

Proposal for an AI Institute Chair on **Collaborative Intelligent Systems**

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Scientific Challenge:

Create the theoretical foundations for AI technologies that enhance human abilities and extend, rather than replace, human intelligence.

Collaborators:

Grenoble Informatics Laboratory: Prf. Julie Dugdale, Prf. Laurence Nigay, Prf. Sylvie Pesty, Prof. Dominique Vaufreydaz GIPSA Lab: Dr. Frédéric Elisei. LaRAC Laboratory: Prf. Philippe Dessus

Scientific Context and Objective:

Deep Learning, planetary scale data collection and related technologies provide a rupture technology that can be used to construct processes that exceed human-level performance at tasks involving perception and action. In parallel, Cognitive Science, multi-modal interaction and related areas have developed theories and models that predict and explain social, emotional and intelligent behavior by humans. Our proposal is to build on these scientific advances to create a theory for systems that understand and interact with humans as individuals, adapting to each individual's physical and cognitive abilities, explaining their reasoning, and providing services that comply with human social, ethical, and cultural norms.

Approach:

We will use theories and models from Cognitive Science, Social Robotics, and Multimodal Interaction to construct and evaluate intelligent systems that observe and model human cognition and emotion in order to provide human-aware collaboration and interaction.

Our research will involve construction and evaluation of systems that observe, model and interact with humans at sensorimotor, corporal, operational and cognitive levels. Sensorimotor interaction integrates information in the form of signals from visual, acoustic, tactile modalities to provide tightly coupled reactions to communicate attention and awareness. Interaction at the corporal level integrates perception of posture, gesture, fixation, and paralinguistic utterances to model human comprehension and emotion. This can be used to generate corporal, visual or acoustic displays that evoke affection or empathy and communicate compliance with social and cultural roles. These displays may include social robots and embodied conversational agents, as well as interactive visualizations tool, intelligent graphical user interfaces, as well as smart objects and environments. Operational interaction involves awareness of human actions, commands, activities and context in order to provide assistance, advice or access to information. Modeling of human cognition and emotion can serve to guide and adapt communication and interaction to comply with the current emotion state and situation awareness of the human partner.

Our research program combines scientific investigation along four research axes:

1. Multi-modal perception of human actions, attention and emotion.
2. Visual, acoustic and corporal displays for interaction with humans
3. On-line modeling of human awareness, emotion and understanding
4. Modelling and evaluating interactive multimodal behaviors for situated collaboration.

The scientific results will provide a foundation for technologies in diverse areas such as Collaborative and Social Robotics, Intelligent User Interfaces, Learning Science, and Collaborative Control for Autonomous Vehicles and Systems.