Los Angeles, CA
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Zijun Cui

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Education

PostDoc. Computer Science, *University of Southern California* Feb, 2023 - present
Ph.D. Computer Systems Engineering, *Rensselaer Polytechnic Institute* Dec, 2022
Thesis: Knowledge-augmented Deep Learning and its Applications
Adviser: Qiang Ji
M.S. Applied Mathematics, *Rensselaer Polytechnic Institute* Dec, 2022
M.S. Electrical Engineering and Computer Engineering, *Brown University* May, 2017
B.S. Modern Physics, *University of Science and Technology of China (USTC)* May, 2015

Research Interests

My research focuses on **AI + Science** that involves two-fold emissions: 1) applying advanced deep learning techniques to address scientific challenges, and 2) incorporating well-established scientific insights to enhance deep learning algorithms. I am interested in utilizing **Probabilistic Graphical Models** to achieve these goals. My research applications include but not limited to *Computer Vision*, *Natural Language Processing*, *Time-series Forecasting*, *Healthcare*, and *Urban Transportation*.

Engineering Research Experience

Research Postdoctal Fellow. Advisor: Dr. Yan Liu. March, 2023 – Present
Melady Lab, University of Southern California *Los Angeles, California*

- Developing sophisticated algorithms for physics-informed deep learning using causal models and physical information. Exploring their applications in time-series forecasting and urban transportation applications.
- Developing interpretable knowledge-augmented deep learning techniques for healthcare application.
- Already published papers at medical conferences, such as MICCAI [16] and AMIA [12].

Research Assistant. Advisor: Dr. Qiang Ji. August, 2017 – December, 2022
Intelligent Systems Lab, Rensselaer Polytechnic Institute *Troy, New York*

- Developed advanced knowledge-augmented deep learning algorithms with diverse types of domain knowledge such as biomechanics and mathematical theorems, and explored their applications in computer vision tasks.
- Developed efficient and accurate learning and inference algorithms on probabilistic graphical models and explored their applications in computer vision tasks.
- Published papers at top conferences, such as CVPR [10,5,4], NeurIPS [3], UAI [8], AAAI [1] and ECCV [9].

Research Assistant. Advisor: Dr. Qiang Ji. May, 2017 – December, 2019
Data-Driven Discovery of Models, Defense Advanced Research Projects Agency

- Developed robust structure learning algorithms through Bayesian approaches under insufficient data.
- Contributed and maintained primitives in the D3M AutoML Ecosystem.
- Published one paper at IJCAI [7].

Research Assistant. Advisor: Dr. Benjamin B. Kimia May, 2016 – May, 2017
Laboratory for Engineering Man/Machine Systems, Brown University *Providence, Rhode Island*

- Developed an effective approach for multi-frame enrichment of motion segmentation from videos.
- Completed a Master thesis titled "Multi-Frame Enrichment of Motion Segmentation".

Physics Research Experience

Research Student. Supervisor: Dr. Linfan Zhu 2014 – 2015
National Laboratory for Physical Sciences at the Microscale, USTC *Anhui, China*

- Improved the accuracy of the ground shape factor computation of the Carbon Monoxide based on vibration wave function.
- Completed a Bachelor thesis titled "Analyze of Electron Diffraction and its Application".

Research Student. Supervisor: Dr. Xiaoliang Ye 2014
Micron-nano Functional Materials Group, Department of Physics, USTC *Anhui, China*

- Obtained the quantum dots composite probes of urchinlike gold nanoparticles and explored its biological applications.
- Won the first prize in University Student Innovative Research Program.

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Industry Experience

Research Collaborator on Google Urban Transportation project — April, 2023 – Present
Collaborators: Carolina Osorio, Martin Mladenov, Chao Zhang — *California*

- Developed a data-efficient physics-inspired algorithm for urban transportation application.
- Submitted one paper to NeurIPS 2023 [15] and introduced the work in the 2nd Sustainable Urban Mobility: Simulation and Optimization Workshop.

Visiting Research Scholar at IBM Thomas J.Watson Research Center — January, 2019 – August, 2019
Collaborators: Kartik Talamadupula, Pavan Kapanipathi , Tian Gao — *Yorktown Heights, New York*

- Developed an effective knowledge-augmented deep learning algorithm for the knowledge graph completion task.
- Published one paper at AAAI [6].

Publication

[16] Emily Nguyen, **Zijun Cui**, Georgia Kokaraki, Joseph Carlson, Yan Liu.
"Transferable and Interpretable Treatment Effectiveness Prediction for Ovarian Cancer via Multimodal Deep Learning". *American Medical Informatics Association (AMIA), 2023.*

[15] Defu Cao, **Zijun Cui**, Sam Griesemer, Carolia Osorio, and Yan Liu.
"Controllable Analytics-Aware Variational Autoencoders for OD Calibration". *Conference on Neural Information Processing Systems (NeurIPS)*, 2023 (Under Review).

[14] Zijun Cui, Hanjing Wang, Tian Gao, Kartik Talamadupula, and Qiang Ji.
"Theory-guided Message Passing Neural Network for Probabilistic Inference". *Conference on Neural Information Processing Systems (NeurIPS)*, 2023 (Under Review).

[13] Yizhou Zhang, Loc Trinh, Defu Cao, **Zijun Cui**, Yan Liu.
"Detecting Out-of-Context Multimodal Misinformation with interpretable neural-symbolic model". *Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2023 (Under Review).

[12] Loc Trinh, Tim Chu, **Zijun Cui**, Anand Malpani, Cherine Yang, Istabraq Delieh, Alvin Hui, Oscar Gomez, Yan Liu, and Andrew Hung.
"Self-supervised Sim-to-Real Kinematics Reconstruction for Video-based Assessment of Intraoperative Suturing Skills". *The 26th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2023.*

[11] Zijun Cui, Tian Gao, Kartik Talamadupula, and Qiang Ji.
"Knowledge-augmented Deep Learning and its Applications: A Survey". *IEEE transactions on neural networks and learning systems* (Under Review).

[10] Zijun Cui, Chenyi Kuang, Tian Gao, Kartik Talamadupula, and Qiang Ji.
"Biomechanics-guided Facial Action Unit Detection through Force Modeling". *The IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2023.

[9] Chenyi Kuang, **Zijun Cui**, Jeffrey Kephart, and Qiang Ji.
"AU-aware 3D Face Reconstruction through Personalized AU-specific Blendshape Learning". *European Conference on Computer Vision (ECCV)*, 2022.

[8] Zijun Cui, Hanjing Wang, Tian Gao, Kartik Talamadupula, and Qiang Ji.
"Variational Message Passing Neural Network for Maximum-A-Posteriori (MAP) Inference". *38th Conference on Uncertainty in Artificial Intelligence (UAI)*, 2022.

[7] Zijun Cui, Naiyu Yin, Yuru Wang, and Qiang Ji.
"Empirical Bayesian Approaches for Robust Constraint-based Causal Discovery under Insufficient Data". *31st International Joint Conference on Artificial Intelligence (IJCAI)*, 2022.

[6] Zijun Cui, Pavan Kapanipathi, Kartik Talamadupula, Tian Gao and Qiang Ji.
"Type-augmented Relation Prediction in Knowledge Graphs". *35th AAAI Conference on Artificial Intelligence (AAAI)*, 2021.

[5] Tengfei Song, **Zijun Cui**, Yuru Wang, Wenming Zheng, and Qiang Ji.
"Dynamic Probabilistic Graph Convolution for Facial Action Unit Intensity Estimation". *IEEE International Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021.

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[4] Tengfei Song, **Zijun Cui**, Wenming Zheng, and Qiang Ji.
"Hybrid Message Passing with Performance-Driven Structures for Facial Action Unit Detection". *IEEE International Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021.

[3] Zijun Cui, Tengfei Song, Yuru Wang, and Qiang Ji.
"Knowledge Augmented Deep Neural Networks for Joint Facial Expression and Action Unit Recognition". *34th Conference on Neural Information Processing Systems (NeurIPS)*, 2020.

[2] Zijun Cui and Qiang Ji.
"Blendshape-augmented Facial Action Units Detection". *Workshop on Differentiable Vision, Graphics, and Physics in Machine Learning at NeurIPS*, 2020.

[1] Zijun Cui, Yong Zhang, and Qiang Ji.
"Label Error Correction and Generation Through Label Relationships". *34th AAAI Conference on Artificial Intelligence (AAAI)*, 2020.

Award

- Allen B. Dumont Prize, Rensselaer Polytechnic Institute — May, 2023
- Conference on Uncertainty in Artificial Intelligence (UAI) Scholarship — June, 2022
- Rensselaer-IBM Artificial Intelligence Research Collaboration Scholarship — September, 2018 - December, 2022
- The first prize in the University Student Innovative Research Program, USTC — 2014
- The third prize for the Academic Excellent Students, USTC — 2014

Skill

Coding Language	Python, Matlab, C/C++, R
Toolbox	OpenCV, Bayes Net Toolbox (BNT), Bnlearn, AMPL
Software	Tensorflow, PyTorch, Visual Studio, Docker, Kubernets, Mathematica, Origin, Blender