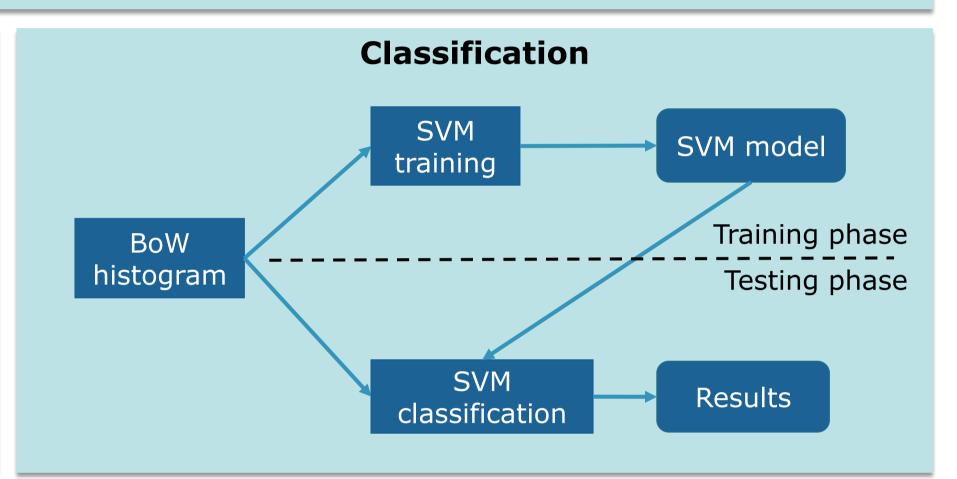
### TOWARDS BETTER LAPAROSCOPIC VIDEO DATABASE ORGANIZATION BY **AUTOMATIC SURGERY CLASSIFICATION**

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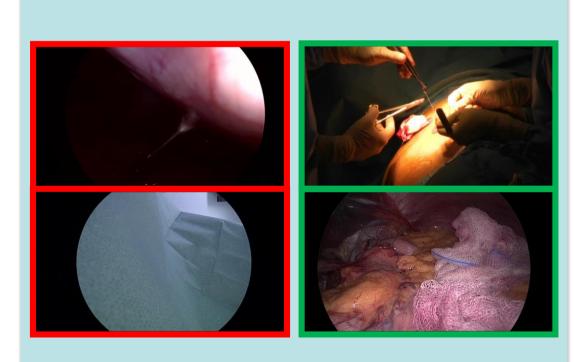
In this work, we introduce the laparoscopic video classification problem, which involves automatically identifying the type of abdominal surgery in a video. We use kernel Support Vector Machines and compare their performance on different types of visual features, which later is improved by combining the visual features using Multiple Kernel Learning [1] approach. The pipeline gives 91.39% accuracy on 151 abdominal videos totaling over 200 hours of 8 kinds of surgeries performed by 10 surgeons.

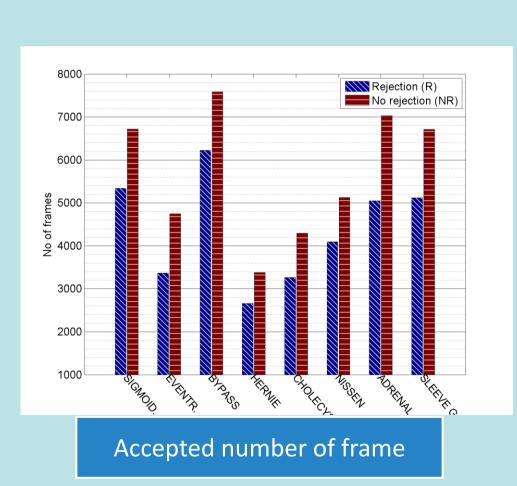
## **Frame Rejection R-value** Reject? **G-value B-value**

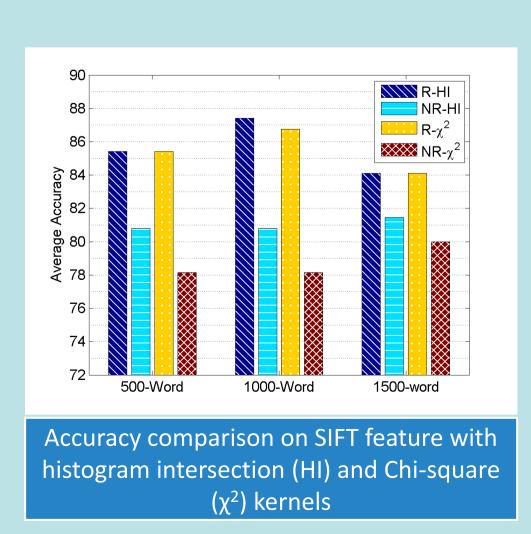
#### **Feature Extraction and Representation** Video BoW RGB **RGB Hist** Feature codebook **HSV** Hist BoW HSV SIFT **BoW SIFT** BoW HOG HOG



### **Frame Rejection Results**







#### **Kernel SVM Classification Results**

Feature	# Words	Linear	X <sup>2</sup>	HI
RGB	100	33.11	33.11	23.48
	300	27.15	41.72	35.76
	500	2847	37.08	37.08
HS	100	26.49	35.09	34.43
	300	33.77 <b>45.03</b>		37.08
	500	30.46	37.74	35.76
SIFT	500	64.34	85.43	85.43
	1K	64.23	86.75	87.41
	1.5K	64.23	84.1	84.10
HOG	500	71.52	84.76	80.79
	1K	74.83	87.41	86.09
	1.5K	70.19	84.76	82.11

## Setup Experimental

Surgery	# Vid	Length (min.)
Sigmoidectomy	18	$106 \pm 44$
Eventration	21	79 ± 57
Bypass	21	$120 \pm 37$
Hernia	34	$53 \pm 29$
Cholecystectomy	25	$68 \pm 42$
Nissen Gerd	17	$80 \pm 31$
Adrenalectomy	7	$117 \pm 43$
Sleeve Gast.	8	$89 \pm 15$

Dim	# Words	
128	500, 1K, 1.5K	
288		
48	100,300,500	
72		
	128 288 48	

#### **MKL Classification Results**

**Combination** Accuracy

	:	SIFT-HOG		89.40		
		All		91.39		
SIGMOID-0.94	1		s	SIGMOID-0.94		
EVENTR	0.86		E	EVENTR	0.76	
BYPASS	0.90			BYPASS	0.90	
HERNIE	0.85			HERNIE	0.94	
CHOLECYST	0	.84	СНОІ	LECYST	0.9	2
NISSEN		0.94		NISSEN		0.94
ADRENAL		1.00	A	DRENAL		1.00
SL GAST		1.00	S	SL GAST		1.00
<b>%</b>	A CHANGE TO A STANK	CHOLE MER TORING CR.		S.C.M.	OK KAJA TE TENKO	OK WEEK TORKE GEV.
(Top) Accuracy of feature combinations using MKL; Confusion						
matrices using combination of (Bot-Left) SIFT-HOG, and						
(Bot-Right) all features						

# Conclusion

state-of-the-art classification pipeline based on Multiple Kernel Learning (MKL) was proposed and shown to solve the problem with high accuracy in spite of the various visual challenges present in the videos.

By combining all visual features using MKL, we demonstrated that an accuracy of 91.39% can be reached on a dataset of 151 videos from 8 classes of abdominal surgery.

Ref.

[1] Varma, M. and Babu, B.R. More generality in efficient multiple kernel learning. In Proceedings of ICML 2009.













