



Advanced Computer Vision: Application to Food Image Analysis (January 02-06, 2023)

Overview

Food is the cornerstone of people's life. Nowadays, more and more people care about the dietary intake since unhealthy diet leads to numerous diseases, like obesity and diabetes. However, food is not only related to health, but also to culture, traditions and industry. Every year, millions of food pictures are posted on social media like Instagram. Automatic analysis of food images and extracting meaningful information (nutritional, cultural, aesthetic, etc.) can have huge value leading to new opportunities for science, society and industry. However, extracting information from food images is a real challenge for Computer Vision (CV) and Machine Learning (ML) community due to the high ambiguity, big inter-class variety and intra-class similarity, huge number of classes/dishes, and lack of well-established semantics (lack of unique labels) for food concepts.

During the course, we will discuss about the Deep Learning, due to its main property of Transfer Learning, allows to propose a novel computational framework to address the challenges of food image analysis. Multi-task and cross-modal learning as well as domain adaptation allow to define novel approaches to combine multi-modal data, transfer knowledge among different domains and solve effectively tasks related to food computing. Going further, we are interested to discuss the efficient algorithms that not only address the food image challenges, giving highly-accurate predictions, but also providing principled confidence and quantifying predictive uncertainty. We will also discuss and show that efficiently integrating uncertainty estimates into deep learning models allows obtaining explicit uncertainty critical for real applications, as well as can be used to further improve transfer learning algorithms. Finally, besides the confidence output, we aim to create novel explainable algorithms for Transfer Learning in the food computing field, where novel forms of explanations will be provided for both predicted output and uncertainty estimates. Lectures will be supported with discussion sessions based on different problems associated with the Food Image Analysis.

In this program, efforts will be made to introduce various tools used in CV and image analysis such as Image analysis, Deep Learning (DL), Convolutional neural networks, GANs, Autoencoder decoder, classification vs Regression by DL, object detection (YOLO vs alternatives), Transformers, Multi-task learning, Uncertainty-aware food image analysis etc. Furthermore, this program will also have sufficient 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 Computer Vision and Image Processing for food recognition, detection, and segmentation to address concrete food-related application problems. Another aim is to discuss the process of food image annotations, to explore the possibilities for multimodal food image analysis and Computational models to analyze and quantify food in food images.

Course Contents

1. Introduction to Food Image Analysis (FIA): motivation, problems to address, limitations and challenges and applications
2. Introduction to Deep Learning
3. Convolutional neural networks
4. GANs and Encoders-Decoders
5. Classification vs. Regression by Deep Learning
6. Food recognition: Deep Learning vs Conventional Image Analysis
7. Food (object) detection by Deep learning: YOLO vs alternatives
8. Food image segmentation
9. Multi-task learning, application to food image analysis
10. Domain adaptation: application to food image analysis
11. Self-supervised learning
12. Learning with noisy labeling
13. Explainable deep learning
14. Uncertainty-aware food image analysis

* Practical Sessions on (a) food image analysis: conventional vs deep learning techniques, (b) multitask learning and (c) food image segmentation.

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| Dates | January 02-06, 2023 (Number of participants for the course will be limited to fifty) | | | | | | | | |
| You Should Attend If... | <ul style="list-style-type: none"> ▪ Students at all levels (B.Tech./M.Sc./M.Tech./Ph.D.) and aspiring researcher within the broad domain of signal, image and video processing, computer vision, machine learning, artificial intelligence. ▪ Practicing engineers, computer scientists, information technologists and data-processing specialists working in diverse areas such as telecommunications, seismic and geophysical, medical, and hospital information systems may find the course useful in their quest to learn advanced techniques for food quantification and nutrients analysis. ▪ Executives, researchers from artificial intelligence, image/video processing, computer vision, food industry, service/government organization including R&D laboratories. ▪ Faculty from academic and technical institutions. | | | | | | | | |
| Fees | <p>The participation fees per person for taking the course is as follows:</p> <table style="margin-left: 40px; border: none;"> <tr> <td>Participants from abroad:</td> <td>USD 200 / INR 15600</td> </tr> <tr> <td>Industry/ Research Organizations:</td> <td>INR 5,900/-</td> </tr> <tr> <td>Academic Institutions (Faculty):</td> <td>INR 4130/-</td> </tr> <tr> <td>Academic Institutions (Student)</td> <td>INR 2950/-</td> </tr> </table> <p>Students have to submit a letter from their institution/Valid Identity card as proof of full-time student enrollment.</p> <p>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. Registration fee should be paid through VNIT Payment gateway https://pay.vnit.ac.in/home. For the complete process, you may visit https://ece.vnit.ac.in/people/deepgupta/gian/acv/</p> <p>Boarding, lodging, and meal charges are not included in the fees. The participants will be provided single/shared accommodation in the Institute Guest house/Guest Rooms/ student hostel on payment basis.</p> | Participants from abroad: | USD 200 / INR 15600 | Industry/ Research Organizations: | INR 5,900/- | Academic Institutions (Faculty): | INR 4130/- | Academic Institutions (Student) | INR 2950/- |
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| Academic Institutions (Faculty): | INR 4130/- | | | | | | | | |
| Academic Institutions (Student) | INR 2950/- | | | | | | | | |
| To Apply | <p>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 https://gian.iitkgp.ac.in/GREGN/index</p> <p>For more details, please follow the link https://ece.vnit.ac.in/people/deepgupta/gian/acv/</p> | | | | | | | | |

The Faculty



Prof. Petia Radeva is a Full Professor at the Universitat de Barcelona (UB), Head of the Consolidated Research Group “Computer Vision and Machine Learning” at the University of Barcelona (CVMLUB) at UB and Senior researcher in Computer Vision Center. She was PI of UB in 7 European, 3 international and more than 25 national projects devoted to applying Computer Vision and Machine learning for real problems like food intake monitoring (e.g. for patients with kidney transplants and for older people). Petia Radeva is a REA-FET-OPEN vice-chair since 2015 on, and international mentor in the Wild Cards EIT program since 2017.

She is an Associate editor of Pattern Recognition journal and International Journal of Visual Communication and Image Representation. She is a Research Manager of the State Agency of Research (Agencia Estatal de Investigación, AEI) of the Ministry of Science and Innovation of Spain. Petia Radeva belongs to the top 2% of the World ranking of scientists with the major impact in the field of TIC according to the citations indicators of the popular ranking of Stanford. She has been a Research Executive Agency Future and Emerging Technologies-Open program vice chair since 2015 and an international mentor in the EIT Health Wild Cards program since 2017. Moreover, she was awarded IAPR Fellow since 2015, ICREA Academia assigned to the 30 best scientists in Catalonia for her scientific merits since 2014, received several international awards (“Aurora Pons Porrata” of CIARP, Prize “Antonio Caparrós” for the best technology transfer of UB, etc). She supervised 23 PhD students and published more than 100 SCI publications and 250 international chapters and proceedings, her Google scholar h-index is 51 with more than 9750 cites.



Dr. Deep Gupta is an Assistant Professor in the Dept. of Electronics and Communication Engineering at Visvesvaraya National Institute of Technology Nagpur, Maharashtra (India). He received his Ph.D. and Master’s degree in Image Processing from Indian Institute of Technology Roorkee, India in 2015 and 2010, respectively. Dr. Gupta is an IEEE senior member and life member of Ultrasonic Society of India. He is also a recipient of Dr. T.K. Saksena Memorial and S. Parthasarathy award from Ultrasonic Society of India in 2016 and 2013, respectively. His research interests include image processing, computer vision, medical image analysis, multimodal image registration and fusion, food image analysis by

end to end learning, histopathological image analysis, event detection 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 Journal of Biomedical and Health Informatics, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Instrumentation and Measurement, IEEE Journal of Translational Engineering in Health and Medicine, IEEE Signal Processing Letters, IEEE Access, IEEE Sensor Journal, IET Image Processing, IET Computer Vision and Biomedical Signal Processing and Control.

About VNIT Nagpur



Visvesvaraya National Institute of Technology, Nagpur is one of the thirty-one National Institutes of Technology in the country. The Govt. of India conferred on the Institute, the Deemed to be University status (under University Grants Commission Act, 1956 (3 of 1956)) with effect from 26th June 2002. Subsequently, the Central Govt. by Act of Parliament (National Institutes of Technology Act, 2007 (29 of 2007)) declared VNIT Nagpur as an Institute of National Importance along with all former regional engineering colleges. The Act was brought into force from 15th August 2007. Earlier, the Institute was known as Visvesvaraya Regional College of Engineering (VRCE). It was established in the year 1960 under the scheme sponsored by Govt. of India and Govt. of Maharashtra. The college was started in June 1960 by amalgamating the State Govt. Engineering College functioning at Nagpur since July 1956. In the meeting held in October 1962, the Governing Board of the College resolved to name it after the eminent engineer, planner, and statesman of the country Sir M. Visvesvaraya.

About Department of ECE



The department of Electronics and Computer Science was created in 1994 from the department of Electrical Engineering. Later, the Department of Electronics and Communication Engineering has been created in May 2014. Department of ECE offers B.Tech. in Electronics and Communication Engineering, M.Tech. in Communication System Engineering, and Ph.D. The department has well qualified and well-motivated faculty members and support staff. There are more than 30 full time Ph.D. students enrolled in the different areas of signal and image processing, medical image analysis, embedded system design, communication system, etc. Department has Centre of Excellence in Combedded Systems and Centre for Artificial Intelligence. The department is actively involved in R&D as well as consultancy projects and has collaborations with several industries, academic institutions and R&D organizations in the country and outside.



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For registration

<https://gian.iitkgp.ac.in/GREGN/index>

For more details:

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