Using an Artificial Social Context for Evaluating Creative Output

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Abstract

This summary outlines my PhD research direction. The aim is to explore if an artificial social context could inform the (automated) evaluation of creative output. This project approach is to develop an agent-based social simulation and model social dynamics and interactions combined with modern AI/ML techniques. I've identified three core aspects that this project will be built around Adaptation, Intention and Evaluation and developed a three-phased plan to explore these interdependent aspects.

Introduction

The creative genius as the sole instigator of creative output is a romantic notion, but even the output of a creative genius is shaped by the work of others. The social aspects of creativity have been widely established in the psychology literature (Martindale 1990; Vygotsky 2004; Gardner 2011; Csikszentmihalyi 2014). Even though many stress the importance of the social context of creativity, many creative systems or agents still operate individually.

Computational Creativity (CC) aims to understand what it means to create and where the creative processes occur through any computational means. This goal is not limited to modelling human creativity, but also investigating creativity as it could be. A major problem in the field is the definition of creativity itself. As an essentially contested concept (Gallie 1955) creativity has a variety of meanings. With the lack of a clear and singular definition, how do we then qualify something as creative? Boden (2004) argues that something is creative if its novel, surprising, and valuable. Colton (2008) established the creative tripod arguing for skill, appreciation, and imagination as the key criteria. We found ways to measure some of these criteria, for example, novelty (Martindale 1990; Saunders and Gero 2001), but how do we measure something like value or imagination? I would argue that these criteria are highly dependent on social context.

Creativity evaluation is a particularly hard problem to tackle without a formal definition. However, this is generally also the case for humans, especially for the artistic domains, which are usually ill-defined. Current creativity evaluations or evaluations of creative output focus on humans-in-the-loop experiments or through a survey or panel of judges. These evaluations are then carried out by choosing a working definition of creativity that fits within the scope of the respective research. Internally, creative systems use measures that focus on the artefact, but with the lack of interaction with a social context, artefacts themselves contain very little information on their own.

The doctoral project summarised here aims to develop novel approaches for (automated) evaluation of creative output leveraging social information. For this purpose, I'm proposing to develop an agent-based social simulation to explore how to combine an artificial social context with modern AI/ML techniques. The hypothesis is that modelling social dynamics and interactions allows for (automated) evaluations of creative output that can possibly explain how that evaluation came to be.

Three Core Aspects

To guide the doctoral project, I have identified three aspects that will be explored across three phases.

Adaptation The first aspect focuses on the structure of the CC agent or system. The goal is to define the requirements so that the system can adapt to and embed new information that subsequently informs the generation of a future artefact. The structures that I will explore are parameter-based, such as Variational Autoencoders (Kingma and Welling 2014), Generative Adversarial Networks (Goodfellow et al. 2014), and topology-based, such as NEAT (Stanley and Miikkulainen 2002), Weight Agnostic Neural Networks (Gaier and Ha 2019). Swarm-based models (Hanna 2005; Bishop and Al-Rifaie 2016) might be another interesting structure to explore. A challenge is how to update these structures in such a way that CC agents produce typical and domain-valid output. In essence, the goal is to induce meaningful concept drift and a method to adapt to it.

Intention The second aspect is about how CC agents and systems perceive their environment and each other. Why was an artefact created? What do other agents or systems think about an artefact? The aim is to generate social information given a suitable structure and develop measures that allow the agents to use and act upon that information autonomously.

Evaluation Finally, the two aspects above come together in the evaluation aspect. Evaluation is essential for any CC system or agent, and this aspect aims to understand how to apply the social information and chosen structure for evaluation purposes.

The goal of this research is not to develop a social creativity framework towards artificial general creativity, but rather an approach to work around the issues of working with ill-defined (artistic) domains and develop novel approaches towards evaluation and using AI/ML techniques for CC purposes.

Work Plan

The research plan consists of three phases that explore the individual, social, and cultural levels of the project. The experiments in each phase are scoped by the key aspects mentioned in the previous section.

Phase 1 This first phase aims to investigate the compatibility of individual CC systems or agents within (artificial) social environments. The goal is to define requirements for the structure of the CC system/agent, and investigate which structures are suitable. How can agents use their structure to embed and perceive artefacts? How do they then generate novel and domain-valid artefacts?

Phase 2 The second phase follows up by exploring different communication policies and how these affect the evaluation of artefacts. How is domain knowledge shared and selected by agents? What social information is required? The experiments should consider not just the evaluation by the current agent, but also consider how other agents evaluate that same artefact.

Phase 3 The third final phase examines how domain knowledge is embedded in the artificial creative society and its impact on evaluation and vice versa. Experiments focus on the maintenance and distribution of domain knowledge.

Currently, the simulation will be applied in the domain of music and/or language. Music is suitable because it is well-defined for certain genres, and language is interesting because it could provide some explainability. Finally, this will result in a framework and its assumptions will be verified and validated against existing knowledge in CC.

Related Work

As mentioned in the introduction, in the psychology literature, creativity as a social phenomenon has been widely established (Martindale 1990; Vygotsky 2004; Gardner 2011; Csikszentmihalyi 2014). Moreover, social interactions and communications is one of the 14 key components for the evaluation of a creative system (Jordanous and Keller 2016). The challenges and research goals for integrating social factors in CC research have been outlined in the subfield Computational Social Creativity (Saunders and Bown 2015).

Relevant to the current proposal is the duality of generative and adaptive creativity (Bown 2012). Generative creativity is creating artefacts without regard for value. Adaptive creativity is the opposite, creation for the benefit of the creator. This means that an individual adapts to its creation, changes some structure, and subsequently, influences future output. Bown argues that individuals are never generatively creative. However, some cases might qualify a generatively creative, for example, creation in the mind which has no effect on the environment. Adaptive creativity then occurs on both the individual and social levels. The division between generative and adaptive creativity is therefore not mutually exclusive and can coexist in the same system, given that they are identified as separate processes. A critique of this duality is that it is based on a strictly anthropocentric view (Guckelsberger, Salge, and Colton 2017) and is difficult to apply to machines. Instead, Guckelsberger et al. (2017) argue to focus on intentional agency, so the system might answer "Why" something is creative. To understand computational creative processes and products, then this is where we should start. This research direction is, in turn, valuable for human creativity. However, one wonders, how do we bridge the explanatory gap?

In CC research, evaluation is an essential research area (Colton and Wiggins 2012) and key to determining if a CC system or agent is successful. There are several methods of assessing creativity, for example, the FACE/IDEA descriptive frameworks (Pease and Colton 2011). The most extensive framework for that purpose is SPECS developed by Jordanous (Jordanous 2012). The 4Ps framework was originally developed by Rhodes (1961) and has later been adapted to include computational systems through changing person to producer (Jordanous 2016). The 4Ps are particularly appealing because it specifically considers a system using a broad perspective through different lenses: producer, product, process and the press/environment. These frameworks could inspire how evaluation in an artificial creative society could be modelled, however, we should be careful to consider that machine creativity might be very different from human creativity.

Current Work

This proposal finds its origin in a current work (Peeperkorn et al. 2022) exploring the use of Variational Autoencoders (VAE) (Kingma and Welling 2014) as a computational model for conceptual spaces (Boden 2004; Gärdenfors 2004) which is to be presented at ICCC'22. In this work, an agent-based social simulation was developed to investigate if VAEs can adapt and maintain their latent spaces to the interactions between computational agents. The pilot study and the initial results proved encouraging for future research.

Conclusion

This summary outlines the current approach for my PhD research. The project seeks to develop an agent-based social simulation to explore the use of an artificial social context to inform the evaluation of creative output. Next, the focus is on a literature review and running various experiments to further explore the possibilities, feasibility and operability of the ideas presented.

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