

Engineering Humanoids with Motion Intelligence

The seminar concerned engineering humanoid with motion intelligence. The speaker gave a portrait of his twenty-four year experience on the subject. Two of the main reasons for building humanoid robots are that they could give a better understanding of ourselves and most of them are programmed to help humans in daily chores, like cooking, or actual jobs, like warehouse maintenance and repair tasks. To being able to build such human-like robots that are actually able to help if not completely substitute the human, complex mechatronics and neural networks are needed. One side of the task is based on providing the robot with the basics to move in space, another is concerned with giving the robot the possibility to learn from human and from experience. For what concerns the first task, researchers are working on providing a library of robot primitives (motion alphabet), also called Motion Primitives. Those are basic motions that put together enable the robot to perform certain complex tasks. The work by decomposition of a complex movement into smaller motion primitives (hierarchical task segmentation). Such subdivision is based on the semantic of the movement: object-hand related changes (like contact/no contact) and the motion: segmentation based on trajectory characteristics (grasp/lift/pour). The representation of the motion alphabet has two distinguished contribution: one is the elementary trajectory, the other one is the shape modulation, which is a probability density which models the offset. The second task is instead aimed at providing the robot with a working memory. The robot is able to generate plans to execute a certain task given a goal by saving it in the working memory. Deep episodic Memory is one kind of working memory which enables the robot to encode visual actions experience on neural networks and recall those experiences to make decisions for the future; for example accelerate or decelerate the action to meet certain time limitations. (decide what actions can be executed faster).