Interactive Storytelling for Fun and Training

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Outline

- Problem Formulation
- Our work
- Applications
Problem Formulation

- **Problem**
  - to develop deeply interactive video games / multimedia training systems

- **Hypothesis**
  - if you know something about the **specific** player/trainee
  - then you can improve **their** gaming/training experience

- **Cannot enclose game master with every game/MOOC**
  - need **AI**
  - for **player-specific** gaming/training
Open-world gaming is the current trend. Yet an emotionally engaging story and character development is desired. Dragon Age: Inquisition.

Traditional methods may not work very well due to player's control over the story. Character foil which involves PC.
Framework

- Player/trainee in an immersive multimedia environment
- his/her experience is managed dynamically/on-line
  - by an AI manager
    - models the player/trainee
    - uses the model to select the next bit of content
    - to follow authorial constraints
- AI-based experience management
1996 - 2000: Intelligent Training Systems

- Training for damage control aboard naval vessels
  - simultaneous crises, uncertainty, stress, teamwork
- Real-life training: rare, expensive and dangerous
- Need immersive multimedia training
- AI for:
  - providing instructional feedback to the trainee
2007 - present: Emotion and Culture Modeling

- Emotions need to be modelled procedurally
- mapping from actions to emotion states
- appraisal model of emotions
- resource model of emotions
- EMA + CAB = CEMA
- Now combining CEMA + COR-E
2007 - present: Play-style Modeling

- Model the player’s inclinations
- RPG style
- Select content which is most aligned to with play style
- PaSSAGE
  - shown to increase the player’s fun
Congratulations, students.
2011 - present: + AI Planning

- Too expensive to manually specify all narrative branches
- AI planning:
  - domain theory + goals = plans
  - use the play-style model to select the best plan
- PAST results:
  - shown to increase perceived agency
Several accommodations of player’s actions may be generated by the planner. Select the one to keep the player on an emotion trajectory.

PACE

iGiselle
iGiselle

end of ballet class

go to a party

player

PACE

socializing with friends

confronting a rival

narrative progression
iGiselle

narrative progression

player's hope

end of ballet class

socializing with friends

confronting a rival

end of ballet class

socializing with friends

confronting a rival
iGiselle

University of Alberta created video game focuses on Romantic ballet Giselle

The University of Alberta prototyped are on pause in creating one of the first video games around ballet. The game will allow players to control the ending of the Romantic ballet Giselle.

The original ballet performance features the deaths of the main characters, but the developers of the video game wanted to change that by allowing users to intervene in the storyline.
Several accommodations of player’s actions may be generated by the planner. Select the one to keep the player in flow.

- Clearly defined goals
- Immediate feedback
- Skills match challenges

Primary source of enjoyment/happiness

“Flow channel” from “The Art of Game Design” by Jesse Schell

2010 - present: Flow Modeling
Past Work

- Flow in a Reinforcement Learning framework (Bulitko & Brown 2012)
- simple value iteration
- additional reward signal: the “flow reward”
  - flow = 1 / |ability - complexity|
- complexity of the subtask is given to the agent
- positive results
  - appropriate ring selected
- limited to RL
Current Work

- Flow as an objective function for meta control
- State space partitioned into levels
- Flow-maximizing meta policy selects the right level
- Ground-level policy controls the agent within its current level

\[ S = \bigcup_{i=0}^{n} L_i \]

**Algorithm 1: Agent Operation**

- **input**: MDP \((S, A, p)\), start state \(s_0\), control policy \(\pi\), meta-control policy \(\tilde{\pi}\)
- **output**: trajectory \((s_0, s_2, \ldots, s_T), s_T \in \{s^\dagger\} \cup L_n\)

1. \(t \leftarrow 0\)
2. **while** \(s_t \notin \{s^\dagger\} \cup L_n\) **do**
3. \(s' \xleftarrow{\tilde{\pi}(s_t), p} s_t\)
4. \(s_{t+1} \xleftarrow{\pi(s'), p} s'\)
5. \(t \leftarrow t + 1\)
Illustration of the Task

- **Angband**
  - a text-based dungeon crawler
  - dungeons (levels) become progressively tougher
  - watch to reach the max dungeon as quickly as possible

- An AI policy exists
  - can be de-coupled from dungeon advance

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![Game Screen](image)

- **hit points**
- **armor class**
- **dexterity**
Maximizing Flow: Angband

You see a Rock lizard (unhurt), O N, 3 E.
Dwarf
Rookie
Warrior
LEVEL 1
NXT 11
AU 84
\(|\sim(\)
STR: 18/40
INT: 5
WIS: 10
DEX: 18
CON: 14
CHR: 6
Cur AC 10
HP 28/29

Average lifetime return

Target level

\plot

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Flow-maximizing Experience Management

- end of ballet class
- go to a party
- socializing with friends
- confronting a rival
- player
- manager
- narrative progression
Flow-maximizing Experience Management

- end of ballet class
- confronting a rival
- socializing with friends

Player's flow vs. narrative progression
Application #1: Video Games

- On-line: dynamic storytelling to keep the player on an emotion curve
- Off-line: aiding the story designer in exploring the story space
- Procedurally emotional NPCs
NPC Emotions in Video Games
Application #2: Intelligent Training

- Build the training scenario on-the-fly to keep the trainee on a certain emotion/stress curve
- Emergency room training
  - Neonatal intensive care program
    - Vazhkudai “Kumar” Kumaran

Application #3: Online Education

- Massive Open Online Courses (MOOCs)
  - use AI to select the content intelligently, per student
    - model the student’s emotional state (e.g., frustration)

University of Alberta
- Jonathan Schaeffer
- Sean Gouglas

Stanford University
- Michael Genesereth
Possible Collaborations with Psychology

- Emotion modeling
  - based on conservation of resources
  - validation
- Flow modeling
  - validation
  - biometrics
- Use of our interactive storytelling game engines for psych experiments
Summary

Improving gaming/training via:

- Al-based experience management on the fly
  - player/trainee modelling
    - play style
    - emotional state
    - automated planning

Applications

- video games
- medical training
- MOOCs

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