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Automatic Video Quality Assessment for Colonoscopy

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Invention Description

Colorectal cancer is the second leading cause of cancer death in the United States and fourth worldwide. Colorectal cancer often develops from precancerous polyps, which, when found through optical colonoscopy screening, may be easily and safely removed. Unfortunately, colonoscopies are operator dependent and the quality is greatly affected by diligence, attentiveness and experience. It is estimated that roughly 22% of polyps remain undetected during an OC screen and 4-6% of those may later develop into cancer. Quality monitoring for optical colonoscopy may improve patient outcomes by encouraging careful colon examination and providing a quantitative score for each colonoscopy.

Researchers at Arizona State University in collaboration with Dr. Gurudu of the Mayo Clinic have developed a system for automatic, objective quality assessment of colonoscopy videos. The overall quality of a colonoscopy is calculated as the average score of each frame in the video. This system can identify hasty/non-informative colon examination shots to help give an assessment of colonoscopy video quality. Compared to gray level co-occurrence matrix (GLCM) and discrete wavelet transform (DWT) methods, which have a 70% and 75% sensitivity, this system has a 93% sensitivity with a 10% false positive rate.

This system has been evaluated with manually labeled colonoscopy images and demonstratively outperforms the existing quality assessment tools on the market by a large margin.
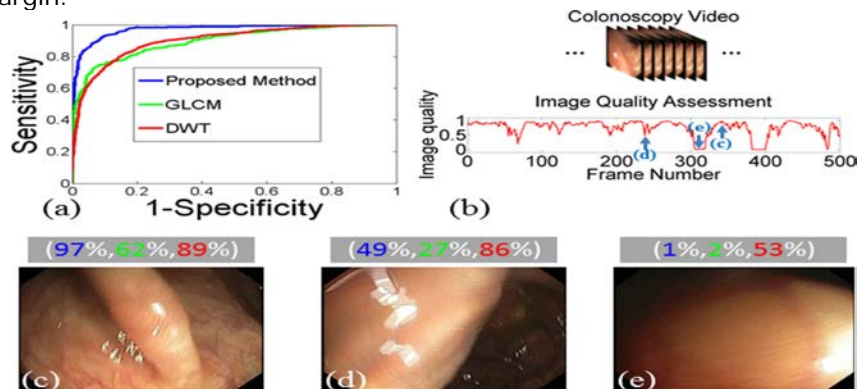
Performance evaluation (a) ROC curves for this mehtod and that of GLCM and DWT. At 10% false positive rate, this proposed method achieves 93% sensitivity, while DWT and GLCM give sensitivity of 70% and 75%, respectively. (b) Image quailty assessment applied to a short video. (c-e) examples of informative, ambigous, and non-informative images along with the scores assigned by the three methods.

Potential Applications

- Objective and automatic video quality assessment for colonoscopy quality control

Benefits and Advantages

- 93% sensitivity with a 10% false positive rate (compared to DWT and GLCM sensitivity of 70% and 75% respectively)

- Scores assigned by this system are more in line with human perception than the scores assigned by GLCM or DWT

- Segmental and overall scores can be shown on the monitor during a procedure – encourages more diligence and dedication from a colonoscopist during a procedure