Paper Reading No.6

A deep neural network improves endoscopic detection of early gastric cancer without blind spots

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1 Brief Paper Intro

- ***Paper ref:*** Endoscopy 2019, http://www.thieme-connect.de/DOI/DOI?10.1055/a-0855-3532
- ***Authors:*** Many doctors and researchers from various of hospitals and medical schools in Wuhan formed the authors of this paper. See Figure 1.

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Appendix e1, Fig. e2 – e6, Fig. e8, Table e1, e2
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ABSTRACT

Background Gastric cancer is the third most lethal malig-

Figure 1: authors' brief intro.

- ***Paper summary:*** This paper uses naive DCNN for the task of early gastric cancer (**EGC**) detection in endoscopic scenario. This task has three sub-tasks:
  - identified EGC from non-malignancy
  - classifying gastric locations into 10 or 26 parts
  - detecting EGC in real-time unprocessed EGD videos
- ***Reading motivation:*** Our team is in a cooperation with the First Affiliated Hospital of Xiamen University to do a research on AI solving EGC detection under endoscopic. Through previous research, we wanted to research on endoscopic positioning + lesion detection. But when we doing literature research, I found this article, which is published on the top journal in the field of endoscopic.

  The authors of this article are almost all doctors, and the method used is also a very basic method in the AI community. Although it's a pity that the field we want to do has been done by this team, the overall idea implementation of this paper is worth learning, and we can still learn from it and bring something new. **So there is not much to be**

introduced in terms of the method used. I will focus on the experimental setup and structure of this article.

2 Backgrounds

Gastric cancer is the third most lethal malignancy worldwide. The aim of this study was to build a system using the DCNN to detect early gastric cancer (EGC) without blind spots during esophagogastroduodenoscopy (EGD).

3 Methods

The flowchart of the data preparation and training/testing procedure of the DCNN is shown in Figure 2. Authors designed 3 sub-networks for filtering blurry images, early gastric cancer identification, and classification of gastric location, respectively.

The sample distribution of the deep convolution neural network (DCNN) in different networks is shown in Figure 3. Authors use common CNN architectures (VGG-16, ResNet) and simple transfer learning for backbone model.

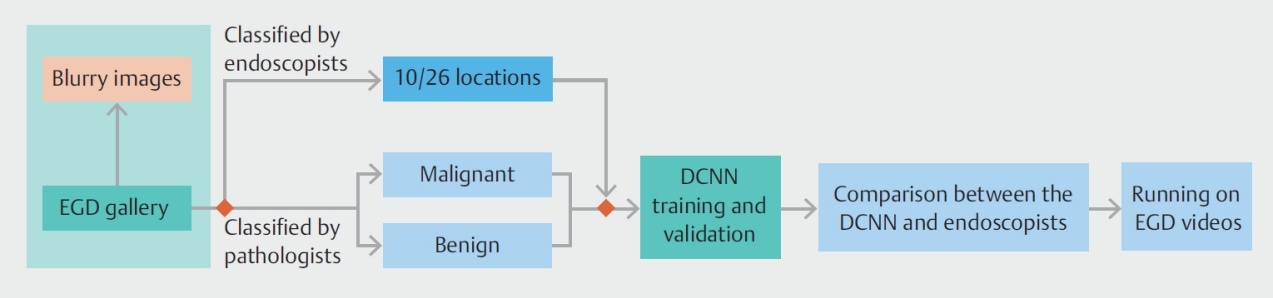

Figure 2: Flowchart of the data preparation and training/testing procedure of the deep convolutional neural network (DCNN) model.

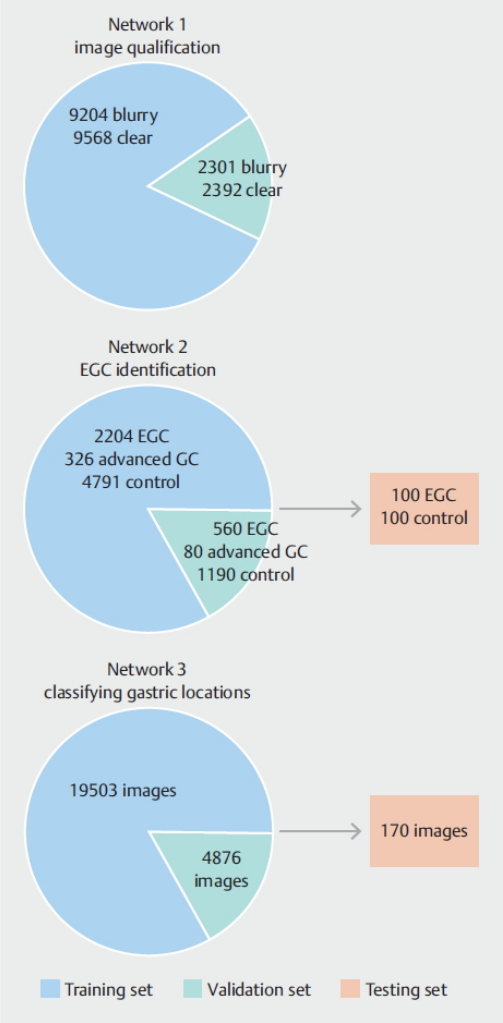

Figure 3: Sample distribution of the deep convolution neural network (DCNN) in different networks.

So this paper has key elements as follows.

1. Clear images are filtered from EGD gallery using a classification model. And these clear images are used for the following stages' training.

2. Authors did a comparison between the performance of DCNN and dif-

ferent level of endoscopists, as is indicated in 4.

3. Also, a classification model is designed for localizing current endoscopy location. The results are compared with different levels of doctors as is displayed in 5. Additionally, 2 localization level are chosen (10 and 26 locations).

4. Testing of the DCNN in unprocessed gastroscope videos. Authors do this by sorting frames from videos, and the localization result demo is shown in video 1, video 2.

	DCCN	Experts (n=6)	Seniors (n=8)	Novices (n=7)
Accuracy	92.50	89.73 (2.15)[1]	86.68 (5.58)[2]	81.16 (5.72)[1]
Sensitivity	94.00	93.86 (7.65)	90.00 (6.05)	75.33 (6.31)[1]
Specificity	91.00	87.33 (7.43)	85.05 (16.18)	88.83 (6.03)
PPV	91.26	91.75 (4.15)	90.91 (5.69)	80.47 (8.75)[1]
NPV	93.81	92.52 (5.76)	88.01 (6.55)[2]	82.32 (11.46)

Figure 4: Performance of the DCNN and endoscopists in the detection of early gastric cancer.

	10 parts	26 parts
DCNN	90.00	65.88
Experts (n = 10)	90.22 (5.09)	63.76 (6.87)
Seniors (n = 16)	86.81 (5.19)	59.26 (6.36)
Novices (n = 9)	83.30 (10.27)	46.47 (7.23)*

Figure 5: Accuracy of the DCNN and endoscopists in classifying gastric location.

4 My thoughts

This paper contains more contents which can be referred in DOI and Appendix. In my opinion, this paper is the pioneer of this field, but, its more like a '占坑' paper. Many aspects worth discussing are not considered:

- The localization results can be used as strong prior for detecting lesions, and this two models are not combined in this paper.
- Different types of EGC are not classified.
- The methods and models used in this paper are too simple, and has not been designed for the characteristics of endoscopic data.

  Therefore, this topic still has a lot of places worth research.