Tuesday, 3 September 2019

Tutorial: Integrating Theory-Driven and Data-Driven Approaches to Affective Computing via Deep Probabilistic Programming
Tutor: Desmond Ong, Zhi-Xuan Tan, Harold Soh, Jamil Zaki, & Noah Goodman
Room: 1
Time: 9:00 – 12:30 (Half day - Morning)

Tutorial Description: Research in affective computing has traditionally fallen into either theory-driven approaches that may not scale well to the complexities of naturalistic data, or atheoretic, data-driven approaches that learn to recognize complex patterns but still fall short of reasoning about emotions. In this tutorial, we introduce deep probabilistic programming, a new paradigm that models psychologically-grounded theories of emotion using stochastic programs. Specifically, this flexible framework combines the benefits of probabilistic models with those of deep learning models, marrying the advantages of both approaches. For example, when modelling someone's emotions in context, we may choose to compose a probabilistic model of emotional appraisal with a deep learning model for recognizing emotions from faces—and we can do this all within a single unified framework for training and performing inference. By leveraging modern advances in deep probabilistic programming languages, researchers can easily scale these models up to larger, naturalistic datasets. Additionally, the lowered cost of model-building will accelerate rigorous theory-building and hypothesis-testing between competing theories of emotion.

The target audience comprises two groups of researchers. The first group includes researchers, such as cognitive psychologists, who favor theoretically-grounded models of affective phenomena, and who wish to scale their models up to complex, naturalistic datasets. The second group includes computer scientists, especially those who primarily use deep learning, who wish to add more emotion theory into their deep learning models, and in a principled manner. Deep probabilistic programming offers a way to combine the benefits of these two approaches to affective computing.

We will be learning from a webbook, using Jupyter notebooks. We will start with introductory primers to probabilistic programming concepts, such as stochastic primitives; compositionality and recursion; and stochastic variational inference. We will then transition into worked examples on previously-collected affective computing datasets. We will be using the open-sourced deep probabilistic programming language Pyro, first released in 2017. Tutorial participants will be able to download and run the code on their local machines as they follow along the material. We hope that by the end of this short tutorial, participants will be inspired---and equipped with some basic skills---to adopt approaches like deep probabilistic programming that merge theory- and data-driven approaches, and that such efforts will lead to greater collaboration between these historically-distinct paradigms in affective computing.

About the presenter: Desmond Ong is an Assistant Professor of Information Systems and Analytics at the National University of Singapore. He holds a concurrent appointment as a Research Scientist with the A*STAR Artificial Intelligence Initiative. He received his Ph.D. in Psychology and his Masters in Computer Science, both from Stanford University in 2017. He graduated summa cum laude in Economics and magna cum laude in Physics from Cornell University in 2011. His research interests include building computational models of emotion and mental state understanding. In his work, he applies a wide range of computational modelling techniques, especially Bayesian probabilistic methods, deep learning, and hybrid approaches that combine the two. He was awarded a Computational Social Science Fellowship from Stanford University, a National Science Scholarship from A*STAR, and a Hunter R. Rawlings III Cornell Presidential Research Fellowship from Cornell University. His interdisciplinary work has been published in top-ranking journals such as the Proceedings of the National Academy of Sciences, Psychological Science, Cognition, IEEE Transactions on Affective Computing, and the Journal of Personality and Social Psychology.

Tutorial: Thermal Imaging-based Physiological and Affective Computing
Tutors: Youngjun Cho & Nadia Bianchi-Berthouze
Room: 1
Time: 14:00 – 17:30 (Half day - Afternoon)

Tutorial Description: As humans are homeothermic, our internal temperature is closely linked with numerous physiological and psychological mechanisms. Given this, human thermal patterns have been explored to improve understandings of our body for a couple of centuries. This tutorial is to bring traditional and advanced methods together into our community to discuss how to reliably interpret a person’s temperature into physiological data.
signatures and how to use them to automatically infer our affective states, possibly in any situations. During the tutorial, we dive into existing methods, paradigms and physiological evidence around the thermal mechanism. First, we start looking at thermal measurements spanning from earlier thermometry to modern thermal imaging, and their use. Second, we review human physiology of heat production and physiological thermal signatures. Third, we discuss existing studies exploring the use of thermography in capturing a person’s physiological cues and understanding affective states through it. We also discuss computational aspects, for example, how to use advanced machine learning techniques for thermal imaging based studies. Finally, we discuss the challenges and limitations emerged from the literature to explore research opportunities and directions in thermal imaging based physiological and affective computing.

Session I: Introduction to Thermal Imaging-based Physiological and Affective Computing
Session II: Practical Guide to Thermal Imaging-based Physiological and Affective Computing
Session III: Challenges, Opportunities and Applications

About the presenters: Youngjin Cho is a Lecturer (assistant professor) in the department of computer science at University College London (UCL). He explores, builds and evaluates novel techniques and technologies for the next generation of physiological and affective computing that help boost disability technology innovation. He has pioneered mobile thermal imaging-based physiological sensing and affect recognition (e.g. mental stress). He obtained a PhD in computational physiology and thermography from Faculty of Brain Sciences at UCL. Before joining UCL Computer Science, he was a senior researcher at LG Electronics (2011-2018) and led a variety of industrial research projects, successfully commercializing his novel sensing and machine learning techniques (e.g. gesture-driven advanced touchscreen for vehicles). He has authored more than 50 articles (including patents) in areas related to affective, physiological computing, machine learning, human-computer interaction and multimodal sensing and feedback. Some of the achievements have been featured in forums for the general public such as BBC News, Phys.Org, Imaging and Machine Vision Europe, and SBS News.

Nadia Berthouze is a Full Professor in Affective Computing and Interaction at the University College London Interaction Centre (UCLIC). Her research focuses on designing technology that can sense people’s affective states. She has pioneered the field of Affective Computing in both lab studies and real-world contexts such as physical rehabilitation (EPSRC Emo&Pain; H2020 EnTimeMent), textile design (EPSRC Digital Sensoria), full-body sensing technology for education (H2020 WeDraw), wellbeing in the industrial workflow (H2020 Human Manufacturing). She has published more than 200 papers in Affective Computing, HCI, and Pattern Recognition. She has secured more than £11M in collaborative projects either as PI or as UCL-PI. She has supervised to completion 10 PhD students and 11 PostDocs/Software Engineer most of which have progressed to academic positions (e.g., lectureship at UCL) or industrial positions (e.g., Team leader at DeepMind). She was invited to give a TEDx talk and various keynotes in both academics and industrial conferences.

Tutorial: The Ambiguous and Uncertain World of Emotion Representation

Tutors: Vidhyasaharan Sethu, Julien Epps, Nicholas Cummins, Shrikanth Narayanan, Emily Mower Provost, Carlos Busso
Room: 2
Time: 14:00 – 17:30 (Half day - Afternoon)

Tutorial Description: This tutorial will focus on the topic of representing emotions in affective computing systems. Most commonly in computing systems, emotions have been represented with categorical labels such as ‘anger’ or ‘happiness’, or as values on numerical scales denoting affective attributes/dimensions, most typically arousal (activation) and valence (pleasantness). There has also been recent interest in ordinal representations of affect, which acknowledge the inherently ordinal characteristic of emotion perception, for example one emotional experience being ‘more’ pleasant than another. While it has been argued that the categorical representations of emotions do not capture every shade, as opposed to numerical or ordinal representations, all three are also single-valued representations that do not quantify the ambiguity present in perceived emotions.

Given how common it is for the expression of emotions to be ambiguous in naturally occurring human interactions, this is a key deficiency that needs to be addressed to develop emotionally aware machines. In order for the machine to exhibit richer, more human like responses it would need to quantify and incorporate this ambiguity into its internal representation of emotions and update it as more information is obtained. This would be hard to do with a chain of single estimates and demands a more nuanced representation which in turn needs the development of a suitably powerful framework within
which emotion representation schemes can be described and developed.

This tutorial aims to present a framework, that was developed based on discussion across five research groups, within which properties for an optimal representation can be explicitly identified and specified. It will discuss a novel approach that seeks to bring together the myriad of emotion representations methods that are currently used under a common framework that also generalises to allow the ambiguity and uncertainty inherent in perceived affect to be quantified. In addition to presentations discussing affect representation methods, ambiguity in affect and a novel framework within which to analyse these methods, the session will also involve interactive group activity and discussions to brainstorm the challenges and shortcomings of current approaches as well as potential future direction.

About the presenters: Vidhyasaharan Sethu is a Senior Lecturer in the School of Electrical Engineering and Telecommunications at the University of New South Wales (UNSW). He was awarded his PhD in 2010 for his work on Automatic Emotion Recognition, by UNSW. Following this, he worked as a Postdoctoral Research Fellow at the speech research group at UNSW on the joint modelling of linguistic and paralinguistic information in speech with a focus on emotion recognition. Currently he is part of the Speech Processing Lab and co-director of the Signal, Information and Machine Intelligence Lab (www.simi.unsw.edu.au) at UNSW. He teaches courses on speech processing, signal processing and electrical system design in the school and is a reviewer for several journals including IEEE TASLP, TAC, Speech Communication, and EURASIP Journal on Audio, Speech and Music Processing and Electronics Letters. His research interests include affective computing, speaker recognition, language identification and frameworks for ambiguity aware machine learning systems in speech processing.

Carlos Basso is an associate professor at the Electrical Engineering Department of The University of Texas at Dallas (UTD). He received the BS and MS degrees with high honors in electrical engineering from the University of Chile, Santiago, Chile, in 2000 and 2003, respectively, and the PhD degree (2008) in electrical engineering from the University of Southern California (USC), Los Angeles, in 2008. At UTD, he leads the Multimodal Signal Processing (MSP) laboratory [http://msp.utdallas.edu]. He is a recipient of an NSF CAREER Award. In 2014, he received the ICMI Ten-Year Technical Impact Award. He also received the Hewlett Packard Best Paper Award at the IEEE ICME 2011 (with J. Jain), and the Best Paper Award at the AAAC ACII 2017 (with Yannakakis and Cowie). His research interest is in human-centered multimodal machine intelligence and applications. His current research includes the broad areas of affective computing, multimodal human-machine interfaces, nonverbal behaviors for conversational agents, and machine learning methods for multimodal processing. His work has direct implication in many practical domains, including national security, health care, entertainment, transportation systems, and education. He was the general chair of ACII 2017. He is a member of ISCA, AAAC, and ACM, and a senior member of the IEEE.

Nicholas Cummins is a habilitation candidate at the Z.D.B Chair of Embedded Intelligence for Health Care and Wellbeing at the University of Augsburg in Germany. He was awarded his PhD in Electrical Engineering from UNSW Australia in February 2016 for my thesis ‘Automatic assessment of depression from speech: paralinguistic analysis, modelling and machine learning’. His current research interests include multisensory signal analysis, affective computing, and computer audition. He is fascinated by the application of machine learning techniques to improve our understanding of different health conditions. He is particularly interested in applying these techniques to mental health disorders. He is currently involved in the DE-ENIGMA, RADAR-CNS, TAPAS and sustAGE Horizon 2020 projects, in which his roles include contributions towards management of the technical work packages. He enjoys working towards solving real-world problems in health and wellbeing as part of these interdisciplinary teams. He has been lecturing since autumn 2017, writing and delivering courses in Speech Pathology, Deep Learning and Intelligent Signal Analysis in Medicine. He has (co-)authored over 90 conference and journal papers leading to over 1000 citations (h-index: 18). He is a frequent reviewer for IEEE, ACM and ISCA journals and conferences as well as serving on program and organisational committees.

Shrikant (Shri) Nanayam holds the Niki & C. L. Max Nikias Chair in Engineering at the University of Southern California, where he is Professor of Electrical & Computer Engineering, and jointly in Computer Science, Linguistics, Psychology, Neuroscience, Pediatrics and Otolaryngology, Director of the Ming Hsieh Institute and Research Director of the Information Sciences Institute. Prior to USC he was with AT&T Bell Labs and AT&T Research. His research focuses on human-centered sensing, computing and information processing. He is a Fellow of the National Academy of Inventors, the Acoustical Society of America, IEEE, ISCA, the American Association for the Advancement of Science (AAAS), the Association for Psychological Science, and the American Institute for Medical and Biological Engineering (AIMBE). He is a recipient of several honors including the 2015 Engineers
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Council’s Distinguished Educator Award, a Mellon award for mentoring excellence, the 2005 and 2009 Best Journal Paper awards from the IEEE Signal Processing Society and serving as its Distinguished Lecturer for 2010-11, a 2018 ISCA Best Journal Paper award, and serving as an ISCA Distinguished Lecturer for 2015-16 and the Willard R. Zemlin Memorial Lecturer for ASHA in 2017. He has published over 800 papers and has been granted seventeen U.S. patents.