Artificial Intelligence and Games

Introduction

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Artificial Intelligence is at the very core of modern game design and development. It plays and tests games, it supports the design of games and it analyses the way we play them. AI techniques used for these tasks include expert domain-knowledge systems, search and optimization, computational intelligence, and machine learning. This course aims to introduce students to the theory and practice of game artificial intelligence.
Learning Objectives

• Describe and theorize on the AI algorithms covered in class.
• Identify tasks that can be tackled through AI techniques and select the appropriate technique for the problem under investigation.
• Compare the performance of different AI techniques and reflect on their suitability for game AI development.
• Design and implement efficient and robust game AI algorithms.
Class Core Aim

• Give a comprehensive overview of AI for games and games for AI, as well as hands-on experiences with new technology

• Enable new exciting inventions and discoveries
Artificial Intelligence
Artificial Intelligence

Making computers able to do things which currently only humans can do
Artificial Intelligence in Games

Making **computers** able to do things which currently only **humans** can do **in games**
What do humans do with games?

• Play them
• Study them
• Build content for them
  • levels, maps, art, characters, missions...
• Design and develop them
• Do marketing
• Make a statement
• Make money!
Games for Artificial Intelligence
Games are hard and interesting problems
Games are content-intensive
Perception
Signal Processing
Machine Learning
Artificial Psychology
Planning and Search
KR and Reasoning
Natural language processing
Navigation
...

Games and AI areas
Games realise AI’s long-standing goals
Liapis, Yannakakis, Togelius: "Computational Game Creativity," in *Proceedings of the Fifth International Conference on Computational Creativity*, 2014.
Artificial Intelligence for Games
AI Plays and Improves your Game
More Content, Better Content!

What is Diablo 3: "[previous] games established the series’ hallmarks: randomized levels, the relentless attacks of monsters and events in a perpetually fresh world, [...]"

"Experience Daylight, a procedurally generated psychological thriller for your PC."
Player Experience – Data Mining
AI and Games History – Academia
A long-lasting love (1950s)
Early Days on the Board (60s-present)
The Digital Era - A milestone

- The Game Turing test was passed by two AI-controlled bot entries in *Unreal Tournament 2004*, in 2012!
- Neuroevolution was one of the approaches
The Digital Era – A few other milestones
From Board to Computer Game AI
IEEE CIG and AIIDE Competitions
Computer Game AI in Academia: History

Game AI [2005-....]

- Games as AI Arenas
  - NPC Performance
- AI for better games
  - Player experience / design / authoring
Computer Game AI

- Player Experience/Believability
- Game DM
- PCG
- Interactive Storytelling
- Pathfinding
- Robotics/A-Life
- Authoring
- NPC
- Board/Math games
Game AI is dead!

Ultimate Experience

NPC Behavior

AI and Games: A bit of history – Industry
**PacMan** (Namco, 1980)

- Implicit cooperation
  - Aggressive **Blinky**, Cunning **Pinky**, Wired **Inky**, Scared **Clyde**
- Attack – don’t care waves
- No randomness
Rogue (AI Design, 1980)

- Level generation
- Constructive approach
- Inspired rogue-like game genre
- Galaxy generation
- Compression

*Elite* (Acornsoft, 1984)
SimCity (Maxis, 1989)

- Cellular automata
- Influence Maps
Civilization (MicroProse, 1991)

- Map/Level generation
Thief (EIDOS, 1998)

- Stealth FPS, FP-Sneaker
- Advanced sensory system
- Guards perceive and respond to the environment
  - Noise, lighting, movement, and shadows.
Half-Life (Valve, 1998)

- FPS + puzzle solving
- Opponent Tactics
  - Coverage, dodging, full-level navigation
- Integration of AI into the story
- Valve hired Quake AI Mod developers for HL 2
**Sims** (EA, 2000)

- Smart (interactive) terrains
- Smart (interactive) objects
Black & White (EA, 2000)

- Perceptrons, Decision Trees, Belief-Desire-Intentions model
- Imitation Learning
- Reinforcement learning: creature slapped or stroked
- Gesture recognition
• The revolution of Behavior Trees
• More human-like bots

*Halo 2* (MS Game Studios, 2004)
• Best AI opponent – bot (at the time)
• Bot squads, teammate behaviors
• Cover when hit from behind
• Intelligent tactics
• Move through walls and under objects
• Planning system based on STRIPS
• “Environments to showcase the AI”

F.E.A.R. (Sierra, 2005)
• Drivatar system
• Imitation Learning
• MS Research – Cambridge

Forza Motorsport (MS game studios, 2005)
**Façade** (Mateas & Stern, 2005)

- Interactive Storytelling
- Natural Language Processing
- AI faults: absorbed by game (character) design
Left 4 Dead (Valve, 2008)

- **AI director**
  - Intelligent enemy placement
  - Intelligent item placement
  - Player emotional cues (visual effects, dynamic music)
**Spelunky (Mossmouth, 2008)**

- Level generation
- Ultimate re-playability
- Guarantees playability
Silent Hill (Konami, 2010)

- Survival horror
- Personality-based adaptation

PSYCHOLOGY WARNING

This video game psychologically profiles you as you play.

It gets to know who you really are then uses this information to change itself. It uses its knowledge against you, creating your own personal nightmare.

This game plays you as much as you play it.
Heavy Rain (Quantic Dream, 2010)
Various Kinect Games (2010 – …)

- E.g. Kate & Milo (demo), Kinectimals, etc..
- Affective AI
- Posture (fully body) Recognition
- Speech recognition
Bioshock Infinite (2k Games, 2013)
*Nevermind* (Flying Mollusk, 2016)
No Man’s Sky (Hello Games, 2016)
A historical “gap”
Some Facts about the “Gap”
Games helps us design better AI...

...and AI can help us make better games ...

...but not necessarily through game agents!

How then?

Procedural Content Generation
“Games cannot be dissociated from emotion and learning...”

Player Modeling
“Games: the final frontier for AI?”

“AI: the next step for Games!”
Welcome to the Artificial Intelligence and Games book. This book aims to be the first comprehensive textbook on the application and use of artificial intelligence (AI) in, and for, games. Our hope is that the book will be used by educators and students of graduate or advanced undergraduate courses on game AI as well as game AI practitioners at large.

**Final Public Draft**

The final draft of the book is available [here](#).