Computational Methods and Systems for the Cognitive Modelling and Support of Creativity and Creative Problem Solving

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Workshop Proposal

Computational creativity and human creativity [Finke et al., 1992, Boden, 2003] are fields modelled with different processes, and evaluated with different methods. To bridge this interdisciplinary divide, we need to (i) disseminate and refine existing computational methods for modelling cognitive processes, (ii) aim to implement more cognitive processes in computational creativity systems and (iii) set benchmarks of comparative evaluation between cognitive human and computational systems [Olteţeanu et al., 2016, Pease et al., 2001].

Various computational methods might lend themselves better to modelling cognitive processes - for example semantic networks might help model associativity processes, case base reasoning [Aamodt and Plaza, 1994] might help model cognitive structured representations which admit variations, etc. Furthermore, various (a) computational models of cognitive process or (b) systems aiming at replicating cognitive process results do exist: e.g. for analogy [Gentner, 1983, Falkenhainer et al., 1989], metaphor, concept blending [Confalonieri et al., 2016a, Fauconnier and Turner, 1998] and concept invention [Confalonieri et al., 2016b, Ontañón et al., 2012], insight [Hélie and Sun, 2010] etc. Also, various systems exist that can perform well in human creativity tests, like the Remote Associates Test [Mednick, 1962, Olteţeanu and Falomir, 2015] and the Alternative Uses test [Guilford, 1967, Olteţeanu and Falomir, 2016]. Other such computational cognitive systems show new possibilities in the improving control over current experimental design [Olteţeanu et al., 2017, Olteţeanu and Schultheis, 2017].

In this workshop we will discuss existing computational methods, systems and models, focusing on questions like the following:

(i) what computational methods are more suitable for implementing computational models of creativity and problem solving, and computational systems supporting creativity and problem solving;

(ii) what types of support can natural cognitive systems benefit from when performing creative problem solving and other creative acts;

(iii) what kind of computational support has been offered so far, what kind of computational support can be offered with the existing techniques and approaches;

(iv) to what extent computational methods must get closer to simulating or modeling cognitive process to make cognitive support possible.

Workshop Duration and Organization

We propose a half-day workshop for the presentation, discussion and elaboration of new computational methods and systems aimed to cognitively support creative problem solving and other creative processes.

The workshop will involve three elements:

(i) Four invited speakers will present existing methods and systems (details below).

(ii) Short presentations of papers and posters will be accepted on the topic.

(iii) The workshop will end with a panel discussion, focused on establishing future directions for methods and systems aimed at supporting creativity and problem solving.

Financial support: The organizer has obtained funds from the German Science Foundation (DFG) for the organization of this workshop, via the grant Creative Cognitive Systems (CreaCogs – OL 518/1-1). These funds will be used to partially support the travel or registration costs of the main speakers.

Publication: The papers submitted for this workshop will be published as a CEUR-WS volume. If enough high quality papers are received, a Special Issue will be proposed by the organizer to the *Cognitive Systems Research* journal, or a topic proposal will be made to TopiCS in Cognitive Science.

Topics for this workshop will be centered around, but not limited to:

- Cognitive methods and Computational methods
- Creative problem solving
- Computational Creativity
- Associativity and Conceptual Spaces
- Semantic networks and semantic graphs
- Case based reasoning
- Ill structured problem solving
- Structured representations
- Knowledge discovery
- Creative cognition
- Creativity tests
- Evaluation of natural and computational cognitive systems

- Neural networks
- Evolutionary algorithms
- Analogy
- Metaphor
- Creative assistive systems
- Modelling of creativity and problem solving

Speakers

- **Sebastien Helie** – Associate Professor of Psychological Sciences, Purdue University. Talk topic: cognitive architectures and creativity.
- **Ashok Goel** – Professor of Computer Science and Cognitive Science in the School of Interactive Computing at Georgia Institute of Technology. Talk topic: computational creativity.
- **Yoed Kenett** – University of Pennsylvania. Talk topic: network science and creativity.
- **Kai Wang** – Assistant Professor of Management, School of Management and Marketing, Kean University Talk topic: creativity support systems.

Organizer - Short biography

Ana-Maria Olteţeanu is the Principal Investigator of the Creative problem solving in cognitive systems (CreaCogs) project funded by the German Research Foundation (DFG) at the Freie Universitat Berlin, Germany.

Ana-Maria has a cross-disciplinary background: she holds a PhD in Musicology (2011) and a *summa cum laude* Doctorate in Cognitive Systems and Artificial Intelligence (2016). Her thesis got nominated for the EurAI Dissertation Prize, the Cognitive Science Society Glushko prize and won the 1st Prize by the OLB for the best Doctoral Dissertation in Science in NW Germany in the last two years (2017).

Ana-Maria authored more than 30 journal articles, papers and book chapters on the topic of creative problem solving. Her book *Cogs in the Creative Machine* is currently being peer reviewed. She has reviewed more than 40 papers for over 20 international conferences and journals. Dr. Dr. Olteţeanu has been a program committee member of 9 workshops and conferences in the field. She organized and chaired 3 Symposia/conference tracks, and is the editor of four volumes/special issues on creativity related topics. Ana-Maria's interests are related to cognitive systems, creative problem solving, cognitive modeling, knowledge discovery and spatial reasoning.

Recent Organizing and Editorial Experience

2018 – Guest Associate Editor for *Frontiers in Psychology-Cognitive Science* and *Frontiers in Artificial Intelligence and Robotics*, for the Topic *Creativity from Multiple Cognitive Science Perspectives* (with Bipin Indurkhya).

2018 – Guest Associate Editor for *Frontiers in Psychology-Cognitive Science* and *Frontiers in Artificial Intelligence and Robotics*, for the Topic *Creativity from Multiple Cognitive Science Perspectives* (with Bipin Indurkhya).

2017-2018 – Guest editor of the Cognitive Systems Research journal, for the special issue on *Problem-solving, Creativity and Spatial Reasoning in Cognitive Systems* (with Zoe Falomir).

2017 – Editor of the *Proceedings of the 2nd Symposium on Problem-solving, Creativity and Spatial Reasoning in Cognitive Systems*, CEUR-Ws vol. 1869 (with Zoe Falomir).

2017 – Co-organized the *ProSocrates - Problem solving, creativity and spatial reasoning in cognitive systems* Symposium, at the Hanse Wissenschafts-Kolleg, Delmenhorst, Germany.

2016 – Co-organized the *ProSocrates - Problem solving, creativity and spatial reasoning in cognitive systems* Symposium, at the German Cognitive Science Society conference - Space for Cognition, Bremen (Germany).

2016 - Local Chair for the Language session, KogWis 2016, Bremen (Germany).

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