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PaSSAGE: A Demonstration of Player Modelling in Interactive Storytelling

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Abstract

This demonstration presents PaSSAGE (Player-Specific Stories via Automatically Generated Events), an Artificial Intelligence system that uses player modelling to dynamically select the content of an interactive story. Through player modelling, PaSSAGE provides game designers with the opportunity to delay some of their design decisions to run-time, allowing further refinement based on an automatically learned model of its current player's preferences. The hands-on component of this demonstration allows players to interact with a PaSSAGE-created story while simultaneously observing its inner workings on a secondary screen.

Introduction

In the video game industry at present, many designers are constrained by the need for their games to sell well. Given the goal of creating products with sufficiently wide appeal, their decisions must aim to meet either the preferences of a "typical" player in their current target genre, or a wide variety of the individual preferences that are held by some players, but not all. With the former approach, designers risk alienating the many potential players whose preferences fall outside of the average set; *i.e.*, in video games, one size does not fit all. With the latter approach, two design techniques are common: either the player is forced sequentially through a wide variety of content (*e.g.*, *Half-Life 2*), or many alternatives are simultaneously made available to the player on a (semi-)regular basis (*e.g.*, *Oblivion*). With the first technique, gameplay often alternates between preferred and less preferred (or even *disliked*) sections of content, trading off high player satisfaction in some sections with low player satisfaction in others (*e.g.*, platform jumping versus combat in *Half-Life 2*). With the second technique, the (necessarily) large number of available alternatives can easily hinder players' attempts to find the kinds of content that they enjoy (*e.g.*, particular side-quests in *Oblivion*). Without any knowledge of the current player's preferences, it is difficult for game designers to ensure an enjoyable player experience.

Supposing that designers *did* have access to the preferences of the current player, what might it be possible to accomplish? Being no longer limited to achieving generally wide appeal, the designers could delve more deeply into their knowledge of how well each element of their content would suit a particular current player, and tailor their decisions to align well with her personal tastes and desires. As a result, one might expect to produce a game which, in addition to showcasing the talents of its designers in terms of its customized detail, would also be more enjoyable for each individual player to play. The primary caveat to this endeavour is a problem of timing; while the vast majority of design decisions are made long before a game ever ships, the preferences of the current player are only available while the game is being played - seemingly too late to be used as an influence in design. To solve this problem, the designers' decisions must be delayed until run time, and they must therefore be made by an Artificial Intelligence system.

PaSSAGE

In this demonstration, we present PaSSAGE (Player-Specific Stories via Automatically Generated Events), an Artificial Intelligence system designed to dynamically select elements of content in a video game based on an automatically learned model of its current player's preferences. In effect, PaSSAGE acts as a proxy for game designers by delaying their decisions until run-time; the longer the delay, the more information about the player's preferences will be available when making each decision, potentially improving the quality thereof. The following subsections describe how PaSSAGE delays designers' decisions by learning and using a model of its current player's preferences.

Player Modelling

When a player is given the opportunity to choose between elements of content within the context of a game (as in *Oblivion*), one might suspect that her choices could help to indicate the preferences that she holds. Assuming this suspicion to be true, the process of acquiring a model of the current player's preferences needs only a mapping from elements of game content and potential player preferences (*e.g.*, players who seek out (enjoy) monster ambushes might prefer to engage in combat). Fortunately, the converse of this mapping is precisely the set of knowledge that game designers traditionally use to inform their game's design (*e.g.*, players who prefer combat will enjoy being ambushed by monsters). By reversing this mapping and encoding it as preference annotations on elements of game content, PaSSAGE is able to both learn and use a model of the player's preferences automatically, at run-time. The learning process continually updates the model, and the model is used to carry out the decisions that the game's designers *would* have made, had they known the current player's preferences in advance.

Interactive Storytelling

PaSSAGE is currently focused on decision-making for Interactive Storytelling - the process of dynamically creating a story whose events depend on both the initial intentions of the story's authors *and* regular interactions with the story's audience. In the context of video games, single player role-playing games are well suited to story-based play. It it often the case, however, that the player's actions in such games matter extremely little in terms of the progression of the story's plot. By contrast, Interactive Storytelling aims to create experiences which afford high player *agency*; that is, players should ideally have the sense that their actions within the game are influencing the ultimate outcome of the story being told. In the domain of entertainment, players' story experiences should also be *fun*.

Using Annotations

As outlined above, PaSSAGE operates based on a set of designer-supplied preference annotations. More specifically, two types of content are annotated: available player actions, and potential story events. Annotations on player actions encode how strongly those actions are indicative of each of five styles of play (**F**ighter, **M**ethod Actor, **S**toryteller, **T**actician, **P**ower Gamer), which are borrowed from Laws' guide for pen-and-paper role-playing games (Laws 2001). When the player performs an annotated action, PaSSAGE revises its model of the player (maintained as a vector of scalar values, one for each style of play). Annotations on story events encode the suitability of that event for each of the given five styles of play (*e.g.*, an encounter with monsters who guard a powerful sword might be annotated as ($\mathbf{F} = 4$, $\mathbf{M} = 0$, $\mathbf{S} = 0$, $\mathbf{T} = 0$, $\mathbf{P} = 4$), showing that this event would be well-suited to fighters and power gamers, but of neutral value to players who favour the other styles of play. When the next event in the story should occur (as guided by the phases of Campbell's Monomyth (Campbell 1949)), PaSSAGE calculates the overall suitability of each available event as an inner-product between its annotation and the current values in the model. For the details of this calculation along with a review of related techniques, please consult our previous work (Thue, Bulitko, & Spetch 2008).

User Study

At AIIDE'07, we presented the results of a human user study designed to test PaSSAGE's ability to create interactive stories against two stories having predetermined structures (Thue *et al.* 2007). In brief, we found that for players with low prior experience playing video games who rated their story experience as being "easy to follow", with 91% confidence, PaSSAGE's stories were more fun, and with 87% confidence, PaSSAGE's stories afforded better agency.

Demonstration Overview

This hands-on demonstration provides players with the opportunity to directly experience a PaSSAGE-created story, implemented as a custom module in *Neverwinter Nights*. During gameplay, the effects of the player's actions are depicted graphically on a secondary monitor. The player model is represented as bar graph with one bar for each style of play; annotated player actions result in immediate adjustments to one or more bars in the graph (Figure 1). Whenever PaSSAGE is about to select a new event in the story, the set of candidate events (along with their author-supplied annotations) appear below the image of the player model, and the event with the highest suitability is highlighted.

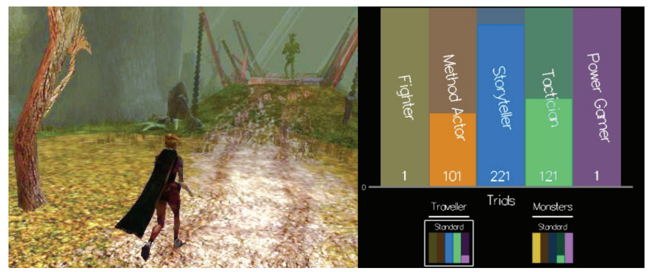

Figure 1: PaSSAGE's game and Player Model Viewer.

Conclusion

In this demonstration, we illustrate the operation of PaSSAGE, an Artificial Intelligence system created to delay the decisions of game designers until the run-time of their game - the time at which information about the current player can be leveraged to provide a more enjoyable, customized gameplay experience. Focusing on Interactive Storytelling, PaSSAGE uses annotations on the player's actions to build a model of her preferred styles of play, and then uses that model (along with play-style annotations on possible story events) to decide what should happen next in an interactive story. Participants in this demonstration have the opportunity to play a short story created by PaSSAGE while observing its operation on a secondary screen. By presenting PaSSAGE's model updates and event selections visually in real time, this demonstration provides strong insight into the inner workings of its modelling and storytelling techniques.

Acknowledgements

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References

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