

A new dataset of distortions on Wireless Capsule Endoscopy Images for pathological identification

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September 28, 2021



Overview

1 Objectives

- Context
- Wireless Capsule Endoscopy
 - Challenges
 - Solutions

2 Existing datasets

- Existing GI datasets
- HyperKvasir dataset

3 Our work



Objectives

The main objective of the project is to develop a smart system for:

- Identify the pathological finding on wireless capsule endoscopy (WCE) images
 - Including a pre-processing module that aims at improving the quality of the acquired images
 - Develop a set of image quality enhancement solutions based on kinds of distortion

There are **many kinds of distortion** & in **different levels**

Context

Alert

Colorectal cancer is a major health problem.

¹ Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A, "Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries", CA Cancer J Clin. 2018 Nov; 68(6):394-424.

² Santé Publique France, <https://www.santepubliquefrance.fr/maladies-et-traumatismes/cancers/cancer-du-colon-rectum>

³ McKESSON, "Colorectal Cancer & Laboratory Screening", 2018

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Example

In 2018, the Colorectal cancer (CRC) is the third (second respectively) leading cause of cancer death in the world (France, respectively).^{1,2}

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Solution

Studies have shown that early detection can result in up to a **92% survival rate for stage I of cancer**.³

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Wireless Capsule Endoscopy

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Wireless capsule endoscopy include its **non-invasive** character and its ability to visualize proximal and distal parts of the intestine

Challenges

- Some common acquisition distortions (**noise**, **blur**, **uneven illumination**, **specular reflection**) may affect the WCE based diagnosis.

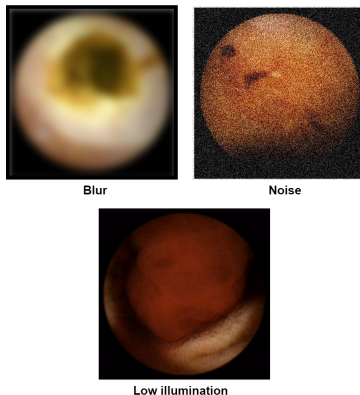


Figure 1: Illustration of some common WCE images distortions

Algorithm

```
input : distorted_image
output : enhanced_image
1 types_distortion = classifier (distorted_image);
2 for type in types_distortion do
3   | enhanced_image  $\leftarrow$  enhancertype (distorted_image)
4 end
5 return enhanced_image
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Requirement:

Create the **classifier** and **enhancer**_{*type*} by using **learning - based** method

Creating a dataset is the **most important** thing to do

Existing datasets

Table 1: An overview of existing GI datasets.

Dataset	Findings	Size
CVC-356 [1]	Polyps	356 images
CVC-ClinicDB (also named CVC-612) [2]	Polyps	612 images
CVC-VideoClinicDB (also named CVC-12k) [1]	Polyps	11954 images
CVC-ColonDB [1]	Polyps	380 images
Endoscopy Artifact detection 2019 [3]	Endoscopic Artifacts	5,138 images
ASU-Mayo polyp database [4]	Polyps	18,781 images
ETIS-Larib Polyp DB [5]	Polyps	196 images
KID [6]	Angiectasia, bleeding, inflammations, polyps	2371 images and 47 videos
GIANA 2017 [7]	Polyps & Angiodysplasia	3462 images and 38 videos
GIANA 2018 [8]	Polyps & Small bowel lesions	8262 images and 38 videos
GASTROLAB [9]	GI lesions	Some 100s of images and few videos
WEO Clinical Endoscopy Atlas [10]	GI lesions	152 images
GI Lesions in Regular Colonoscopy Data Set [11]	GI lesions	76 images
Atlas of Gastrointestinal Endoscope [12]	GI lesions	1295 images
El salvador atlas of gastrointestinal video endoscopy [13]	GI lesions	5071 video clips
Kvasir [14]	Polyps, esophagitis, ulcerative colitis, Z-line, pylorus, cecum, dyed polyp, dyed resection margins, stool	8000 images
Kvasir-SEG [15]	Polyps	1000 images
Nerthus [16]	Stool - categorization of bowel cleanliness	21 videos

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They are rather small, and often limited to polyps. Several of these have also lately become unavailable.

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Using **HyperKvasir** [17] dataset

HyperKvasir dataset

Table 2: Overview of the data records in the HyperKvasir dataset.

Data Record	# Files	Description
Labeled images	10,662 images	23 classes of findings
Segmented Images	1,000 images	Segmentation masks for polyp findings
Unlabeled Images	99,417 images	Unlabeled
Videos	374 videos	30 different classes

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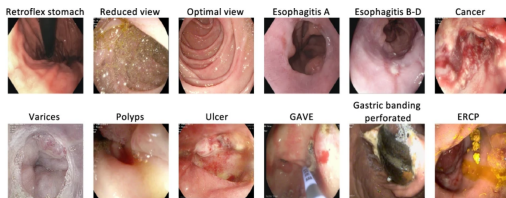
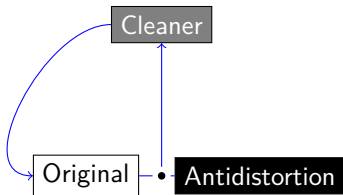


Figure 2: Image examples of the various labeled classes for images and/or videos.

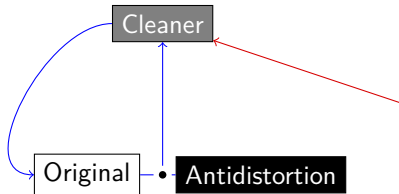
Ourwork



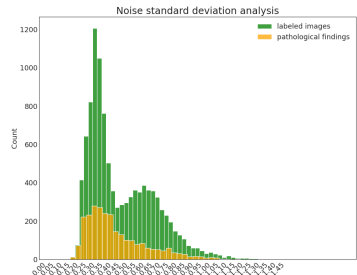
a) Clean the image

Step 1 Cleaning the existing distortion in HyperKvasir dataset

Ourwork

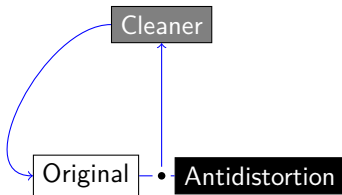


a) Clean the image



Step 1 Cleaning the existing distortion in HyperKvasir dataset

Ourwork



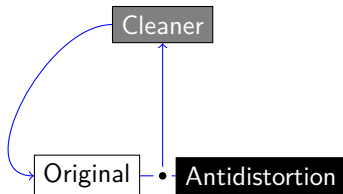
a) Clean the image



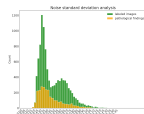
b) Create model

Step 2 Creating the model to generate the new artificial distortions

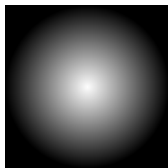
Ourwork



a) *Clean the image*



b) *Create model*



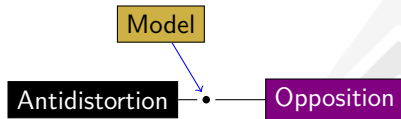
Ourwork

Step 3 Add the new artificial distortions to the antidiistorted images



a) Clean the image

b) Create model



c) Add artificial distortion

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Thank you for watching!

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