Declarative Spatial Reasoning for Intelligent Cinematography

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Abstract

We present computational visuo-spatial representation and reasoning from the viewpoint of the research areas of artificial intelligence, spatial cognition and computation, and human-computer interaction. The particular focus is on demonstrating recent advances in the theory and practice of spatial reasoning, and its significance and potential as a foundational AI method for (intelligent) computational cinematography & editing systems.

Categories and Subject Descriptors (according to ACM CCS): I.2 [Artificial Intelligence]: Knowledge Representation Formalisms and Methods—Relational Systems

Hypothetical reasoning is a form of counterfactual inference —the ability to consider alternate possibilities— that is useful in numerous creative design, planning, and problem-solving areas. Within a dynamic spatio-temporal context, this form of inference necessitates the ability to model computational reasoning capabilities encompassing *space, actions,* and *change* [Bha12]. Here, of special significance is reasoning with ontological primitives such as spatial objects and relationships, events & actions, motion patterns.

In [BF10], we presented a very first proof-of-concept on realising this kind of hypothetical reasoning in the context of a rather specific problem: that of (qualitative) spatio-temporal scenario and narrative completion realised in the context of the (discrete) Event Calculus, a high-level formalism for representing and reasoning about actions and their effects. The approach was demonstrated using a (toy) example from the domain of automatic (virtual) cinematography / story-visualization and story-boarding, where the objective is to control camera / perspectives and animate a scene on the basis of apriori known film-heuristics and partial scene descriptions available from discourse material. Albeit naive, underlying the example scenario stood a systematic ability to perform spatio-temporal abduction in a generic context.

Declarative spatial reasoning –in a nutshell– denotes the ability to (declaratively) specify and solve real-world problems related to mixed geometric and qualitative representation and reasoning about space and motion. In this proposed presentation, we demonstrate:

- the manner in which our position on the theme of spatio-temporal abduction has developed further, leading to a new family of declarative spatial representation and reasoning methods and tools, e.g., CLP(QS) [BLS11], ASPMT(QS) [WBS15], rooted in state of the art methods in knowledge representation and reasoning
- the implications and possibilities of robust, scalable declarative

spatial representation and reasoning particularly for the field of Intelligent Cinematography and Editing.

This presentation will utilise work-in-progress case-studies aimed at show-casing the concept of *declarative spatial reasoning* on the one hand, and its proof-of-concept application for commonsense reasoning about the "search" and "realisation" of scene staging patterns based on conceptual domain specific and independent heuristics, e.g., encompassing cinematographic rules, empirically established visual perception and recipient effects etc [SBY16].

References

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