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Editorial

Integration of cognitive systems across disciplinary boundaries

Ron Sun, Vasant Honavar, Gregg C. Oden

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The present issue is the beginning of a new journal – *Cognitive Systems Research* – which we have developed in response to what we perceive to be an unfilled niche in the current literature in the areas of Cognitive Science and Artificial Intelligence.

The rationale

Recent years have seen substantial growth in the study of cognitive and neural modeling, cognitive psychology, planning, robotics, language processing, neural engineering, machine learning, knowledge representation, uncertainty management, artificial life, and related areas. Unfortunately, this progress has also been accompanied by a fragmentation of the field into sub-disciplines devoted to studying specific aspects of cognitive phenomena often with contradictory assumptions, and using what are commonly perceived to be fundamentally different paradigms (e.g., symbolic artificial intelligence, neural networks, evolutionary computation, fuzzy logic). The resulting proliferation of separate journals and largely insulated research communities for different topics is, in our opinion, an obstacle to progress in this field.

While work on well-delineated sub-problems (e.g., planning, cognitive modeling) using specific theoretical tools (e.g., search or neural networks) of specific paradigms does help to make progress on the chosen problems, such efforts must be complemented by broader theories and models that integrate ideas, concepts, constructs, tools, and techniques drawn

from various sub-disciplines and paradigms in order to construct a coherent picture of how the various pieces fit together overall. Such a synthesis is essential to the discovery of designs for general cognitive systems. This is especially important at this early stage of development in understanding cognitive systems.

We feel strongly that the time is ripe for synthesis and integration. First of all, over the last couple of years, a significant number of researchers have begun to address problems of integrating models, theories, and systems developed within cognitive psychology, linguistics, symbolic and Bayesian artificial intelligence, artificial neural networks, evolutionary computation, and other areas. Numerous recent edited books, workshops at major international conferences, and special issues of major journals on this topic are indicative of the current interest in this area. Second, as important as integrating models and theories from different paradigms is the need for development of models and systems that seamlessly integrate several aspects of cognition and intelligent behavior (e.g., perception, action, language, learning, representation). Some of the recent work in intelligent agent architectures has begun to address problems in this area.

Despite the growth of research in such directions, at present there is no journal that adequately meets the needs of researchers in this broad field of cognitive systems. A major objective of this journal is to provide a forum for relatively rapid publication of rigorously refereed original research articles and comprehensive surveys in this area, with an em-

phasis on (1) the integration of a variety of approaches; (2) the synthesis of various sub-areas; and (3) the fostering of emerging approaches and areas.

The scope

The title of the journal indicates that it will be concerned with the study of the full variety of cognitive systems at different levels ranging from social/cultural cognition, to individual cognitive agents, to sub-agent cognitive systems (cognitive components and functionalities). The emphasis will be on models for such systems, at different levels of detail and from different perspectives, and especially on inter-model reductions and integration. Thus, the scope of the journal includes all the major topics in the study of cognitive processes, in both natural and artificial systems, with special emphasis on the use of new and existing approaches, ideas, and techniques from multiple disciplines as well as multiple research paradigms. In addition, the journal will also cover novel approaches to cognitive science and artificial intelligence. The journal will, as a major part of its mission, emphasize promising new topics and approaches. The journal will also seek contributions describing new results obtained within well-established paradigms if such work has broad implications and relevance.

More specifically, the journal will solicit and publish high-quality refereed articles that are geared towards an inter-disciplinary audience on topics such as

- problem solving – novel (or novel combinations of) approaches to problem solving (including planning, decision making, creativity and discovery) with special emphasis on parallel and distributed algorithms, neural, and stochastic approaches; integrated architectures for problem solving, learning and evolution in developing problem solving behaviors
- knowledge representation and reasoning – including representation of a variety of different knowledge types (including conceptual/linguistic, procedural, spatial, temporal aspects); scientific, mathematical, and commonsense knowledge; reasoning, especially commonsense reasoning (for deductive, inductive, and abductive inference and belief revision, including various logics); neural architectures for knowledge representation and reasoning; evolution of representations
- perception – including perception of different modality (visual, auditory and tactile) as well as selective attention, parallel and distributed algorithms and architectures, and psychological studies
- action – including models of planning, decision making, adaptive behavior, and action in complex dynamic environments
- memory – various forms of memory, including semantic and episodic memory; working memory; neural substrates of memory, memory organization in problem solving and learning
- learning – including traditional forms of learning, as well as new and integrated forms; neural and statistical approaches, and integrated active learning systems; learning of linguistic concepts (and language acquisition in general); discovery in scientific, mathematical and other domains; studies of interaction of learning and representation in artificial and natural systems; psychological models; performance studies; evolution of learning
- language and communication – including models of language acquisition, communication with multiple modalities, evolution of communication and language
- intelligent agents – integrated agent architectures for perception, learning, and action; situated cognition; evolutionary development of agent architectures; social and cultural behavior; robotic implementation; studies of motivational structures, emotions, awareness, and consciousness
- integrative studies of cognitive systems, including
 - multi-level analysis (ranging from neural substrates to behavioral phenomenology to evolution) of specific cognitive phenomena from psychological, developmental, social, neurobiological, and evolutionary perspectives
 - comparison, analysis, and synthesis of various paradigms in artificial intelligence and cognitive science
 - integrated theories of both natural as well as artificial cognitive systems
 - multi-disciplinary approaches to study of

creativity in domains such as arts, sciences, and mathematics

- multi-disciplinary approaches to study of emotional and motivational structures and their role in cognition
- multi-disciplinary approaches to study of awareness and consciousness in the context of cognitive systems

This broad scope is to be achieved by attracting high-quality contributions not only in all the traditional areas of study in cognitive science but also in the non-traditional and emerging topics and approaches at the frontiers of research on cognitive systems, from artificial intelligence, linguistics, psychology, psychiatry, philosophy, system and control theory, anthropology, sociology, biological sciences, and neuroscience. The journal seeks to provide an inter-disciplinary forum where relevant ideas are meshed together, compared, contrasted, and combined.

Editorial policies

It is our objective to make the journal as inclusive as possible in an attempt to promote inter-disciplinary interaction and integration in the study of cognitive systems without compromising quality. The journal will include the following sections:

1. refereed articles describing original research
2. short research communications
3. surveys or reviews of the state of the art (by experts in specific areas)
4. commentaries on the papers published in the journal
5. book reviews
6. conference reports

Each paper submitted will be assigned an *action editor*, who will be in charge of the refereeing process. Each paper will be reviewed by at least two reviewers, in addition to the action editor. In case of multi-disciplinary, integrated work, more reviewers will be used to ensure adequate assessment. Every effort will be made to ensure that submitted publications will receive fair and adequate reviews, in an inter-disciplinary way, in a timely fashion.

Concluding remarks

In summary, this journal aims to counter-balance the inevitable pressures towards increasing specialization that fosters insulated research communities for different subtopics. Given the importance of cross-paradigmatic interaction in the development of theories that offer a coherent picture of cognitive phenomena, a journal that seeks to promote inter-disciplinary integration has an important place in the marketplace for academic journals.

Ron Sun

CECS Department, University of Missouri at Columbia, 201 Engineering Building West, Columbia, MO 65211-2060, USA

Vasant Honavar

Artificial Intelligence Research Laboratory, Department of Computer Science, 210 Atanasoff Hall, Iowa State University, Ames, IA 50011-1040, USA

Gregg C. Oden

Department of Psychology, University of Iowa, Iowa City, IA 52242, USA