Combining CNNs and 2-D visualization method for GI tract lesions classification

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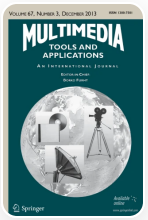

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Abstract

In recent years, artificial intelligence and its tools are demonstrated enough potential for analyzing medical images. Several deep learning models have been proposed in previous studies for gastrointestinal (GI) tract like ulcers, polyps, bleeding, and other lesions. Hand-operated investigation of these lesions requires time, cost, and an expert physician. Automatic detection and classification of GI tract lesions are vital because misdiagnosis of them can affect the quality of human life. In our study, an effective model is proposed for a GI tract classification with the best performance. The proposed method's main aim is to classify GI tract lesions precisely from endoscopic video frames automatically. The different scenarios are designed, assessed, and compared by implementing 5-fold cross-validation on

the KVASIR V1 dataset to achieve this aim. This dataset includes anatomical landmarks (pylorus, z-line, and cecum), pathological findings (esophagitis, ulcerative colitis, and polyp), and polyp removals (dyed lifted polyps, and dyed resection margins) as output classes. Each class includes 500 images, and an image's resolution varies from 750 × 576 to 1920 × 1072 pixels. These first and second scenarios are based on deep neural networks (DNNs). However, in the first scenario, a novel approach is proposed for visualizing 2-D data maps from features extracted from the convolutional auto-encoder (CAE). The last one is schemed based on pre-trained convolutional neural networks (CNNs). The experimental results illustrate the average accuracy of the first, second, and third scenarios is 99.87 ± 0.001, 92.07 ± 0.086, and 90.55 ± 0.111, respectively. The first scenario outperforms the compared ones with an average accuracy of 99.87 ± 0.001 and an AUC of 100.00 ± 0.000.

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