

The First CAIS Conference (CAIS 2017): "Cognitive-and-Immersive Systems: Advanced Plan Recognition"

Cognitive-and-Immersive Systems (CAIS) in a Nutshell

Cognitive-and-immersive systems (CAIS, pronounced to rhyme with "buys") comprise of three sub-areas that are symbiotically linked to each other in a cyclical flow, and yet are at the same time capable of standalone cognitive computing (see Figure 1). The first area is responsible for perception and sensing within immersive environments (e.g. face and gesture recognition, and speech recognition), and for rapid forms of cognitive computing (Area 1). The second area covers deeper and more deliberative phenomena traditionally associated with AI: e.g. planning, reasoning over rich declarative content, learning, and deep NLP (Area 2). The third area is devoted to generating and displaying data and insights in various ways (e.g. by showing narrative in visual and audio forms) that generate and sustain immersion (Area 3). Every instance of a CAIS is in addition supported by an ensemble of machines on "the outside" – that is, outside the immersive environment. These supporting machines can feed data to an instance of a CAIS, and can process requests, queries, and tasks received from an instance of a CAIS. Note that Figure 1 depicts these supporting machines as outside, but as interacting with, the cyclical flow that is the heart of a CAI system.



Figure 1: Three areas of a CAIS

CAIS are engineered for the benefit of groups of humans who enter these immersive systems in order to achieve some goals; the reaching of these goals is made possible by the power of such systems. Three types of specific CAIS are in development at Rensselaer: CAI classrooms, CAI command-&-control centers (e.g. for intelligence analysis and cyber-defense), and CAI consultation rooms to track and conquer, through time, ongoing diseases. CAIS mark the arrival of a new discipline that cannot be reduced to any extant one. For instance, while contemporary AI is devoted to building artificial agents that perceive, then process, then act, and continue the cycle (see Russell & Norvig 2009, the dominant textbook in AI), CAIS *subsumes* AI, and *adds* forms of self-contained cognition inherent to the perception and sensing of Area 1, and also forms inherent to the presentation of information in Area 3.

The traditional artificial agents of AI can be simple and disembodied (a computer program that merely computes a simple arithmetic function such as square root counts as such an agent on the Russell-Norvig model), but a CAI system is by definition a system having *human-level* intelligence, and it also by definition is a system that is both embodied and built on the basis of multiple machine intelligences to serve multiple humans. AI of the modern variety started in 1956; CAIS has by contrast begun only very recently. The world is fast transitioning from mere AI to CAIS. In fact, even the home is before our eyes evolving into a cognitive-and-immersive system in which all the three areas of Figure 1 are active, and are supported by machines outside the home in the IoT.

The Cognitive-and-Immersive Systems Laboratory

The Cognitive and Immersive Systems Lab (CISL), under the leadership of Dr. Hui Su, is a multi-year collaboration program between Rensselaer Polytechnic Institute and IBM Research to lead the frontier of research and development in immersive cognitive systems. CISL promotes a culture of multidisciplinary research across science, engineering, art, communications, architecture, and business. Our mission is to create scientific breakthroughs and technical innovations that augment group intelligence in real world scenarios.

The core platform of CISL is the Cognitive Immersive Room (also called "Situations Room") — an immersive, interactive, reconfigurable physical environment that can augment group intelligence in complex problem solving and decision making. The initial domains investigated for the situations room include cyber-enabled exploration and discovery, cognitive and immersive learning, corporate decision making, and intelligence analysis.

Plan for CAIS 2017

The first CAIS conference (CAIS 2017) will be in the form of a workshop, held in the Cognitive-and-Immersive Systems Laboratory (CISL) in EMPAC at Rensselaer, on May 11, the day before the Advances in Cognitive Systems (ACS) Conference of 2017 starts, also to be located in CISL. CAIS 2017 will be by invitation only, and will focus on key technology areas for CAI systems: plan recognition, spatial intelligence, creative and immersive narration generation, etc. Experts in this area from Rensselaer and IBM, and from other universities teaming with IBM in the general space of cognitive computing, will be in attendance.

Morning: The Landscape

- 8:00-9:00: Breakfast & Registration
- 9:00-9:15: Welcome & Introductions
- 09:15am - 10:00am: “Overview of Cognitive-and-Immersive Systems” (= CAIS), of CISL@EMPAC, of the RPI-IBM Relationship (Presenter: Hui Su). 30 min straight presentation, 15 min discussion.
- 10:00-10:15: Break
- 10:15am - 11:00am: “The Centrality, to CAIS, of Plan Recognition at the Robust Theory-of-Mind Level.” 30 min straight presentation, 15 min discussion. (Presenters: Selmer Bringsjord & Naveen Sundar G.)
- 11:00-12:00: “Cognitive Environment and Spatial Intelligence.” (Presenter: Jeff Kephart, Distinguished Research Staff Member, IBM Research)
- 12:00-1:30: Lunch and Demonstrations. (An overview of the existing and potential future CISL work in the various application areas will be given by David Allen (CIR Demo), Matthew Peveler (Planning), Atriya Sen (Education), Zev Battad & Dr. Mei Si (Creative and Immersive Narrative Generation), Rahul Divekar & Rui Zhao & Kang Wang (Mandarin Project & Spatial Intelligence))

Afternoon: Breakout Analysis; Reception & Dinner

- 1:30-3:00: Three breakout work in the context of the 3 application areas mentioned in Dr. Su’s talk
 - Plan Recognition and Collaborative Decision Making
 - Spatial Intelligence
 - Creative and Immersive Narrative Generation
- 3:00-3:30: Break. Coffee etc.
- 3:30-4:15: A report back from each breakout group is given. 15 min each.
- 4:15-5:00: Open discussion.
- 5:00-5:15: Final remarks, next steps, etc.