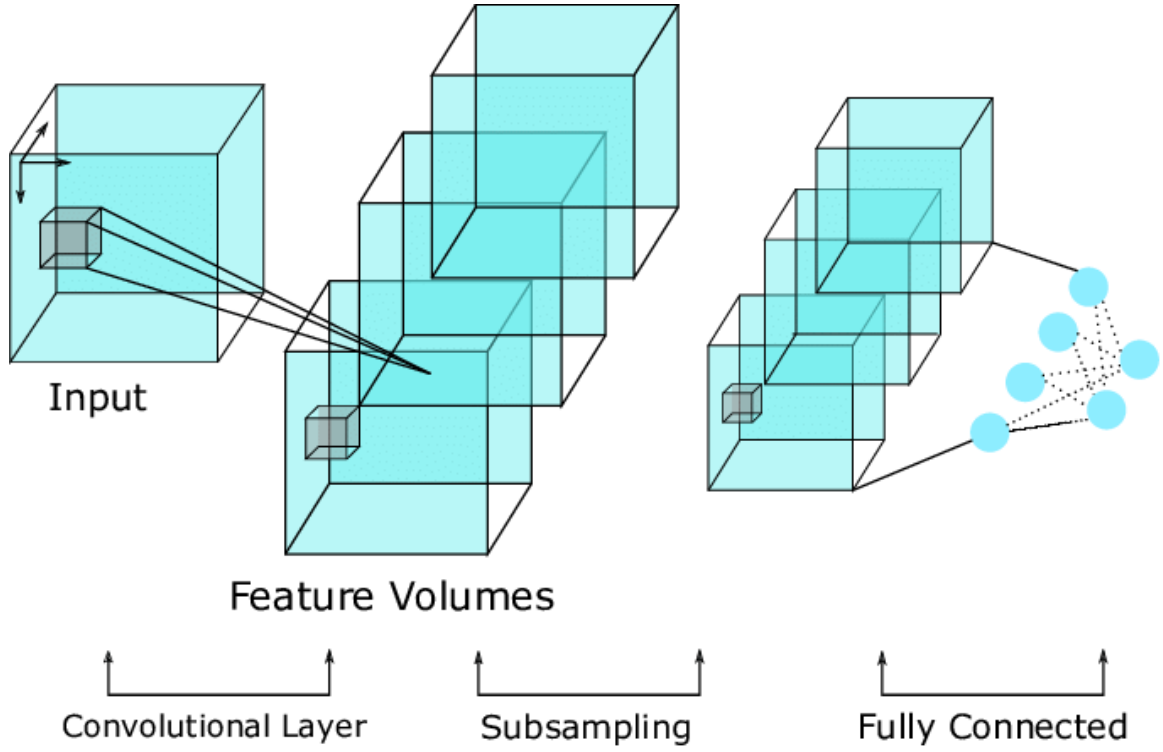

Figure 1. 3D CNN basic architecture [2].

Results:

The accuracy of 3D CNN model to automatically identify pulmonary embolism in the analyzed image datasets was 0.81 in the validation group.

Since we only had 39 positive cases, the accuracy can likely be further improved once/if more data become available.

Ideas/aims for future extramural project:

The PI left the University of Iowa.

Publications resulting from project:

1. Hasib Zunair, Aimon Rahman, Nabeel Mohammed, and Joseph Paul Cohen, Uniformizing Techniques to Process CT scans with 3D CNNs for Tuberculosis Prediction, arXiv:2007.13224

2. Roy, Aprameyo, and Mishra, Deepak, ECNN: Activity Recognition Using Ensembled Convolutional Neural Networks, 2019/02/06, DO - 10.13140/RG.2.2.13080.44808