

# Zhihong Deng

Australian Artificial Intelligence Institute, University of Technology Sydney

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My current research focuses on **causal reinforcement learning** (RL), an emerging research field that incorporates prior knowledge and assumptions about causal relationships into RL, empowering agents to better comprehend the world. By harnessing causal relationships, agents gain insights into complex environments and tasks, facilitating informed decision-making. Ultimately, the goal of my research is to advance the progress of **next-generation AI agents** towards human-level intelligence with **robustness, fairness, and interpretability**.

## EDUCATION

**University of Technology Sydney, Sydney, Australia**

Faculty of Engineering and Information Technology

Advisor: Jing Jiang and Chengqi Zhang

Ph.D. student

Mar. 2021–Now

**Southern University of Science and Technology, Shenzhen, China**

Department of Computer Science and Engineering

Visiting Scholar

Sep. 2020–Feb. 2021

**Sun Yat-sen University, Guangzhou, China**

School of Data and Computer Science

Advisor: Chang-Dong Wang

M.Eng.

Sep. 2018–Jun. 2020

**Sun Yat-sen University, Guangzhou, China**

School of Data and Computer Science

Advisor: Chang-Dong Wang

B.Eng.

Sep. 2013–Jun. 2017

## PUBLICATION

**Causal Reinforcement Learning: A Survey** [[paper](#)][[repo](#)][[tutorial](#)]

Zhihong Deng, Jing Jiang, Guodong Long, Chengqi Zhang

*Transactions on Machine Learning Research*, 2023 (Survey Certification)

- The first comprehensive survey on causal reinforcement learning.
- A problem-oriented taxonomy and analyses of existing methods and their limitations.
- Shed light on promising research directions including advancing theoretical understanding, establishing benchmarks, and tackling specific problem settings.

**False Correlation Reduction for Offline Reinforcement Learning** [[paper](#)][[code](#)]

Zhihong Deng, Zuyue Fu, Lingxiao Wang, Zhuoran Yang, Chenjia Bai, Tianyi Zhou, Zhaoran Wang, Jing Jiang

*IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2023 (**CORE A\***, **IF=24.31**)

- A simple yet effective approach with theoretical guarantees for offline RL without OOD sampling and large-scale ensemble.
- Deploys an annealing behavior cloning regularizer to help produce high-quality estimations of uncertainty, which is crucial for eliminating false correlations.
- Achieves state-of-the-art performance with 3.1x speedup on D4RL.

**Pessimistic Bootstrapping for Uncertainty-Driven Offline Reinforcement Learning**

[[paper](#)][[code](#)]

Chenjia Bai, Lingxiao Wang, Zhuoran Yang, Zhihong Deng, Animesh Garg, Peng Liu, Zhaoran Wang

*International Conference on Learning Representations*, 2022 (**CORE A\***, **Spotlight Paper**)

- An uncertainty-driven model-free algorithm for offline RL.
- A novel approach to quantify uncertainty in offline RL using OOD samples, allowing refined conservatism and better control of OOD actions.

**G<sup>3</sup>SR: Global Graph Guided Session-Based Recommendation** [[paper](#)][[code](#)]

**Zhihong Deng**, Chang-Dong Wang, Ling Huang, Jian-Huang Lai, Philip S. Yu

*IEEE Transactions on Neural Networks and Learning Systems*, 2022 (**CORE A\***, **IF=10.4**)

- An innovative graph-based framework for session-based recommendation that incorporates a unsupervised pre-training stage to extract global item-to-item relational information.
- A novel parameter-free readout mechanism to aggregate item representations.

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### **DeepCF: A Unified Framework of Representation Learning and Matching Function Learning in Recommender System** [[paper](#)][[code](#)][[talk](#)]

**Zhihong Deng**, Ling Huang, Chang-Dong Wang, Jian-Huang Lai, Philip S. Yu

*Annual AAAI Conference on Artificial Intelligence*, 2019 (**CORE A\***, **Oral Paper**)

- A general framework for recommender systems that unifies deep learning-based representation learning and matching function learning.
- A novel model that has great flexibility to learn the complex matching function while being efficient to learn low-rank relations between users and items.

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### **Serendipitous recommendation in e-commerce using innovator-based collaborative filtering** [[paper](#)]

Chang-Dong Wang, **Zhihong Deng**, Jian-Huang Lai, Philip S. Yu

*IEEE Transactions on Cybernetics*, 2019 (**CORE A**, **IF=11.8**)

- One of the earliest attempts to solve the serendipity problem in recommender systems.
- Introduces the Rogers' Innovation Adoption Curve from sociology to identify innovators.
- A recommendation algorithm that captures users' potential interests through a group of innovators who are skilled at discovering new and niche items.

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## **HONOURS & AWARDS**

<b>Student Best Paper Award</b> ( <b>Three Ph.D. students per year</b> )	2023
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Australian Artificial Intelligence Institute

<b>International Research Training Program Scholarship</b>	2021
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University of Technology Sydney

<b>First-class Scholarship for Graduate Students</b> ( <b>Top 5% students</b> )	2020
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Sun Yat-sen University

<b>National Scholarship for Graduate Students</b> ( <b>Top 1% students</b> )	2020
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Sun Yat-sen University

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## **INVITED TALKS & PRESENTATIONS**

<b>Towards Causal Reinforcement Learning</b>	2024
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Zhihong Deng, Jing Jiang, Chengqi Zhang

International Joint Conference on Neural Networks. Yokohama, Japan

<b>Causal Reinforcement Learning: Empowering Agents with Causality</b> [ <a href="#">slides</a> ]	2023
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Zhihong Deng, Jing Jiang

International Conference on Advanced Data Mining and Applications. Shenyang, China

<b>From Predict to Control &amp; From RL to Offline RL</b> [ <a href="#">slides</a> ]	2020
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Zhihong Deng

Southern University of Science and Technology. Shenzhen, China

<b>A Unified Framework of Representation Learning and Matching Function Learning in Recommender System</b> [ <a href="#">slides</a> ]	2019
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Zhihong Deng

Graduate Student Academic Forum of The Guangdong-Hong Kong-Macao Greater Bay. Guangzhou, China.

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## PROFESSIONAL SERVICE

**Conference Reviewer**

ICML, NeurIPS, IJCAI, KDD, CIKM, ICDM, ADMA

**Journal Reviewer**

IEEE TNNLS, IEEE TCYB, ESWA

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