09:30, Jeremy Wyatt (Keynote):

Title: Sharing spaces: planning and learning for interactions between robots and humans

Abstract: In this talk I will describe some of the baseline approaches to robot planning and interaction that we have pursued in our lab over the past ten years. I will cover a variety of the work we have done in our lab on planning for interaction with humans and which touches on issues of interaction and on how to work with robots that co-habit spaces with humans. I'll focus less on safety per se, and more about what some of the challenges are for appropriate interaction.

11:00, Sami Haddadin:

Title: A Human-Robot Interaction-Planning Framework for Task Allocation in Collaborative Industrial Assembly Processes

Abstract: In this talk I will describe our framework for task allocation in human-robot collaborative assembly planning. It distinguishes between two main layers of abstraction and allocation. In the higher layer we use an abstract world model, incorporating a multi-agent human-robot team approach in order to describe the collaborative assembly planning problem. From this, nominal coordinated skill sequences for every agent are produced. In order to be able to treat humans and robots as agents of the same form, we move relevant differences/peculiarities into distinct cost functions. The layer beneath handles the concrete skill execution. On atomic level, skills are composed of complex hierarchical and concurrent hybrid state machines, which in turn coordinate the real-time behavior of the robot. Their careful design allows to cope with unpredictable events also on decisional level without having to explicitly plan for them, instead one may rely also on manually designed skills. Such events are likely to happen in dynamic and potentially partially known environments, which is especially true in case of human presence.

12:00, Petar Kormushev:

Title: Teaching Robots to Do Our Chores via Safe and Natural Human-Robot Interaction

Abstract: Robots with human-like abilities to perform physical tasks in a smooth and natural way have been a dream of many roboticists. Currently, the robot hardware is physically capable to do most house chores, as can be easily proven by robot teleoperation (a.k.a. “robot puppeteering”).

In the near future, most households will likely have a domestic robot with some basic functionality. But how would people teach their robots to do new house chores?

Ideally, robots should be able to acquire new skills through safe and natural interaction with humans. However, acquiring new motor skills is not simple and involves various forms of learning, such as learning by imitation and reinforcement learning. This talk will overview the existing methods for robot learning of new motor skills. A variety of example tasks will be presented, such as: learning to manipulate objects, learning to recover from failures, visuospatial skill learning, and whole-body motor skill learning.

14:00, Sylvain Calinon:

Title: Challenges in extending learning from demonstration to collaborative robots

Abstract: Human-centric robot applications requires a tight integration of learning and control. This connexion can be facilitated by shared probabilistic representations of the tasks and objectives to achieve. In human-robot collaboration, such representation can take various forms. Movements must be enriched with perception, force and impedance information to anticipate the users' behaviours and generate safe and natural gestures.

I will present two applications in which learning from demonstration techniques need to be extended to assistive tasks and semi-autonomous teleoperation. In the DexROV project, a bimanual underwater robot is distantly controlled by a user wearing an exoskeleton with force feedback. The transmission delays are handled by treating the problem as classification and synthesis with the shared encoding of a set of motion, synergy and impedance primitives employed as task-adaptive building blocks assembled in sequence and in parallel. In the STIFF-FLOP project, a continuum robot with variable stiffness is used in minimally invasive surgery to go through narrow openings and manipulate soft organs. Since the surgeon cannot control all the degrees of freedom simultaneously, the teleoperation is considered as a shared task in which a learning interface is used to assist the surgeon with semi-autonomous behaviours.

15:00, Fulvio Mastrogiovanni:

Title: Can we use robot skin to enable a dependable human-robot cooperation?

Abstract: In the past few years, much research work has been carried out (both at the hardware and software/modelling levels) to enable tactile-based robot behaviours. However, what differentiates the last decade from the past 40 years is the work on large-scale robot skin. The availability of tactile sensors covering large surfaces of a robot body poses a number of significant system-level challenges: design, manufacturing, embedded networking, real-time data representation and processing, tactile-based motion control, just to name a few. In this talk, we will discuss about the interplay between the representation of tactile data and its use for implementing dependable robot behaviours, specifically for human-robot cooperation purposes.

16:00, Daniele Magazzeni:

Title: Automated Planning and Verification - A Never-Ending Story

Abstract: Artificial Intelligence planning and verification have a strong record of contributions in real applications, and the research advances in these areas are mainly motivated by the growing need for efficiency, reliability and robustness of new solutions. AI Planning is moving towards ever more demanding applications that present temporal, spatial and continuous constraints, and require planning techniques capable of reasoning with suitably rich models. At the same time, there is a growing need for guarantees of safety and robustness of generated plans, especially in scenarios involving human-autonomous system interactions.

This calls for a stronger synergy between AI planning and verification techniques during the planning model design as well as at plan execution time.

This talk will provide an overview of the challenges and opportunities of such a synergy, with examples from real scenarios.