Iowa Initiative for Artificial Intelligence

Final Report

Project title:	USING MACHINE LEARNING ALGORITHMS TO PREDICT FINAL INFARCT VOLUME AND FUNCTIONAL OUTCOMES BASED ON BRAIN COLLATERAL PATTERNS, CLINICAL FEATURES AND TIME+ DEGREE OF RECANALIZATION
Principal Investigator:	Santiago Ortega Gutierrez, Brian Smith, Andres Dajles, Mudassir Farooqui
Prepared by (IIAI):	Yanan Liu
Other investigators:	
Date:	

Were specific aims fulfilled:	In part
Readiness for extramural proposal?	N
If yes … Planned submission date	
Funding agency	
Grant mechanism	
If no … Why not? What went wrong?	lack of segmentation mask (segmentation ground truth not provided by clinical team)

Brief summary of accomplished results:

We built a pipeline to automatically extract stroke area from brain MRI images and validated the calculated volume against manual calculations received from the clinicians (ground truth). The Pearson correlation between automatic results and ground truth is 0.84.

Research report:

Aims (provided by PI):

Aim 1: To develop a prediction model incorporating machine learning methodologies to estimate final infarct volume and functional outcomes in patients presenting with acute stroke and large vessel occlusions.

Aim 2. To internally validate our prediction model using a k-cross validation technique.

Due to lack of ground truth segmentation mask, we only extracted 10 patients' infarct volumes and compared them with ground truth (manually calculated volumes).

Data:

We have previously performed a data search and had 10 patient cases and stroke volume.

AI/ML Approach:

None

Experimental methods, validation approach:

In image processing, thresholding is the simplest method of segmenting images. From a grayscale image, thresholding can be used to create binary images. The simplest thresholding method is to replace each pixel in an image with a black pixel if the image intensity is less than a fixed value called the threshold, or a white pixel if the pixel intensity is greater than that threshold.

In this project, MRI images were threshold by 620 to segment infarct area. In addition, MRI images were threshold by 0 to segment background area. The difference between mask threshold by 620 and background was the infarct area. In order to reduce noise in the infarct volume, BET (brain extraction tool) was used to extract brain. Volume was calculated in the largest connected area in the mask. The pipeline is shown in Figure 1.
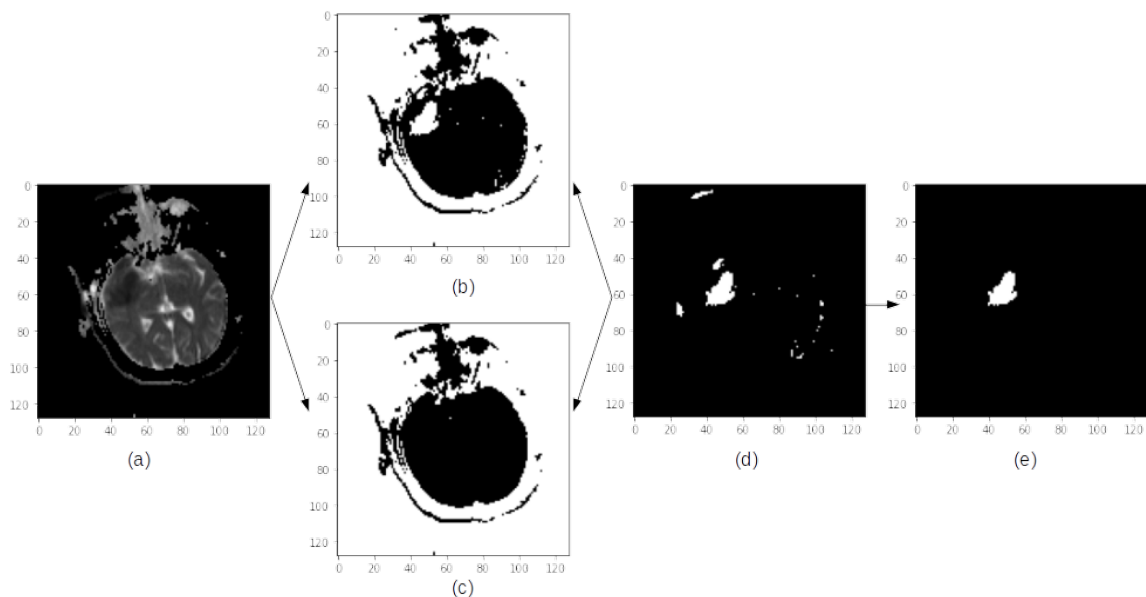

Figure 1 Pipeline. (a) original MRI image (b) Mask image (thresholding by 620) (c) background image (thresholding by 0) (d) difference image (e) final infarct area

Results:

We validated the pipeline against 10 patients and compared with the ground truth. For all 10 cases, the pipeline was able to correctly highlight the region of stroke and agreed with expert chest radiologists' opinion. (Figure 2) The Pearson correlation of calculated volume and ground truth is 0.84. (Figure 3)
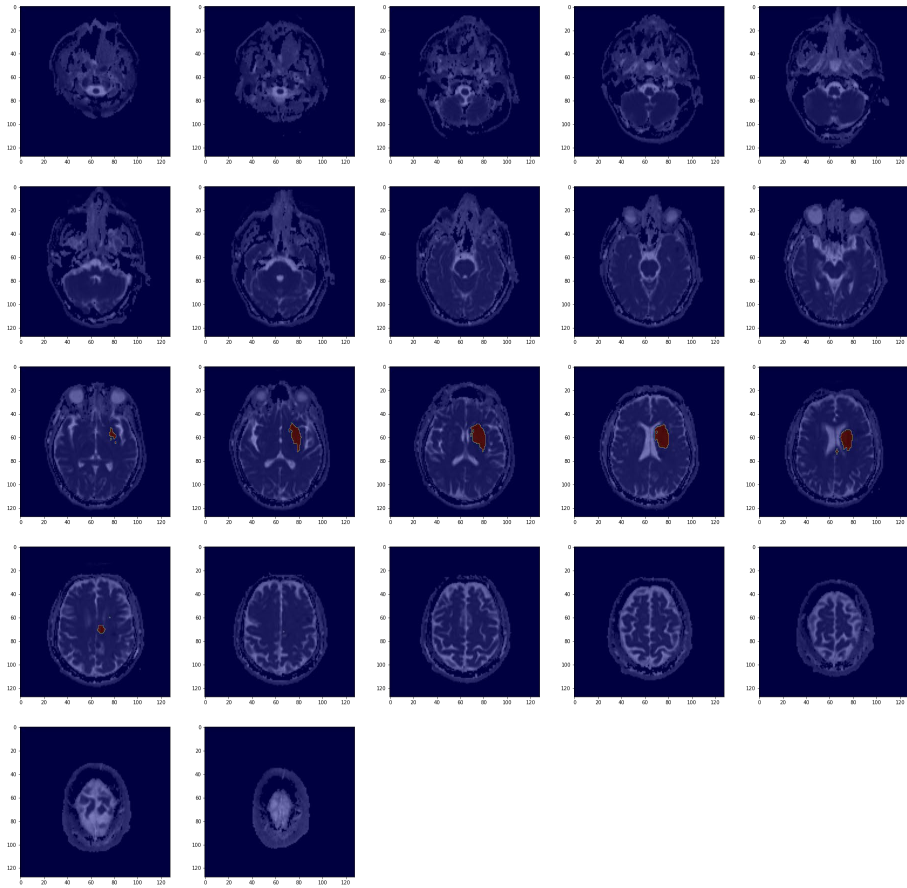
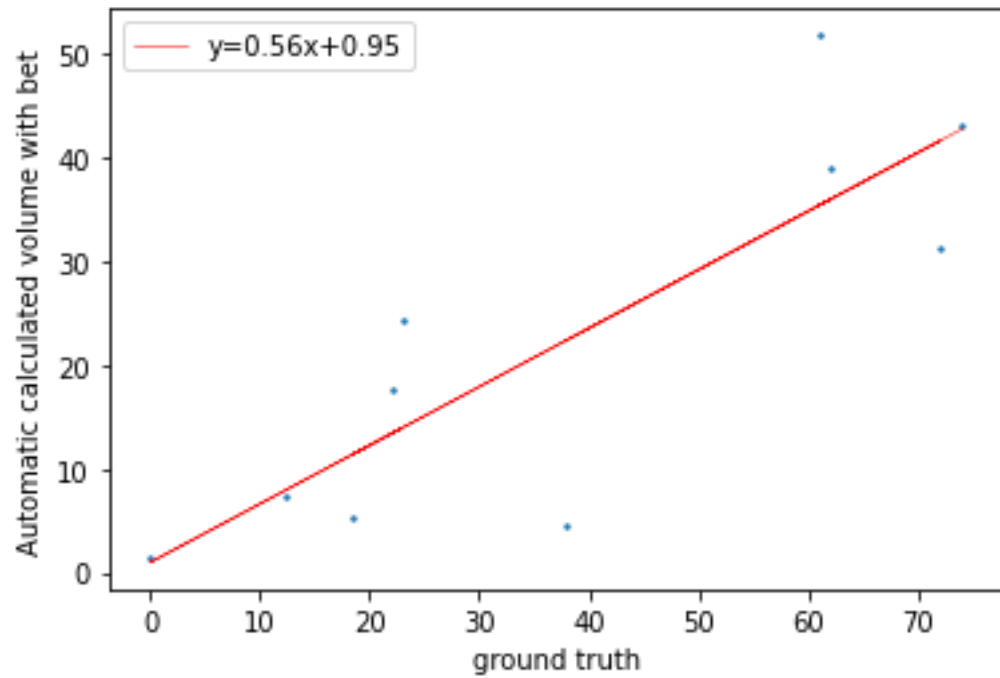Figure 2. MRI image and its detection result.

Figure 3. Automatic calculated volumes and ground truth.

Ideas/aims for future extramural project:

None

Publications resulting from project:

None