Chapter 3.21
Quantitative Analysis of Hysteroscopy Imaging in Gynaecological Cancer

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ABSTRACT

The objective of this chapter is to propose a quantitative hysteroscopy imaging analysis system in gynaecological cancer and to provide the current situation about endoscopy imaging. Recently works, involves endoscopy, gastroendoscopy, and colonoscopy imaging with encouraging results. All the methods are using image processing using texture and classification algorithms supporting the physician diagnosis. But none of the studies were involved with the pre-processing module. Also, the above studies are trying to identify tumours in the organs and no of the are investigates the tissue texture. The system supports a standardized image acquisition protocol that eliminates significant statistical feature differences due to viewing variations. In particular, the authors provide a standardized protocol that provides texture features that are statistically invariant to variations to sensor differences (color correction), angle and distance to the tissue. Also, a Computer Aided Diagnostic (CAD) module that

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supports the classification of normal vs abnormal tissue of early diagnosis in gynaecological cancer of the endometrium is discussed. The authors investigate texture feature variability for the aforementioned targets encountered in clinical endoscopy before and after color correction. For texture feature analysis, three different features sets were considered: (i) Statistical Features, (ii) Spatial Gray Level Dependence Matrices, and (iii) Gray Level Difference Statistics. Two classification algorithms, the Probabilistic Neural Network and the Support Vector Machine, were applied for the early diagnosis of gynaecological cancer of the endometrium based on the above texture features. Results indicate that there is no significant difference in texture features between the panoramic and close up views and between different camera angles. The gamma correction provided an acquired image that was a significantly better approximation to the original tissue image color. Based on the texture features, the classification algorithms results show that the correct classification score, %CC=79 was achieved using the SVM algorithm in the YCrCb color system with the combination of the SF and GLDS texture feature sets. This study provides a standardized quantitative image analysis protocol for endoscopy imaging. Also the proposed CAD system gave very satisfactory and promising results. Concluding, the proposed system can assist the physician in the diagnosis of difficult cases of gynaecological cancer, before the histopathological examination.

INTRODUCTION

In the United States, in 2007, it is estimated that over 39,080 new cases will be diagnosed with gynaecological cancer of the endometrium resulting to approximately 7,400 deaths (American Cancer Society). Within the female population, gynaecological cancer accounts for the second highest mortality rate. Early diagnosis and treatment of gynaecological cancer are essential for better quality of life and longer life.

The development of minimally invasive surgery has presented the possibility of new approaches to certain longstanding problems in gynaecology. The initial efforts with hysteroscopy, transabdominal/transvaginal laparoscopy operations have already demonstrated the advantages of endoscopic techniques over traditional open and endovascular approaches. The advantages of laparoscopic/hysteroscopic methods are especially significant in patients with a low risk factor when the operation is usually prophylactic (Cohen et al, 2003).

The objective of this chapter is to provide a standardized protocol for eliminating significant differences in texture feature analysis of endoscopy images that is also used for classifying ROIs into normal and abnormal tissue. For gynaecological cancer, we show that the proposed approach eliminates significant statistical different due to sensor variations (color correction), distance from the tissue (panoramic vs close up) and camera angle. We validate the approach for texture features extracted at difference viewing conditions from: calf endometrium chosen for its resemblance to human tissue, chicken cavities chosen for providing a more realistic laparoscopy/hysteroscopy operation environment, and also verify the findings for human subjects.

The structure of the chapter is as follows. In section II, a brief sections on overview of hysteroscopy/laparoscopy imaging is given. This is followed by methodology, results, discussion, and concluding remarks.

BACKGROUND

In laparoscopic/hysteroscopic imaging, the physician guides the telescope inside the uterine or abdominal cavity investigating the internal anatomy, in search of suspicious, cancerous lesions (Bankman et al, 2000). During the exam, the