

Tracheobronchial Foreign Bodies Detection Using SEResNet18

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Abstract— Inhalation of foreign bodies in the airway is a rare event. Most cases of foreign body inhalation are eliminated through protective mechanisms of the body, such as coughing. However, there are some instances where the foreign body remains in the airway, even without the patient noticing. The symptoms of foreign body inhalation vary depending on the size and shape of the object. If it does not cause complete obstruction, it is often overlooked in image interpretation. In this study, the YOLOv5 is first used to locate the respiratory region in high-resolution computed tomography (HRCT), and this serves as the initial point for the 3D region growing. After identifying the airway using 3D region growing, the images are then analyzed using SEResNet18 to determine if any foreign bodies are present. The experimental results showed that using the primary YOLOv5's object detection method, an accuracy of 87.3% was achieved. After incorporating the SE channel attention mechanism into the YOLOv5 framework, the accuracy improved to 92.4%. In the foreign bodies classification, an accuracy of 85% was obtained.

Keywords—High-resolution Computed Tomography, Object Detection, YOLO, ResNet18

I. INTRODUCTION

When fish bones or thin bone fragments enter the airway, they most often get lodged in the narrower sections, especially at the bifurcation or carina of the bronchus. Due to their shape, it is difficult to cough them out. This can also cause physicians to mistake the fishbone or thin bone fragment as a ridge or prominence of the bronchus when observing high-resolution computed tomography images. There were many researchers focused on how to accurately segment the airway (including the trachea and finer bronchi) [1-3]. However, this paper focuses on detecting lesions within the airway, which still needs to be addressed. Therefore, this paper proposes a method that combines YOLOv5 [4] and 3D region growing locate airway region, and proposes a SEResNet18 for foreign object classification.

II. METHOD

Lesions in the airway may include secretions, foreign bodies, tumors, etc., which are referred to as respiratory foreign bodies in this paper. We use YOLOv5 combined with 3D region growing for airway detection and then using a SEResNet18 to detect airway foreign bodies. The system flowchart is shown in Figure 1. Table I shows the airway detection result with three different YOLOv5 backbones. The CSPNet achieved the highest accuracy of 87.3%. Figure 1 shows a case of foreign object detection result. The foreign objects classification results by SEResNet18 is 85%.

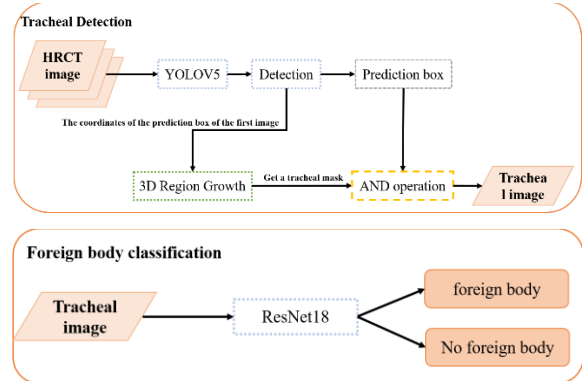


Fig. 1. The system flowchart.

TABLE I. AIRWAY DETECTION WITH DIFFERENT YOLO BACKBONES

| Model | Backbone | mAP |
|--------|--------------|-------|
| YOLOv5 | CSPNet | 87.3% |
| YOLOv5 | MobileNet V3 | 80.7% |
| YOLOv5 | ConvNeXt | 76.3% |

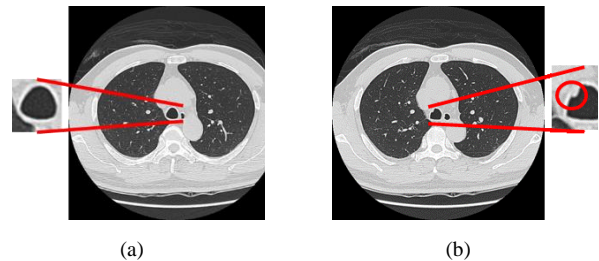


Fig. 2 foreign object classification result.

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