

2018 IEEE Conference on Computational Intelligence and Games (CIG 2018)

**Maastricht, Netherlands
14 – 17 August 2018**



**IEEE Catalog Number: CFP18CIG-POD
ISBN: 978-1-5386-4360-0**

**Copyright © 2018 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP18CIG-POD
ISBN (Print-On-Demand):	978-1-5386-4360-0
ISBN (Online):	978-1-5386-4359-4
ISSN:	2325-4270

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

Table of Contents

Preface	iii
Organizing Committee	iv
Table of Contents	v
Programme Committee	x
Sponsors	xiv

Main Track

Shallow Decision-Making Analysis in General Video Game Playing	1
<i>Ivan Bravi, Diego Perez-Liebana, Simon M. Lucas and Jialin Liu</i>	
Q-DeckRec: A Fast Deck Recommendation System for Collectible Card Games	9
<i>Zhengxing Chen, Christopher Amato, Truong-Huy D. Nguyen, Seth Cooper, Yizhou Sun and Magy Seif El-Nasr</i>	
Inferring Design Constraints From Game Ruleset Analysis	17
<i>Michael Cook, Simon Colton and Azalea Raad</i>	
Intelligent Middle-Level Game Control	25
<i>Amin Babadi, Kouros Naderi and Perttu Hämäläinen</i>	
Human-Like Playtesting with Deep Learning	33
<i>Stefan Gudmundsson, Philipp Eisen, Erik Poromaa, Alex Nodet, Sami Purmonen, Richard Meurling, Bartłomiej Kozakowski and Lele Cao</i>	
A Critical Analysis of Punishment in Public Goods Games	41
<i>Garrison W. Greenwood, Hussein Abbass and Eleni Petraki</i>	
Monte-Carlo Tree Search for Implementation of Dynamic Difficulty Adjustment Fighting Game AIs Having Believable Behaviors	46
<i>Makoto Ishihara, Suguru Ito, Ryota Ishii, Tomohiro Harada and Ruck Thawonmas</i>	
Monte-Carlo Tree Search Implementation of Fighting Game AIs Having Personas	54
<i>Ryota Ishii, Suguru Ito, Makoto Ishihara, Tomohiro Harada and Ruck Thawonmas</i>	
General Win Prediction from Agent Experience	62
<i>Raluca D. Gaina, Simon M. Lucas and Diego Perez-Liebana</i>	
Building Evaluation Functions for Chess and Shogi with Uniformity Regularization Networks	70
<i>Shanchuan Wan and Tomoyuki Kaneko</i>	
Regular Language Inference for Learning Rules of Simplified Boardgames	78
<i>Jakub Kowalski and Andrzej Kisielewicz</i>	
Strategic Features and Terrain Generation for Balanced Heroes of Might and Magic III Maps	86
<i>Jakub Kowalski, Radoslaw Miernik, Piotr Pytlik, Maciej Pawlikowski, Krzysztof Piecuch and Jakub Sekowski</i>	

Monte Carlo Methods for the Game Kingdomino	94
<i>Magnus Gedda, Mikael Z. Lagerkvist and Martin Butler</i>	
Evolving Number Sentence Morphing Puzzles	102
<i>Daniel Ashlock and Courtney Kolthof</i>	
Toward General Mathematical Game Playing Agents	110
<i>Daniel Ashlock, Eun-Youn Kim and Diego Perez-Liebana</i>	
Predicting Skill Learning Outcomes in a Large, Longitudinal MOBA Dataset	117
<i>Myat Aung, Valerio Bonometti, Anders Drachen, Peter Cowling, Athanasios V. Kokkinakis, Christian Yoder and Alex Wade</i>	
An Eye Gaze Model for Controlling the Display of Social Status in Believable Virtual Humans	125
<i>Michael Nixon, Steve Dipaola and Ulysses Bernardet</i>	
Evolutionary Multi-objective Optimization of Real-Time Strategy Micro	133
<i>Rahul Dubey, Joseph Ghantous, Sushil Louis and Siming Liu</i>	
Monster Carlo: An MCTS-based Framework for Machine Playtesting Unity Games	141
<i>Oleksandra Keehl and Adam M. Smith</i>	
Deep RTS: A Game Environment for Deep Reinforcement Learning in Real-Time Strategy Games	149
<i>Per-Arne Andersen, Morten Goodwin and Ole-Christoffer Granmo</i>	
New And Surprising Ways to be Mean: Adversarial NPCs with Coupled Empowerment Minimisation	157
<i>Christian Guckelsberger, Christoph Salge and Julian Togelius</i>	
Accelerating Empowerment Computation with UCT Tree Search	165
<i>Christoph Salge, Christian Guckelsberger, Rodrigo Canaan and Tobias Mahlmann</i>	
Multi-Agent Pathfinding with Real-Time Heuristic Search	173
<i>Devon Sigurdson, Vadim Bulitko, William Yeoh, Carlos Hernandez and Sven Koenig</i>	
Bayesian Opponent Exploitation in Imperfect-Information Games	181
<i>Sam Ganzfried and Qinyung Sun</i>	
Geometry and Generation of a New Graph Planarity Game	189
<i>Rutger Kraaijer, Marc van Kreveld, Wouter Meulemans and André van Renssen</i>	
Ensemble Decision Making in Real-Time Games	197
<i>Philip Rodgers, John Levine and Damien Anderson</i>	
Integrated Balancing of an RTS Game: Case Study and Toolbox Refinement	205
<i>Mike Preuss, Thomas Pfeiffer, Vanessa Volz and Nicolas Pflanzl</i>	
Applying Commitment to Churn and Remaining Players Lifetime Prediction	213
<i>Luiz Bernardo Martins Kummer, Júlio César Nievola and Emerson Cabrera Paraiso</i>	
Neuroevolution for RTS Micro	221
<i>Aavaas Gajurel, Sushil J. Louis, Daniel J. Méndez and Siming Liu</i>	
Tabular Reinforcement Learning in Real-Time Strategy Games via Options	229
<i>Anderson R. Tavares and Luiz Chaimowicz</i>	

Generating Novice Heuristics for Post-Flop Poker	237
<i>Fernando de Mesentier Silva, Julian Togelius, Frank Lantz and Andy Nealen</i>	
Scale-Free Evolutionary Level Generation	245
<i>André Siqueira Ruela and Karina Valdivia Delgado</i>	
Evolutionary MCTS for Multi-Action Adversarial Games	253
<i>Hendrik Baier and Peter I. Cowling</i>	
Skilled Experience Catalogue: A Skill-Balancing Mechanism for Non-Player Characters using Reinforcement Learning	261
<i>Frank G. Glavin and Michael G. Madden</i>	
The Evolutionary Race: Improving the Process of Evaluating Car Controllers in Racing Simulators	269
<i>Mohammed Salem, Antonio M. Mora and Juan J. Merelo</i>	
<hr/> Special Session 1: Deep Learning in Games <hr/>	
Using a Surrogate Model of Gameplay for Automated Level Design	277
<i>Daniel Karavolos, Antonios Liapis and Georgios N. Yannakakis</i>	
Learning to Play General Video-Games via an Object Embedding Network	285
<i>William Woof and Ke Chen</i>	
Automated Curriculum Learning by Rewarding Temporally Rare Events	293
<i>Niels Justesen and Sebastian Risi</i>	
Learning Map-Independent Evaluation Functions for Real-Time Strategy Games	301
<i>Zuozhi Yang and Santiago Ontañón</i>	
Imitation Learning with Concurrent Actions in 3D Games	308
<i>Jack Harmer, Linus Gisslén, Jorge del Val, Henrik Holst, Joakim Bergdahl, Tom Olsson, Kristoffer Sjö and Magnus Nordin</i>	
Deep Reinforcement Learning for General Video Game AI	316
<i>Ruben Rodriguez Torrado, Philip Bontrager, Julian Togelius, Jialin Liu and Diego Perez-Liebana</i>	
<hr/> Special Session 2: Intelligent Games for Learning <hr/>	
Promotion of Learning Motivation through Individualization of Learner-Game Interaction	324
<i>Sandra Kaczmarek and Sintija Petroviča</i>	
A Virtual Agent Toolkit for Serious Games Developers	332
<i>Samuel Mascarenhas, Manuel Guimarães, Rui Prada, João Dias, Pedro A. Santos, Kam Star, Ben Hirsh, Ellis Spice and Rob Kommeren</i>	
The Influence of Feedback Choice on University Students' Revision Choices and Performance in a Digital Assessment Game	339
<i>Maria Cutumisu</i>	

A Plot from the Stars: Educational Game Development for Teaching Basic Mathematical Functions.....	346
<i>Gabriel Toschi de Oliveira, Claudio Fabiano Motta Toledo, Seiji Isotani, Geiser Chaclo Chalco and Hugo Henriques Pereira</i>	

Special Session 3: Integrating IoT Technologies with Serious Games

Scenarios for Educational and Game Activities using Internet of Things Data.....	354
<i>Chrysanthi Tziortzioti, Irene Mavrommati, Georgios Mylonas, Andrea Vitaletti and Ioannis Chatzigiannakis</i>	
Exploiting IoT Technologies for Personalized Learning.....	362
<i>Evaggelos Spyrou, Nicholas Vretos, Andrew Pomazanskyi, Stylianos Asteriadis and Helen C. Leligou</i>	
InLife: Combining Real Life with Serious Games using IoT.....	370
<i>Pavlos Kosmides, Konstantinos Demestichas, Evgenia Adamopoulou, Nikos Koutsouris, Yannis Oikonomidis and Vanessa De Luca</i>	

Short Papers

Multi-Parameterised Matchmaking: A Framework.....	377
<i>Anders Harbøll Christiansen, Emil Gensby and Bo Friis Nielsen</i>	
Using Discrete Time Markov Chains for Control of Idle Character Animation.....	381
<i>Adam Streck and Thomas Wolbers</i>	
A Machine-Learning Item Recommendation System for Video Games.....	385
<i>Paul Bertens, Anna Guitart, Pei Pei Chen and África Periañez</i>	
Learning Battles in ViZDoom via Deep Reinforcement Learning.....	389
<i>Kun Shao, Dongbin Zhao, Nannan Li and Yuanheng Zhu</i>	
Anxious Learning in Real-Time Heuristic Search.....	393
<i>Vadim Bulitko and Kacy Doucet</i>	
Analysis of Self-Adaptive Monte Carlo Tree Search in General Video Game Playing.....	397
<i>Chiara F. Sironi and Mark H. M. Winands</i>	
Game AI Research with Fast Planet Wars Variants.....	401
<i>Simon M. Lucas</i>	
A Refined 3D Dataset for the Analysis of Player Actions in Exertion Games.....	405
<i>Chrysoula Varia, Georgios Tsatiris, Kostas Karpouzis and Stefanos Kollias</i>	

Competition Papers

Evolving Agents for the Hanabi 2018 CIG Competition.....	409
<i>Rodrigo Canaan, Haotian Shen, Ruben Torrado, Julian Togelius, Andy Nealen and Stefan Menzel</i>	
Standard Economic Models in Nonstandard Settings – StarCraft: Brood War.....	417
<i>Bryan S. Weber</i>	

Forward Model Approximation for General Video Game Learning	425
<i>Alexander Dockhorn and Daan Apeldoorn</i>	
Applying Hybrid Reward Architecture to a Fighting Game AI.....	433
<i>Yoshina Takano, Wenwen Ouyang, Suguru Ito, Tomohiro Harada and Ruck Thawonmas</i>	
μ CCG, a CCG-based Game-Playing Agent for μ RTS	437
<i>Pavan Kantharaju, Santiago Ontańón and Christopher W. Geib</i>	
Improving Hearthstone AI by Combining MCTS and Supervised Learning Algorithms	445
<i>Maciej Świechowski, Tomasz Tajmajer and Andrzej Janusz</i>	
Wall Building in the Game of StarCraft with Terrain Considerations	453
<i>Martin L.M. Rooijackers and Mark H. M. Winands</i>	
<hr/>	
Vision Papers	
<hr/>	
Explainable AI for Designers: A Human-Centered Perspective on Mixed-Initiative Co-Creation	458
<i>Jichen Zhu, Antonios Liapis, Sebastian Risi, Rafael Bidarra and Michael Youngblood</i>	
Using a Team of General AI Algorithms to Assist Game Design and Testing.....	466
<i>Cristina Guerrero-Romero, Simon M. Lucas and Diego Perez-Liebana</i>	
A Social Science-based Approach to Explanations for (Game) AI.....	474
<i>Vanessa Volz, Kevin Majchrzak and Mike Preuss</i>	
Towards Game-based Metrics for Computational Co-Creativity	482
<i>Rodrigo Canaan, Stefan Menzel, Julian Togelius and Andy Nealen</i>	
Modern Techniques for Ancient Games	490
<i>Cameron Browne</i>	
<hr/>	
Demos	
<hr/>	
Web-Based Interface for Data Labeling in StarCraft	498
<i>In-Chang Baek and Kyung-Joong Kim</i>	
<hr/>	
Author Index	500
Keyword Index	505