

Format of Tutorial: Half-Day

Title: Social Analytics

Abstract: This course will cover the topic of social analytics through standard and person borne cameras from which group level social interactions can be acquired using both visual and auditory channels. This tutorial will cover five main topics. First, we will consider the role of video analytics in terms of base capabilities such as: person tracking, PTZ control, articulated motion analysis, gaze detection, facial expression, emotion, valence, arousal, and general behavior recognition. Second, using speech to text algorithms, the semantic analysis of speech can be performed. This topic will include the analysis of speech acts, narrative analysis and the construction of models focused on salient social concepts such as respect and rapport. Third, the topic of paralinguistics will be presented. This form of analysis is not focused on what was said but how it was said. In this way speech patterns may allow for the inference of affects such as sarcasm and excitement. In addition, the analysis of pauses and abrupt changes in tone allows for analysis of interaction dynamics. Fourth, perspectives from behavioral and social science will be presented with the idea that such constructs and frameworks allow for a more nuanced interpretation of observed features. Finally, various fusion strategies that incorporate all four of the previous topics will be discussed with respect to the following outcome variables: normative behaviors, perceived procedural justice, change point detection, emotion, valence, and arousal.

Prerequisites: None

Motivation and Focus: With the proliferation of standard surveillance and wearable cameras, the opportunity to observe and analyze authentic social interactions in unconstrained conditions is quickly becoming an imperative for commercial, government and military use. Increasingly, psychological and sociological phenomena such as normative behaviors, civil interaction, emotional state, rapport, respect, and intention can be understood through the lens of automatic analysis. This application space includes

the use of fixed multi-camera installations, active sensors such as Pan Tilt Zoom cameras as well as mobile devices such as person and drone borne cameras. Use case scenarios include interactions between members of the public and police officers or military personnel, doctor patient interactions, school yards and classrooms, shopping centers and other public venues, commercial sales, and entertainment events. This tutorial will cover an array of topics that are foundational for this research agenda.

Syllabus

- Multi-View Video Analytics (Peter Tu and Guy Ben-Yosef GE)
 - The Sherlock system, which makes use of multi-person tracking, automatic PTZ camera control, pose, gaze and expression recognition, will be presented. Methods for extracting social signals such as proximity, interaction and emotional state will be described along with a Bayesian inference engine capable of predicting high level latent social cues such as rapport and hostility will be discussed.
 - Modern state of the art approaches in terms of behavior recognition using raw pixels as well as skeleton models and the measurement of expression as well as emotional arousal and valence will be reviewed.
 - The use of visual language models allowing for increasingly nuanced behavior recognition will be presented.
- Semantics analysis of speech (Marc Tomlinson and Vivian Ta)
 - Methods that allow for the construction of specific social models based on text representations of speech will be presented.
 - Analysis of speech in terms of speech acts and their communicative and social implicatures will be described.

- The use of semantic models for the purposes of narrative description will be reviewed.
- Paralinguistics (Mari Ostendorf)
 - Machine learning methods that transform auditory signals into rich embeddings will be presented.
 - Temporal analysis methods as applied to auditory embeddings will be reviewed.
- Social and Behavioral Science (Jonathan Wender, Brian Lande, and David Matsumoto)
 - Behavioral science models as they pertain to the topic of procedural justice will be reviewed.
 - An overview of social modelling with respect to cross cultural interaction will be presented.
- Fusion of visual, semantic, and audio cues (Marc Tomlinson)
 - Methods that allow for the fusion of visual, semantic and auditor cues will be discussed in the context of social and behavioral science.
 - A review of experiments associated with perceived procedural justice, normative behaviors, change point detection, emotion, valence and arousal will be presented.

Tutor	Affiliation	Topic
Peter Tu	General Electric	Video Analytics
Guy Ben-Yosef	General Electric	Video Analytics
Marc Tomlinson	Language Computer	Semantic Analysis
Vivian Ta	Lake Forest College	Semantic Analysis
Mari Ostendorf	University of Washington	Paralinguistics
Jonathan Wender	Polis Solutions	Social Science
Brian Lande	Polis Solutions	Social Science

David Matsumoto	Humintell and San Francisco State University	Social Science
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Biographies:

Peter H. Tu (GE Global Research, Chief Scientist): Dr. Tu received his Bachelor of Science degree in Systems Design Engineering from the University of Waterloo Canada. He then received a DPhil from the Department of Engineering Science at Oxford University. While at Oxford, his research was devoted to the development of computer vision methods for the automatic analysis of seismic imagery. In 1997 Dr. Tu became a senior research scientist working at General Electric's Global Research center. In partnership with Lockheed Martin, he developed a set of latent fingerprint matching algorithms for the FBI Automatic Fingerprint Identification System (AFIS). Dr. Tu has also developed optical methods for the precise measurement of 3D parts in a manufacturing setting via methods known as Helmholtz Stereopsis. Dr. Tu was the Principal Investigator for the FBI ReFace project, which was tasked with developing an automatic system for face reconstruction from skeletal remains. In 2006, he was the principal investigator for the National Institute of Justice's 3D Face Enhancer Program. This work was focused on improving face recognition from poor quality surveillance video. In subsequent years Dr. Tu led a number of NIJ programs focused on topics such as face face recognition and behavior understanding. In 2008, Dr Tu led the GE video analytics team that participated in the DHS STIDP demonstration program - the goal of STIDP was to establish an effective defence against suicide bomber attack. Dr Tu was the Principal Investigator for the DARPA sponsored Sherlock effort focused on group level social behavior understanding at a distance based on visual cues. Dr. Tu was the Principal Investigator for the DARPA GAILA, CREATE and Geometry of Learning programs focused on language acquisition via visual grounding, interagent cooperation and data analysis through the lens of differential geometry. Currently Dr. Tu is GE's Chief Scientist for Artificial Intelligence, topics of interest include: developing new forms of agency and awareness, the grounding problem, associative memory and artificial intentionality. Dr Tu has over 75 peer reviewed publications and has filed more than 50 U.S. patents.

Marc Tomlinson (Language Computer, Principal Scientist): Dr. Tomlinson started with B.S. in computer science from Rensselaer Polytechnic Institute, before moving on to a start-up investigating automated analysis of cover letters and resumes for identifying the best potential candidates. He then went on to earn a PhD in cognitive psychology from the University of Texas at Austin. While there his research focused on understanding how individuals learn and reason about the world around them and how this

interacts with language. In 2011, Dr. Tomlinson started at Language Computer, working on and leading several IARPA programs, from which he published numerous papers on using language to understand an individual's psychological state, motivations, and social goals and social actions in a variety of languages. During those efforts he was also involved in understanding cultural differences at the nation and sub-nation level in those expressions. He has commercialized some of these ideas at a second start-up, successfully predicting financial outcomes from an individual's social media communications, opening new credit options for financially invisible consumers. In addition to his work in social sciences, Dr. Tomlinson is the principal investigator for DARPA's Causal Exploration program, developing new methods for understanding how causality is expressed in language and advancing the state of the art in automated ontology creation and other core natural language processing areas. Currently he is the Principal Investigator for DARPA's Computational Cultural Understanding program where he is investigating the fusion of multi-modal data for understanding cultural norms. Dr. Tomlinson is interested in how language can be used as a medium for conversation and interaction with both people and machines, and how these interactions can establish, reinforce, or break social bonds.

Dr. Brian Lande, Ph.D: Dr. Lande is co-founder of Polis Solutions and serves as its Chief Science Officer. In that capacity, he oversees Polis' applied and basic research portfolio, including development and implementation of evidence-based training and performance evaluation systems. His pioneering work on computational social science led to his appointment as program manager at DARPA for the Good Stranger program. Dr. Lande currently represents Polis on a range of research and training projects ranging from improving officer decision-making related to de-escalation and lawful use of force to automating analysis of body-worn camera footage in order to identify procedurally just officer actions. Dr. Lande has over fifteen years of operational experience as a police officer in the State of California. He holds a Ph.D. in Sociology from UC Berkeley.

Dr. Vivian Ta, Ph.D: Dr. Ta serves as Polis' Chief Data Scientist, and is also Assistant Professor of Psychology at Lake Forest College in Lake Forest, IL. She is the director of the Technology, Relationships, and Language Lab, which focuses on using natural language processing and text analysis to examine psychological processes during social interactions in public safety and other community settings. Dr. Ta is currently working on several DOJ-funded projects to expand the use of natural language processing and machine learning to improve the accuracy, scalability, and cost-effectiveness of tools for measuring police performance and expertise in training and operational settings. Her work has been published in journals

such as Psychological Science, Journal of Language and Social Psychology, and Negotiation and Conflict Management Research, and has been funded by agencies such as the National Science Foundation, Andrew C. Mellon Foundation, and American Psychological Association. Dr. Vivian Ta holds a Ph.D. in Experimental Psychology from the University of Texas at Arlington.

Dr. Jonathan Wender, Ph.D: Jonathan Wender is Polis' co-founder and CEO. He is a twenty-year police veteran and interdisciplinary social scientist whose area of expertise is face-to-face social interactions in critical situations where risk is high and trust is low. Jonathan has broad experience developing and implementing large-scale technology, training and technical assistance programs that foster accountable, transparent, equitable policing. He is lead developer of Polis' T3 - Tact, Tactics, and Trust and ADAPT programs, and is currently directing Polis' efforts to build systems that use natural language processing and computer vision to automate the analysis of body-worn camera data. Prior to co-founding Polis, Jonathan served at the US DoD DARPA as a senior advisor on the "Good Stranger" program. He also previously served on the faculty at the University of Washington in the Department of Sociology and Law, Societies, and Justice Program. Jonathan is internationally recognized as a subject-matter expert on police-community interactions, police reform, police use of force, officer decision-making, police training, and other related topics. He holds a Ph.D. in criminology from Simon Fraser University (2004).

David Matsumoto: Dr. Matsumoto is a world-renowned expert in the fields of emotion, nonverbal behavior, deception, and culture. He received his B.A. from the University of Michigan in 1981, double majoring in psychology and Japanese and receiving High Honors in both. He obtained his Masters (1983) and Doctoral (1986) degrees in Psychology from the University of California at Berkeley. He has been a Professor of Psychology at San Francisco State University (SFSU) since 1989, and is the Founder and Director of SFSU's Culture and Emotion Research Laboratory. He has produced over 400 academic works including books, journal articles, book chapters, and conference presentations. His books include well-known titles such as the Culture and Psychology, the APA Handbook of Nonverbal Communication (ed.), Nonverbal Communication: Science and Application (ed.), the Cambridge Dictionary of Psychology (ed.), Cross-Cultural Research Methods in Psychology (ed.), the APA Handbook of Interpersonal Communication (ed.), the APA Handbook of Intercultural Communication (ed.), and The Oxford Handbook of Culture and Psychology (ed.). He is the recipient of many awards and honors in the field of psychology, and is a Fellow of the Association for Psychological Science, the Society for Personality and Social Psychology, the International Academy of Intercultural Research, and the International Association for Cross-Cultural

Psychology. He is the series editor for Cambridge University Press' series on Culture and Psychology, and former Editor-in-Chief for the Journal of Cross-Cultural Psychology. He has been President and CEO of Humintell (www.humintell.com) since its founding in 2009.