

Matthew J. Guzdial

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Research Interests

My research focuses on creative **artificial intelligence** and **machine learning**. By creative I refer to the set of techniques, problem domains, and sources of knowledge that inspire my research. Modern AI and ML systems have shown great success at replicating the past, but struggle to generate classes of what hasn't been seen before. With creative AI and ML we can find novel, valuable, and surprising solutions to problems across domains.

Education

Georgia Institute of Technology *2014- 2019 (anticipated)*
Ph.D. in Computer Science

Georgia Institute of Technology *2010-2014*
B.S. in Computational Media
Certificate in Social Psychology

Course Information

Courses Taught

Term	Course	Comments
Spring 2018	CS 4641 Machine Learning	
Summer 2017	CS 4731/7632 Game AI	Grad/undergrad

Curriculum Development

CS 4731 Game Artificial Intelligence: The course explores the role of artificial intelligence in computer games and other entertainment computing applications as envisioned for the future. I co-designed the course to focus on more advanced Game AI topics. This unique approach to teaching Game AI emphasizes critical thinking and design over low-level implementation details and is meant to be a model for other universities. **My redesigned class assignments have been adopted by faculty at Northeastern University.**

Individual Student Guidance

Shao-Yu Chen (CS Masters)
Spring 2016-Summer 2017
Publications: 01
Procedural Content Generation

Nicholas Liao (CS Undergrad)

Spring 2016-Present

Publications: O3

Player Modeling

Jonathan Chen (CS Undergrad)

Summer 2017-Present

Publications: O1

Procedural Content Generation

Vishwa Shah (CS Undergrad)

Fall 2017-Present

Computational Creativity

Shukan Shah (CS Undergrad)

Fall 2017-Present

Procedural Content Generation

Zijin Lou (CS Undergrad)

Fall 2017-Present

Computer Vision

Josh Reno (CS Undergrad)

Spring 2018-Present

Procedural Content Generation

Publications

Refereed Journal

- J1.** Summerville, A., Snodgrass, S., **Guzdial, M.**, Holmgård, C., Hoover, A., Isaksen, A., Nealen, A., and Togelius, J. Procedural Content Generation via Machine Learning (PCGML). *IEEE Transactions on Games*, 2018.

Refereed Conference

- C1.** **Guzdial, M.**, Li, B., and Riedl, M. Game Engine Learning from Video. *Proceedings of the Twenty-Sixth International Joint Conference on Artificial Intelligence*, Melbourne, Australia, 2017.
- C2.** Siu, K., **Guzdial M.**, and Riedl M. Evaluating Singleplayer and Multiplayer in Human Computation Games. *Proceedings of the Twelfth International Conference on the Foundations of Digital Games*, Cape Cod, MA, 2017.

- C3.** **Guzdial, M.**, and Riedl, M. Game Level Generation from Gameplay Videos. *Twelfth Annual AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, San Francisco, California, 2016.
- C4.** **Guzdial, M.**, and Riedl, M. Learning to Blend Computer Game Levels. *Proceedings of the Seventh International Conference on Computational Creativity*, Paris, France, 2016. **Best Paper Award.**
- C5.** **Guzdial, M.**, Harrison, B., Li, B., and Riedl, M. Crowdsourcing Open Interactive Narrative. *Proceedings of the 10th International Conference on the Foundations of Digital Games*, Pacific Grove, CA, 2015.

Refereed Workshop

- W1.** **Guzdial, M.** and Riedl, M. Combinatorial Creativity for Procedural Content Generation via Machine Learning. *Proceedings of the AAAI 2018 Workshop on Knowledge Extraction in Games*, New Orleans, Louisiana, 2018.
- W2.** **Guzdial, M.** and Riedl, M. Combinatorial Meta Search. *Proceedings of the NIPS 2017 Workshop on Machine Learning Creativity and Design*, Long Beach, California, 2017
- W3.** **Guzdial, M.**, Long, D., Cassion, C., and Das, A. Visual Procedural Content Generation with an Artificial Abstract Artist. *Proceedings of the 3rd Computational Creativity in Games Workshop*, Atlanta, GA, 2017.
- W4.** **Guzdial, M.**, Sturtevant, N., and Li, B. Deep Static and Dynamic Level Analysis: A Study on Infinite Mario. *Proceedings of the 3rd Experimental AI in Games Workshop*, San Francisco, CA, 2016.
- W5.** Summerville, A., **Guzdial, M.**, Mateas, M., and Riedl, M. Learning Player Tailored Content From Observation: Platformer Level Generation from Video Traces using LSTMs. *Proceedings of the 3rd Experimental AI in Games Workshop*, San Francisco, CA, 2016.
- W6.** **Guzdial, M.**, and Riedl, M. Toward Game Level Generation from Gameplay Videos. *Proceedings of the Workshop on Procedural Content Generation in Games*, Pacific Grove, CA, 2015.

Other

- O1.** **Guzdial, M.**, Chen, J., Chen, S., and Riedl, M. "A General Level Design Editor for Co-creative Level Design" *Demonstration at the 4th Experimental AI in Games Workshop*, Snowbird, UT, 2017.
- O2.** Zook, A., Summerville, A., **Guzdial, M.**, and Hoover, A. "Machine Learning for Procedural Content Generation" *Panel at the Twelfth International Conference on the Foundations of Digital Games*, Cape Cod, MA, 2017.
- O3.** Liao, N., **Guzdial, M.**, and Riedl, M. "Deep Convolutional Player Modeling on Log and Level Data" *Extended Abstract in the Proceedings of the Twelfth International Conference on the Foundations of Digital Games*, Cape Cod, MA, 2017.

- 04. Guzdial, M., and Riedl, M.** “Conceptually Blended Levels in a Unity Engine” *Proceedings of the Playable Experience Track at the Twelfth Annual AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, San Francisco, 2016.
- 05. Guzdial, M., and Riedl, M.** “An Intelligent Game Level Design Editor Informed by Gameplay Videos” *Demonstration at the 2nd Experimental AI in Games Workshop*, Santa Cruz, 2015.
- 06. Guzdial, M.** “Solutions Manual for Introduction to Computing and Programming in Python: A Multimedia Approach, 4th Edition” 2015.

Invited Presentations

- “Procedural Content Generation via Machine Learning” at Blizzard Entertainment. 2017.

Awards and Honors

- **Unity Graduate Fellowship, 2018**
- **Foley Scholar Finalist, 2017**
- **Best Paper Award**, Guzdial, M., and Riedl, M. Learning to Blend Computer Game Levels. *Proceedings of the Seventh International Conference on Computational Creativity*, Paris, France, 2016
- **National Science Foundation Graduate Student Fellowship Honorable Mention, 2015**
- **Georgia Tech College of Computing Best Undergraduate Research Award, 2013**
- **Presidential Undergraduate Research Grant, 2013**

Research Projects

Automated Game Creation from Gameplay Videos

Automated Game Creation from Gameplay Videos supports novice and expert developers creating games for education, entertainment, and other purposes. It draws on probabilistic modeling, rule learning, and machine vision to extract design knowledge from videos of humans playing games and reinterpret this knowledge to a desired effect.

Related publications: C1, C2, C4, W5, O1, O5

Scheherazade-IF

Scheherazade-IF is an “open interactive narrative generator”, capable of creating an interactive narrative game of near-human quality on any subject. It learns this model by reading stories on the desired subject. The system relies on crowdsourcing from everyday individuals to supply these stories, addressing the time and experience requirements of game development.

Related publications: C5

Service

Journal Reviewing

- **Reviewer**, Journal of Parallel and Distributed Computing (JPDC), 2018
- **Reviewer**, IEEE Transactions on Games (TOG), 2017-present
- **Reviewer**, IEEE Transactions on Computational Intelligence and AI in Games (TCIAIG): Special Issue on AI-based and AI-assisted Game Design, 2017

Conference Committee Activities

- **Program Committee**, International Joint Conference on Artificial Intelligence (IJCAI), 2018-present
- **Program Committee**, ACM CHI Conference on Human Factors in Computing Systems (CHI), 2018-present
- **Program Committee**, ACM CHI Conference on Designing Interactive Systems (DIS), 2018
- **Program Committee**, Special Session on Deep Learning in Games at the IEEE Conference on Computational Intelligence and Games (CIG), 2018
- **Program Committee**, International Conference on the Foundations of Digital Games (FDG), 2017-present
- **Program Committee**, International Conference on Computational Creativity (ICCC), 2017-present
- **Program Committee**, Playable Experiences Track at the Twelfth Annual AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE), 2017
- **Program Committee**, AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE), 2016-present

Workshop and Other Committee Activities

- **Program Committee**, Experimental AI in Games Workshop (EXAG), 2016-present
- **Program Committee**, Workshop on Procedural Content Generation (PCG), 2016-present
- **Juror Committee**, IndieCade 2014-present

Academic Service

- **Workshop Co-organizer**, First Knowledge Extraction from Games Workshop 2018
- **Local Coordinator**, Eighth Workshop on Procedural Content Generation 2017
- **Media Chair**, Eighth International Conference on Computational Creativity 2017
- **Workshop Co-organizer**, Third Computational Creativity in Games Workshop 2017

- **Local Coordinator**, Third Experimental AI in Games Workshop 2016

Work Experience

Disney Research, Pittsburgh, PA *May 2016-August 2016*

Research Assistant Intern

Applied DNN techniques to player experience prediction and simulation

Zynga Inc., Orlando, FL

May 2014-August 2014

Design Intern

Led weekly bug-fix count across entire team of twenty-six developers

Georgia Institute of Technology, Atlanta, GA *January 2012-December 2013*

Undergraduate Research Assistant

Ran human subject studies, developed virtual environments for research

Zynga Inc., San Francisco, CA

May 2013-August 2013

Production Intern

Developed mobile game prototype single-handedly

Popular Media Mentions

“AI learns to re-create Super Mario Bros. by watching someone else play it”

The Verge, September 2017

<https://www.theverge.com/2017/9/10/16276528/ai-video-games-game-engine>

“Artificial Intelligence is Learning To Develop Games” Rolling Stone, September 2017 <https://www.rollingstone.com/glixel/news/artificial-intelligence-is-learning-how-to-develop-games-w502882>

“Has a Black Mirror episode predicted the future of video games?” The Guardian, October 26, 2016

<https://www.theguardian.com/technology/2016/oct/26/black-mirror-episode-playtest-predicted-future-video-games-augmented-reality>

“How Computers Learned to Play Mario,” Smithsonian Magazine, November 3, 2015. <http://www.smithsonianmag.com/smart-news/how-computers-learned-to-play-nintendo-180957125/?no-ist>

“Algorithm Turns Fiction into Interactive Games,” Popular Science, September 3, 2015. <http://www.popsci.com/algorithm-helps-you-write-an-interactive-fiction-story>

“This AI Creates Interactive Fiction by Reading Other People’s Stories,”
Motherboard, September 2, 2015. <http://motherboard.vice.com/read/this-ai-creates-interactive-fiction-by-reading-other-peoples-stories>

“This AI Builds Super Mario Levels by Watching YouTube,” WIRED, June, 24,
2015. <http://www.wired.com/2015/06/mario-level-creator-ai/>