Automatic Blurry Colon Image Detection Using Laplacian Operator Based Features

Biomedical Signal and Image Processing Laboratory, Abdullah Gul University, Kayseri, Turkey

Electrical & Computer Engineering, Abdullah Gul University, Kayseri, Turkey

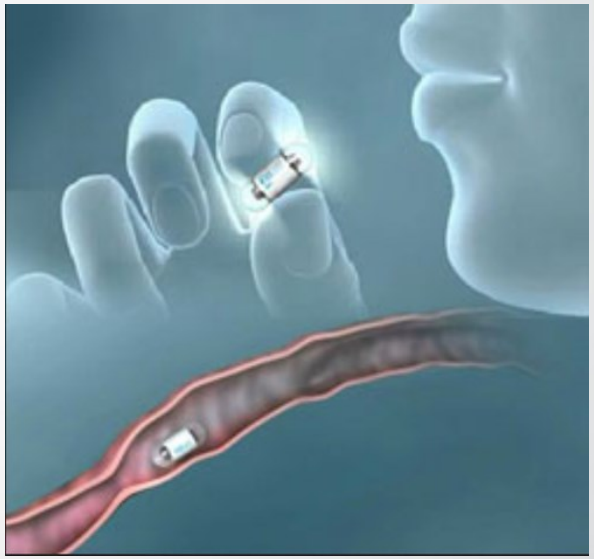
Rukiye Nur Kaçmaz, Bülent Yılmaz, Mehmet Sait Dündar

What is colon cancer and colonoscopy?

- Colon cancer (CC) develops in large intestine which is the last part of our digestive system
- According to American Cancer Society, CC is the third most common type of deadly cancer
- Colonoscopy is the most preferred technique to detect abnormalities in the colon

Wireless Capsule Endoscopy

- Wireless Capsule Endoscopy is a pill taken orally and takes images for about 8 hours
- Images are collected wirelessly
- Collects about 60,000 images!
- A lot more than conventional colonoscopy
- Hard to select useful pictures for a good diagnosis





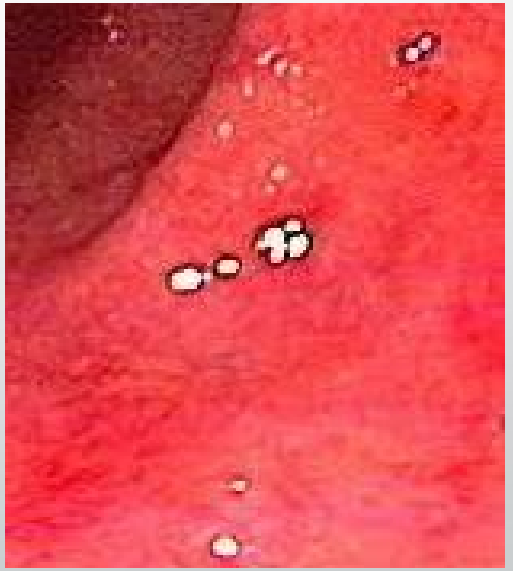
*Wireless Capsule Endoscopy. (2007). *Practical Pediatric Gastrointestinal Endoscopy*, 194-199

What is the problem?

- Colonoscopy probe or capsule movement causes blurry images



BLURRY IMAGE



VISUALLY CLEAR IMAGE

Aim of the study

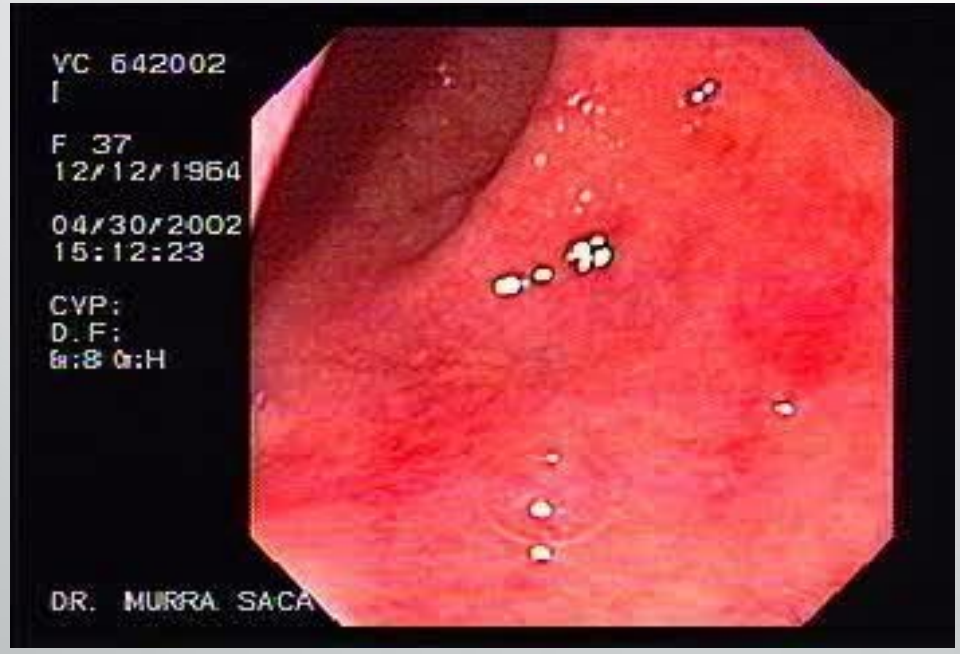
- The aim of this study is discriminating blurry images from visually clear images
- With visually clear images, the diagnosis will be easier
- Automatic disease detection would also be easier

Images used in this study

- 15 videos which belongs to different patients were obtained from https://www.gastrointestinalatlas.com
- Nearly 120,000 frames were extracted from colonoscopy videos (not from WCE)
- 40 blurry and 40 visually normal images were selected

Frame Selection

- The black border that includes time, data and name of the patient were cropped from all the frames



240×352 (Original Image)



176×156 (Cropped Image)

*Murra-Saca, J. El Atlas Gastrointestinal. Retrieved from https://www.gastrointestinalatlas.com

Feature Extraction

We used 4 different types of Laplacian Method

- Energy of Laplacian
- Diagonal Laplacian
- Variation of Laplacian
- Modified Laplacian

*Pertuz, S., Puig, D., & Garcia, M. A. (2013). Analysis of focus measure operators for shape-from-focus. Pattern Recognition, 46(5), 1415-1432

Classification & Result

- In this study, we've used support vector machines (SVM) approach to classify extracted features
- The features were utilized as the inputs to the classification method (cubic SVM)
- The classification accuracy value we obtained was 82.5%

Images



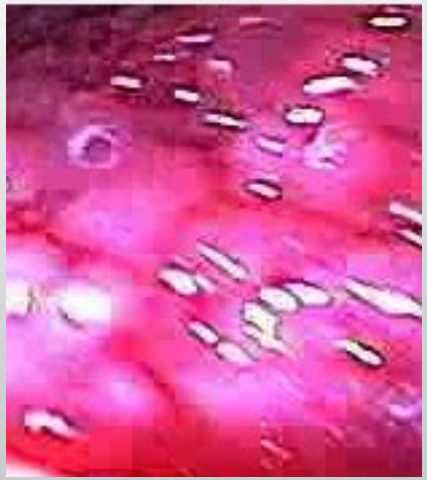
Visually Clear



Blurry



Visually Clear



Blurry

*Murra-Saca, J. El Atlas Gastrointestinal. Retrieved from https://www.gastrointestinalatlas.com

Conclusion

- ✓ No need for threshold selection, the detection of blurry images is automatic
- ✓ With lots of colonscopy images, the diagnosis would be easier because of the elimination of the blurry images
- ✓ The result of this study indicates that for the automatic detection of blurry images in colon videos, Laplacian operator based features is feasible

Discussion & Future Work

- More data
- Different classification methods
- Wireless Capsule Endoscopy

Thank You

msaitdundar@hotmail.com