Advanced Medical Imaging: Wireless Endoscopy Analysis

Overview

During the past quarter century, imaging technology has advanced as fast as any technology in medicine. Imaging innovations have resulted in enormous expansion of the research capabilities. In the course, we will illustrate in a problem-based learning way, the basic computer vision and medical imaging techniques to address the problem of wireless endoscopy analysis. Wireless Capsule Endoscopy (WCE) is a tool designed to allow for inner-visualization of the entire gastrointestinal tract. It was developed in the mid-1990s. The invention is based on a swallowable capsule, equipped with a light source, camera, lens, radio transmitter and battery that is propelled by the peristalsis along all GastroIntestinal (GI) tract, allowing the full visualization of it from inside without pain and sedation. This technology was positively accepted by the gastroenterology community, because it allows minimally invasive inspections, even of those parts of the intestine that are not accessible by classical means. Nowadays, despite the inability to control the motion and position of the capsule in the GI tract, this device is considered the gold standard technique for the diagnosis of bleeding, and it is becoming very popular investigation tool for possible future diagnosis of particular diseases such as tumors, chronic abdominal pain and motility disorders. The limitations of the WCE-based diagnosis are the length of its videos and the complexity of the images. A normal small intestine video can represent up to 8 hours of recording. This means that a single video can contain up to 57, 600 images, if 2 frames-per-second capsule is used (this number can become even larger with higher frame-rate capsules). Hence, the problem of WCE is a perfect example to illustrate how different image processing techniques can be successfully applied to solve the problem of intestine motility analysis. Lectures will be supported with discussion sessions based on different problems associated with the WCE.

In this program, efforts will be made to introduce various tools used in medical image analysis such as filtering, segmentation, sequence extraction, feature extraction, textural analysis, image retrieval, classification and object detection to characterize and analyze the endoscopic images. Furthermore, this program will also have two practical sessions to support the lectures. It is expected that participants will attain sufficient knowledge in this area after attending this program.

Objectives

The main objective of this course is to explain the basic and advanced concepts of Medical Image analysis and to apply them to address a concrete Medical problem- the characterization of endoscopic images acquired by wireless endoscopic capsule in order to ease the diagnosis of intestine motility in patients with severe motility diseases.

Course Contents

1. Introduction to Wireless Capsule Endoscopy (WCE)
2. Image filtering, smoothing and sharpening of endoscopic images
3. Segmentation of endoscopic images and videos
4. Change Detection and sequence extraction in endoscopic videos
5. Intestine frames characterization and Texture analysis of intestine images
6. Endoscopic image retrieval
7. Classification for severe motility diagnosis and to characterize endoscopic images
8. Object detection to analyze endoscopic images
9. Bag of words for image characterization of endoscopic images

* Two practical Sessions on (a) filtering, segmentation of WCE videos and texture analysis of intestine images. (b) Image retrieval and classification for severe motility diagnosis.

Dates	**January 02-06, 2018** (Number of participants for the course will be limited to fifty)
You Should Attend If…	▪ Students at all levels (B.Tech./M.Sc./M.Tech./Ph.D./Medical) and aspiring researcher within the broad domain of signal, image and video processing. ▪ Practicing engineers, computer scientists, information technologists, medical physicists, and data-processing specialists working in diverse areas such as telecommunications, seismic and geophysical applications, biomedical applications, and hospital information systems may find the course useful in their quest to learn advanced techniques for biomedical image analysis. ▪ Executives, researchers from medical instrumentation industry, service and government organization including R&D laboratories. ▪ Faculty from reputed academic institutions, medical and technical institutions.
Fees	The participation fees per person for taking the course is as follows: **Participants from abroad: US $300** **Industry/ Research Organizations: Rs. 5,000/-** **Academic Institutions (Faculty): Rs. 2950/-** **Academic Institutions (Student) Rs. 1770/-** **Academic Institutions (SC/ST Student) Rs. 1180/-** Students have to submit a letter from their institution/Valid Identity card as proof of full time student enrollment. SC/ST students will have to submit a valid Caste/Tribe Certificate. The above fees include all instructional materials, computer use for practical sessions, internet facility. The course fee is inclusive of 18% GST as per institute norm. Boarding, lodging and meal charges are not included in the fees. The participants will be provided single/shared accommodation in Institute Guest house/student hostel on payment basis.
To Apply	For participants both within and outside VNIT Nagpur, a one-time fee of Rs. 500/- will be charged for registration at the GIAN portal for all future courses in subsequent years. Login and Apply at **http://www.gian.iitkgp.ac.in/GREGN** For more details, Please follow the link **http://ece.vnit.ac.in/people/deepgupta/**

The Faculty

Dr. Petia Radeva completed her UG on Applied Mathematics at the University of Sofia, Bulgaria, in 1989. In 1996, she received a Ph.D. degree in Computer Vision at UAB. In 2007, she moved as Tenured Associate professor at the Universitat de Barcelona, Department of Mathematics and Informatics, where from 2009 to 2013 she was Director of Computer Science Undergraduate Studies.

Petia Radeva is Head of the Consolidated Group Computer Vision at the University of Barcelona (CVUB) and Head of the Medical Imaging Laboratory of Computer Vision Center (www.cvc.uab.es). Petia Radeva's research interests are on Development of learning-based approaches for computer vision, and their application to health. Currently, she is involved on projects that study the application of wearable cameras and life-logging, to extract visual diary of individuals to be used for memory reinforcement of patients with mental diseases. Moreover, she is exploring how to extract semantically meaningful events that characterize lifestyle and healthy habits of people from egocentric data. Other projects she is involved are: Machine learning tools for large scale object recognition, Food analysis by Computer Vision, Tissue characterization and plaque analysis in carotid images, etc. She has h-index of 34 (Google Academic), with 4803 citations publishing 95 JCR articles and 232 international scientific publications. She is a coauthor of 24 international patents in the field of Computer Vision applied to Medical Imaging. Associate editor of International Journal of Visual Communication and Image Representation. She obtained the ICREA award from the Catalonian Government for her scientific merits in 2014, the international award "Aurora Pons Porrata" from CIARP in 2016 and the Prize "Antonio Caparrós" for the best technology transfer project of 2013.

Dr. Deep Gupta is an Assistant Professor in the Electronics & Communication Engineering Department, Visvesvaraya National Institute of Technology, Nagpur (India). He received his Ph.D. and Master degree in Medical Image Processing form Indian Institute of Technology Roorkee, India in 2015 and 2010, respectively. Dr. Gupta is a recipient of Dr. T.K. Saksena Memorial and S. Parthasarathy award from Ultrasonic Society of India in 2016 and 2014, respectively. His research interests include medical image processing and analysis, biomedical instrumentation, signal processing and cognitive analysis. He has authored several papers in the refereed journals and conferences of international repute. He acts as a regular reviewer for reputed journals such as IEEE Transactions on Medical Imaging, IEEE Transactions on Image Processing, IEEE Signal Processing Letters, IET Image Processing, IET Computer Vision and Biomedical Signal Processing and Control Journal.

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Course Co-ordinator

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