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Thick Data Techniques for Identifying Abnormality in Video Frames for Wireless Capsule Endoscopy

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Abstract : Capsule endoscopy (CE) is an established noninvasive diagnostic modality in investigating small bowel disease. CE has a pivotal role in assessing patients with suspected bleeding or identifying evidence of active Crohn's disease in the small bowel. However, CE produces lengthy videos with at least eighty thousand frames, with a frequency rate of 2 frames per second. Gastroenterologists cannot dedicate 8 to 15 hours to reading the CE video frames to arrive at a diagnosis. This is why the issue of analyzing CE videos based on modern artificial intelligence techniques becomes a necessity. However, machine learning, including deep learning, has failed to report robust results because of the lack of large samples to train its neural nets. In this paper, we are describing a thick data approach that learns from a few anchor images. We are using sound datasets like KVASIR and CrohnIPI to filter candidate frames that include interesting anomalies in any CE video. We are identifying candidate frames based on feature extraction to provide representative measures of the anomaly, like the size of the anomaly and the color contrast compared to the image background, and later feed these features to a decision tree that can classify the candidate frames as having a condition like the Crohn's Disease. Our thick data approach reported accuracy of detecting Crohn's Disease based on the availability of ulcer areas at the candidate frames for KVASIR was 89.9% and for the CrohnIPI was 83.3%. We are continuing our research to fine-tune our approach by adding more thick data methods for enhancing diagnosis accuracy.

Keywords : thick data analytics, capsule endoscopy, Crohn’s disease, siamese neural network, decision tree
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