Computational Creativity: an interdisciplinary approach.

Organisers:

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Description

Artistic creativity remains a mysterious, enigmatic subject — a "grand challenge" for Computer Science. While computers have exceeded the capabilities of humans in a number of limited domains (e.g. chess playing, music classification, theorem proofs, induction), human creativity generally remains unchallenged by machines and is considered a fundamental factor in our intellectual success. There is a sense that artistic creativity is somehow "special" in a way that could not be captured in an algorithm, hence implemented on a machine. This seminar aims to show that creativity is indeed special, but that it *can* be an emergent property of mechanical processes.

The seminar will address problems in *computational creative discovery* where computer processes assist in enhancing human creativity or may autonomously exhibit creative behaviour independently. The intention is to develop ways of working with computation that achieve creative possibilities unattainable from any existing software systems. These goals will be developed in the context of artistic creation (visual art and music composition), however the results may be applicable to many forms of creative discovery.

The specific seminar aims are to:

- Contribute to fundamental research on our understanding of artistic creativity in humans and machines;
- Develop new methodologies for creative design in digital media, with particular emphasis on evolutionary ecosystem dynamics, where new algorithms for creative discovery are inspired by biological processes;
- Bring together researchers from a variety of disciplines and backgrounds, with coverage across the arts and sciences, but with a common goal of furthering our understanding of how computers may generate creative behaviour, using an interdisciplinary approach.

Creativity is a vast and complex topic, investigated by many disciplines. In broad terms it involves the generation of something *novel* and *appropriate* (i.e. unexpected, valuable). In this seminar we focus on artificially creative systems, either simulated in software or software process working in synergetic tandem with a human artist. The necessary conditions for any artificial creative system must be the ability to *interact with its environment, learn, and self-organise,* and this is the basis of the seminar's approach.

Darwinian evolution has been described as the only theory with the explanatory power for the design and function of living systems, accounting for the amazing diversity and astonishing complexity of life. Evolutionary synthesis is a process capable of generating unprecedented *novelty*, i.e. *it is creative*. It has been able to create things like prokaryotes,

eukaryotes, higher multicellularity and language through a non-teleological process of replication and selection. We would like to investigate, on a metaphoric level, the mechanisms of biological evolution in order to develop new approaches to computational creativity.

Questions Addressed by the Seminar:

- How can we further our formal understanding of the artistic creative process in a variety of disciplines, including visual art and music? By inviting a group of leading creative practitioners in visual art and music, we hope to gain insight on how computational systems can be creative from the perspective of creative artists.
- How can evolutionary algorithms be extended to encompass heterogeneous environments and more complex process cycles? If evolution is a process for creative discovery, how can this process be adapted to human-creative domains (as opposed to biological ones)?
- What are the appropriate mappings and metaphors if we are to use biological process and systems as a basis for developing creative systems with computers?
- What is the best approach in developing autonomous creative systems (i.e. machines that exhibit independently creative behaviour).
- What are the appropriate methods and measures to objectively verify and validate creative behaviour in artificial systems.
- Which is the better approach to understanding creativity in discrete devices: combinatorial emergence (the understanding that creativity is the creative combination or recombination of previously existing elements) or creative emergence (creativity begins with knowledge, skill and abilities, and *emerges* from these faculties through interaction with the environment; new primitives emerge in the underlying system, leading to a transformation of the conceptual space).

Objectives and results expected to be produced by the seminar:

We intend to invite a gathering of many of the world's leading researchers in this area with a view to making a significant contribution to state-of-the-art knowledge in this area. We have selected researchers with expertise in artificial intelligence, agent-based modelling, evolutionary algorithms, fine art, music composition, cognitive science and philosophy. We will request each participant to develop a position paper that addresses one or more of the research questions stipulated above. Following on from the seminar we would expect to edit a new scholarly book in the area of computational creativity that explores the topics discussed at the Dagstuhl seminar in greater depth.