

# **Bleeding classification of enhanced wireless capsule endoscopy images using deep convolutional neural network**

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## **ABSTRACT**

This paper investigates the performance of a Deep Convolutional Neural Network (DCNN) algorithm to identify bleeding areas of wireless capsule endoscopy (WCE) images without known prior knowledge of bleeding and normal features of the images. In this study, a pre-processing technique has been proposed to improve the classification accuracy of WCE images into bleeding areas and normal areas by enhancing the WCE images. The proposed technique is applied to WCE images from six cases and divided into one training case and five test cases. To evaluate the effectiveness of the processes, the results were then compared between DCNN, SVM and Fuzzy, and also between DCNN with completely enhanced images and DCNN with normalized images. DCNN has shown to give a better result compared to SVM and Fuzzy logic; and the latter experiment has shown that the WCE images that have undergone the proposed enhancement technique gives better classification result compared to those images that did not go through the technique. The specificity, sensitivity and average are 0.8703, 0.8271 and 0.8907 respectively. In conclusion, DCNN has been proven to be able to successfully detecting bleeding areas from images without having any specific knowledge on imaging diagnosis or pathology.

## **KEYWORDS**

Convolutional neural network; Wireless capsule endoscopy; Deep learning; Classification; Detection

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