

Di Chen

Contact	E-mail: di@deepreasoningai.com , chendi9412@gmail.com Address: Seattle, WA 98109, USA	Mobile: (+1) 607-262-2806
Research Interests	Machine Learning and Artificial Intelligence in general My current research includes solving structured prediction, multi-entity modeling, covariate shift, task-based learning, reinforcement learning, and, especially, combining prior knowledge-based logical and constraint reasoning with deep learning.	
Education	Cornell University • Ph.D. in Computer Science from Cornell University • Advised by Prof. Carla P. Gomes	Jul. 2017 ~ Dec. 2021
	Shanghai Jiao Tong University • B.S. for Computer Science in Zhiyuan College • Member of ACM Honored Class (Top 30 students in SJTU) • Admitted to SJTU without college entrance exam. • Major GPA: 3.91/4.00 (92.81/100) Rank: 3/30 • Overall GPA: 3.76/4.00 (90.14/100) Rank: 4/30	Sep. 2013 ~ Jul. 2017
Employment	Director of Research & Engineering, Deep Reasoning AI • AI Research & Development - Led research and development at Deep Reasoning AI, pioneering rapid and personalized 3D anatomical modeling. - Developed state-of-the-art 3D modeling algorithms using CT scans to reconstruct the full skeletal system, including specialized anatomical structures such as the spine, pelvis, and craniomaxillofacial regions, all with sub-millimeter accuracy and optimized for 3D printing and AR/VR applications - Developed advanced 3D modeling algorithms using CTA imaging for full arterial system reconstruction, achieving sub-millimeter precision. The model encompasses secondary arteries in the head, carotid arteries, the complete aortic system, iliac arteries, femoral arteries, and extends down to the arteries of the lower legs and feet, including the popliteal, tibial, and pedal arteries. Additionally, the model accurately represents grafts, stents, and calcifications, ensuring seamless integration with 3D printing and AR/VR visualization. - Developed an advanced spine and pelvis 3D modeling algorithm that relies solely on asynchronous biplanar X-ray imaging (async 2D to 3D), generating highly accurate, 3D-printable models from frontal and lateral X-ray images. - Research and development collaboration with our clinical partner, Mayo Clinic. - Developing the quality management system for all developed services.	Jan. 2022 ~ present
	Research Intern, Watson IBM • Financial Service Research Group, advised by Dr. Yada Zhu • Topic: Time Series Financial Forecasting - Proposed task-oriented prediction network, a novel learning scheme that optimizes the prediction model directly towards the ultimate task-based reward. Applied to revenue surprise forecasting and credit risk modeling, our model boosted the profit by 20% in backtesting, compared with industry benchmarks.	May. 2019 ~ Aug. 2019
	Research Assistant, Cornell University • Institute for Computational Sustainability, advised by Prof. Carla P. Gomes • Topics: Multi-entity Distribution Modelling, Covariate Shift & Deep Reasoning Network	Jul. 2017 ~ Dec. 2021

- Proposed the Deep Reasoning Network (DRNets), the first end-to-end unsupervised framework that combines deep learning for pattern recognition with logical and constraint reasoning. DRNets reached superhuman performance in crystal-structure phase mapping problems, a key problem in material discovery, and subsequently led to the discovery of a new material that is important for solar fuels technology. (2019)
- Proposed the Shift Compensation Network (SCN), an end-to-end learning scheme which learns the covariate shift from the scientific objectives to the biased data, while compensating the shift by re-weighting the training data. (2018)
- Proposed a flexible deep generalization of the classic Multivariate Probit Model (MVP), the Deep Multivariate Probit Model (DMVP), which is an end-to-end learning scheme that uses an efficient parallel sampling process to exploit GPU-boosted deep neural networks. We present both theoretical and empirical analysis of the convergence behavior of DMVP's sampling process demonstrating the advantages of DMVP's sampling compared with MCMC-based methods. (2018)
- Proposed an end-to-end approach to multi-entity dependence learning based on a conditional variational auto-encoder, which handles high dimensional space effectively, and can be tightly integrated with deep neural nets to take advantages of rich contextual information. (2017)

Research Intern, Cornell University

Jul. 2016 ~ Jan. 2017

- Institute for Computational Sustainability, advised by Prof. Carla P. Gomes
- Topics: Multi-Species Distribution Modelling & Crowdsourcing Problem
 - Led the project and proposed [DMSE](#), a novel multi-species distribution model which outperformed existing models and further provided quantitative analysis for the interactions between species.
 - Built a [crowdsourcing platform](#) to collect and analyze the elephant call data. Introduced deep learning to the embedding method, leading to data quality improvement and helping analyze the performance bias of participants.

Research Assistant, Shanghai Jiao Tong University

Jun. 2015 ~ Jun. 2016

- Learning and Optimization Group, advised by Prof. Zhihua Zhang
- Topics: Low-rank Matrix Approximation, Matrix Completion & Statistical Machine Learning
 - Proposed a computationally efficient & scalable algorithm for matrix completion using dynamical low-rank factorization, which outperformed the state-of-the-art on large-scale datasets.
 - Had in-depth studies on Low-Rank Approximation, Matrix Completion, Matrix Decomposition, and Advanced Linear Algebra.

Patents

[Task-oriented machine learning and a configurable tool thereof on a computing environment](#)
Yada Zhu, **Di Chen**, Xiaodong Cui, Upendra Chitnis, Kumar Bhaskaran, Wei Zhang
Patent number 11586919, 2023.

Publications

Ecology 2023 [Deep learning with citizen science data enables estimation of species diversity and composition at continental extents](#)
Courtney L. Davis, Yiwei Bai, **Di Chen**, Orin Robinson, Viviana Ruiz-Gutierrez, Carla P. Gomes, Daniel Fink *Ecology*, 2023.

ICAIF 2022 [Cost-Efficient Reinforcement Learning for Optimal Trade Execution on Dynamic Market Environment](#)
Di Chen, Yada Zhu, Miao Liu, Jianbo Li *ICAIF*, 2022.

Computational Materials 2022 [Materials structure-property factorization for identification of synergistic phase interactions in complex solar fuels photoanodes](#)
Dan Guevarra, Lan Zhou, Matthias H. Richter, Aniketa Shinde, **Di Chen**, Carla P. Gomes & John M. Gregoire *npj. Computational Materials*, 2022.

IJCAI 2022 Monitoring Vegetation from Space at Extremely Fine Resolutions via Coarsely-Supervised Smooth U-Net

Joshua Fan, **Di Chen**, Jiaming Wen, Ying Sun, Carla Gomes. *Proceedings of the 31st International Joint Conference on Artificial Intelligence (IJCAI-2022)*, 2022.

NeurIPS workshop 2021 Super Fine-Resolution SIF via Coarsely-Supervised UNet Regression

Joshua Fan, **Di Chen**, Jiaming Wen, Ying Sun, Carla Gomes. *Tackling Climate Change with Machine Learning workshop at NeurIPS 2021*, 2021

CP 2021: CLR-DRNets: curriculum learning with restarts to solve visual combinatorial games
Yiwei Bai, **Di Chen**, Carla P. Gomes. *International Conference on Principles and Practice of Constraint Programming (CP-2021)*, 2021

Cover of Nature Machine Intelligence 2021 Sep: Automating Crystal-Structure Phase Mapping by Combining Deep Learning with Constraint Reasoning

Di Chen, Yiwei Bai, Sebastian Ament, Wenting Zhao, Dan Guevarra, Lan Zhou, Bart Selman, R. Bruce van Dover, John M. Gregoire & Carla P. Gomes. *Nature Machine Intelligence*, 2021

Medical Image Analysis 2021: VerSe: A Vertebrae labelling and segmentation benchmark for multi-detector CT images

Anjany Sekuboyina, ..., **Di Chen**, Yiwei Bai, Brandon H Rapazzo, et al. *Medical Image Analysis*, 2021

IJCAI 2020: Task-Based Learning via Task-Oriented Prediction Network with Applications in Finance

Di Chen, Yada Zhu, Xiaodong Cui, Carla P. Gomes. *Proceedings of the Twenty-ninth International Joint Conference on Artificial Intelligence (IJCAI-2020)*, 2020

IJCAI 2020: Deep Hurdle Networks for Zero-Inflated Multi-Target Regression: Application to Multiple Species Abundance Estimation

Shufeng Kong, Junwen Bai, Jae Hee Lee, **Di Chen**, Andrew Allyn, Michelle Stuart, Malin Pinsky, Katherine Mills, Carla Gomes. *Proceedings of the Twenty-ninth International Joint Conference on Artificial Intelligence (IJCAI-2020)*, 2020

ICML 2020: Deep Reasoning Networks for Unsupervised Pattern De-mixing with Constraint Reasoning

Di Chen, Yiwei Bai, Wenting Zhao, Sebastian Ament, John M. Gregoire, Carla P. Gomes, 2019. *Proceedings of the 37th International Conference on Machine Learning (ICML-2020)*, 2020.

AAAI 2019: Bias Reduction via End-to-End Shift Learning: Application to Citizen Science

Di Chen, Carla Gomes. *Proceedings of the Thirty-Third AAAI Conference on Artificial Intelligence (AAAI-2019)*, 2019.

AAAI 2019: Automatic Detection and Compression for Passive Acoustic Monitoring of the African Elephant

Johan Bjrck, Brendan Rappazzo, **Di Chen**, Richard Bernstein, Peter Wrege, Carla Gomes, *Proceedings of the Thirty-Third AAAI Conference on Artificial Intelligence (AAAI-2019)*, 2019.

IDETC-CIE 2019: Convolutional Neural Network-Based Intention Forecasting and Lane Change Path Predicting of the Human Driver

Kaiming Yang, Zhanhong Yan, **Di Chen**, Xuewu Ji, Kimihiko Nakano *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, 2019.

ICML 2018: End-to-End Learning for the Deep Multivariate Probit Model

Di Chen, Yexiang Xue, Carla Gomes. *Proceedings of the 35th International Conference on Machine Learning (ICML-2018)*, 2018.

AAAI 2018: Multi-Entity Dependence Learning with Rich Context via Conditional Variational

Auto-encoder

Luming Tang, Yexiang Xue, **Di Chen**, Carla Gomes. *Proceedings of the Thirty-Second AAAI Conference on Artificial Intelligence (AAAI-2018)*, 2018.

SAE 2018: Piecewise affine-based shared steering torque control scheme for cooperative path-tracking: A game-theoretic approach

Kaiming Yang, Xiangkun He, Yulong Liu, Xuewu Ji, **Di Chen** *SAE Technical Paper*, 2018.

IJCAI 2017: Deep Multi-Species Embedding

Di Chen, Yexiang Xue, Daniel Fink, Shuo Chen, Carla Gomes. *Proceedings of the Twenty-Sixth International Joint Conference on Artificial Intelligence (IJCAI-2017)*, 2017

Honors and Awards

VerSe20 Large Scale Vertebrae Segmentation Challenge hosted by MICCAI 2020

- **Best** mean-performance and overall **rank 2** out of 26 teams, 2020

ACM International Collegiate Programming Contest

- **56th out of 140 teams in the 42nd ACM-ICPC World Finals** in Beijing, China, 2018
- **Champion** in New York, GNYR Regional, 2017
- **Gold Medal** in Taiwan, Asia Regional, 2014
- **Silver Medal** in Xi'an, Asia Regional ,2014

2017 Zhiyuan Outstanding Student Scholarship

2014 KoGuan Scholarship

2014 Academic Excellence Scholarship

National Olympiad in Informatics, China

- **Silver Medal (National)**, 2012
- **Gold Medal (Province)**, 2011 & 2012

Skills

Programming Languages: C/C++, Java, Python, Matlab, R, MySQL, Javascript, etc.

Softwares and Platforms: TensorFlow, Pytorch, Keras, Theano, Numpy, Scipy, Armadillo, Git, Vim, Linux