



## Motion artifact detection in colonoscopy images

Rukiye Nur Kaçmaz<sup>1,4\*</sup>, Bülent Yılmaz<sup>1,2,3,4</sup>, Mehmet Sait Dünder<sup>1,4</sup> and Serkan Doğan<sup>5</sup>

### Abstract

Computer-aided detection is an integral part of medical image evaluation process because examination of each image takes a long time and generally experts' do not have enough time for the elimination of images with motion artifact (blurred images). Computer-aided detection is required for both increasing accuracy rate and saving experts' time. Large intestine does not have straight structure thus camera of the colonoscopy should be moved continuously to examine inside of the large intestine and this movement causes motion artifact on colonoscopy images. In this study, images were selected from open-source colonoscopy videos and obtained at Kayseri Training and Research Hospital. Totally 100 images were analyzed half of which were clear. Firstly, a modified version of histogram equalization was applied in the pre-processing step to all images in our dataset, and then, used Laplacian, wavelet transform (WT), and discrete cosine transform-based (DCT) approaches to extract features for the discrimination of images with no artifact (clear) and images with motion artifact. The Laplacian-based feature extraction method was used for the first time in the literature on colonoscopy images. The comparison between Laplacian-based features and previously used methods such as WT and DCT has been performed. In the classification phase of our study, support vector machines (SVM), linear discriminant analysis (LDA), and k nearest neighbors (k-NN) were used as the classifiers. The results showed that Laplacian-based features were more successful in the detection of images with motion artifact when compared to popular methods used in the literature. As a result, a combination of features extracted using already existing approaches (WT and DCT) and the Laplacian-based methods reached 85% accuracy levels with SVM classification approach.

**Keywords:** Image processing, motion-artifact, colonoscopy

### Introduction

Large intestine (colon) is the last part of our digestive system. In order to detect any kind of disease in the large intestine, three different methods are employed which are virtual colonoscopy (CT), optical colonoscopy (conventional) and wireless capsule endoscopy. Although each method have advantages and disadvantages, used images in this study were obtained from optical colonoscopy, which is more invasive method when compared to virtual colonoscopy. Optical colonoscopy is the most preferred technique because it has a specific component to remove abnormal tissue during the operation whereas virtual colonoscopy is used only for imaging (1). In addition to these techniques, wireless capsule endoscopy has been launched approximately 20 years ago but this technique produces 60,000 images for each patient, thus it is not an easy task to detect any disease among all the images for an expert. *According to the American Cancer Society*, colorectal cancer prevalence ranks third among all cancer types. New studies show that 97.220 people will suffer from colon cancer in 2018 (1). During the operation, experts either record video or take an image, in order not to miss any abnormalities. Due to the folded structure of colon, disease detection process may not be completed during the operation. Experts may need to make interpretations from videos or images that are obtained during the operation. However, colonoscopy images are exposed to artifacts due to the camera movement, which is called the motion artifact. If an image includes motion artifact, interpretation of

<sup>1</sup>Department of Electrical and Computer Engineering, Graduate School of Engineering and Natural Sciences, Abdullah Gül University, Kayseri, Turkey

<sup>2</sup>Department of Electrical-Electronics Engineering, School of Engineering, Abdullah Gül University, Kayseri, Turkey

<sup>3</sup>Department of Bioengineering, Graduate School of Engineering and Natural Sciences, Abdullah Gül University, Kayseri, Turkey

<sup>4</sup>Biomedical Instrumentation and Signal Analysis Laboratory (BISA), School of Engineering, Abdullah Gül University, Kayseri, Turkey

<sup>5</sup>Training and Research Hospital, Gastroenterology Clinic, Kayseri, Turkey

\*Corresponding author: R. N. Kaçmaz  
E-mail: rukiyenurkacmaz@gmail.com

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