

Iowa Initiative for Artificial Intelligence

Final Report

Project title:	Post Operative Scoliosis Assist Program		
Principal Investigator:	Howard O’Rourke		
Prepared by (IIAI):	Yanan Liu		
Other investigators:			
Date:			
Were specific aims fulfilled:		Y	
Readiness for extramural proposal?		Y, currently working on submission	
If yes ... Planned submission date		By January 2026	
Funding agency		RSNA	
Grant mechanism		Resident/Fellow Research Grant RSNA	
If no ... Why not? What went wrong?			

Brief summary of accomplished results:

We developed and validated a VGG-16 model to automatically detect metal discontinuity/failure/disengagement following treatment of scoliosis with hardware on post-operative radiographs with accuracy equals 0.78.

Research report:

Aims (provided by PI):

Aims – Detect metal discontinuity/failure/disengagement following treatment of scoliosis with hardware on post-operative radiographs.

Scoliosis is a common condition in our orthopedic practice and if severe enough, it is often treated with spinal fusion hardware. The hardware commonly extends from the upper thoracic spine through the pelvis.

Given the number of screws/rods, detection of hardware complications (broken screw/broken vertical rod/disengagement) can be difficult.

These findings can be missed by experienced musculoskeletal radiologists. It would be helpful to have a program that can assist in detecting hardware complications in this clinical scenario.

Data:

We got 576 radiographs from 98 patients with broken hardware. They were classified into normal group (267 images) and hardware failure group (309 images).

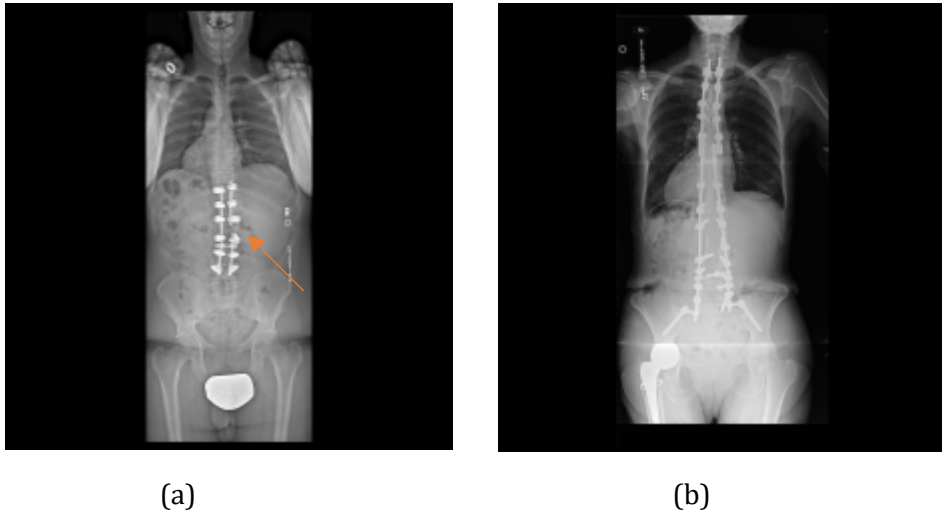


Figure 1. Input example. (a) hardware failure (rod fracture) (b) normal image

AI/ML Approach:

In this study, a VGG-16 model was implemented for image classification. Training/validation split was 460/116.

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 cropped the image, made it square by padding zeros, and resized the image to [224,224]. 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 [0,1] by its maximum and minimum values.

Image classification

The VGG-16 is one of the most popular pre-trained models for image classification.

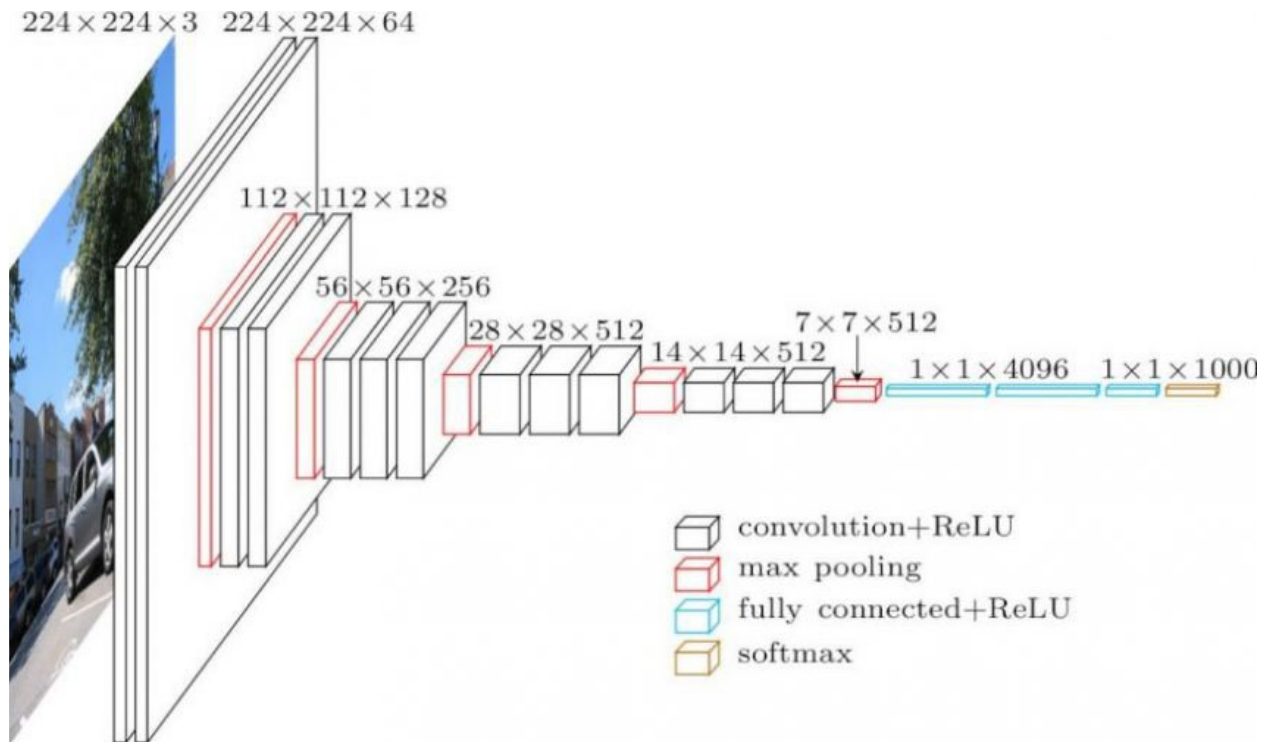


Figure 2. VGG16 architecture [1]

Results:

The accuracy of VGG-16 model to automatically classify hardware was 0.78 with confusion matrix [48,12;14,42] and F1 is 0.76 in validation group.

Table 1 confusion matrix of validation group

	Predicted Normal	Predicted Failure
Normal	48	12
Failure	14	42

Ideas/aims for future extramural project:

We are exploring an RSNA grant to support a larger scale of this project.

Publications resulting from project: Pending.

References:

1. K. Simonyan and A. Zisserman, "Very Deep Convolutional Networks for Large-Scale Image Recognition," ILSVRC, 2014