Proceedings of the Fifteenth AAAI Conference on Artificial
Intelligence and Interactive Digital Entertainment (AIIDE-19)

Interactive Narrative Authoring Using Cognitive Models in Narrative Planning

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Abstract

My research aims to allow for human authors to collaborate with a computational system to work on narrative generation. This will be done with the help of work done in the domains of narrative understanding, narrative planning and reasoning based on cognitive models. This sort of approach would greatly benefit the enrich growing set of variables of narrative planning.

Introduction

Narrative authoring is a long and tedious process: a lot of thought goes into creating the plot, designing the characters to tell an interesting story, and then presenting the story in a way to evoke the intended emotions from the audience. A story-writer uses their creative thinking to come up with characters that feel well-defined, and situations that are interesting and novel. Then the writer must also ensure that their plot is consistent: are there any inconsistencies in the story world created? Are the actions performed by character justified by their motivations? Is the plot presented in a manner that allows for the reader or viewer to follow the narrative and feel the intended suspense or drama of the moments in the narrative? These are just a few of the questions a writer must ask themselves while creating a narrative.

The domain of computational narratives considers similar questions while focusing on using computational methods to generate narrative. Work in narrative planning has been effective at borrowing policy planning and state-space search algorithms from AI in order to generate plot.Narrative planners use planning build plot and further replicate common features of narrative, such as manipulating conflict (Ware et al. 2014), incorporating character plan failure (Thorne and Young 2017), and preserving character intentionality (Riedl and Young 2010). These algorithms use AI planning strategies and apply them towards narrative and world-building. They are also applied to discourse, allowing systems to generate complex discourse patterns for narrative (Barot, Potts, and Young 2015).

To this end, I am interested in bringing these tools for computational narrative generation to assist a human author. I argue that generation of narratives would work best with a hybrid approach: computational models of narrative planning can generate the structural properties of narratives, and the human author focuses on the creative aspects and guides the planner towards more interesting or desired narratives. The process would be an interactive process where both the human author and the computational narrative generator can collaborate to generate narrative.

Previous Work

Story generation approaches initially leveraged AI planning to create plot lines, but were limited to the expressivity afforded in conventional real-world task-planning algorithms. To enrich impoverished plan representations, narrative planning research has incorporated additional constructs into the planning process to support aspects of character intention management. IPOCL (Riedl and Young 2004) added an explicit representation of *intention frames*, groupings of actions performed by a character in furtherance of a single goal. Extending IPOCL, Ware and Young (Ware and Young 2011) introduce a model of conflict wherein characters may undertake actions which thwart the intentions of other characters operating in the plan. The planning algorithm that they define, called Glaive (Ware and Young 2014), constrained plans so that they might also contain actions across frames of commitment that interfere with one another. Teutenberg and Porteous also added the ability to allow for characters in stories to act as their own planning agents (Teutenberg and Porteous 2013). Thorne and Young (Thorne and Young 2017) added the ability for planners to encode plan failure as part of narrative, as characters failing at their intentions is a common property in narratives.

Computer-assisted authoring is also growing towards understanding stories and providing real-time feedback. Creative Help (Roemmele and Gordon 2015) is a tool that attempts to give possible continuations to a story and serves as a creative writing assistant. LISA aims to assist story writers by providing real-time feedback on logical inconsistencies in the story (Sanghrajka et al. 2017) with the help of handcoded set of logical rules in the story world. The CARDINAL system (Marti et al. 2018) performs script previsualization and also allows for interaction with the story through question answering (Sanghrajka et al. 2018). Aesop (Meo et al. 2019) also allows for building stories through conversations with an AI agent. Recently, Mimisbrunnur (Stefnis-

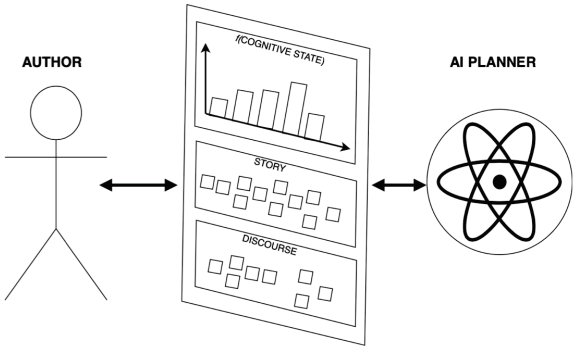

Figure 1: Proposed interactive narrative authoring framework. The AI planner and human author work collaboratively on the same narrative domain, with ability to make changes to the story, discourse and the cognitive states.

son and Thue 2018) uses planning to provide narrative feedback to the author on plot outlines.

There is relevant work in cognitive psychology on narrative comprehension (Branigan 2013; Porteous et al. 2017). Studies in narrative comprehension come up with various models about what readers track while experiencing a story (Kurby and Zacks 2008; Radvansky and Zacks 2017; Zwaan, Langston, and Graesser 1995). Creative writing instruction and film editing provide valuable information about discourse techniques to highlight certain aspects of story to invoke specific cognitive recognition and response from the audience (Magliano and Zacks 2011; Gerrig and Bernardo 1994). Work in narrative planning that accounts for such cognitive features is also relevant and serves as a guideline for future work in this domain (Bae and Young 2014; Cheong and others 2007).

Approach

In order to develop tools that allow for collaborative narrative authoring between human and a computational system, I believe that I need to work on the various components of this research problem and then work on connecting them together. The components of this problem involve working on narrative understanding, narrative planning, and reasoning about cognitive models in narratives.

Narrative Understanding

In the domain of narrative understanding, researchers are working on problems of story understanding (Mostafazadeh et al. 2017). There is still work that needs to be done in this field to be able to understand high-level story information.

As an undergraduate, I developed the LISA system (Sanghrajka et al. 2017), addressing a related problem in narrative information extraction – the use of natural language processing methods to identify events and other features of a story from a story text. LISA's design extends previous work (Valls-Vargas 2016) to use logical reasoning to make inferences about events in a textual story. During a subsequent internship at Disney Research, I extended this work by proposing a theoretical model for knowledge extraction and reasoning of movie scripts (Marti et al. 2018; Sanghrajka et al. 2018), and integrated these methods into an intelligent scriptwriting tool for scriptwriters being developed by Disney. While this approach has shown promise, the work focused on representations of story structure rather than discourse structure. I hope to connect the knowledge representation of the above approach to planning domain-compatible representations. The goal is to be able to create representations needed as input for planning algorithms from the output of narrative understanding components.

Narrative Planning

Narrative planning methods need to work towards generating narratives which have structural properties similar to narratives authored by human authors. This will help in generating more interesting narratives and also allow the narrative planners to understand the kind of features an author might desire in their story.

Currently, I am working on the implementation of a story planner called HeadSpace (Thorne and Young 2017; Young 2017), which allows for characters in a narrative to create plans based on a perceived world state which may not be the same as the real world state. This leads to characters coming up with possibly flawed plans which could fail. The planner also allows characters to reevaluate their knowledge when their actions fail, and come up with a new plan to achieve their goals. It lets characters formulate multiple plans to achieve their intentions, and enforces that actions performed by these characters are performed strictly in order to meet one or more of their intentions.

Cognitive Models

I hope to use cognitive models as a tool for the author to refer to, and use them towards the narrative planning aspect of the interactive authoring approach. My goal in this component will be to study approaches in measuring various cognitive states from narrative text. The Natural Language Processing community has work in affective event extraction, and I hope to be able to add such capabilities in stories (Goyal, Riloff, and Iii 2013; Lehnert 1981). Another part of this goal will be to use the cognitive measures extracted and then use them in the narrative planning part of the authoring process (Cardona-Rivera et al. 2012). Work in this field has been done for cognitive models such as suspense (Gerrig and Bernardo 1994). I hope to be able to connect this component to be able to leverage these models along with the planning methods developed.

Future Work

There are quite a few challenges that pertain to the work proposed above. First, I need to look at how a system that integrates the above components would function: what would the user interface look like? Figure 1 gives a vague idea of the working of a system of such capability, but further work needs to be done on the design of such form of human-computer interaction. Another challenge lies in evaluation: evaluation metrics for such a system would also need to be addressed in future work.

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