Endoscopic Vision Challenge 2017 - Workflow Subchallenge Read Me

1. Data description

The data provided is a combination of endoscopic video and sensor data from medical devices in an integrated operating room (Karl Storz OR1). The data was obtained during laparoscopic surgeries at the University Hospital of Heidelberg, a center of excellence for minimally invasive surgery. All surgeries were annotated framewise for surgical phases by a surgeon.

The surgeries recorded are colorectal surgeries, namely of type rectal resection, sigmoid resection or proctocolectomy. In contrast to surgeries such as cholecystectomy, these procedures are more complex. This means there are more variations regarding the surgical strategy (length or order of phases) and phases may change repeatedly. Also, every procedure includes an extra-abdominal phase (bowel anastomosis, the connection of two parts of bowel) that is prepared without use of the laparoscope.

1.1 Video data

For each operation, the video of the laparoscopic feed is included in this dataset (Prokto X. avi, Rektuk X. avi, Sigma X. avi). Frames from extra-abdominal views have been replaced by blue frames (RGB 0 0 255) to ascertain anonymity of the patient and the surgical staff.

1.2 Device data

For each operation, the device streams of the available surgical devices are also provided in csv files (DeviceData.zip: Prokto*X*_Device.csv, Rektum*X*_Device.csv, Sigma*X*_Device.csv). The csv files have the following format:

Column	Device	Signal
1	Endoscope	Frame #
2		Current gas flow rate
3		Target gas flow rate
4	Thermoflator	Current gas pressure
5		Target gas pressure
6		Used gas volume
7		Gas supply pressure
8		Device on?
9		All lights off?
10	OR lights	Intensity light 1
11		Intensity light 2
12	Endoscopic light source	Intensity
13		White balance
14	Endoscope	Gains
15		Exposure index

If a signal is currently not available, it will be assigned a value of -1.

1.3 Phase annotation

The surgical phases for each operation in the training sets was annotated. The annotations are included in PhaseAnnotation.zip (ProktoX.csv, RektumX.csv, SigmaX.csv). The format used is the following:

<frame #>,<phase id>
e.g.:

0,0 1,0

. . .

2453,5 2454,5

. . .

Also, we provided a subtitle file for each operation (tested on VLC player).

Proctocolectomy

Preparation and orientation at abdomen

Dissection of lymphnodes and blood vessels

Phases

Sigmoid resection

Preparation and orientation at abdomen

Dissection of lymphnodes and blood vessels

Retroperitoneal preparation to lower pancreatic border

The three types of colorectal surgery differ slightly in the phases contained. The following table shows the phases and the id used during annotation. Furthermore it demonstrates which phases can occur in each type of surgery. Italicized phases *may* occur. The next table gives short descriptions/comments of the phases.

Retroperitoneal preparation of duodenum and pancreatic head

Rectal resction

Preparation and orientation at abdomen

Dissection of lymphnodes and blood vessels

Retroperitoneal preparation to lower pancreatic border

rectoperitori	lear preparation of duodenum and pancreatic nead		
		Mobilizing the sigmoid and the descending colon	
		Mobilizing the spenic flexure	
		Mobilizing the tranverse colon	
		D'andian de la contraction de	
		Dissection and resection of rectum	
		Preparing the anastomosis extraabdominally	
		Preparing the anastomosis intraabdominally Placing stoma	
		Finishing the operation	
	. орстаноп	NOOP	
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
	•	abdomen. May include attaching uterus to ab-	
Preparation and orientation at abdomen		dominal wall. (Usually) ends, when the first instrument is inserted to manipulate colon.	
	Includes dissection of mesorectum after division of vessels		
Retroperitoneal preparation to lower pancreatic border		Includes retroperitoneal preparation towards lower border of pancreas.	
		Preparation of duodenum which is behind ascending colon. Phase is similar to Pancreas	
Retroperitoneal preparation of duodenum and pancreatic head		· · ·	
		Comprises both, sigmoid and descending colon below splenic flexure. Includes position-	
	ing and control of descending colon after mobilization		
	Includes retroperitoneal preparation towards lower border of pancreas		
	Includes separation from greater omentum		
Dissection and resection of rectum		For sigmoid can include only circular preparation of rectosigmoid for resection. Can include preparation of right ureter	
Dissection and resection of rectum		Includes supraumbilical incision and extraction of specimen. For procto includes prepara-	
Preparing the anastomosis extraabdominally			
	<u>'</u>		
Preparing the anastomosis intraabdominally		Starts when extraabdominal preparation of anastomosis is finished. Includes irrigation and stopping of bleeding of small pelvis and other places in the abdomen after resection and after extrabdominal preparation of anastomosis. May also include additional mobilisation of ileum, colon or (in sigma surgery) remaining rectum to avoid tension on the anastomosis.	
	control for torquation of bowel. Suturing of	oning of stoma and afterwards laparoscopic f stoma may take place before final laparoscopic	
		ation and final check for bleeding. May include	
Finishing the operation		final suturing of bowel lesions.	
	Mobilizing the Mobilizing the Mobilizing the Mobilizing the Mobilizing the Mobilizing the Dissection and Preparing the Preparing the Placing stone Finishing the NOOP	Mobilizing the sigmoid and the descending colon Mobilizing the spenic flexure Mobilizing the tranverse colon Mobilizing the ascending colon Dissection and resection of rectum Preparing the anastomosis extraabdominally Placing stoma Finishing the operation NOOP Comment/Description Starts when camera is first inserted into a dominal wall. (Usually) ends, when the first includes dissection of mesorectum after of the includes retroperitoneal preparation toward preparation of duodenum which is behind for descending colon. Comprises both, sigmoid and descending ing and control of descending colon after includes retroperitoneal preparation toward includes retroperitoneal preparation toward includes retroperitoneal preparation toward includes retroperitoneal preparation toward includes separation from greater omentures For sigmoid can include only circular preparation of a ileal pouch Starts when extraabdominal preparation of a stopping of bleeding of small pelvis and of after extrabdominal preparation of anastor of ileum, colon or (in sigma surgery) remains include extraabdominal part for positic control for torquation of bowel. Suturing of control or afterwards. Includes insertion of drain as well as irriginal preparation of anastor of ileum, colon or afterwards.	

Phases start when the instrument that will perform the first activity relevant for this phase enters the view. An example is a grasper providing tissue tension for dissection). If a change of the anatomical region marks the beginning of a phase, the start of the camera movement in direction of the new region marks the phase start. If the camera leaves the body or stays longer within the trocar when the anatomical region is changed, the new phase starts with the first frame without visible trocar.

1.4 Instrument annotation

The instrument usage for each operation in the training sets was annotated. The annotations are included in InstrumentAnnotation.zip (Prokto*X*.csv, Rektum*X*.csv, Sigma*X*.csv). The format used is the following:

```
<Frame #>, <Instrument Type 1 visible?>,..., <Instrument Type n visible?>
e.g.

1500, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
3000, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0
4500, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0
```

One frame per minute was annotated in this fashion. Frames outside the body were ignored.

2. Submission guidelines

Submission Guidelines

Participants are invited to submit results and a short description of the used method(s) together with a signed <u>form</u>. We encourage participants to provide results based on stand-alone video data, stand-alone device data and a combination of the two, though is not required and participants are free to just provide results for one or two the three possibilities. We only allow submissions from methods that do not rely on information from future frames to predict the current phase, i.e. **online workflow analysis**.

Submission Format

Please upload your results, the signed honor code and the description of the method used in a zip archive. Please indicate whether video, device or combined data were used to compute the results. < Username > _Results_[Video|Device|Combined].zip.

Please provide a csv file (Filename: *<OriginalName>_res.csv*) for each operation in the following format:

```
<frame number>,<detected phase id>
e.g.:
0,0
1,0
...
2453,5
```

2454,5

. . .