Computer vision for social machines

General information

Intelligent machines (e.g., robots, virtual agents, user interfaces, smart phones etc.) are increasingly being used to support humans in everyday tasks. This requires them to be endowed with "social skills", in order to behave in a safe, socially acceptable manner and adapt to human users in an intelligent way. Computer vision, coupled with machine learning, is of key importance in providing machines with these skills, offering tools to program the ability to, for example, recognise objects, humans, non-verbal behaviours (e.g., facial expressions and body movements), and the context in which the interaction with humans takes place. This course will involve computer vision techniques (e.g., Camshift algorithm, Lucas-Kanade optical flow algorithm, etc.), estimators (e.g. Kalman and Particle filters for automatic tracking) and machine learning-based approaches (e.g. static vs. dynamic classifiers) that can be used to program social abilities in intelligent machines capable of interacting in a safe and social manner with humans in challenging, complex natural environments.

Lecturers

Ginevra Castellano and Anders Hast, Department of Information Technology, Uppsala University

Course structure/format

The course consists of 8 lectures and gives 5 hp.

Course schedule

Lecture 1 (Tue 21 April 14:00-16:00): introduction to the course; face and body detection and tracking; face and body features detection and tracking (Ginevra Castellano)

Lecture 2 (Tue 28 April 10:00-12:00): discussion of research paper (Ginevra Castellano)

Lecture 3 (Tue 5 May 10:00-12:00): feature extraction (Anders Hast)

Lecture 4 (Tue 12 May 10:00-12:00): automatic analysis of multimodal behaviour; automatic inference of affect and social meanings (Ginevra Castellano)

Lecture 5 (Tue 19 May 10:00-12:00): discussion of research paper (Anders Hast)

Lecture 6 (Tue 26 May 10:00-12:00): discussion of research paper (Ginevra Castellano)

<u>Lecture 7 (Wed 3 June 14:00-16:00)</u>: group project (Ginevra Castellano)

<u>Lecture 8 (Mon 15 June 10.00-12.00)</u>: presentation of projects by students (Ginevra Castellano and Anders Hast)

Location

The course will take place in the seminar room (2115) of the Division of Visual Information and Interaction, Department of Information Technology, Uppsala University.

Target students

The course could be of interest to PhD students in applied mathematics, image processing, machine learning and human-computer interaction, and, more in general, is open to students with an interest in low-level computer vision as well as to those with an interest in the higher level use of computer vision tools to analyse behaviours of humans interacting with intelligent machines.

Assessment

Project. Students will be encouraged to propose a personal project on some of the course topics involving their own research. Projects ideas will also be provided.

How to register

Please email the course organisers (ginevra.castellano@it.uu.se; anders.hast@it.uu.se) as soon as possible to register your attendance.

Literature

Bradski, G., and Kaehler, A. (2008). Learning OpenCV: Computer Vision with the OpenCV Library. O'Reilly.

Breazeal, C. (2008). Role of expressive behaviour for robots that learn from people. Philosophical Transactions of the Royal Society B, vol. 364, pp. 3527–3538, 2009.

Castellano, G., Gunes, H., Peters, C., and Schuller, B. (2015). Multimodal Affect Recognition for Naturalistic Human-Computer and Human-Robot Interactions. In R.A. Calvo, S.K. D'Mello, J. Gratch and A. Kappas (Eds). Handbook of Affective Computing. Oxford University Press.

Pantic, M., and Bartlett, M. (2007). Machine Analysis of Facial Expressions. In K. Delac, M. Grgic Eds., Face Recognition. I-Tech Education and Publishing, Vienna, Austria, pp. 377 - 416, 2007.