Section A. PERSONAL DATA

		Date		30/09/2019

Name and Surnames	Jorge Bernal del Nozal		
Id Number	12407987Q	Age	36
Researcher identification numbers		Researcher ID	H-4647-2015
		ORCID code	0000-0001-8493-9514

A.1. Current Position

| University / Institution	Computer Vision Center and Computer Science Department, Universitat Autònoma de Barcelona		
Department	Image Sequence Evaluation lab research group		
Address and country	Edificio O, Campus UAB, 08193 Bellaterra, Barcelona, Spain		
Phone number	935814090	e-mail	Jorge.Bernal@uab.cat
Current position	Associate Professor at Universitat Autònoma de Barcelona (UAB), Associated Researcher at CVC	Starting date	December 2018
UNESCO spec. codes	120323; 120601; 220990		
Keywords	Computer Vision, Machine Vision, Medical Image Analysis, Diagnosis Support Systems, Endoscopy		

A.2. Academic record

Academic Level	University	Year
Phd in Computer Science, European Mention, Cum Laude	Universidad Autónoma de Barcelona	2012
MSc in Computer Vision and Artificial Intelligence	Universidad Autónoma de Barcelona	2009
Telecommunications Engineering	Universidad de Valladolid	2008

A.3. General indicators of the quality of the research

- PhD Thesis: 2 finished and 2 on-going.
- Total number of citations (Google Scholar): 512
- Mean number of citations per year: 93.6.
- Number of Q1 JCR journals: 5**.**
- H-index: 10.

I am an interim Associate Professor in the Computer Science Department at the Autonomous University of Barcelona and an associate researcher at the Computer Vision Center. My main research activity in recent years has focused on the development and validation of intelligent systems for colonoscopy, more specifically on the development of methods for a complete characterization of polyps (detection, segmentation and automatic obtaining of their histological category). I present the following summary of my scientific production, extracted from Google Scholar.

	Total	From 2014
Citations	512	468
H-index	10	10
i10 index	11	10
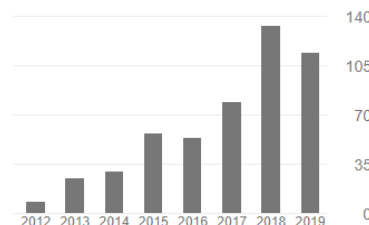
Date: 30/09/2019

https://scholar.google.es/citations?user=GsyL_kUAAAAJ&hl=es

My publications can be broken down into 12 journals indexed with an impact index, 5 Q1 -, 20+ participations in international conferences published in proceedings and 3 book chapters. Out of all my publications, I would highlight the following 4: 1) our contribution in Pattern Recognition (Q1), which consolidated our position in the field of endoscopic image processing, 2) our article in Computerized Medical Imaging and Analysis, which was the first

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one written with participation of clinical staff and in which we present our first joint database, 3) our contribution in Endoscopy (Q1), where we present a first study of the possibilities offered by our method of classification of polyps in order to be used in endoscopic examinations to assist in histological prediction tasks and 4) our contribution in IEEE Transactions on Medical Imaging (Q1) where we present an extensive comparative analysis of different methodologies for the automatic detection of polyps in colonoscopy imaging, within the context of an assigned challenge to the most important international conference in the field of an Medical image analysis (MICCAI).

Regarding obtaining sources of funding, I have been Principal Investigator: a technology transfer project - PRODUCTE 2014, AGAUR - within the field of videobronchoscopy image analysis and another competitive project - IVENDIS, MICINN 2015 - about the development of intelligent systems for endoscopy. I currently coordinate the Image Sequence Evaluation lab (ISE lab) research group funded under the SGR (2017SGR166) call.

Finally, I would like to mention my active participation in the preparation of funding requests (MICINN, PRODUCTE 2014, NIH, HORIZON 20/20), in the signing of collaboration agreements with key clinical partners (Hospital Clinic, Hospital de Bellvitge) and in the establishment of strategic research collaborations with international groups dedicated to endoscopic image processing (Arizona State University, ETIS group at ENSEA, University of Cergy-Pontoise).

My participation in research projects is summarized in the following table:

		Number	Amount (€, without taxes)
PI	**Contracts**	1	200.030,05
Team member	**Competitive**	2	312.934,01
	Private	1	18.000,00

Part B. Summary of the CV

The context of my research career is the use of computer vision as a transversal tool that can be used in different application domains: health, quality control, video surveillance, document analysis, etc. My main research activity is focused on the development of intelligent systems in the context of assistance in clinical interventions, more specifically in the development of colonoscopy imaging methods. Within this context, I have participated in the development and validation of algorithms that have stablished the current state of the art in location, segmentation and histological prediction of polyps. In addition, I have pioneered the creation of annotated public databases with the objective of proposing a global validation framework for testing the developed methods. Under the premise of transferring knowledge from the field of research to society, I have dedicated much of my efforts in establishing strategic alliances with local institutions, such as the Hospital Clinic, in order to create synergies between technical and clinical staff with the in order to develop systems that can be used in the exploration room. I have also assumed a significant role in the preparation of research articles, contributions to international conferences, funding requests and in the signing of collaboration agreements between institutions. Finally, I have been director of a doctoral thesis in the field of videobronchoscopy image analysis and two others (one of them already completed) in the development of innovative computer vision methods applied to colonoscopy and another in the development of systems of Endoscopy navigation. sistemas de navegación en endoscopia.

Part C. RELEVANT MERITS

C.1. Publications (ordered by year and relevance)

Articles in Indexed Journals

(1) Sanchez-Montes, C., Sánchez, F.J., **Bernal, J.**, Córdova, H., López-Cerón, M., Cuatrecasas, M., Rodriguez de Miguel, C., García-Rodríguez, A., Garcés-Durán, R., Pellisé, M., Llach, J., Fernádez-Espárrach, G. (2019). Computer-aided prediction of polyp histology on white light colonoscopy using surface pattern analysis. IF= 6.629. 11/80 (Q1) in Gastroenterology and Hepatology, 5/200 in Surgery (Q1). (3/12)

(2) Sánchez, F.J., **Bernal, J.,** Sánchez-Montes, C., Rodríguez de Miguel, C., Fernández-Esparrach, G. (2017). Bright Spots Region Segmentation and Classification for Specular Highlights Detection in Colonoscopy Videos, Machine Vision and Applications (accepted,

2017). IF= 1.272: 10/22 (Q2) in Computer Science, Cybernetics, 71/130 (Q3) in Computer Science, Artificial Intelligence, 130/257 (Q3) Engineering, Electrical and Eletronic. (2/5)

(3) **Bernal, J.,** Tajbakhsh, N., Sanchez, FJ., et al. (2017). Comparative Validation of Polyp Detection Methods in Video Colonoscopy: Results from the MICCAI 2015 Endoscopic Vision Challenge, IEEE Transactions on Medical Imaging (in-press, 2017). IF=3.756: 17/124 (Q1) in Radiology, Nuclear Medicine and Medical Imaging, 9/76 (Q1) in Biomedical Engineering, 9/104 (Q1) in Computer Science, InterDisciplinary App. (1/24)

(4) Fernández-Esparrach, G., **Bernal, J.,** López-Cerón, M., Córdova, H., Sánchez-Montes, C., Rodríguez de Miguel, C., Sánchez, F. J. (2016). Exploring the clinical potential of an automatic colonic polyp detection method based on the creation of energy maps. Endoscopy (in-press, June 2016 issue), IF= 5.634. 12/78 (Q1) in Gastroenterology and Hepatology, 6/199 in Surgery (Q1). (2/7)

(5) **Bernal, J.,** Sánchez, F. J., Fernández-Esparrach, G., Gil, D., Rodríguez, C., & Vilariño, F. (2015). WM-DOVA maps for accurate polyp highlighting in colonoscopy: Validation vs. saliency maps from physicians. Computerized Medical Imaging and Graphics, Vol. 43, pp. 99-111., IF= 1.496, 72/122 in Radiology, Nuclear Medicine & Medical Imaging (Q3), 42/76 in Biomedical Engineering (Q3). (1/6)

(6) Sánchez, C., **Bernal, J.,** Sánchez, F. J., Diez, M., Rosell, A., & Gil, D. (2015). Toward online quantification of tracheal stenosis from videobronchoscopy. International journal of computer assisted radiology and surgery, Vol. 10, Issue 6, pp. 935-945. IF= 1.659, 36/76 in Biomedical Engineering (Q2), 64/122 in Radiology, Nuclear Medicine & Medical Imaging (Q3), 84/204 en Surgery (Q2). (2/6)

(7) **Bernal, J.,** Sánchez, F. J., & Vilariño, F. (2012). Towards automatic polyp detection with a polyp appearance model. Pattern Recognition, Vol, 45(9), pp. 3166-3182. IF= 2.584, 22/121 in Computer Science, Artificial Intelligence (Q1), 40/248 in Engineering, Electrical & Electronic (Q1). (2/3)

Book chapters

(1) **Bernal, J.,** Sánchez, F.J., Fernández-Esparrach, G. & Rodríguez, C. (2015). Building up the future of colonoscopy: A synergy between clinicians and computer scientists. Colonoscopy and Colorectal Cancer Book. INTECH Open Access Publisher, Vol 1, pp. 109-141. (265 downloads, 19/04/2017).

Participation in International Conferences

(1) Vázquez, D., **Bernal, J.,** Sánchez, F.J., Fernández-Esparrach, G., López, A., Romero, A., Drozdzal, M., Courville, A. (2017) "A Benchmark for Endoluminal Scene Segmentation of Colonoscopy Images", Computer Assisted Radiology and Surgery (Comunicación oral).

(2) Angermann, Q., Bernal, J., Sánchez-Montes, C., Hammami, M., Fernández-Esparrach, G., Dray, X., Romain, O., Sánchez, F.J., Histace, A. (2017) " Real-Time Polyp Detection in Colonoscopy Videos: A Preliminary Study For Adapting Still Frame-based Methodology to Video Sequences Analysis", Computer Assisted Radiology and Surgery (Comunicación oral).

(3) Sánchez-Montes, C., Fernández-Esparrach, G., Córdova, H., López-Cerón, M., Rodríguez de Miguel, C., Llach, J., Sánchez, F.J., Bernal, J. (2017) ", Automatic Polyp Detection (APODEC): Polyp Search Using Energy Maps", Digestive Disease Week (Video presentation)

(4) Fernández-Esparrach, G., **Bernal, J.,** Rodríguez, C., Gil, D., Vilariño, F., Córdova, H., Sánchez-Montes, C., Araujo, I., López-Ceron, M., Llach, J. & Sánchez, F.J. (2015). "Colonic polyps are correctly identified by a computer vision method using WM-DOVA energy maps". Proceedings of United European Gastroenterology Week 2015.

(5) **Bernal, J.,** Gil, D., Sánchez, C., & Sánchez, F. J. (2014). "Discarding non informative regions for efficient colonoscopy image analysis". In Computer-Assisted and Robotic Endoscopy, MICCAI 2014 (pp. 1-10). Springer International Publishing. (Comunicación oral). Best Paper Award.

(6) Sánchez, C., **Bernal, J.,** Gil, D., & Sánchez, F. J. (2014). "On-line lumen centre detection in gastrointestinal and respiratory endoscopy". In Clinical image-based procedures Translational Research in Medical Imaging (pp. 31-38). Springer International Publishing. (Comunicación oral). Best Paper Award.

C.2. Research projects

(1) **Title:** Validación clínica del primer sistema in-vivo de predicción histológica automática de los pólipos de colon integrando la visión del endocopista con la visión por computador (Clinical validation of the first in-vivo system of automatic histological prediction of colon

polyps integrating endocopist vision with computer visión) (HISINVIA). **Funding agency:** Instituto de Salud Carlos III (FIS), PI17/00894. **Participating entities:** Hospital Clinic de Barcelona (HCB), Centro de Visión por Computador (CVC). **Length**: January 2018 - December 2020 (36 months). **PI:** Gloria Fernández-Esparrach and Henry Córdova**. Funding:** *113.700 €.* **Role:** Team member. **Number of researchers:** 9.

(2) **Title:** iVENDIS: Intelligent In-Vivo Endoscopic Diagnosis And Intervention Support Systems. **Funding agency:** DPI2015-65286-R. **Participating entities:** Centro de Visión por Computador (CVC), Hospital Clinic de Barcelona (HCB), Hospital Universitario de Bellvitge (HUB). **Length**: January 2016 - August 2018 (32 months). **PI:** Jorge Bernal, Debora Gil**. Funding:** *143.700 €.* **Role:** PI. **Number of researchers:** 11.

(3) **Title:** SENSA: System for Endoscopy Stenosis Assessment. **Funding agency:** AGAUR. **Participating entities:** Centro de Visión por Computador (CVC), Hospital Universitario de Bellvitge (HUB). **Length**: September 2015 - January 2017 (18 months). **PI:** Jorge Bernal**. Funding:** *46.330,05 €.* **Role:** PI. **Number of researchers:** 4.

(4) **Title**: FISIOLOGICA. **Funding agency:** TIN2012-33116. **Participating entities:** Centro de Visión por Computador (CVC). **Length**: January 2013 - January 2016 (36 months). **PI:** Debora Gil. **Funding:** *99.163 €.* **Role:** Team member. **Number of researchers:** 8.

(5) **Title**: COLON-QA Automatic Colon Cancer detection for quality assessment in colonoscopy. **Funding agency:** TIN2009-10435. **Participating entities:** Centro de Visión por Computador (CVC). **Length**: January 2010 - December 2013 (48 months). **PI:** Fernando Luis Vilariño Freire. **Financiación:** 82.401.01 €. **Role:** Team member. *http://mv.cvc.uab.es/projects/colon-qa.* **Number of researchers:** 7.

C.3. Other merits
PhD thesis advised:

(1) "Tracheal Structure Characterization using Geometric and Appearance Models for Efficient Assessment of Stenosis in Videobronchoscopy", Carles Sánchez. 2014

(2) "Análisis del Rendimiento Off-line de Métodos Computacionales para la Detección y Predicción Histológica de Pólipos en Imágenes de Colonoscopia" (Analysis of Off-line Performance of Computational Methods for Histological Detection and Prediction of Polyps in Colonoscopy Images), Cristina Sánchez-Montes, 2019. (PhD in Medicine)

(3) "Beneficios Clínicos de emplear Sistemas Computacionales de Soporte en Procedimientos de Colonoscopia" (Clinical Benefits of using Computer Support Systems in Colonoscopy Procedures), Ana García-Rodríguez (en curso) (PhD in Medicine)

(4) "Automatic Production of Classical Music Events", Arturo Fuentes (on-going)

I have been organizer of **5 international challenges internacionales** as part of the main international conferences in the field:

(1) *ISBI 2015 Grand Challenge in Automatic Polyp Detection in Colonoscopy Videos,* ISBI 2015,

(2) *MICCAI 2015 Endoscopic Vision Challenge: Sub-challenge on Automatic Polyp Detection in Colonoscopy Videos,* MICCAI 2015, http://polyp.grand-challenge.org

(3) *MICCAI Endoscopic Vision Challenge: Sub-challenge on Gastrointestinal Image Analysis (GIANA),* MICCAI 2017 y MICCAI 2018. http://giana.grand-challenge.org

I am frequent reviewer of 5 of the top journals (IEEE TMI, IEEE TIP, IEEE TBME, Image and Vision Computing, IJCARS), in 4 international conferences (ISBI, MICCAI, CARE, CLIP) and I have been associated editor of a journal (ELCVIA).

Finally, I would like to highlight the following achievements related to my research career:

(1) ISBI 2015 Challenge in Automatic Polyp Detection – 2nd position

(2) MICCAI 2015 Challenge in Automatic Polyp Detection – 2nd position

(3) MICCAI-CARE 2014 – Best Contribution Award for *Discarding non informative regions for efficient colonoscopy image analysis*

(4) *MICCAI-CLIP 2013 – Best Contribution Award On-line lumen centre detection in gastrointestinal and respiratory endoscopy*

(5) *EADA Demo Day 2016, technology valorization – 2nd position APODEC (Automatic Polyp Detection in Colonoscopy)*

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