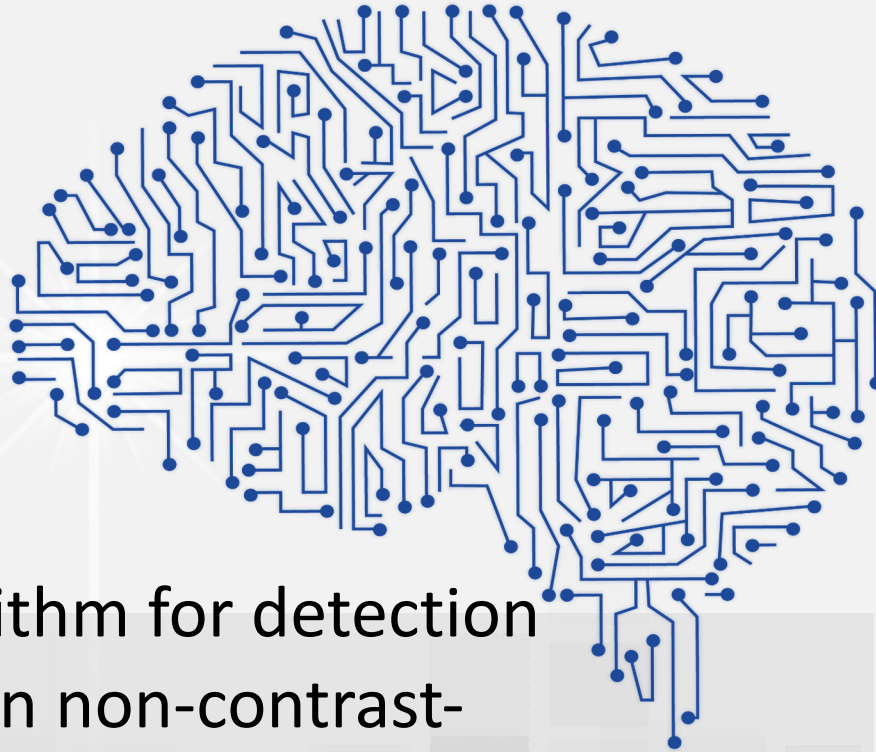

Machine learning algorithm for detection of aortic dissection on non-contrast-enhanced CT

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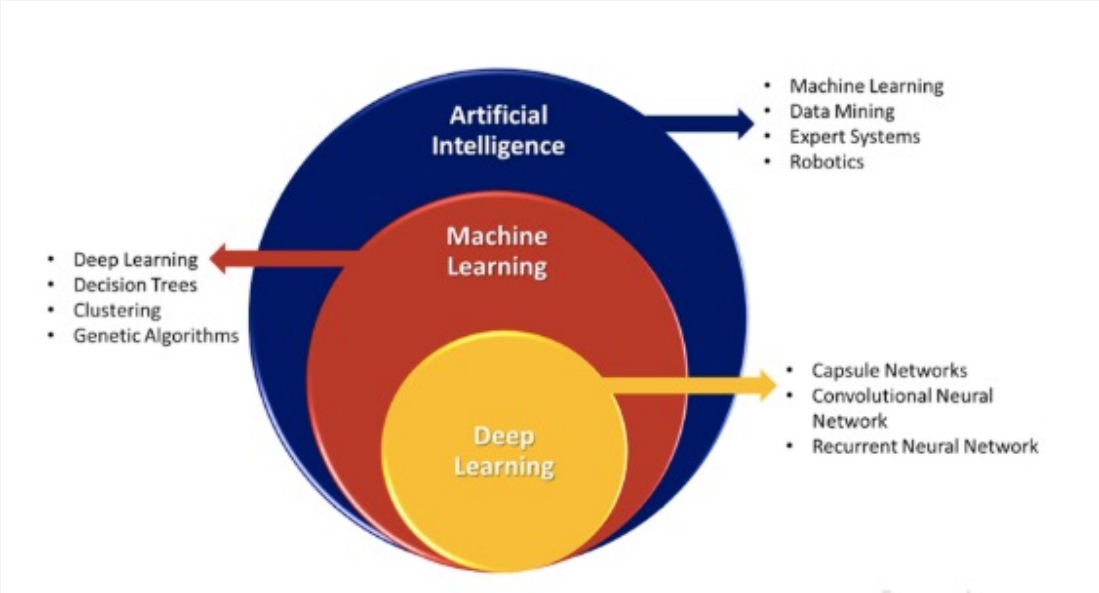
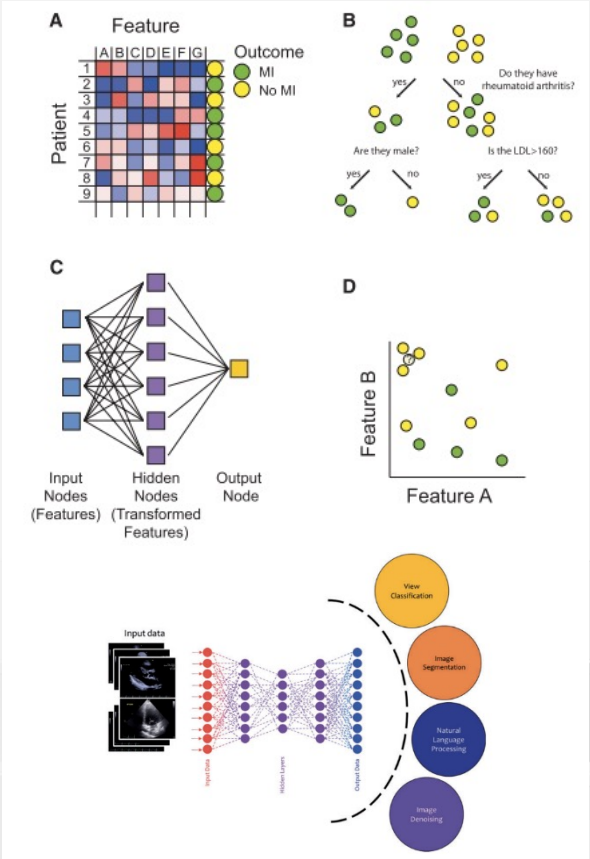


As shown in the figure, deep learning, machine learning, and artificial intelligence can be expressed by an implication relationship, Artificial intelligence includes machine learning, and machine learning includes deep learning.

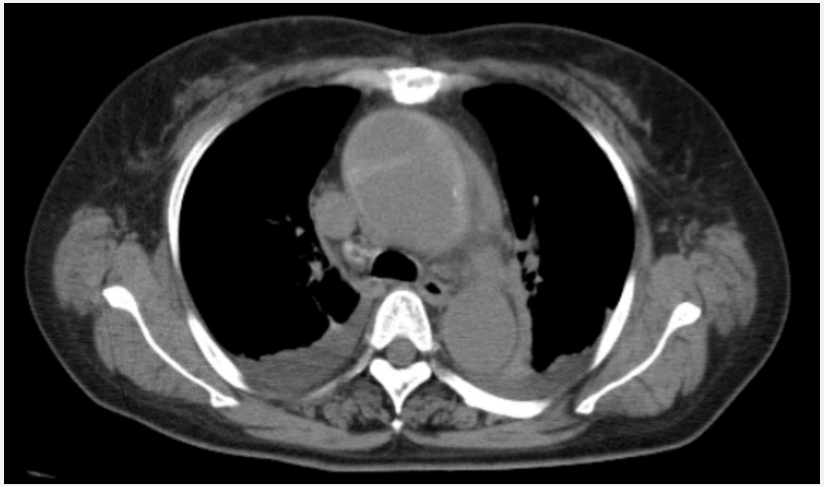
Deep Learning

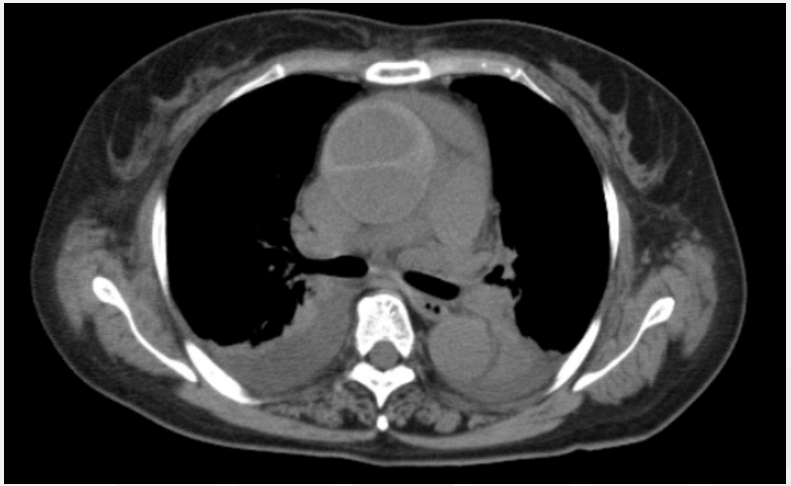
The core of deep learning is the ability to automatically summarize hierarchical features from data rather than manually discovering and designing features based on domain-specific knowledge, as in the past. An essential function of deep learning is to unify feature extraction and learning in a deep neural network. In particular, it can automatically perform feature extraction during learning.



Aortic CTA examination is the most widely used due to its high sensitivity and specificity and has gradually become the “gold standard” for diagnosing aortic dissection disease and judging prognosis. However, due to limitations in technology and rescue capabilities (most patients with aortic dissection are in critical condition and may have allergic reactions to contrast media), it is difficult for some small hospitals to conduct emergency aortic CTA examinations for the first time. A problem that cannot be ignored is that the renal function of emergency patients is unknown. Performing CTA examination on emergency patients who already have renal insufficiency may aggravate the patient's renal damage or even lead to acute renal failure. Chest CT scan is a prevalent examination for emergency patients. It is easy to operate and has significantly lower risks than CTA.

Can Non-contrast enhanced images diagnose aortic disease?





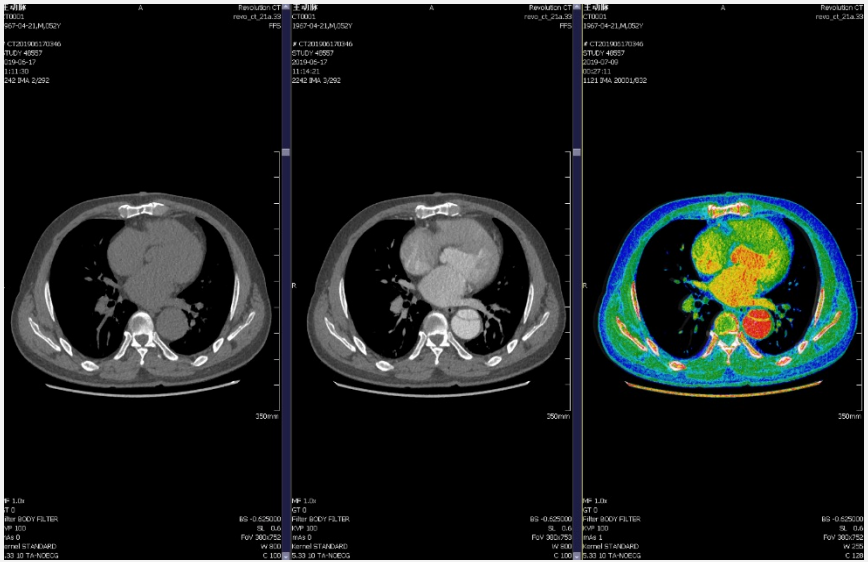
Objective:

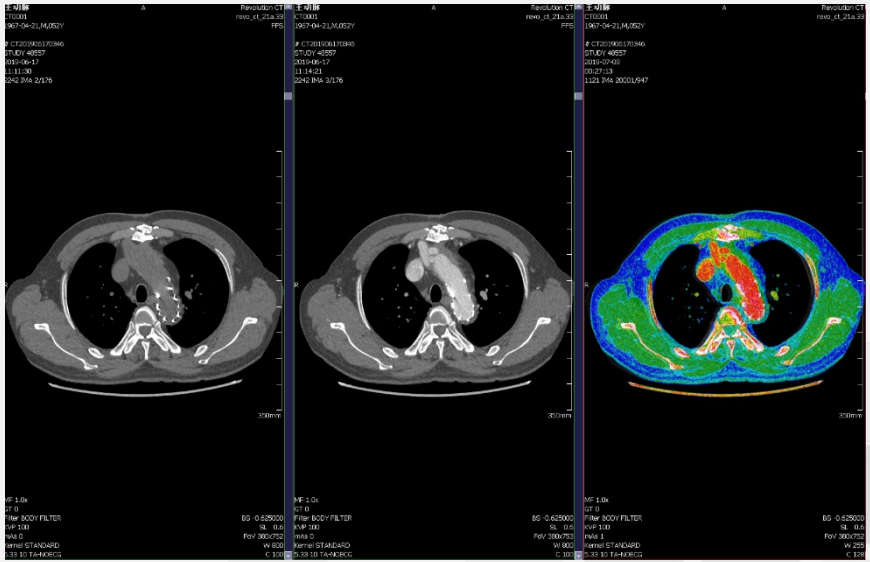
To propose a machine learning algorithm to detect aortic dissection on non-contrast-enhanced CT and evaluate the diagnostic ability of the algorithm compared with those of radiologists.

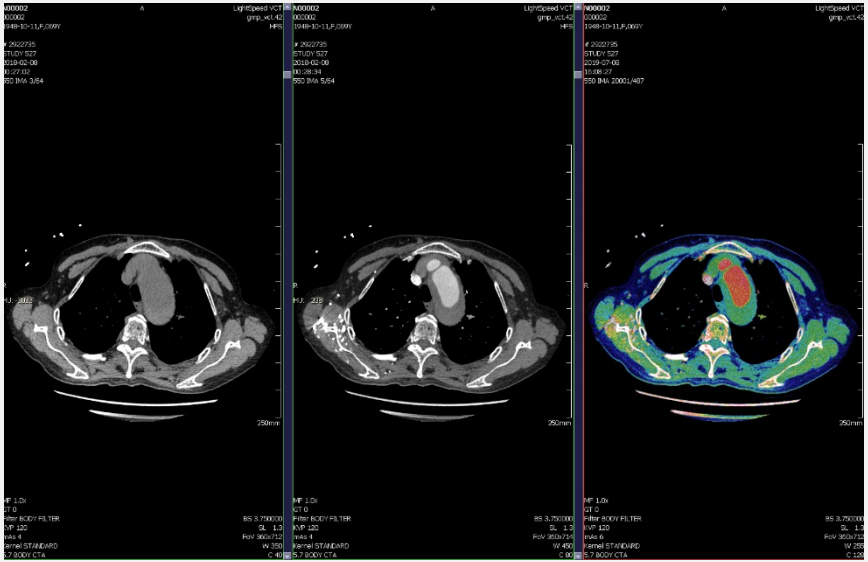
Methods:

This study developed a machine learning algorithm using single-center data collected between January 1, 2022, and December 31, 2022. Included in the study were 130 patients (65 with AD and 65 without AD). An AD detection algorithm was developed using a 3D full-resolution U-net architecture. We have continuously trained and developed an algorithm based on machine learning to segment the true and false lumens of the aorta and then determine whether there is aortic dissection. The diagnostic capabilities of our algorithm and three radiologists were also compared.

image fusion







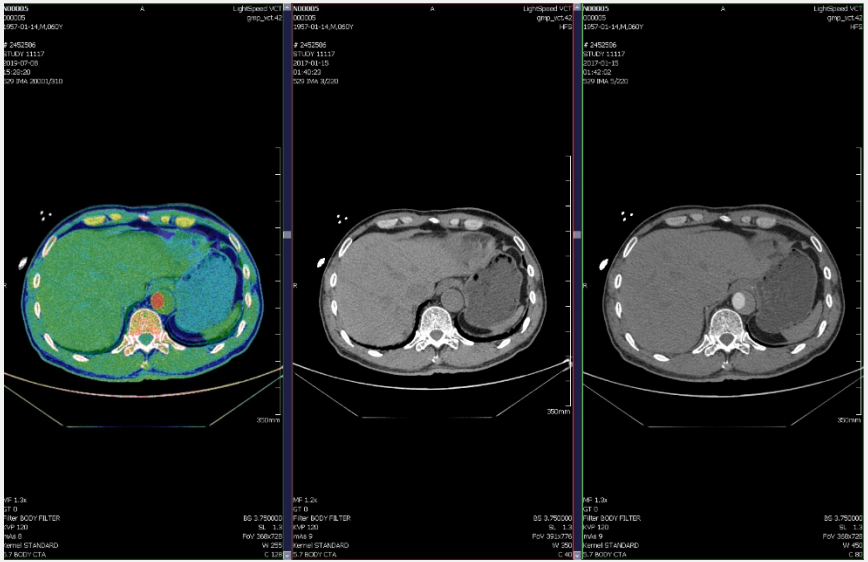
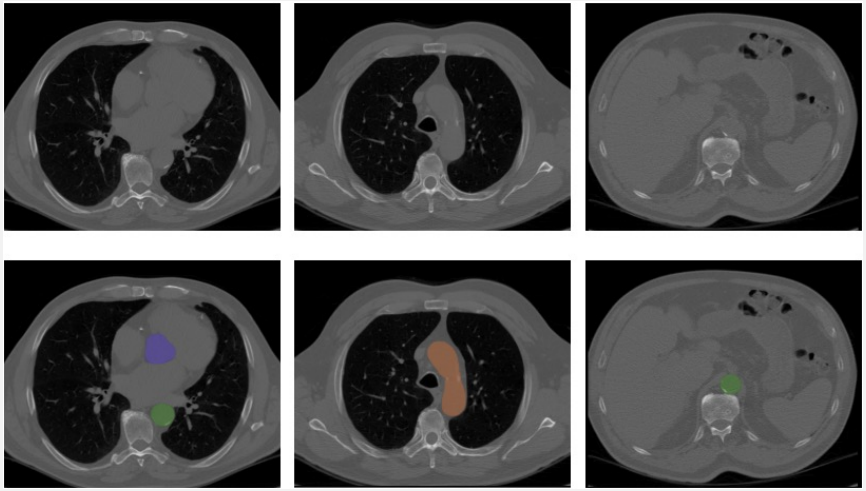
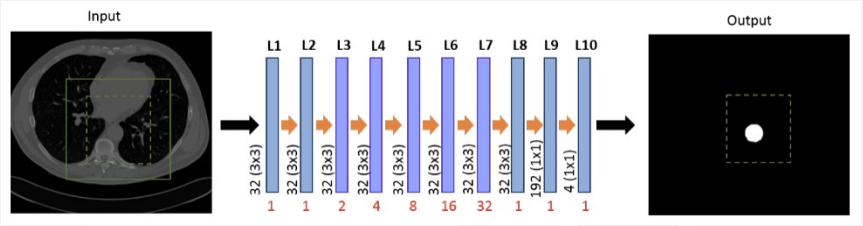


image fusion

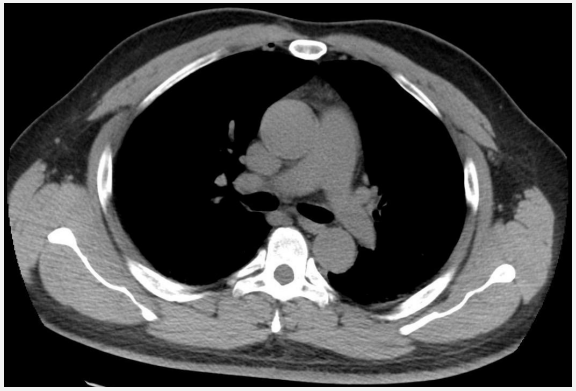
Image annotation and feature extraction

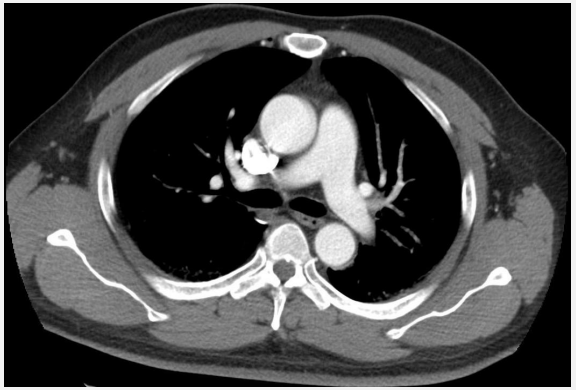


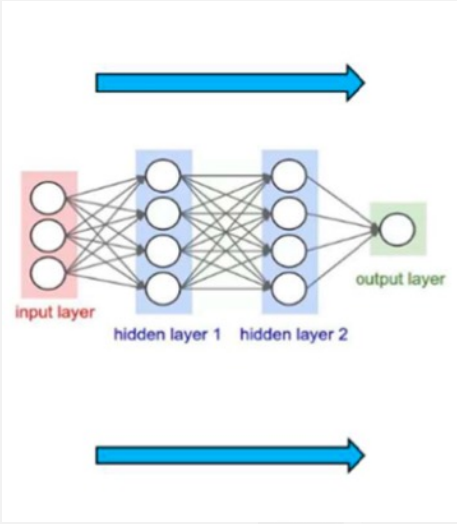


CNN
（Convolutional neural network）

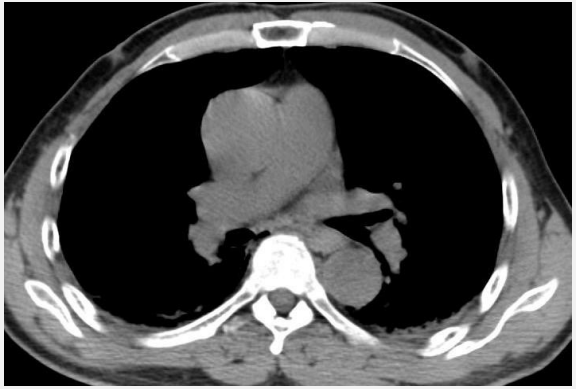
Non-AD







AD



3D Full Resolution U-Net

NCE-CT pictures

Synthetic CE-CT pictures

Results:

The developed algorithm achieved an accuracy of 94.8%, a sensitivity of 93.6%, and a specificity of 96.6%. For radiologists, accuracy, sensitivity, and specificity were 88.9%, 90.8%, and 94.6%, respectively. The algorithm's performance was similar to the mean performance of radiologists in terms of accuracy, sensitivity, or specificity.

Thank you for your time!