Techniques for AI-Driven Experience Management in Interactive Narratives

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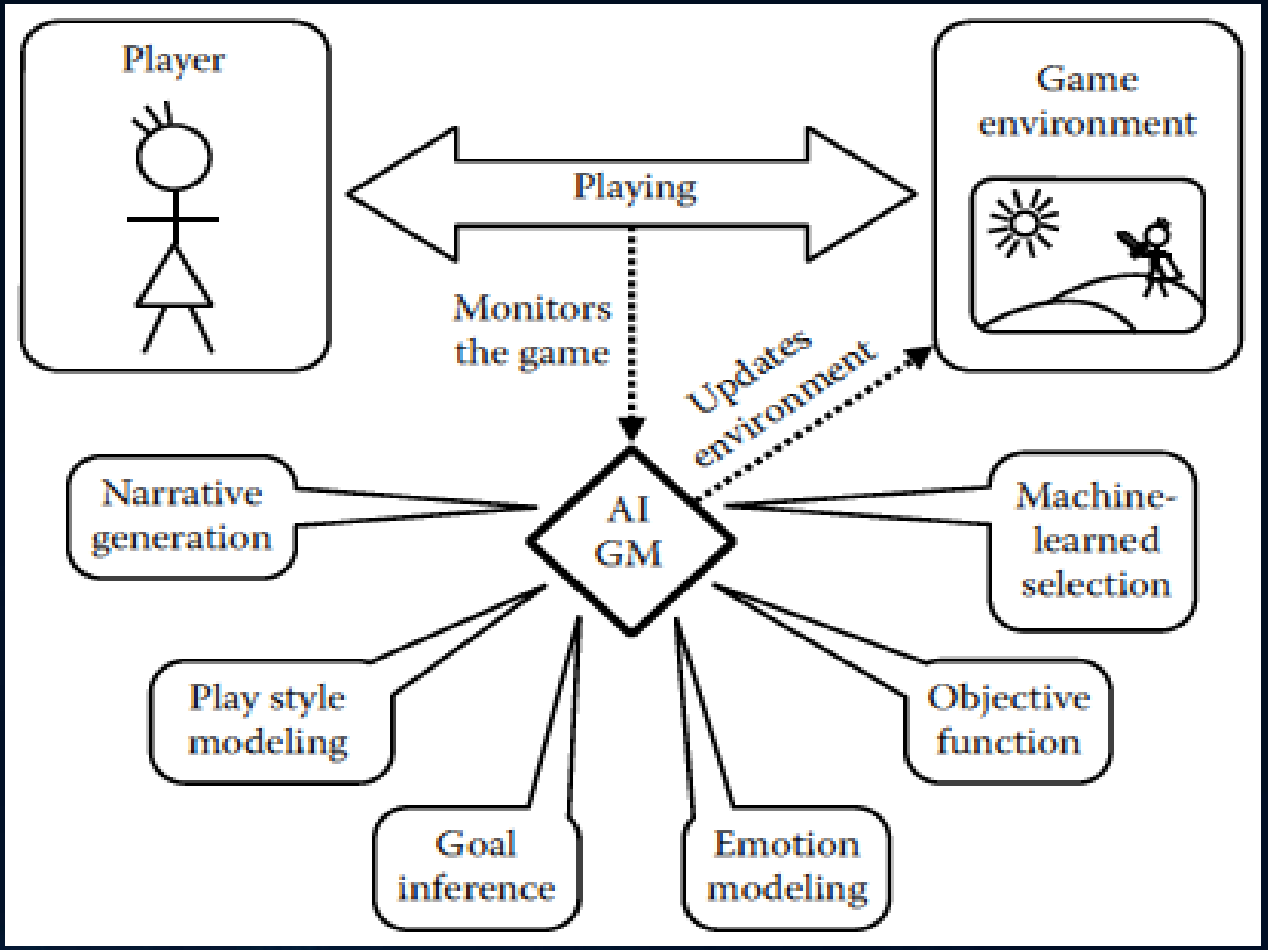
Little Red Riding Hood

- Red brings cake to grandmother
- Comes across to the wolf
- Wolf eats Grandmother

- What would be happen if the Red kills the Wolf?

AI-Driven Experience Management Techniques

General Overview



Introduction

- AI for automated story generation
- Author's goals vs. Player's goals
- AI GM (Game Master)
- Generate stories dynamically
- Select based on play style, goals, emotions, …

AI-Driven Experience Management
Planning Domain Definition Language (PDDL)

```
(define (action eat)
    :parameters (?eater ?eatee)
    :precondition (and (knows ?eater ?eatee)
                       (predator ?eater)
                       (alive ?eatee)
                       (alive ?eater)
                       (not (eaten ?eatee))
                       (hungry ?eater)
                       (person ?eatee))
    :effect (and (eaten ?eatee)
                 (in ?eatee ?eater)
                 (not (hungry?eater))))
```

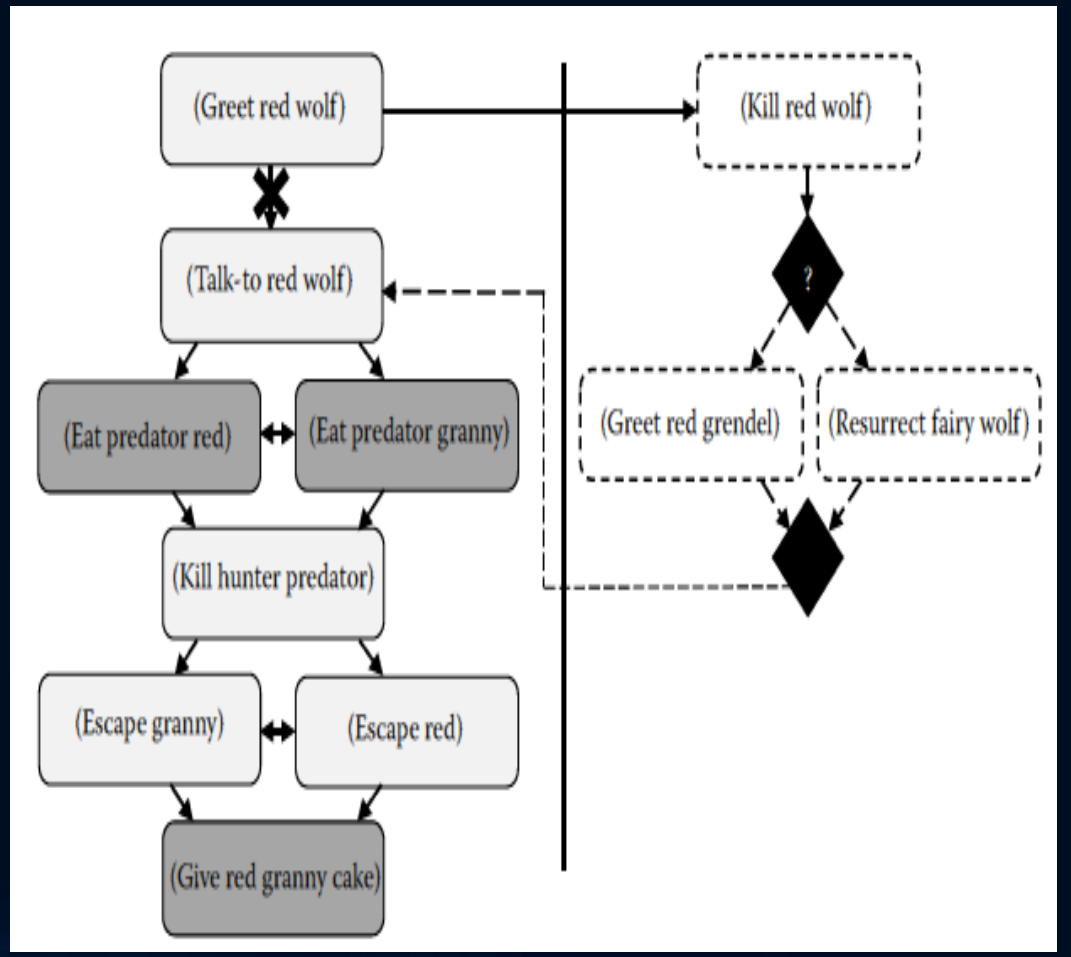
- Parameters
- Preconditions
- Effects

AI-Driven Experience Management Techniques
General Overview

- General Overview
- Narrative Generation
- Play Style Modeling
- Goal Inference
- Emotional Modeling
- Objective Function Maximization
- Machine-Learned Narrative Selection

AI-Driven Experience Management Techniques
Narrative Generation

- Automated Planner
- AI Planner assembles start-to-finish narratives during gameplay
- Consistency between GM goals and player goals
- Satisfaction of particular story
- Dynamically and real time



AI-Driven Experience Management Techniques
Play Style Modeling

- Narrative selection
- Modeling the player as vector of numbers
- Canonical RPG Types (F:0.9, M:0.2, S:0.1, T:0.4, P:0.3)
- AI GM observation
- AI GM real time update

AI-Driven Experience Management Techniques
Goal Inference

Play Style Inclination	Goal 1: Kill Grendel	Goal 2: Avoid Grendel
Fighter	0.9	0.1
Method actor	0.7	0.3
Storyteller	0.2	0.6
Tactician	0.4	0.8
Power gamer	0.6	0.1

$$\begin{pmatrix} 0.9 & 0.7 & 0.2 & 0.4 & 0.6 \\ 0.1 & 0.3 & 0.6 & 0.8 & 0.1 \end{pmatrix} \times \begin{pmatrix} 0.9 \\ 0.2 \\ 0.1 \\ 0.4 \\ 0.3 \end{pmatrix} \approx \begin{pmatrix} 1.31 \\ 0.56 \end{pmatrix}$$

- To AI GM infer the player's current goals
- Player inclinations
- What happens if a new killer would be introduced?
- The player model
  (F: 0.9, M: 0.2, S: 0.1, T: 0.4, P: 0.3)
- Normalization of $\begin{pmatrix} 1.31 \\ 0.56 \end{pmatrix} \cong (0.7, 0.3)$

AI-Driven Experience Management Techniques
Emotional Modeling

- Having idea about player's current emotions
- Appraisal-style model of emotions
- (J:0.8, H:0.6,F:0.2, D:0)
- An appraisal-style model needs to know the player's goals and the likelihood of accomplishing
- Example; kill or avoid Grendel (0.7, -0.3),
  player has 50% chance kill and 10% of dying,
  hopeful at the intensity of 0.5 × 0.7 = 0.35
  No longer hope, but joy.
  Killing is uncertain, there is no joy from it yet.
  Fear 0.1 * 0.3=0.03

  Final: (J:0, H:0.35, F:0.03, D:0)

AI-Driven Experience Management Techniques
Objective Function Maximization

- Annotation of narratives with respect to different styles of play
- Example, *introduce Grendel* (F: 0.9, M: 0, S: 0, T: 0, P: 0)
  introduce magic fairy (F: 0, M: 0, S: 0.9, T: 0, P: 0)
- Dot product between the player inclination model and each annotation
- The narrative with the highest dot product
- $(0.9 \quad 0 \quad 0 \quad 0 \quad 0) \cdot (0.9 \quad 0.2 \quad 0.1 \quad 0.4 \quad 0.3) = 0.81$ *(introduce Grendel)*
  $(0 \quad 0 \quad 0.9 \quad 0 \quad 0) \cdot (0.9 \quad 0.2 \quad 0.1 \quad 0.4 \quad 0.3) = 0.09$ *(introduce magic fairy)*

AI-Driven Experience Management Techniques
Machine Learned Narrative Selection

- Automatically acquire a mapping from game and player states to the set of alternative narratives
- Appropriate when training data are available
- Example, Similar with how Internet search engines map user queries to a ranked list of web pages
- Implemented by SCoReS approach

Implementation Approaches

- PaSSAGE *(Player-Specific Stories via Automatically Generated Events)*
- PAST *(Player-Specific Automated Storytelling)*
- PACE *(Player Appraisal Controlling Emotions)*
- SCoReS *(Sports Commentary Recommendation System)*

Implementation Approaches
Player-Specific Stories via Automatically Generated Events (PaSSAGE)

- An interactive storytelling system
- Uses player modelling to automatically learn a model of the player's preferred style of play
- Combines two techniques:
  - play style inclination modeling
  - maximizing a simpler version of the aforementioned objective function
- Chooses among story branches

Implementation Approaches
Player-Specific Automated Storytelling (PAST)

- Combines the AI planner of Automated Story Director (ASD) and the playstyle model of PaSSAGE
- Uses a PaSSAGE style model of playstyle inclinations
- Automatically update from the player's actions
- Automated Story Director (ASD) to compute narratives

Implementation Approaches
Player Appraisal Controlling Emotions (PACE)

- Uses four techniques of narrative generation
  - play style modeling
  - goal inference
  - emotion modeling
  - more advanced type of the objective function
- selects the narrative that brings the player closest to the target emotional trajectory
- Example, *iGiselle*

Implementation Approaches
Sports Commentary Recommendation System (SCoReS)

- Machine-learned narrative selection
- Automatically suggest stories for commentators to tell during games
- Selects story within library in sport games
- Learns offline to connect sports stories
- Learned mapping is then used during baseball games to suggest relevant stories

Conclusion

- Conflict between authorial and player goals
- AI GM and Automated Planning System
- Story selection and generation approaches
- Implementations