Game Artificial Intelligence
( CS 4731/7632 )

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http://www.cc.gatech.edu/~surban6/2018-gameAI/ (soon)
Piazza
T-square
What’s this all about?

• Industry standard approaches to employing “AI” in modern computer games
• Distinctions between Game AI as a discipline and standard AI as a discipline
• Go beyond industry standard Game AI to look at emerging techniques
About the rest

• Self
• Teaching Philosophy
• Syllabus
• Course Trajectory & Structure
  – (see webpage)
Course Topics

• State of the industry (standard practice)
  – Movement and path planning
  – Decision making
  – Strategy

• Procedural Content generation

• Advanced topics (/Case studies)
  – Believable characters and storytelling
  – Game analytics
  – Reinforcement learning; camera control
Prerequisites

• Intro to AI course
• Data structures
• Comfort with “no right answer”
• Python familiarity
Homework Assignments

• Custom game engine:
  – http://game-ai.gatech.edu

• Homeworks progressively build on each other

• Concludes with an AI that can play a Multiplayer Online Battle Arena (MOBA)

• Approximately every 1-2 weeks

• First homework due next week (1/22)
Assignments & Grading

• Homework sequence (70%):
  – 1 Grid navigation
  – 2 Path network navigation
  – 3 Nav mesh generation
  – 4 A* pathfinding
  – 5 Minion Agents
  – 6 Hero Agents
  – 7 SMB level generation
  – 8 RL (7k), Squad or Camera (4k)

• Exams (15% each)
• Participation and Quizzes (-10%)
Optional Textbooks

• Millington and Funge, *Artificial Intelligence for Games* 2nd ed.
• Buckland, *Programming Game AI by Example*
Artificial Intelligence

• Getting a computer to do something that a “reasonable person” would think requires intelligence
Important Dates

• 1/15 Official Institute Holiday
• 1/22 Verification of Student Participation in Class
• 3/14 Grade Mode and withdrawal deadline
• 3/19 to 3/23 Spring break
• 4/23 Final instructional class days
• 4/26 to 5/3 Final exams
• 5/5 End of term
• 5/7 Grade submission deadline
What this class is about

- **AI for games**
  - Ways in which AI can—and is used to—enhance game play experiences
  - Set of algorithms, representations, tools, and tricks that support the creation and management of real-time digital experiences

- In the game development industry, AI is the set of tricks and techniques to bring about a particular game design

- “Game AI is game design”
What this class is about

• How a game design can be brought into existence through the application of algorithms that are often thought of as intelligent

• About making the entities/opponents/agents/companions/etc. in games appear intelligent

• Not a substitute for an Intro to AI course
• Not going to teach good game design
What this class is NOT about

• **AI in games**
  – John Laird and Michael van Lent (2000): Games are perfect test-beds for “human level” AI
  – AI should play games as if human
    • Vision
    • Decision making in real-time
    • Handling uncertainty
    • Learning
    • Opponent modeling
  – Demonstrated with an AI agent that played Quake
## Goals of AI

<table>
<thead>
<tr>
<th>Systems that think like humans</th>
<th>Systems that think rationally</th>
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<tr>
<td>Systems that act like humans</td>
<td>Systems that act rationally</td>
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Goals of Game AI

• To support the player’s experience in a game
• Note: this might mean doing simple AI, or things that academic researchers marginally consider AI
What is a game?

- A system of rules
- A goal
Types of games?
First Person Shooter
Real Time Strategy (RTS)
Role Playing Games (RPGs)
Platformer
God Games
Sports Games
What brought you here?
General functions of Game AI?

• Do anything a player or game designer cannot or will not do
  – NPC (companion or opponent) Strategy
  – ” Decision making
  – ” Movement

• Content creation & scripting
  – Easing the cost of development

• Tailoring/adapting to player individual differences
Why AI in games?

Automation—because you need other people to do things, but don’t always have those people

• Opponents
• Companions
• NPCs (shopkeepers, farmers, villains)
• Dungeon master?
• Plot writer?
• Game designer?
Goals of Game AI

• Kill you good
• Make non-player characters (NPCs)—opponents, companions, etc.—look convincing
  — Believable characters
• Play like a human
• Make game more enjoyable
Why distinct from “academic AI”?

• Resource limits
• Complexity fallacy (G.O.L.)
• Fun vs. smart: goal is not always to beat the player
• Optimal/rational is rarely the right thing to do
Common “AI” Tricks

• Move before firing – no cheap shots
• Be visible
• Have horrible aim (being Rambo is fun)
• Miss the first time
• Warn the player
• Attack “kung fu” style (Fist of Fury; BL vs School)
• Tell the player what you are doing (especially companions)
• React to own mistakes
• Pull back at the last minute
• Intentional vulnerabilities or predictable patterns
Half-life: Freemans’ Marine Encounter

- Do they attack Kung-Fu style?
Half-Life Kung-Fu Attack

• Actually no more than 2 marines are attacking at any time

• The other marines take cover, move around etc.

• When one of the attacking marines run out of ammo, is wounded, dies, etc., one of the others take his place

• Some reactions are hard-coded and scenario-dependent
Common Game AI techniques

- Path planning, obstacle avoidance
- Decision making
  - Finite state machines
  - Trigger systems
  - Behavior trees
  - Robotics architectures
- Scripting
- Command hierarchies—strategic, tactical, individual combat
- Emergent behavior—flocking, crowds
- Formations
- Smart environments
- Terrain analysis—finding resource, ambush points
- Dynamic difficulty adjustment
Cheating
Intelligent vs. random