Mission

Human activities and the environments in which they occur (real or virtual) are perceived in an increasingly sophisticated manner by artificial agents, and they can trigger complex interactions with "intelligent" software agents or "autonomous"robot. The research activities aims to study new architectures and methodologies to better manage the cycle "perception-understanding-action" of artificial autonomous systems, taking inspiration also from human cognitive models. The perception usually requires the elaboration of a large amount of raw data of the real environment (eg by artificial vision), or data originating from real and virtual sensors (soft sensors). Understanding instead requires capacity for representation and processing of knowledge at multiple levels of abstraction. Currently, hybrid architectures are the subject of study and experimentation in order to integrate frameworks of different types (sub-conceptual, conceptual and symbolic), to create conceptual structures (eg through conceptual spaces, semantic spaces, and ontologies), to create the association of these structures to symbolic constructs, and finally to allow learning, reasoning and action planning within models of the human mind. The goal of the research is to integrate both aspects of basic cognitive capabilities (understanding, learning, decision making, and communicating), and higher-level aspects such as emotions (by affect computing), creativity (by computational creativity paradigms), introspective capabilities, and motivations which strongly influence the actions in real environments. Another important goal is that concerning the social interaction of the system, through the development of language, the analysis of textual information (by social/semantic computing), and the models of human-robot interaction. The experiments deal with both autonomous software agents (eg chatbot), and humanoid robotic platforms.

Fields of application

Smart homes and cities, cultural heritage fruition, entertainment, education and e-learning, monitoring and environmental safety, monitoring of processes, human actions, and social interactions.

Research themes

Cognitive robotics at bio-inspired architectures. A cognitive architecture allows a robot to emulate human behavior and his cognitive mechanisms, integrating emotions, motivations, thinking processes inspired by the dual theory. The model Psi has been chosen as reference model, and the research aims to integrate in this architecture some relevant aspects of the "computational creativity" paradigm: associative mechanisms in long-term memory, models of internal and external evaluation, modules modeling mental realization and physical one of "creative" artifacts. The information flowing between man and machine, both in the learning phase, and during action or interaction phase, is conveyed by natural mechanisms and uses typical human communication (natural Human-Machine interaction), especially using the visual information and other sensorial data.

Conceptual Spaces and Geometric Representation of Knowledge. The research is focused on how the knowledge can be represented through geometric spaces (eg conceptual spaces), that allow intelligent agents to have different levels of abstraction, ranging from sensorial to the linguistic level. Conceptual spaces are currently used to study and setup inovative semantic computing approaches. These methodologies can be successful applied to conversational agents, chatbots, learning supporting systems, sentiment and emotional analysis, and so on.