

HISTOLOGICAL PREDICTION OF COLONIC POLYPS BY COMPUTER VISION. PRELIMINARY RESULTS.

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Background: during colonoscopy, clinicians perform visual inspection of the polyps to predict histology. Kudo's pit pattern classification is one of the most commonly used for optical diagnosis. These surface patterns present a contrast with respect to their neighboring regions and they can be considered as bright regions in the image that can attract the attention of computational methods.

Objective: to assess the accuracy of a new computer system based on bright regions for colonic polyps' histological classification.

Methods: our system relies on the shape of the bright regions in the polyp surface, attributing a high presence of tubular patterns to an adenomatous histology whereas the absence of prominent tubular structures is associated to non-adenomatous polyps. We characterized bright regions using a tubularity metric (*Tub*) designed to obtain low values for circular shapes and high values for tubular regions of the same area. We tested our method in high definition (HD) white light polyp images which were obtained with a colonoscope Olympus CIF-H190 at Hospital Clinic in Barcelona. Neither conventional nor virtual chromoendoscopy were used. These images were selected to show as much variability in polyp appearance as possible. We used the mean of all *Tub* values for an image to classify it into two classes: Adenoma and Non-Adenoma. A ROC curve was constructed to select the optimal threshold value of *Tub*. Then, we compared the histology prediction provided by our system and the actual histology obtained after lesion removal.

Results: 51 polyp images were analyzed: 38 (74.5%) Adenoma and 13 (25.5%) Non-adenoma. Mean size of polyps was 14 ± 13 (range 1-40) and had the following morphology based on Paris classification: 5 (9.8%) 0-Ip, 27 (52.9%) 0-Is and 19 (37.3%) 0-IIa. Mean *Tub* values were different for Adenoma compared to Non-adenoma (19.5 ± 6.5 vs 14.1 ± 6.3 ; $p=0.013$). An optimal threshold value of *Tub* = 13.14 to separate Adenoma vs. Non adenoma was selected from the operating point of the ROC curve. With this value, our method was able to provide an accurate histological diagnosis in 44 out of 51 images (86%) (View table) with a Sensitivity, Specificity, PPV and NPV for the diagnosis of adenoma of 95%, 61%, 88% and 80%, respectively. Global accuracy was 86%. On the other hand, processing of a single HD image took 2.7 seconds making feasible its use in the endoscopy room.

		Histological Gold standard		total
		Non-adenoma	Adenoma	
Automatic prediction	Non-adenoma	8	2	10
	Adenoma	5	36	41
	total	13	38	51

Conclusion: a computer vision based system on bright regions in the image has a high accuracy for predicting histology during real-time colonoscopy. The addition of the tubularity metric to other polyp characteristics (i.e. shape, color, vessels...) could improve its performance.