## 2022 IEEE Conference on Games (CoG)

## Program

### Welcome Messages

On behalf of the Organizing Committee, we welcome you all to attend 2022 IEEE Conference on Games (CoG), which is held virtually from Aug. 21 to 24, 2022.

IEEE Conference on Games (CoG) originates from IEEE Conference on Computational Intelligence and Games (CIG) and has been renamed to CoG since 2019. Games not only establish one of the most profitable industries worldwide, but also offer a general and challenging environment for the advance of Artificial Intelligence (AI) and Computational Intelligence (CI). IEEE CoG 2022 brings together leading researchers and practitioners from academia and industry in the field of games to discuss recent advances and explore future directions. It covers all topics in the field of games, from game design to game intelligence and game theory, including scientific, technical, engineering and societal aspects.

IEEE CoG 2022 features 8 Keynote talks given by world-renowned scholars, 5 tutorial talks, 4 industry talks, regular paper sessions, auxiliary paper sessions, poster sessions, special sessions, competition sessions, and journal paper & abstract presentation session. This is the first time to initiate the double-anonymous paper review mechanism. Selected papers are recommended to IEEE Transactions on Games for further publication. In addition, the conference also holds 18 competitions with wide variety.

Thanks to the technical sponsorship from IEEE Computational Intelligence Society, and the Institute of Automation, Chinese Academy of Sciences. Thanks to the Platinum sponsors: Inspir.AI, NetEase YAOTAI, SITONHOLY, Nuverse, and the Bronze sponsor 4Paradigm.

Besides, to enrich the virtual experience, the last day's event will be also held with strongly interactive platform. We hope you will enjoy the event both intellectually and interactively.

General Chairs: Dongbin Zhao, Simon Lucas

Program Chairs: Diego Pérez Liébana, Yuanheng Zhu, Jialin Liu

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### About

- Founded in 2017, inspir. ai focuses on research and applications of Artificial General Intelligence technologies.
- Our mission is to create extraordinary AI Beings and immersive interaction experiences for games, the virtual world and Metaverse.

### Technology ===

- Deep Reinforcement Learning (DRL) Our DRL Agent (StarCraft Commander) beat StarCraft II champions in June 2020. Won competitions and published on NeurIPS, ICML, CVPR.
- Large-scale Model of **Cognitive & Decision-Making Intelligence**

Large language model + reinforcement learning model = Intelligent decisionmaking brain for AI Beings



Our AI products optimize user experiences, content production cost and efficiency for games, virtual world and Metaverse.

- Al Player
- AI Character
- Al Designer
- AI Commander
- Al Beings Platform

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## IEEE CoG2022 Program at a glance

August 21			
8:30-9:00	IEEE CoG2022 Opening, Chair: Dongbin Zhao		
9:00-10:00	Keynote I: On Game-Based Control Systems, Spea	aker: Lei Guo, Chair: Dongbin Zhao	
10:00-12:00	Industry Talks	Tutorial I: Evolutionary Computation in Games: Learning, Planning, and Designing, Speakers: Julian Togelius & Jialin Liu	
15:00-16:00 Keynote II: Emotion-Centric AI: from Hubris and Nemesis to Catharsis, Speaker: Georgios N. Yannakakis, Chair: Diego Perez Liebana			
16:00-18:00	Tutorial II: Learning in Sparse Reward and Imperf	ect Information Games, Speakers: Junliang Xing & Kai Li	

	August 22				
8:30-8:50	Sponsored Talk: NPC AI in Action - Research, Appl	ications and Ch	nallenges, Speaker: Xiangjun Wang (inspir.ai)		
9:00-10:00	Keynote III: Going beyond Games: Towards Decision Making in The Real-world, Speaker: Yuandong Tian, Chair: Jialin Liu				
10:00-12:00	Tutorial III: Solving Zero-sum Games Through Reinforcement Learning, Speaker: Yaodong Yang	10:00-11:30	Tutorial IV: A Designer's Reflection on Game Design Considering Players' Emotions, Speakers: Hamna Aslam & Joseph Alexander Brown		
15:00-16:00	AI4Playing I Game Testing				
16:00-17:00	00 Keynote IV: Agent-Human Complex Games for Multi-agent Studies, Speaker: Sarit Kraus, Chair: Simon Lucas				
17:00-18:20	Al4Playing II Game Design				
20:00-20:50	AI4Playing III				
21:00-21:30	Player Modelling	20:00-22:30	CoG2022 Competitions		
21:30-23:30	ToG Outstanding Paper Nominees Presentation				

August 23				
9:00-10:00	Keynote V: An Unquenchable Appetite: Games, Play, and Climate Change, Speaker: Jessica Hammer, Chair: Yuanheng Zhu			
10:00-11:00	PCG I	DRL for Game	25	
15:00-16:00	PCG II	Benchmark a	nd Competition I	
16:00-17:00	Keynote VI: Player-AI Interaction: What Can Human-Centered AI Learn from Computer Games and Other Creative Domains, Speaker: Jichen Zhu, Chair: Diego Perez Liebana			
17:00-18:00	PCG III Benchmark and Competition II			
18:00-20:00	Tutorial V: Player Modelling through Affective Computing, Speakers: Phil Lopes & David Melhart			
20:00-20:30	Game HCI	20:00-21:00	Benchmark and Competition III	
20:30-22:00	Game Analytics	21:00-22:00	VR and AR	

August 24					
14:00-15:00	Keynote VII: On Comput	ation Charact	erization in Game Theo	ry, Speaker: X	iaotie Deng, Chair: Zongqing Lu
15:00-16:00	Vision Papers	15.00 16.20	MCTS for Comos	15:00-16:10	Game Theory & Board Games
16:00-17:00	Demo Papers	12:00-10:30	wich's for Games	16:10-17:00	Benchmark and Competition IV
				_	
17.20 10.20	CoG2022 Best Paper	17:30-19:00	Multi-player Games	17:30-18:30	Journal Paper & Abstract Presentation
17:30-19:30	Nominees Presentation	19:00-19:30	Serious Games	18:30-19:30	Poster Session
20:00-21:00	Keynote VIII: AlphaStar:	Grandmaster	r Level in StarCraft II us	ing Multi-agen	t Reinforcement Learning, Speaker: Oriol
	Vinyals, Chair: Simon Lucas				
21:00-22:00	IEEE CoG2022 Closing, C	hair: Simon Lu	ucas		

1. From August 21 to August 23, all events will be held using Zoom Webinars.

2. On **August 24**, live presentation of **Keynotes and Oral Sessions** will be given using **Zoom Webinars** and **Zoom Meeting**. To increase the virtual interactive fun, the registers can also login the **Yaotai platform** (up to 100 logins at once) and watch the rebroadcast. There will be a Main Venue for Keynotes, three Branch Venues for Oral sessions, and four Longe rooms for small groups of discussion.

3. On **August 24**, the **Poster Session** will be held on **Yaotai Poster Venue**. All posters will be pasted beforehand on virtual walls by CoG technicians.

4. The **exclusive access to Zoom Webinars** for each register has been sent by emails with the subject of [Panelist for IEEE CoG2022-ZoomWebinar-1] and [Panelist for IEEE CoG2022-ZoomWebinar-2]. The **invitation ticket to Yaotai Platform** has been sent to each register by emails with the subject of [[2022 IEEE Conference on Games] Event registration success! Please check the ticket].

5. Some Keynotes under the speakers' permission will be broadcast to the public on the official livestream channel of Chinese Academy of Sciences, Institute of Automation. Stay tuned to <u>http://live.bilibili.com/22426517</u> and below channels.





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#### - About Nuverse

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- English offcial website WWW.NVSgames.com - Chinese official website WWW.NVSgames.cn

## **Keynotes in IEEE CoG2022**

## Keynote I

## **On Game-Based Control Systems**

Lei Guo

Academy of Mathematics and Systems Science, China

IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 9:00-10:00, August 21 (GMT+8)

### Abstract:

In the traditional control systems theory, the plant to be controlled or regulated usually does not have its own payoff function, and much progress in both theory and applications has been made in this fields. However, in many practical systems such as those in social, economic and the future "intelligent" engineering systems, the dynamical systems to be regulated may have their own objectives to pursue, which may not be the same as that of the global regulator or controller. Such hierarchical decision making dynamical systems may be called as game-based control systems (GBCS), where the system models may contain various uncertainties and the global regulator can be feedback signals. This lecture will present some backgrounds and examples for introducing GBCS, followed by an investigation of some basic characteristics and properties of GBCS. It will be shown how the macro-states of the GBCS may be regulated by intervening the Nash equilibrium that is reached at the micro-level. In particular, we will present some basic results on global controllability and stabilizability of linear GBCS with multi-players at the micro-level. Both deterministic and stochastic systems will be investigated, and a main technical issue involves the analysis and control of forward-backward (stochastic) differential equations.

### **Biography**:

Lei Guo received his BS degree from Shandong University in 1982 and Ph.D degree from the Chinese Academy of Sciences(CAS) in 1987. He is currently a professor of the Academy of Mathematics and Systems Science, CAS, and serves as the Director of the National Center for Mathematics and Interdisciplinary Sciences, CAS. He is a Fellow of IEEE, a Member of CAS, a Foreign Member of Royal Swedish Academy of Engineering Sciences, and the recipient of Hendrik W. Bode Lecture Prize from the IEEE Control Systems Society in 2019. His research interests include adaptive estimation, adaptive filtering, adaptive control, adaptive game theory, control of stochastic and nonlinear uncertain systems, feedback capability, multi-agent systems, and game-based control systems.



## Keynote II Emotion-Centric AI: from Hubris and Nemesis to Catharsis

Georgios N. Yannakakis University of Malta, Malta

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 15:00-16:00, August 21 (GMT+8)

### Abstract:

Why bother about emotions and their computation? Why is emotion such a critical element of every aspect of AI and Games research nowadays? How can emotion help us test games, represent the games we play, design creative AI algorithms, offer reliable agency to AI, and ultimately understand player experience? In this talk, I will attempt to address these questions through a series of milestone research studies (hubris) that led to a number of key lessons learned over the years (nemesis). I will conclude the talk by suggesting directions through which emotion can reframe the ways we build AI algorithms and develop games (catharsis).

### Biography:

**Georgios N. Yannakakis** is a Professor and Director of the Institute of Digital Games, University of Malta, and a co-founder of modl.ai. He does research at the crossroads of artificial intelligence, computational creativity, affective computing, and humancomputer interaction and he has published over 300 journal and conference papers in the aforementioned fields (h-index 60). His research has been supported by numerous European and national grants and has appeared in Science Magazine and New Scientist among other venues. He has been involved in a number of journal editorial boards and he is currently the Editor in Chief of IEEE Transactions on Games and an Associate Editor



of IEEE Transactions on Evolutionary Computation. Prof. Yannakakis has been the General Chair of key conferences in the area of game artificial intelligence (IEEE CIG 2010) and games research (FDG 2013, FDG 2020). He is the co-author of the Artificial Intelligence and Games textbook and the co-organiser of the Artificial Intelligence and Games summer school series.

## Keynote III Going beyond Games:

### **Towards Decision Making in The Real-world**

Yuandong Tian Meta AI, US

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 9:00-10:00, August 22 (GMT+8)

### Abstract:

Deep Reinforcement Learning (DRL), as a smart search technique that dynamically improves its policy and value estimation based on observation given previous data, has shown human-level or even super-human performance for games such as Go, chess and StarCraft. On the other hand, when applying DRL in real-world applications, new challenges emerge such as effective integration with current working systems, learning representation of large state and action spaces, or even redefining the temporal structure of sequential decision making. In this talk, I will cover our recent works that include learning initial solutions to the existing solver, learning state representations, or even learning the structure of sequential decision itself.

### **Biography**:

**Yuandong Tian** is a Research Scientist and Senior Manager in Meta AI Research (FAIR), working on deep reinforcement learning, representation learning and optimization. He is the recipient of 2021 ICML Outstanding Paper Honorable Mentions and 2013 ICCV Marr Prize Honorable Mentions. He is the lead scientist and engineer for ELF OpenGo project. Prior to that, he worked in Google Self-driving Car team in 2013-2014 and received a Ph.D in Robotics Institute, Carnegie Mellon University in 2013. He has been appointed as area chairs for NeurIPS, AAAI and AIStats.



## Keynote IV Agent-Human Complex Games for Multi-agent Studies

Sarit Kraus Bar-Ilan University, Israel

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 16:00-17:00, August 22 (GMT+8)

### Abstract:

Intelligent computer agents are increasingly being deployed in group settings in which they interact with people in order to carry out tasks. To operate effectively in such settings, computer agents need capabilities for making decisions and negotiating with other participants—both people and computer-based agents. To construct effective agent strategies, it is almost impossible to use only a purely analytical approach, but there is a need to learn and evaluate agent strategies empirically in specific domains. In the talk, we will discuss five types of domains: (i) real applications such as agents for road safety; (ii) simulations of real applications such as autonomous car simulations; (iii) complex, off-the-shelf games such as Diplomacy or card games; (iv) designed games for the specific research questions such as the Colored Trails environment; and (v) abstract simple games such as the Ultimatum game. For each of the domain types, we will present several examples and demonstrate their use in agents' development and evaluation. We will discuss the advantages and the challenges of agent studies in each of the settings.

### Biography:

**Sarit Kraus** (Ph.D. Computer Science, Hebrew University, 1989) is a Professor of Computer Science at Bar-Ilan University. Her research is focused on intelligent agents and multi-agent systems integrating machine-learning techniques with optimization and game theory methods. For her work, she received many prestigious awards. She was awarded the IJCAI Computers and Thought Award, the ACM SIGART Agents Research Award, the ACM Athena Lecturer, the EMET prize and was twice the winner of the IFAAMAS influential paper award. She is an ACM, AAAI, and EurAI fellow and a recipient of the advanced ERC grant. She also



received a special commendation from the city of Los Angeles. She is an elected member of the Israel Academy of Sciences and Humanities.

## Keynote V An Unquenchable Appetite: Games, Play, and Climate Change

Jessica Hammer Carnegie Mellon University, US

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 9:00-10:00, August 23 (GMT+8)

### Abstract:

Mitigating climate change is an urgent challenge. It is also an extremely difficult one, not just from a climate systems perspective but from the perspective of mobilizing effective action. Barriers include understanding complex systems, supporting collective action, and resisting climate despair. While these are hard problems, they are also ones where games can help. In this talk, we will explore how game designers can contribute our knowledge and expertise to this grand challenge.

### **Biography**:

**Jessica Hammer** is the Thomas and Lydia Moran Associate Professor of Learning Science at Carnegie Mellon University, jointly appointed in the Human-Computer Interaction Institute and the Entertainment Technology Center. Her work focuses on transformational games, which are games that change how players think, feel, or behave. She is also an award-winning game designer.



## Keynote VI Player-AI Interaction: What Can Human-Centered AI Learn from Computer Games and Other Creative Domains

Jichen Zhu IT University of Copenhagen, Denmark

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 16:00-17:00, August 23 (GMT+8)

### Abstract:

Recent growth in artificial intelligence and machine learning propels human-AI interaction, especially with endusers, to the forefront of HCI research. Among the fast-growing body of literature on human-AI interaction design, an overlooked area is the context of play and playful interaction. Since computer games naturally focus on end-user experience, the fields of game AI and game design have accumulated decades of valuable design knowledge. In this talk, we will synthesize the current trends of player-AI interaction and discuss how they can advance broader open problems in Human-Center AI, such as interpretability/explainability, trust and ethics, and human-machine collaboration. Built on examples from recent AI-based games and digital art, we will propose open problems in the design and technical implementation of player-AI interaction.

### **Biography**:

**Dr. Jichen Zhu** is an Associate Professor of Digital Design at the IT University of Copenhagen (Denmark) Where she directs the Procedural eXpression Lab (PXL) and leads the User eXperience (UX) Design Specialization. Her research interest lies at the intersection of human-computer interaction, interaction/game design, and artificial intelligence (AI). Her focus is on designing and developing novel human-AI interaction, especially in the form of personalized games for learning and health.



## **Keynote VII**

## **On Computation Characterization in**

### **Game Theory**

Xiaotie Deng Peking University, China

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) (Rebroadcast on Yaotai Main Venue) 14:00-15:00, August 24 (GMT+8)

### Abstract:

We discuss the line of research approach in understanding the computational wisdom of game theory, in terms of rationality, complexity, and dynamics.

### Biography:

**Xiaotie Deng** got his BSc from Tsinghua University, MSc from the Chinese Academy of Sciences, and PhD from Stanford University.

He is currently a chair professor at Peking University. He taught in the past at Shanghai Jiaotong University, University of Liverpool, City University of Hong Kong, and York University. Before that, he was an NSERC international fellow at Simon Fraser University. Deng's current research focuses on algorithmic game theory, with applications to the Internet and Blockchain Economics and Finance.



He is an ACM fellow for his contribution to the interface of algorithms and game theory, an IEEE Fellow for his contributions to computing in partial information and interactive environments, and a CSIAM Fellow for contributions to game theory and blockchain. He is a foreign member of Academia Europaea.

He is a winner of the 2022 Test of Time Award of ACM SIGecom for settling the complexity of computing a Nash equilibrium.

### **Keynote VIII**

## AlphaStar: Grandmaster Level in StarCraft II using Multi-agent Reinforcement Learning

Oriol Vinyals Google DeepMind, UK

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) (Rebroadcast on Yaotai Main Venue) 20:00-21:00, August 24 (GMT+8)

### Abstract:

Games have been used for decades as an important way to test and evaluate the performance of artificial intelligence systems. As capabilities have increased, the research community has sought games with increasing complexity that capture different elements of intelligence required to solve scientific and real-world problems. In recent years, StarCraft, considered to be one of the most challenging Real-Time Strategy (RTS) games and one of the longest-played esports of all time, has emerged by consensus as a "grand challenge" for AI research.

In this talk, I will introduce our StarCraft II program AlphaStar, the first Artificial Intelligence to reach Grandmaster status without any game restrictions. The focus will be on the technical contributions which made possible this milestone in AI, and which yielded a cover in the prestigious journal Nature. To end, I'll also reflect on what has happened since the release of AlphaStar.

### Biography:

**Oriol Vinyals** is a Principal Scientist and Deep Learning Team Lead at DeepMind. His work focuses on deep learning and artificial intelligence, with particular emphasis on machine learning and reinforcement learning. Prior to DeepMind, Oriol was part of the Google Brain team. He holds a Ph.D. in EECS from the University of California, Berkeley and is a recipient of the 2016 MIT TR35 innovator award.



His research has been featured multiple times by the New York Times, Financial Times, WIRED, BBC, etc., with his articles being cited over 130,000 times. Contributions such as

seq2seq, knowledge distillation, or TensorFlow are used in Google Translate, Text-To-Speech, and Speech recognition, serving billions of queries every day. Other notable contributions include being the lead researcher for the AlphaStar project, and a contributor to the research and papers of the AlphaFold project, both breakthrough achievements featured on the cover of Nature.

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## **Tutorials in IEEE CoG2022**

## Tutorial I

## **Evolutionary Computation in Games:**

## Learning, Planning, and Designing

Julian Togelius New York University, USA Jialin Liu Southern University of Science and Technology, China

### IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142) 10:00-12:00, August 21 (GMT+8)

**Description**: This tutorial introduces several techniques and application areas for evolutionary computation in games, such as board games and video games. We will give a broad overview of the use cases and popular methods for evolutionary computation in games, and in particular cover the use of evolutionary computation for learning policies (evolutionary reinforcement learning using neuroevolution), planning (rolling horizon and online planning), and designing (particularly procedural content generation via evolutionary and machine learning methods). The basic principles will be explained and illustrated by examples from our own research as well as others' research.

The tutorial will be given in two parts (1.5 hours each, in total 3 hours duration). The first part will cover the computational intelligence for game-playing while the second part will cover the computational intelligence for game design, as detailed in the Outline. Questions are welcomed during and after the tutorials.

**Biography**: Julian Togelius is an Associate Professor in the Department of Computer Science and Engineering, New York University, USA. He works on artificial intelligence for games and games for artificial intelligence. His current main research directions involve procedural content generation in games using evolution and machine learning, general video game playing, player modeling, generating games based on open data, and fair and relevant benchmarking of AI through game-based competitions. He was Editor-in-Chief of IEEE Transactions on Games until 2021, and has been chair or program chair of several of the main conferences on AI and Games. Julian holds a BA



from Lund University, an MSc from the University of Sussex, and a Ph.D. from the University of Essex. He has previously worked at IDSIA in Lugano and at the IT University of Copenhagen.

**Jialin Liu** is currently an Assistant Professor in the Department of Computer Science and Engineering of Southern University of Science and Technology (SUSTech), China. Before joining SUSTech, she was a Postdoctoral Research Associate at Queen Mary University of London (QMUL, UK) and one of the founding members of the Game AI research group of QMUL. Her research interests include, but not limited to, AI in Games (AI for playing games, AI for designing games, particularly procedural content generation), optimization under uncertainty (derivation-free optimisation, dynamic resampling strategies, algorithm portfolio), evolutionary computation and its



applications, such as vehicle routing problems. Jialin is an Associate Editor of IEEE Transactions on Games. She is the Program Co-Chair of the 2022 IEEE Conference on Games (IEEE CoG2022) and was a Program Co-Chair of the 2018 IEEE Conference on Computational Intelligence and Games (IEEE CIG2018). She has also served as Competition Chair of several main conferences on evolutionary computation and AI in games.

## Tutorial II Learning in Sparse Reward and Imperfect Information Games

Junliang Xing Tsinghua University, China Kai Li Institute of Automation, Chinese Academy of Science, China

IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142) 16:00-18:00, August 21 (GMT+8)

**Description**: In recent years, many breakthroughs have been made in artificial intelligence, from playing Atari games to learning complex robotic manipulation tasks. However, an agent still faces challenges from sparse reward and imperfect information in many real-world scenarios. Sparse reward refers to a reward function that is zero in most of its domain and only gives positive values to very few states. It is difficult for an agent to learn effective policies in sparse reward games since it will not get any feedback about whether its instantaneous actions are good or bad. Moreover, the presence of imperfect information in games, where an agent does not fully know the state of the world, makes learning more difficult since learning in such imperfect information games requires reasoning under uncertainty about other agents' private information.

This tutorial will focus on commonly used approaches for learning in sparse reward and imperfect information games. The first part of the tutorial will discuss learning in sparse reward games, in which we will cover prediction error-based, novelty-based, and information gain-based methods. We will also introduce the latest results of our research group, such as self-navigation-based, potential-based, and influence-based learning algorithms. The second part of the tutorial will focus on learning in imperfect information games. We will first introduce the formal definition of imperfect information games. Then we will discuss regret-based (CFR) and population-based methods (PSRO) to learn fixed optimal worst-case policies. Finally, we will introduce opponent modeling-based methods to learn adaptive policies. We will also discuss the unsolved problems and the directions for future research. We hope this tutorial inspires and motivates attendees to continue learning and contributing to the current development in this field.

**Biography**: Junliang Xing is currently a Researcher with the Tsinghua University. He received his B.E. degrees in Computer Science and Technology as well as Applied Mathematics from Xi'an Jiaotong University in 2007 and his Ph.D. degree in Computer Science and Technology from Tsinghua University, 2012. Dr. Xing has published over 120 peer-reviewed conference papers in IJCAI, AAAI, ICCV, CVPR, and journal papers in TPAMI, IJCV, AI. He has translated two books in computer vision and wrote one book on deep learning. His main research



areas lie in computer vision and computer gaming, with a current focus on agent learning in complex decisionmaking problems.

**Kai Li** is currently an associate professor at the Institute of Automation, Chinese Academy of Sciences. He received his Ph.D. degree in pattern recognition and intelligent system from the Institute of Automation, Chinese Academy of Sciences, in 2018. His main research interests are imperfect information game solving, opponent modeling, and deep multiagent reinforcement learning. He has published dozens of papers at top artificial intelligence conferences and journals.



## Tutorial III

## **Solving Zero-sum Games through**

### **Reinforcement Learning**

Yaodong Yang Peking University, China

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 10:00-12:00, August 22 (GMT+8)

**Description**: Recent advances in multiagent reinforcement learning have seen the introduction of a new learning paradigm that revolves around population-based training. The idea is to consider the structure of games not at the micro-level of individual actions, but at the meta-level of the which agent to train against for any given game or situation. A typical framework of population based training is Policy Space Response Oracle (PSRO) method where, at each iteration, a new Reinforcement Learning agent is discovered as the best response to a Nash mixture of agents from the opponent populations. PSRO methods can provably converge to Nash, correlated and coarse correlated equilibria in N-player games; particularly, they have showed remarkable performance on solving large-scale zero-sum games. In this tutorial, I will introduce the basic idea of PSRO methods, the necessity of using PSRO methods in solving real-world games such as Chess, the recent results on solving N-player games and mean-field games, how to promote behavioral diversity during training, and the relationship of PSRO method to the conventional no-regret methods. At last, I will introduce a new meta-PSRO framework named Neural Auto-Curricula where we make AI learning to learn a PSRO-like solution algorithm purely from data, and a new PSRO framework called online double oracle that inherits the benefits from both population-based methods and no-regret methods.

**Biography**: **Yaodong Yang** is a machine learning researcher with ten-year working experience in both academia and industry. Currently, he is an assistant professor at Peking University. His research is about reinforcement learning and multi-agent systems. He has maintained a track record of more than forty publications at top conferences and journals, along with the best system paper award at CoRL 2020 (first author) and the best blue-sky paper award at AAMAS 2021 (first author). Before joining Peking University, he was an assistant professor at King's College London. Before KCL, he was a principal research scientist at Huawei U.K. where he headed the multi-agent system



team in London. Before Huawei, he was a senior research manager at AIG, working on AI applications in finance. He holds a Ph.D. degree from University College London, an M.Sc. degree from Imperial College London and a Bachelor degree from University of Science and Technology of China.

## Tutorial IV A Designer's Reflection on Game Design Considering Players' Emotions

Hamna Aslam

Joseph Alexander Brown

IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142) 10:00-11:30, August 22 (GMT+8)

**Description**: Emotions and perceptions are associated with each play experience. Therefore, players' potential emotional outcomes must be regarded at an early stage of game design. Games are usually designed with a theme or mechanics setup as a starting point. However, only after the theme and mechanics are laid out, the player experience can be investigated. This tutorial entails a process that prioritizes and ensures that gameplay can (to a great extent) achieve the designer's goal for player experience and emotions along with desired mechanics and settings. This design process includes several questions for the designer. These questions help game designers reflect on the mechanics to identify players' potential emotional outcomes.

This tutorial aims to demonstrate to the audience how to design a game, taking into account the player's emotional outcomes and the designer's intended theme and mechanics. Playtesting is a crucial part of the development process; however, a designer can obtain an understanding of a player's emotional journey at a point when they have only decided on some broader details and ideas about the game. The player's mental process cannot be assumed without a playtest and investigation as players are diverse, and so are their gameplay experiences. This tutorial aims at helping designers to formulate the game template with possible emotional outcomes that they deem closer to players' mental processes.

**Biography**: **Hamna Aslam** is a Ph.D. student at the University of Toulouse, France, and an instructor at Innopolis University. Her research interest includes game design, player perceptions, artificial intelligence, and requirements engineering. She has published numerous peer-reviewed papers on the topic of human factors and game design.

**Joseph Alexander Brown** received a B.Sc. (Hons.) with first-class standing in Computer Science with a concentration in software engineering, and an M.Sc. in Computer Science from Brock University, St. Catharines, ON, Canada in 2007 and 2009, respectively. He received a Ph.D. in Computer Science from the University of Guelph in 2014.

He previously worked for Magna International Inc. as a Manufacturing Systems Analyst and as a visiting researcher at ITU Copenhagen in their Games Group. He is currently an Associate Professor and Head of the Artificial Intelligence in Games Development Lab

at Innopolis University in Innopolis, Republic of Tatarstan, Russia, and an Adjunct Professor of Computer Science at Brock University, St. Catharines, ON, Canada.

He is a Senior Member of the IEEE, a chair of the yearly Procedural Content Generation Jam (ProcJam), the proceedings chair for the IEEE 2013 Conference on Computational Intelligence in Games (CIG), and Vice-Chair for the IEEE Committee on Games.



## **Tutorial V**

## **Player Modelling through Affective Computing**

Phil Lopes Universidade Lusófona de Humanidades e Tecnologias, Lisboa David Melhart University of Malta, Malta

IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 18:00-20:00, August 23 (GMT+8)

**Description**: Affective computing is a field of computer science that focuses on the sensing and prediction of affect and emotions. Games provide a rich and robust testbed for affective computing applications due to a unique mix of constrained environment and emergent interaction. However, affective computing also has value to game research for both academic and industrial applications. Methodologies lifted from affective computing can help game researchers build more robust predictive models of not just behaviour but also player experience.

This tutorial aims to introduce affective computing concepts and methods for player modelling. The first part of the tutorial gives a broad overview of the field of affective computing in the games domain including fundamental concepts, best practices, tools, and industry applications. The second part of the tutorial focuses on the frontiers of affective computing research in games and touch on the topics of VR and research into embodied cognition.

**Biography**: **Phil Lopes** is an Assistant Professor at the Universidade Lusofona, Lisbon, Portugal. He has a PhD in Artificial Intelligence applied in the field of Human-Computer and Digital Game Interaction. He graduated in 2017 from the Institute of Digital Games of the University of Malta. His main research interest lies in the development of automated digital game experiences personalized to each individual user. Before this he was a Post-Doc at the University of Geneva and the École Polytechnique Fédérale de Lausanne (EPFL), where he worked at the crossroads of neuroscience, affective



computing, artificial intelligence, virtual reality and digital games. He is currently a guest editor for Frontiers in Virtual Reality and a published author for several IEEE, ACM and Springer peer-reviewed conferences and journals.

**David Melhart** is a post-doctoral researcher at the University of Malta, Msida, Malta, focusing on player modelling, annotation tools, research design, affective corpora, and general affect modelling in games. He earned his PhD at the University of Malta, Institute of Digital Games in 2021. During his studies, he was involved in 6 industrial and academic collaborations with partners including the acclaimed game-studio Ubisoft Massive Entertainment. He has also played a key role in organizing the GALA Conference in 2019 and the Conference on the Foundations of Digital Games in 2020. He has been a recurring organizer of the International Summer School series on AI and Games since



its inception (2018-2022). He has published conference and journal papers in various venues from the IEEE Conference on Games, the AAAI Conference on Affective Computing and Intelligent Interaction, and the International Joint Conference of AI to the International Journal of Child-Computer Interaction. His work has been nominated for awards at the IEEE Conference on Games 2 times (runner up for Best Short-Video and Best Paper in 2019 and 2021 respectively). He is currently a Guest Editor for the Frontiers in Virtual Reality and an Editorial Assistant for the IEEE Transactions on Games.

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## Industry Talks in IEEE CoG2022

### "Nosso Museu", A Serious Game in Virtual Reality as A Tool to Support the Identification of Risks on Archaeological Collections

Michelle Mayumi Tizuka

Fercant & Yahto Scientific Consulting / Majime Labs, Brazil

### IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 10:00-10:30, August 21 (GMT+8)

**Abstract**: After mapping ten museums with archaeological collections located in the state of Paraná, Brazil, we identified that less than 5% of their teams had received any training in the area of security and risks related to collections in the last decade. Faced with the challenge of engaging these teams, we developed and applied a serious game in virtual reality. The game was evaluated through the QUIS method in one of the researched Museums, with the participation of the entire team of six employees who have different positions. The results indicate a high degree of satisfaction about the methodology used, and raise assumptions for the use of analysis techniques in gamification for the elaboration of prescriptive models applied to risk management protocols in museums.

**Biography**: Michelle Mayumi Tizuka is a doctoral student in Computer Science at UFF, with research in the area of Provenance, Gamification Analytics and virtual reality. He is also the Consultant Archaeologist at Fercant & Yahto Scientific Consulting and CEO of Majime Labs.

### Data Science Solutions throughout Games' Lifecycles Leveraging Big Data and Al

Qiaolin Chen Tencent IEG Global, China

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 10:30-11:00, August 21 (GMT+8)

**Abstract**: Data science are driving the tremendous evolvement of the gaming industry. What used to be a human-designed game has now transformed into a data-driven designed game that provides an exceptional gaming experience. In this presentation, we are going to cover how Data Science is playing a significant role in the gaming industry, by combining advanced statistics and machine learning to leverage the hidden potential of game data.

We will first give an overview of data science applications across game life cycle from data driven decisions, efficient production, to effective user acquisition after launch and sustainable user growth. Next we discuss data science use cases demonstrating how big data can help game developers and publishers optimize and improve their games, such as game AI, user acquisition, personalized in-game recommendation, monetization, churn prediction and prediction. With these novel applications, data science can take users' experiences to the next level and transforms the gaming industry.

**Biography**: Qiaolin Chen is the Chief Data Scientist at Tencent IEG Global, leading efforts related data science solutions throughout game product life cycle, including data driven game design and production, game AI, user acquisition, LTV prediction, in-game recommendation, user life cycle analysis, virtual economy, user profile system. She joined Tencent Games in 2018, prior to which she was data scientist at SparkBeyond and a principal statistician at Novartis. She received her B.S. from Peking University and Ph.D. in Biostatistics from UCLA.

### **Application of AI Virtual Player in the 3D Action Game.**

Shihong Deng ByteDance, China

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 11:00-11:30, August 21 (GMT+8)

**Abstract**: Introduce how we achieve state-of-art ai in the 3D action game, and how we use it in several scenarios to benefit both game players and game designer.

**Biography**: Shihong Deng is currently the researcher at department of game ai, ByteDance.

### Applying Reinforcement Learning in Naraka: Bladepoint.

### Kai Guan NetEase Fuxi Al Lab, China

### IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 11:30-12:00, August 21 (GMT+8)

**Abstract**: Naraka: Bladepoint is an action-adventure battle royale game developed by 24 Entertainment and published by NetEase Games Montreal. This game incorporates martial arts-inspired melee combat and features a rock-paper-scissors combat system. There are vast arsenals of melee and ranged weapons to choose from, as well as a grappling hook that can be used for both combat and traversal. This talk is about how we apply reinforcement learning to improve the navigation and combat Al in Naraka.

Navigation Mesh (NavMesh) is a general-used approach for characters' navigation in game industry, which mathematically traverses the nodes and edges of a map to calculate possible navigate solutions. It is well known that NavMesh lacks capability to reach destination in complex three-dimensional terrains, and limit the character's abilities for movement such as using grappling hook. By introducing reinforcement learning into navigation, we adopt radar feature and depth map to represent the local view of agent, achieving a 60% improvement of character's arrival rate in Naraka. Besides, the performance of our RL-based AI is more efficient and flexible, also more human-like than NavMesh-driven method by using adaptive moving abilities.

The rock-paper-scissors combat system of Naraka brings much difficulty to traditional combat AI like behavior tree or rule-based approaches because players usually predict or guess their opponents' next move by estimating their history behaviors. Various weapons, diverse heroes also increase the complexity of building combat AI, making behavior tree infeasible in these battle scenarios. Our RL-based AI adopts a general modeling scheme to learn fighting with different heroes and weapons. To anticipate opponents' behavior, we modeling opponents' move in training phase, which helps AI learn multiple strategies to deal with different opponents. Our AI beats built-in rule-based AI with 100% win rate, and is above 90% of ranked human players in a small scale assessment in solo match.

**Biography**: Kai Guan is a senior AI engineer in NetEase Fuxi AI Lab, Hangzhou, China since 2018. He is in charge of the technology transfer group which focus on the reinforcement learning area since 2021. He received the MA.Sc. degree in computer science from Zhejiang University in 2018. His working interests include reinforcement learning, game AI and distribute compute system. The RL-based AI which he was involved in developing has been successfully applied to a number of important games in NetEase, such as: Justice PC, Ghosts PC, Naraka, etc.

## Sponsored Talk in IEEE CoG2022

### NPC AI in Action - Research, Applications and Challenges

Xiangjun Wang inspir.ai

> IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) 8:30-8:50, August 22 (GMT+8)

**Abstract**: There have been significant advancements in AI research on games such as Atari, AlphaGo, OpenAI Five, AlphaStar, etc. In turn, modern AI technologies such as deep learning and deep reinforcement learning create a lot of opportunities for enhancing user experiences and game design.

In this talk, I'll share inspir.ai's work on NPC AI, including research on deep reinforcement learning, language models, and various applications for games such as AI Commander, AI Player, AI Character, AI Designer, etc., as well as the challenges in applying those modern technologies in commercial games.

**Biography**: Xiangjun Wang is the Chief Algorithms Officer at inspir.ai, leading both Al research and applications. His work focuses on deep reinforcement learning, large language models, and building general Al methods that are scalable and applicable to real-world applications. Prior to inspir.ai, he led the core recommendation team at Netflix. He has published and served on committees on NeurIPS, ICML, CVPR, etc.





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NetEase YAOTAI has held immersive virtual activities for users in **more than twenty countries** including the United States, Japan, and Singapore, covering multiple fields.

Examples: NetEase CloudMusic IPO Conference, International Conference on Distributed Artificial Intelligence (DAI 2020), Huatai Securities 2022 Annual Investment Summit, Henan Wisdom Tourism Conference, etc.



8:30-9:00	IEEE CoG2022 Opening
	Chair: Dongbin Zhao (Chinese Academy of Sciences, Institute of Automation, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)
9:00-10:00	Keynote I: On Game-Based Control Systems
	Speaker. Lei Guo (Academy of Mathematics and Systems Science, China)
	Chair: Dongbin Zhao (Chinese Academy of Sciences, Institute of Automation, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)

10:00-12:00	Industry Talks
	<i>Chair</i> : Hongliang Li (ByteDance.com, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)
	<ul> <li>"Nosso Museu", a serious game in virtual reality as a tool to support the identification of risks on archaeological collections</li> <li>Speaker: Michelle Mayumi Tizuka</li> <li>Affiliation: Fercant &amp; Yahto Scientific Consulting / Majime Labs, Brazil</li> </ul>
	<ul> <li>Data Science Solutions throughout Games' Lifecycles Leveraging Big Data and Al 10:30-11:00</li> <li>Speaker: Qiaolin Chen</li> <li>Affiliation: Tencent IEG Global, China</li> </ul>
	<ul> <li>Application of AI Virtual Player in the 3D Action Game 11:00-11:30</li> <li>Speaker: Shihong Deng</li> <li>Affiliation: ByteDance, China</li> </ul>
	<ul> <li>Applying Reinforcement Learning in Naraka: Bladepoint</li> <li>Speaker: Kai Guan</li> <li>Affiliation: NetEase Fuxi Al Lab, China</li> </ul>
10:00-12:00	Tutorial I: Evolutionary Computation in Games: Learning, Planning, and Designing
	Speakers: Julian Togelius (New York University, USA)
	Jialin Liu (Southern University of Science and Technology, China)
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)

15:00-16:00	Keynote II: Emotion-Centric AI: from Hubris and Nemesis to Catharsis
	Speaker: Georgios N. Yannakakis (University of Malta, Malta)
	Chair. Diego Perez Liebana (Queen Mary University of London, UK)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)
16:00-18:00	Tutorial II: Learning in Sparse Reward and Imperfect Information Games
	Speakers. Junliang Xing (Tsinghua University, China)
	Kai Li (Institute of Automation, Chinese Academy of Science, China)
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)

9:00-10:00	Keynote III: Going beyond Games: Towards Decision Making in The Real-world
	<i>Speaker</i> : Yuandong Tian (Meta Al, US)
	Chair: Jialin Liu (Southern University of Science and Technology, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)

10:00-12:00	Tutorial III: Solving Zero-sum Games through Reinforcement Learning
	Speaker: Yaodong Yang (Peking University, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)
10:00-11:30	Tutorial IV: A Designer's Reflection on Game Design Considering Players' Emotions
	<i>Speakers</i> : Hamna Aslam
	Joseph Alexander Brown
	IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)

15:00-16:00	AI4Playing I			
	Chair. Junge Zhang (Chinese Academy of Sciences Institute of Automation, China)			
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)			
	<ul> <li>(101) MOBA Game Item Recommendation via Relation-aware Graph Attention Network Authors: Lijuan Duan, Shuxin Li, Wenbo Zhang, Wenjian Wang Affiliation: Beijing University of Technology</li> </ul>	15:00-15:20		
	<ul> <li>(50) DouZero+: Improving DouDizhu AI by Opponent Modeling and Coach-guided Learning Authors: Youpeng Zhao, Jian Zhao, Xunhan Hu, Wengang Zhou and Houqiang Li Affiliation: University of Science and Technology of China</li> </ul>	15:20-15:40		
	> (216) Learning Continuous 3-DoF Air-to-Air Close-in Combat Strategy using Proximal Polic	y Optimization 15:40-15:50		
	<i>Authors</i> : Luntong Li, Zhiming Zhou, Jiajun Chai, Zhen Liu, Yuanheng Zhu and Jianqiang <i>Affiliation</i> : Chinese Academy of Sciences Institute of Automation	Yi		
	<ul> <li>(222) Improving DNNs-based 2048 Players with Position Embedding Authors: Wang Weikai and Matsuzaki Kiminori Affiliation: Kochi University of Technology</li> </ul>	15:50-16:00		
15:00-16:00	Game Testing			
	Chair. Yingfeng Chen (NetEase Fuxi Al Lab, China)			
	IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)			
	(82) Inspector: Pixel-based Automated Game Testing via Exploration, Detection, and Invest	igation 15:00-15:20		
	Authors: Guoqing Liu, Mengzhang Cai, Li Zhao, Tao Qin, Adrian Brown, Jimmy Bischoff and Tie-Yan Liu Affiliation: Microsoft Research Asia, University of Science and Technology of China, Xbox Studios Quality			
	Affiliation: Microsoft Research Asia, University of Science and Technology of China, Xbox	and Tie-Yan Liu Studios Quality		
	<ul> <li>Authors: Guoquig Eld, Mengzhang Cal, El Zhao, Hao Qui, Authan Brown, Jinniy Bischon Affiliation: Microsoft Research Asia, University of Science and Technology of China, Xbox</li> <li>(67) Automatic Testing and Validation of Level of Detail Reductions Through Supervised Leaders</li> </ul>	and Tie-Yan Liu Studios Quality arning 15:20-15:40		
	<ul> <li>Authors: Guoqing Eu, Mengzhang Cal, Erzhao, Hao Qin, Auhan Brown, Jinniy Bischon Affiliation: Microsoft Research Asia, University of Science and Technology of China, Xbox</li> <li>(67) Automatic Testing and Validation of Level of Detail Reductions Through Supervised Lev Authors: Matilda Tamm, Olivia Shamon, Héctor Anadon Leon, Konrad Tollmar and Linu Affiliation: Uppsala University, Linköping University, SEED - Electronic Arts</li> </ul>	and Tie-Yan Liu Studios Quality arning 15:20-15:40 us Gisslén		

16:00-17:00	Keynote IV: Agent-Human Complex Games for Multi-agent Studies	
	Speaker: Sarit Kraus (Bar-Ilan University, Israel)	
	Chair: Simon Lucas (Queen Mary University of London, UK)	
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)	
17:00-18:20	AI4Playing II	
	Chair: Mike Preuss (Leiden University, The Netherlands)	
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)	
	(85) On the Verge of Solving Rocket League using Deep Reinforcement Learning and Sim-to-sim Tran 17:00-17:2	sfer 20
	Authors: Marco Pleines, Jannik Drögemüller, Frederik Rohkrähmer, Hendrik Meyer, Sebastian P Thilo Röthemeyer, Leon Büttinghaus, Matthias Pallasch, Konstantin Ramthun, Yannik Wegener, Alexar Kaschwig, Oliver Chmurzynski, Roman Kalkreuth, Frank Zimmer and Mike Preuss Affiliation: TU Dortmund University, Rhine-Waal University of Applied Sciences, Universiteit Leiden	rior, nder
	> (94) Improving Bidding and Playing Strategies in the Trick-Taking game Wizard using Deep Q-Network 17:20-17:-	ks 40
	Authors: Jonas Schumacher and Marco Pleines Affiliation: TU Dortmund University	
	<ul> <li>(37) Learning General Game State Representations from Unlabeled Images</li> <li>Authors: Chintan Trivedi, Konstantinos Makantasis, Antonios Liapis and Georgios N. Yannakakis</li> <li>Affiliation: University of Malta</li> </ul>	00
	<ul> <li>(105) Task Relabelling for Multi-task Transfer using Successor Features</li> <li>Authors: Martin Balla and Diego Perez-Liebana</li> <li>Affiliation: Queen Mary University of London</li> </ul>	20
17:00-18:10	Game Design	
	<i>Chair</i> : Cameron Browne (Maastricht University, the Netherlands)	
	IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)	
	<ul> <li>(10) Paste You Into Game: Towards Expression and Identity Consistency Face Swapping</li> <li>Authors: Hao Zeng, Wei Zhang, Keyu Chen, Zhimeng Zhang, Lincheng Li and Yu Ding</li> <li>Affiliation: Netease Fuxi AI Lab</li> </ul>	20
	<ul> <li>(16) Realistic Game Avatars Auto-Creation from Single Images via Three-pathway Network 17:20-17: Authors: Jiangke Lin, Lincheng Li, Yi Yuan and Zhengxia Zou Affiliation: NetEase Fuxi AI Lab, University of Michigan</li> </ul>	:40
	<ul> <li>(119) Declarative AI design in Unity using Answer Set Programming</li> <li>Authors: Denise Angilica, Giovambattista Ianni and Francesco Pacenza</li> <li>Affiliation: University of Calabria</li> </ul>	00
	<ul> <li>(187) Generalizations of Steering - A Modular Design</li> <li>Authors: Lars Wagner, Christopher Olson and Alexander Dockhorn</li> <li>Affiliation: Otto von Guericke University Magdeburg, Leibniz University Hannover</li> </ul>	10

20:00-22:30	CoG2022 Competitions	
	Chairs. Xiaochuan Zhang (Chongqing University of Technology, China)	
	Raluca Gaina (Queen Mary University of London, UK)	
	IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)	
20:00-20:50	Al4Playing III	
	Chair. Amy Hoover (New Jersey Institute of Technology, USA)	
	At IEEE Co C2022 To an Making 1 (ID 050 0002 7107)	
	At IEEE CoG2022-ZoomWebInar-T (ID 858 0082 7 197)	

	Authors: Stephen G. Ware and Rachelyn Farrell Affiliation: University of Kentucky	
	<ul> <li>(111) Mitigating cowardice for reinforcement learning agents in combat scenarios</li> <li>Authors: Steve Bakos and Heidar Davoudi</li> <li>Affiliation: Ontario Tech University</li> </ul>	20:20-20:40
	> (164) MAIDCRL: Semi-centralized Multi-Agent Influence Dense-CNN Reinforcement Learnin	g 20:40-20:50
	Authors: Ayesha Siddika Nipu, Siming Liu and Anthony Harris Affiliation: Missouri State University	
21:00-21:30	Player Modelling	
	<i>Chair</i> : Yuanheng Zhu (Chinese Academy of Sciences, Institute of Automation, C At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)	China)
	<ul> <li>(166) Regularized Soft Actor-Critic for Behavior Transfer Learning Authors: Mingxi Tan, Ludovic Denoyer, Andong Tian and Alexis Rolland Affiliation: Ubisoft</li> </ul>	21:00-21:10
	> (176) Improved Action Prediction through Multiple Model Processing of Player Trajectories	21:10-21:20
	Authors: Branden Corwin Ingram, Benjamin Rosman, Clint Van Alten and Richard Klein Affiliation: University of the Witwatersrand	I
	<ul> <li>(175) Evaluating Navigation Behavior of Agents in Games using Non-Parametric Statistics Authors: Ian Colbert and Mehdi Saeedi Affiliation: Advanced Micro Devices Inc.</li> </ul>	21:20-21:30
21:30-23:30	ToG Outstanding Paper Nominees Presentation	
	<i>Chair</i> . Georgios N Yannakakis (University of Malta, Malta)	
	Chair. Georgios N Yannakakis (University of Malta, Malta) At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)	
	<ul> <li>Chair. Georgios N Yannakakis (University of Malta, Malta)</li> <li>At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)</li> <li>➢ Deep Learning for Video Game Playing         <ul> <li>Authors: Niels Justesen, Philip Bontrager, Julian Togelius, Sebastian Risi</li> <li>Affiliation: IT University of Copenhagen, New York University</li> </ul> </li> </ul>	21:30-21:50
	<ul> <li>Chair. Georgios N Yannakakis (University of Malta, Malta)</li> <li>At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)</li> <li>Deep Learning for Video Game Playing         <ul> <li>Authors: Niels Justesen, Philip Bontrager, Julian Togelius, Sebastian Risi</li> <li>Affiliation: IT University of Copenhagen, New York University</li> </ul> </li> <li>Procedural Puzzle Generation: A Survey         <ul> <li>Authors: Barbara De Kegel, Mads Haah</li> <li>Affiliation: Trinity College Dublin, University College Dublin</li> </ul> </li> </ul>	21:30-21:50 21:50-22:10
	<ul> <li>Chair: Georgios N Yannakakis (University of Malta, Malta)</li> <li>At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)</li> <li>Deep Learning for Video Game Playing         <ul> <li>Authors: Niels Justesen, Philip Bontrager, Julian Togelius, Sebastian Risi</li> <li>Affiliation: IT University of Copenhagen, New York University</li> </ul> </li> <li>Procedural Puzzle Generation: A Survey         <ul> <li>Authors: Barbara De Kegel, Mads Haah</li> <li>Affiliation: Trinity College Dublin, University College Dublin</li> </ul> </li> <li>Winning Is Not Everything: Enhancing Game Development With Intelligent Agents         <ul> <li>Authors: Yunqi Zhao, Igor Borovikov, Fernando de Mesentier Silva, Ahmad Beirami,</li> <li>Caedmon Somers, Jesse Harder, John Kolen, Jervis Pinto, Reza Pourabolghasem, James F</li> <li>Chaput, Mohsen Sardari, Long Lin, Sundeep Narravula, Navid Aghdaie, Kazi Zaman</li></ul></li></ul>	21:30-21:50 21:50-22:10 22:10-22:30 Jason Rupert, Pestrak, Harold
	<ul> <li>Chair: Georgios N Yannakakis (University of Malta, Malta)</li> <li>At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)</li> <li>Deep Learning for Video Game Playing <ul> <li>Authors: Niels Justesen, Philip Bontrager, Julian Togelius, Sebastian Risi</li> <li>Affiliation: IT University of Copenhagen, New York University</li> </ul> </li> <li>Procedural Puzzle Generation: A Survey <ul> <li>Authors: Barbara De Kegel, Mads Haah</li> <li>Affiliation: Trinity College Dublin, University College Dublin</li> </ul> </li> <li>Winning Is Not Everything: Enhancing Game Development With Intelligent Agents <ul> <li>Authors: Yunqi Zhao, Igor Borovikov, Fernando de Mesentier Silva, Ahmad Beirami,</li> </ul> </li> <li>Caedmon Somers, Jesse Harder, John Kolen, Jervis Pinto, Reza Pourabolghasem, James F</li> <li>Chaput, Mohsen Sardari, Long Lin, Sundeep Narravula, Navid Aghdaie, Kazi Zaman <ul> <li>Affiliation: Electronic Arts</li> </ul> </li> <li>Self-Adaptive Monte Carlo Tree Search in General Game Playing <ul> <li>Authors: Chiara F. Sironi, Jialin Liu, Mark H. M. Winands</li> <li>Affiliation: Maastricht University, Southern University of Science and Technology</li> </ul> </li> </ul>	21:30-21:50 21:50-22:10 22:10-22:30 Jason Rupert, Pestrak, Harold 22:30-22:50
	<ul> <li>Chair: Georgios N Yannakakis (University of Malta, Malta)</li> <li>At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)</li> <li>Deep Learning for Video Game Playing         <ul> <li>Authors: Niels Justesen, Philip Bontrager, Julian Togelius, Sebastian Risi</li> <li>Affiliation: IT University of Copenhagen, New York University</li> </ul> </li> <li>Procedural Puzzle Generation: A Survey         <ul> <li>Authors: Barbara De Kegel, Mads Haah</li> <li>Affiliation: Trinity College Dublin, University College Dublin</li> </ul> </li> <li>Winning Is Not Everything: Enhancing Game Development With Intelligent Agents         <ul> <li>Authors: Yunqi Zhao, Igor Borovikov, Fernando de Mesentier Silva, Ahmad Beirami,</li> <li>Caedmon Somers, Jesse Harder, John Kolen, Jervis Pinto, Reza Pourabolghasem, James F</li> <li>Chaput, Mohsen Sardari, Long Lin, Sundeep Narravula, Navid Aghdaie, Kazi Zaman                  Affiliation: Electronic Arts</li> <li>Self-Adaptive Monte Carlo Tree Search in General Game Playing                  Authors: Chiara F. Sironi, Jialin Liu, Mark H. M. Winands                 Affiliation: Maastricht University, Southern University of Science and Technology</li> </ul> </li> <li>Adaptive Music Composition for Games         <ul> <li>Authors: Patrick Edward Hutchings, Jon McCormack</li> <li>Affiliation: Monash University</li> </ul> </li> </ul>	21:30-21:50 21:50-22:10 22:10-22:30 Jason Rupert, Pestrak, Harold 22:30-22:50 22:50-23:10
	<ul> <li>Chair: Georgios N Yannakakis (University of Malta, Malta)</li> <li>At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)</li> <li>&gt; Deep Learning for Video Game Playing Authors: Niels Justesen, Philip Bontrager, Julian Togelius, Sebastian Risi Affiliation: IT University of Copenhagen, New York University</li> <li>&gt; Procedural Puzzle Generation: A Survey Authors: Barbara De Kegel, Mads Haah Affiliation: Trinity College Dublin, University College Dublin</li> <li>&gt; Winning Is Not Everything: Enhancing Game Development With Intelligent Agents Authors: Yunqi Zhao, Igor Borovikov, Fernando de Mesentier Silva, Ahmad Beirami, Caedmon Somers, Jesse Harder, John Kolen, Jervis Pinto, Reza Pourabolghasem, James F Chaput, Mohsen Sardari, Long Lin, Sundeep Narravula, Navid Aghdaie, Kazi Zaman Affiliation: Electronic Arts</li> <li>&gt; Self-Adaptive Monte Carlo Tree Search in General Game Playing Authors: Chiara F. Sironi, Jialin Liu, Mark H. M. Winands Affiliation: Maastricht University, Southern University of Science and Technology</li> <li>&gt; Adaptive Music Composition for Games Authors: Patrick Edward Hutchings, Jon McCormack Affiliation: Monash University</li> <li>&gt; Infinite Loot Box: A Platform for Simulating Video Game Loot Boxes Authors: Dominic Kao Affiliation: Purdue University</li> </ul>	21:30-21:50 21:50-22:10 22:10-22:30 Jason Rupert, Destrak, Harold 22:30-22:50 22:50-23:10 23:10-23:30

9:00-10:00	Keynote V: An Unquenchable Appetite: Games, Play, and Climate Change
	Speaker: Jessica Hammer (Carnegie Mellon University, US)
	Chair: Yuanheng Zhu (Chinese Academy of Sciences, Institute of Automation, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)

10:00-11:00	PCG I	
	<i>Chair</i> . Jialin Liu (Southern University of Science and Technology, China)	
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)	
	> (218) Learning Level Orderings using Playtraces and Level Structure in Human Comp	utation Games 10:00-10:10
	Authors: Anurag Sarkar and Seth Cooper Affiliation: Northeastern University	
	> (88) Toward Cooperative Level Generation in Multiplayer Game: A User Study in Overcook	ed 10:10-10:30
	Authors: In-Chang Baek, Tae-Gwan Ha, Tae-Hwa Park and Kyung-Joong Kim Affiliation: GIST	
	<ul> <li>(49) Online Level Generation with Music: A Player-Adaptive Approach Authors: Ziqi Wang and Jialin Liu Affiliation: Southern University of Science and Technology</li> </ul>	10:30-10:50
	<ul> <li>(155) Surrogate Infeasible Fitness Acquirement FI-2Pop for Procedural Content Generation Authors: Roberto Gallotta, Kai Arulkumaran and L. B. Soros Affiliation: Araya Inc., Cross Labs</li> </ul>	10:50-11:00
10:00-10:50	DRL for Games	
10:00-10:50	<b>DRL for Games</b> <i>Chair</i> : Luntong Li (Chinese Academy of Sciences, Institute of Automation, Chin	a)
10:00-10:50	DRL for Games Chair: Luntong Li (Chinese Academy of Sciences, Institute of Automation, Chin At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)	a)
10:00-10:50	DRL for Games         Chair. Luntong Li (Chinese Academy of Sciences, Institute of Automation, Chin         At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)         ▶ (183) Towards Modern Card Games with Large-Scale Action Spaces Through Action	a) <i>Representation</i> 10:00-10:10
10:00-10:50	<ul> <li>DRL for Games</li> <li>Chair: Luntong Li (Chinese Academy of Sciences, Institute of Automation, Chin At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)</li> <li>▶ (183) Towards Modern Card Games with Large-Scale Action Spaces Through Action Authors: Zhiyuan Yao, Tianyu Shi, Site Li, Yiting Xie, Yuanyuan Qin, Huan Lu, Xiongjie Xie Affiliation: Stevens Institute of Technology, University of Toronto, rct Al</li> </ul>	a) <i>Representation</i> 10:00-10:10 e and Yan Zhang
10:00-10:50	<ul> <li>DRL for Games</li> <li>Chair. Luntong Li (Chinese Academy of Sciences, Institute of Automation, Chin At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)</li> <li>▶ (183) Towards Modern Card Games with Large-Scale Action Spaces Through Action</li> <li>Authors: Zhiyuan Yao, Tianyu Shi, Site Li, Yiting Xie, Yuanyuan Qin, Huan Lu, Xiongjie Xie Affiliation: Stevens Institute of Technology, University of Toronto, rct AI</li> <li>▶ (116) Multi-goal Reinforcement Learning via Exploring Successor Matching Authors: Xiaoyun Feng Affiliation: University of Science and Technology of China</li> </ul>	a) <i>Representation</i> 10:00-10:10 e and Yan Zhang 10:10-10:30
10:00-10:50	<ul> <li>DRL for Games</li> <li>Chair. Luntong Li (Chinese Academy of Sciences, Institute of Automation, Chin At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)</li> <li>▶ (183) Towards Modern Card Games with Large-Scale Action Spaces Through Action Authors: Zhiyuan Yao, Tianyu Shi, Site Li, Yiting Xie, Yuanyuan Qin, Huan Lu, Xiongjie Xie Affiliation: Stevens Institute of Technology, University of Toronto, rct AI</li> <li>▶ (116) Multi-goal Reinforcement Learning via Exploring Successor Matching Authors: Xiaoyun Feng Affiliation: University of Science and Technology of China</li> <li>▶ (148) CGAR: Critic Guided Action Redistribution in Reinforcement Leaning Authors: Tairan Huang, Xu Li, Hao Li, Mingming Sun and Ping Li Affiliation: Beihang University, Baidu Research, Peking University</li> </ul>	a) <i>Representation</i> 10:00-10:10 and Yan Zhang 10:10-10:30 10:30-10:40

15:00-15:50	PCG II	
	Chair: Yuanheng Zhu (Chinese Academy of Sciences, Institute of Automation, Chin	na)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)	
	<ul> <li>(60) Generating Game Levels of Diverse Behaviour Engagement</li> <li>Authors: Keyuan Zhang, Jiayu Bai and Jialin Liu</li> </ul>	5:00-15:20

	Affiliation: Southern University of Science and Technology	
	<ul> <li>(13) EST-GAN: Enhancing Style Transfer GANs with Intermediate Game Render Passes Authors: Helmut Hlavacs, Martina Mittermueller and Zhanxiang Ye Affiliation: University of Vienna</li> </ul>	15:20-15:40
	<ul> <li>(194) Quick generation of crosswords using concatenation</li> <li>Authors: Jakub Dakowski, Piotr Jaworski and Waldemar Wojna</li> <li>Affiliation: Adam Mickiewicz University</li> </ul>	15:40-15:50
15:00-16:00	Benchmark and Competition I	
	<i>Chair</i> : Haifeng Zhang (Chinese Academy of Sciences, Institute of Automation,	China)
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)	
	<ul> <li>(100) Agent X: Improving Exploration vs Exploitation in the State of the Art Angry Birds AI Authors: Daniel Lutalo Affiliation: Australian National University</li> </ul>	15:00-15:20
	> (27) Enemy Spotted: In-game Gun Sound Dataset for Gunshot Classification and Localizati	on
	Authors: Junwoo Park, Youngwoo Cho, Gyuhyeon Sim, Hojoon Lee and Jaegul Choo Affiliation: Korea Advanced Institute of Science and Technology	15:20-15:40
	<ul> <li>(133) DareFightingICE Competition: A Fighting Game Sound Design and AI Competition Authors: Ibrahim Khan, Thai Nguyen, Xincheng Dai and Ruck Thawonmas Affiliation: Ritsumeikan University</li> </ul>	15:40-16:00

16:00-17:00	Keynote VI: Player-AI Interaction: What Can Human-Centered AI Learn from Computer
	Games and Other Creative Domains
	Speaker. Jichen Zhu (IT University of Copenhagen, Denmark)
	Chair. Diego Perez Liebana (Queen Mary University of London, UK)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)

17:00-18:00	PCG III		
	Chair. Marco Scirea (University of Southern Denmark, Denmark)		
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)		
	<ul> <li>(52) Space segmentation and multiple autonomous agents: a Minecraft settlement generator 17:00-17:20</li> </ul>		
	Authors: Sebastian Christiansen and Marco Scirea Affiliation: University of Southern Denmark		
	(112) Mario Plays on a Manifold: Generating Functional Content in Latent Space through Differential Geometry 17:20-17:40		
	Authors: Miguel González-Duque, Rasmus Berg Palm, Søren Hauberg and Sebastian Risi Affiliation: IT University of Copenhagen, Technical University of Denmark		
	<ul> <li>(54) Compressing and Comparing the Generative Spaces of Procedural Content Generators 17:40-18:00</li> <li>Authors: Oliver Withington and Laurissa Tokarchuk</li> <li>Affiliation: Queen Mary University of London</li> </ul>		
17:00-18:00	Benchmark and Competition II		
	Chair. Haoran Li (Chinese Academy of Sciences, Institute of Automation, China)		
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)		
	<ul> <li>(109) CaiRL: A High-Performance Reinforcement Learning Environment Toolkit</li> <li>17:00-17:20</li> <li>Authors: Per-Arne Andersen, Morten Goodwin and Ole-Christoffer Granmo</li> <li>Affiliation: University of Agder</li> </ul>		
	> (59) Towards verifiable Benchmarks for Reinforcement Learning 17:20-17:40		

Authors: Matthias Müller-Brockhausen, Mike Preuss and Aske Plaat Affiliation: Leiden University
> (30) LevDoom: A Benchmark for Generalization on Level Difficulty in Reinforcement Learning 17:40-18:00
Authors: Tristan Tomilin, Tianhong Dai, Mykola Pechenizkiy and Meng Fang Affiliation: Eindhoven University of Technology, Imperial College London

18:00-20:00	Tutorial V: Player Modelling through Affective Computing
	Speakers: Phil Lopes (Universidade Lusófona de Humanidades e Tecnologias, Lisboa)
	David Melhart (University of Malta, Malta)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)

20:00-20:30	Game HCI
	Chair. Qichao Zhang (Chinese Academy of Sciences, Institute of Automation, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)
	<ul> <li>▶ (64) Mouse Sensitivity in First-person Targeting Tasks</li> <li>20:00-20:20</li> </ul>
	Authors: Ben Boudaoud, Josef Spjut and Joohwan Kim Affiliation: NVIDIA
	(163) Smelling on the Edge: Using Fuzzy Logic in Edge Computing to Control an Olfactory Display in a Video Game 20:20-20:30
	Authors: Miguel Angel Garcia-Ruiz, Pedro Cesar Santana-Mancilla, Laura Sanely Gaytan-Lugo and Raul
	Aquino-santos Affiliation: Algoma University, University of Colima
20:00-21:00	Benchmark and Competition III
	Chair. Raluca Gaina (Queen Mary University of London, UK)
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)
	<ul> <li>(223) A Deep Reinforcement Learning Blind Al in DareFightingICE</li> <li>20:00-20:20</li> <li>Authors: Thai Nguyen, Xincheng Dai, Ibrahim Khan, Ruck Thawonmas and Hai V. Pham</li> <li>Affiliation: Ritsumeikan University, Hanoi University of Science and Technology</li> </ul>
	<ul> <li>(177) TAG: Pandemic Competition</li> <li>Authors: Raluca Gaina and Martin Balla</li> <li>Affiliation: Queen Mary University of London</li> </ul>
	<ul> <li>(181) Keke AI Competition: Solving puzzle levels in a dynamically changing mechanic space 20:40-21:00</li> <li>Authors: M Charity and Julian Togelius</li> <li>Affiliation: New York University</li> </ul>
20:30-22:00	Game Analytics
	Chair. Jialin Liu (Southern University of Science and Technology, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197)
	> (47) Face in the Game: Using Facial Action Units to Track Expertise in Competitive Video Game Play
	Authors: Gianluca Guglielmo, Paris Mavromoustakos Blom, Michał Klincewicz, Boris Čule and Pieter Spronck
	Affiliation: Tilburg University
	(214) Playing Good-Quality Games with Weak Players by Combining Programs with Different Roles 20:50-21:00
	Authors: Kokolo Ikeda and Chu-Hsuan Hsueh
	Affiliation: Japan Advanced Institute of Science and Technology
	<ul> <li>(89) PGD: A Large-scale Professional Go Dataset for Data-driven Analytics</li> <li>Authors: Yifan Gao</li> </ul>

	Affiliation: Northeastern University	
	<ul> <li>(44) DOTA 2 match prediction through deep learning team fight models</li> <li>21:20-21:40</li> <li>Authors: Cheng Hao Ke, Haozhang Deng, Congda Xu, Jiong Li, Xingyun Gu, Borchuluun Yadamsure</li> <li>Rafet Sifa, Anders Drachen and Simon Demediuk</li> </ul>	n,
	Affiliation: Northwestern University, Fraunhofer, University of Southern Denmark, University of York	
	(127) GCN-WP - Semi-Supervised Graph Convolutional Networks for Win Prediction in Esports 21:40-22:00	I
	Authors: Alexander Bisberg and Emilio Ferrara Affiliation: University of Southern California	
21:00-22:00	VR and AR	
	Chair. Guenter Wallner (Johannes Kepler University Linz, Austria)	
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142)	
	> (18) Ethermal - Lightweight Thermal Feedback for VR Games 21:00-21:20	
	Authors: Bas A. Plijhaer, Guenter Wallner and Regina Bernhaupt Affiliation: Eindhoven University of Technology, Johannes Kepler University Linz	
	> (117) Acoustic Rendering Based on Geometry Reduction and Acoustic Material Classification 21:20-21:40	)
	Authors: Mattia Colombo, Alan Dolhasz, Jason Hockman and Carlo Harvey Affiliation: Birmingham City University, DMT Lab	
	<ul> <li>(172) Fly My Little Dragon: Using AR to Learn Geometry</li> <li>21:40-21:50</li> <li>Authors: Sebastian Oberdörfer, Philipp Krop, Samantha Straka, Silke Grafe and Marc Erich Latoschik</li> <li>Affiliation: University of Würzburg</li> </ul>	¢
	> (199) Co-located Immersive Gaming: A Comparison between Augmented and Virtual Reality 21:50-22:00	)
	Authors: Moinak Ghoshal, Juan Ong, Hearan Won, Dimitrios Koutsonikolas and Caglar Yildirim Affiliation: Northeastern University	

14:00-15:00	Keynote VII: On Computation Characterization in Game Theory
	Speaker. Xiaotie Deng (Peking University, China)
	Chair. Zongqing Lu (Peking University, China)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) and Rebroadcast at Yaotai Main Venue

15:00-16:00	Vision Papers	
	<i>Chair</i> : Jialin Liu (Southern University of Science and Technology, China)	
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) and Rebroadcast at Yaotai Branch-1 V	/enue
	<ul> <li>(174) User-Generated Content and Editors in Video Games: Survey and Vision</li> <li>Authors: Haihan Duan, Yiwei Huang, Yifan Zhao, Zhen Huang and Wei Cai</li> <li>Affiliation: The Chinese University of Hong Kong</li> </ul>	15:00-15:20
	<ul> <li>(179) Optimists At Heart: Why Do We Research Game AI?</li> <li>Authors: Michael Cook</li> <li>Affiliation: Knives &amp; Paintbrushes</li> </ul>	15:20-15:40
	> (224) Let's Make Games Together: Explainability in Mixed-initiative Co-creative Game Desi	ign 15:40-16:00
	Authors: Solange Margarido, Penousal Machado, Licínio Roque and Pedro Martins Affiliation: University of Coimbra	
15:00-16:10	Game Theory & Board Games	
	Chair. Chaoxu Mu (Tianjin University, China)	
	At IEEE CoG2022-ZoomMeeting-3 (ID 822 5782 3877) and Rebroadcast at Yaotai Branch-3	/enue
	$\succ$ (132) A Viewpoint on Construction of Networked Model of Event-triggered Hybrid D	ynamic Games
	Authors: Xiangyong Chen, Feng Zhao, Ming Guo and Jianlong Qiu Affiliation: Linyi University	15.00 15.20
	<ul> <li>(136) Learning Strategies for Imperfect Information Board Games using Depth-limited Regret Minimization and Belief State</li> <li>Authors: Chen Chen and Tomoyuki Kaneko</li> <li>Affiliation: The University of Tokyo</li> </ul>	Counterfactual 15:20-15:40
	> (203) Stirring the Pot - Teaching Reinforcement Learning Agents a "Push-Your-Luck" board	game 15:40-15:50
	Authors: Maximilian Hünemörder, Mirjam Bayer, Nadine-Sarah Schüler and Peer Krög Affiliation: Christian-Albrechts Universität Kiel, Ludwig-Maximilians Univeristät Münche	er n
	(212) Supervised and Reinforcement Learning from Observations in Reconnaissance Blind	Chess 15:50-16:10
	<i>Authors</i> : Timo Bertram, Johannes Fürnkranz and Martin Mueller <i>Affiliation</i> : Johannes Kepler University Linz, University of Alberta	
15:00-16:30	MCTS for Games	
	Chair. Mark H. M. Winands (Maastricht University, Netherlands)	
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142) and Rebroadcast at Yaotai Branch-2 \	/enue
	<ul> <li>(73) Combining Monte-Carlo Tree Search with Proof-Number Search <i>Authors</i>: Elliot Doe, Mark H. M. Winands, Dennis J. N. J. Soemers and Cameron Brown <i>Affiliation</i>: Maastricht University</li> </ul>	15:00-15:20 le
	<ul> <li>(91) MultiTree MCTS in Tabletop Games</li> <li>Authors: James Goodman, Simon Lucas and Diego Perez-Liebana</li> </ul>	15:20-15:40

	Affiliation: Queen Mary University of London	
	> (93) Turning Zeroes into Non-Zeroes: Sample Efficient Exploration with Monte Carlo Graph	Search 15:40-16:00
	Authors: Marko Tot, Michelangelo Conserva, Sam Devlin and Diego Perez Liebana Affiliation: Queen Mary University of London, Microsoft Research	
	<ul> <li>(110) Elastic Monte Carlo Tree Search with State Abstraction for Strategy Game Playing Authors: Linjie Xu, Alexander Dockhorn, Jorge Hurtado-Grueso, Dominik Jeurissen ar Liebana Affiliation: Queen Mary University of London, Leibniz University Hannover, Maastricht L</li> </ul>	16:00-16:20 nd Diego Perez- Jniversity
	<ul> <li>(206) Quickly Detecting Skill Trace in Games</li> <li>Authors: Cameron Browne</li> <li>Affiliation: Maastricht University</li> </ul>	16:20-16:30
16:00-17:00	Demo Papers	
	Chair. Yaran Chen (Chinese Academy of Sciences Institute of Automation, Chin	a))
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) and Rebroadcast at Yaotai Branch-1 V	Venue
	<ul> <li>(180) Turing Test Framework for Cooperative Games</li> <li>Authors: In-Chang Baek, Tae-Hwa Park, Tae-Gwan Ha and Kyung-Joong Kim</li> <li>Affiliation: GIST</li> </ul>	16:00-16:10
	<ul> <li>(190) A Smile Interface to Promote the Spectator's Emotion</li> <li>Authors: Febri Abdullah, Mury F. Dewantoro, Ruck Thawonmas and Fitra A. Bachtiar</li> <li>Affiliation: Ritsumeikan University, Brawijaya University</li> </ul>	16:10-16:20
	<ul> <li>(191) Parallel Dance: A Social Game on Campus Public Screens</li> <li>Authors: Jiahao Li</li> <li>Affiliation: Tsinghua University</li> </ul>	16:20-16:30
	<ul> <li>(192) The Effect of a Virtual Character to Players' Engagement and Enjoyment in a Game Artwork Description Data</li> <li>Authors: Albertus Agung, Roman Savchyn, Pujana Paliyawan and Ruck Thawonmas Affiliation: Ritsumeikan University</li> </ul>	e for Collecting 16:30-16:40
	<ul> <li>(200) Gulliver's Game: Multiviewer and Vtuber Extreme Asymmetric Game Authors: Jiahao Li and Ke Fang Affiliation: Tsinghua University</li> </ul>	16:40-16:50
	<ul> <li>(145) Subtle Attention Guidance for a New Virtual Reality Game</li> <li>Authors: Alexandre Berthault, Camille Richard, Mathieu Anthoine and Maël Addoum</li> <li>Affiliation: ISART Digital</li> </ul>	16:50-17:00
16:10-17:00	Benchmarks and Competitions IV	
	<i>Chair</i> : Jia Le Xu (Chinese Academy of Sciences Institute of Automation, China)	
	At IEEE CoG2022-ZoomMeeting-3 (ID 822 5782 3877) and Rebroadcast at Yaotai Branch-3	Venue
	(128) MiaoSuan Wargame: A Multi-Mode Integrated Platform for Imperfect Information G	iame
	Authors: Jia Le Xu, Jian Hu, Shi Xian Wang, Xu Yang Yang and Wan Cheng Ni Affiliation: University of Chinese Academy of Sciences, Chinese Academy of Scienc Automation	ces Institute of
	<ul> <li>(76) ChemGrid: An Open-Ended Benchmark Domain for an Open-Ended Learner Authors: Miklos Kepes, Nicholas Guttenberg and Lisa Soros Affiliation: Cross Labs</li> </ul>	16:30-16:50
	<ul> <li>(167) World of Bugs: A Platform for Automated Bug Detection in 3D Video Games</li> <li>Authors: Benedict Wilkins and Kostas Stathis</li> <li>Affiliation: Royal Holloway University of London</li> </ul>	16:50-17:00

17:30-18:30	Journal Paper & Abstract Presentation	
	Chair. Yuanheng Zhu (Chinese Academy of Sciences Institute of Automation, C	hina)
	At IEEE CoG2022-ZoomMeeting-3 (ID 822 5782 3877) and Rebroadcast at Yaotai Branch-3 V	/enue
	(226) Breaking Ban: Assessing the effectiveness of Belgium's gambling law regulation of v boxes Authors: Leon V Viao	ideo game loot 17:30-17:50
	Affiliation: IT University of Copenhagen, Queen Mary University of London, The Honour Lincoln's Inn	able Society of
	<ul> <li>(227) Designer Modeling through Design Style Clustering</li> <li>Authors: Jose Font, Alberto Alvarez and Julian Togelius</li> <li>Affiliation: Malmo University, New York University</li> </ul>	17:50-18:10
	<ul> <li>(N/A) The Impact of Artificial Intelligence on the Chess World Authors: Delia Monica Duca Iliescu</li> <li>Affiliation: Universitatea Transilvania din Brasov</li> </ul>	18:10-18:30
17:30-19:00	Multi-player Games	
	Chair. Junliang Xing (Tsinghua University, China)	
	At IEEE CoG2022-ZoomWebinar-2 (ID 875 7863 6142) and Rebroadcast at Yaotai Branch-2 \	/enue
	> (78) Mastering the Game of 3v3 Snakes with Rule-Enhanced Multi-Agent Reinforcement L	earning 17:30-17:50
	Authors: Jitao Wang, Dongyun Xue, Jian Zhao, Wengang Zhou and Houqiang Li Affiliation: University of Science and Technology of China	
	(103) Speedup Training Artificial Intelligence for Mahjong via Reward Variance Reduction Authors: Jinqiu Li, Shuang Wu, Haobo Fu, Qiang Fu, Enmin Zhao and Junliang Xing	17:50-18:10
	Affiliation: Chinese Academy of Sciences Institute of Automation, University of Chine Sciences, Tencent Al Lab, Tsinghua University	se Academy of
	<ul> <li>(28) Crowdsourcing Controller - Utilizing Reliable Agents in a Multiplayer Game Authors: Kacper Kenji Lesniak and Maria Maistro Affiliation: University of Copenhagen</li> </ul>	18:10-18:30
	<ul> <li>(162) Mjx: A framework for Mahjong AI research</li> <li>Authors: Sotetsu Koyamada, Keigo Habara, Nao Goto, Shinri Okano, Soichiro Nishimor</li> <li>Affiliation: Kyoto University</li> </ul>	18:30-18:50 i and Shin Ishii
	<ul> <li>(170) Towards a Competitive 3-Player Mahjong AI using Deep Reinforcement Learning Authors: Xiangyu Zhao and Sean B. Holden Affiliation: University of Cambridge</li> </ul>	18:50-19:00
17:30-19:30	Best Paper Nominees Presentation	
	<i>Chair</i> . Diego Perez Liebana (Queen Mary University of London, UK)	
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) and Rebroadcast at Yaotai Branch-1 \	/enue
	<ul> <li>(75) Using Heart Rate and Machine Learning for VR Horror Game Personalization</li> <li>Authors: Sumaira Erum Zaib and Masayuki Yamamura</li> <li>Affiliation: Tokyo Institute of Technology</li> </ul>	17:30-17:50
	<ul> <li>(55) Bayesian Opponent Exploitation by Inferring the Opponent's Policy Selection Pattern Authors: Kuei-Tso Lee and Sheng-Jyh Wang Affiliation: National Yang Ming Chiao Tung University</li> </ul>	17:50-18:10
	> (11) VMAPD: Generate Diverse Solutions for Multi-Agent Games with Recurrent Trajectory	Discriminators 18:10-18:30
	Authors: Shiyu Huang, Chao Yu, Bin Wang, Dong Li, Yu Wang, Ting Chen and Jun Zhu Affiliation: Tsinghua University, Huawei Noah's Ark Lab	
	<ul> <li>(45) Counter-Strike Deathmatch with Large-Scale Behavioural Cloning Authors: Tim Pearce and Jun Zhu</li> </ul>	18:30-18:50

	Affiliation: Tsinghua University
	<ul> <li>(114) Play-style Identification through Deep Unsupervised Clustering of Trajectories</li> <li>18:50-19:10</li> <li>Authors: Branden Corwin Ingram, Benjamin Rosman, Richard Klein and Clint Van Alten</li> <li>Affiliation: University of the Witwatersrand</li> </ul>
	<ul> <li>(69) On Linking Level Segments</li> <li>Authors: Colan Biemer and Seth Cooper</li> <li>Affiliation: Northeastern University</li> </ul>
18:30-19:30	Poster Session
	At Yaotai Poster Venue
	<ul> <li>(12) Illuminating the Space of Enemies Through MAP-Elites</li> <li>Authors: Breno Maurício de Freitas Viana, Leonardo Tórtoro Pereira and Claudio Fabiano Motta</li> <li>Toledo</li> <li>Affiliation: Universidade de São Paulo</li> </ul>
	<ul> <li>(20) LILAC: Learning a Leader for Cooperative Reinforcement Learning</li> <li>Authors: Yuqian Fu, Jiajun Chai, Yuanheng Zhu and Dongbin Zhao</li> <li>Affiliation: Wuhan University, Chinese Academy of Sciences Institute of Automation</li> </ul>
	<ul> <li>(34) VRCockpit: Mitigating Simulator Sickness in VR Games Using Multiple Egocentric 2D View Frames Authors: Hao Chen, Rongkai Shi, Diego Monteiro, Nilufar Baghaei and Hai-Ning Liang Affiliation: Duke Kunshan University, Xi'an Jiaotong-Liverpool University, Birmingham City University, University of Queensland</li> </ul>
	<ul> <li>(62) Moody5: Personality-biased agents to enhance interactive storytelling in video games</li> <li>Authors: Francesco Garavaglia, Renato Avellar Nobre, Laura Anna Ripamonti, Dario Maggiorini and</li> <li>Davide Gadia</li> <li>Affiliation: University of Milano</li> </ul>
	<ul> <li>(84) Benni's Forest – a serious game on the challenges of reforestation</li> <li>Authors: Hidde Bolijn, Martin Li, Andries Reurink, Cas van Rijn and Rafael Bidarra</li> <li>Affiliation: Delft University of Technology</li> </ul>
	<ul> <li>(86) Reinforcement Learning using Reward Expectations in Scenarios with Aleatoric Uncertainties <i>Authors</i>: Yubin Wang, Yifeng Sun, Jiang Wu, Hao Hu, Zhiqiang Wu and Weigui Huang <i>Affiliation</i>: Information Engineering University     </li> </ul>
	<ul> <li>(95) Memory-Augmented Episodic Value Network <i>Authors</i>: Fanyu Zeng, Guangyu Xing and Shuzhi Ge <i>Affiliation</i>: Nanjing University of Posts and Telecommunications, Sichuan University, University of Electronic Science and Technology of China     </li> </ul>
	<ul> <li>(98) Hero featured learning algorithm for winning rate prediction of Honor of Kings</li> <li>Authors: Peng Tian, Xiao Zhang and Wenfei Lan</li> <li>Affiliation: South-Central Minzu University</li> </ul>
	<ul> <li>(122) Neighborly: A Sandbox for Simulation-based Emergent Narrative Authors: Shi Johnson-Bey, Mark Nelson and Michael Mateas Affiliation: University of California Santa Cruz, American University</li> </ul>
	<ul> <li>(129) Using Wordle for Learning to Design and Compare Strategies</li> <li>Authors: Chao-Lin Liu</li> <li>Affiliation: National Chengchi University</li> </ul>
	<ul> <li>(228) Procedural Generation of Dungeons' Maps and Locked-door Missions Through an Evolutionary Algorithm Validated with Players</li> <li>Authors: Leonardo Pereira, Paulo Victor de Souza Prado, Rafael Miranda Lopes and Claudio Toledo Affiliation: Universidade de São Paulo</li> </ul>
19:00-19:30	Serious Games
	Chair. Haoran Li (Chinese Academy of Sciences Institute of Automation, China)

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> (87) Training and assessing perspective taking through 'A Hole New Perspective' 19:00-19:20
Authors: Ruben Band, Maarten Lips, Julivius Prawira, Jurgen van Schagen, Simon Tulling, Ying Zhang,
Aicha A. Benaiss, Ineke J.M. van der Ham, Mijael Bueno and Rafael Bidarra
Affiliation: Delft University of Technology, Leiden University
> (173) An Interactive Module for Learning and Evaluating the Basic Rules in Health Consultations
Authors: Mael Addoum, Yannick Bourquin, Quentin Bleuse, Auriane Gros, Jean Breaud, Marilou Serris
and Philippe Robert
Affiliation: ISART Digital, Universite Cote d'Azur

20:00-21:00	Keynote VIII: AlphaStar: Grandmaster Level in StarCraft II using Multi-agent
	Reinforcement Learning
	Speaker. Oriol Vinyals (Google DeepMind, UK)
	Chair: Simon Lucas (Queen Mary University of London, UK)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) and Rebroadcast at Yaotai Main Venue
21:00-22:00	Closing
	Chair: Simon Lucas (Queen Mary University of London, UK)
	At IEEE CoG2022-ZoomWebinar-1 (ID 858 0082 7197) and Rebroadcast at Yaotai Main Venue