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Research Article

Proposing Novel Data Analytics Method for Anatomical Landmark Identification from Endoscopic Video Frames

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Background. The anatomical landmarks contain the characteristics that are used to guide the gastroenterologists during the endoscopy. The expert can also ensure the completion of examination with the help of the anatomical landmarks. Automatic detection of anatomical landmarks in endoscopic video frames can be helpful for guiding the physicians during screening the gastrointestinal tract (GI). *Method*. This study presents an automatic novel method for anatomical landmark detection of GI tract from endoscopic video frames based on semisupervised deep convolutional neural network (CNN) and compares the results with supervised CNN model. We consider the anatomical landmarks from Kvasir dataset that includes 500 images for each class of Z-line, pylorus, and cecum. The resolution of these images varies from 750×576 up to 1920×1072 pixels. *Result*. Experimental results show that the supervised CNN has highly desirable performance with accuracy of 100%. Also, our proposed semi-supervised CNN can compete with a slight difference similar to the CNN model. Our proposed semisupervised model trained using 1, 5, 10, and 20 percent of training data records as labeled training dataset has the average accuracy of 83%, 98%, 99%, and 99%, respectively. *Conclusion*. The main advantage of our proposed method is achieving the high accuracy with small amount of labeled data without spending time for labeling more data. The strength of our proposed method saves the required labor, cost, and time for data labeling.

1. Introduction

According to the World Health Organization (WHO), in 2018, stomach and colorectal cancer was among the 5 most common cancers in the world. Altogether, stomach and colorectal cancer accounted for about 2.8 million new cases and 1.6 million deaths in 2018 [1].

According to the development of minimally invasive surgeries (MIS), endoscopy is used to examine the upper gastrointestinal tract (GI), including the esophagus, stomach, and the first part of the small bowel [2].

The anatomical landmarks contain the characteristics that are used to guide the gastroenterologists during the endoscopy [3]. The expert can also ensure the completion of examination with the help of the anatomical landmarks [3]. They are of necessity as a guideline to describe the location of a lesion [3]. Landmarks in the upper GI tract include Z-line and pylorus. Also, one of the landmarks in the lower GI tract is cecum [4]. Z-line is also known as the squamocolumnar junction (SCJ) is a place that the squamous mucosa of the esophagus transitions to the columnar mucosa of the stomach [5, 6]. It works like a border between the esophagus and the stomach. Examination of the Z-line is very useful for measuring the gastric mucosal fold and illustrating sign of reflux [6]. The pylorus is also known as a muscular valve that is around the stomach and the duodenal bulb (or the first part of the small bowel). Both sides of the pylorus must be examined to detect abnormalities like ulcer or erosion [5, 7]. With screening GI tract, the physician can ensure that the pylorus can control the motion of food by condensing muscles [8].