JUNZE LIU

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OBJECTIVE

Applied Scientist at Amazon specializing in Large Language Models (LLMs) and their applications across Amazon products. Formerly a PhD in Computer Science, with expertise in deep learning for physics and bioimaging.

EDUCATION

University of California, Irvine Sept. 2019 - Dec. 2024
Ph.D. in Computer Science *GPA: 4.0/4.0*

- *Thesis: Deep Learning in Three-Dimensional Space for Physics and Bio-Imaging*
- Thesis Committee: Pierre Baldi (chair), Xiaohui Xie, Jianming Bian

University of Illinois at Urbana-Champaign Aug. 2016 - May. 2018
M.Eng. in Computer Engineering *GPA: 3.7/4.0*

- *Project: Machine Learning in High Energy Physics*
- Adviosr: Benjamin Hooberman

Shandong University Sept. 2012 - June 2016
B.E. in Communication Engineering *GPA: 86.6/100*

- *Thesis: Image Segmentation Using Partial Differential Equations*
- Advisor: Mingyan Jiang

SKILLS

Programming Languages	Java, Python, C/C++, CUDA, C#, JavaScript, HTML5, CSS3
Tools & Platforms	Tensorflow, PyTorch, Git, WebGL, Unity3D, Matlab, AWS S3

WORK EXPERIENCE

Applied Scientist Jan 2025 - Present
Amazon *CA*

- Developing and optimizing Large Language Models (LLMs), including lightweight architectures (under 10B), pre-training, and post-training for enhanced efficiency and scalability.
- Implementing reinforcement learning techniques such as Direct Preference Optimization (DPO) and Group Robust Preference Optimization (GRPO) to improve LLM alignment and performance.
- Driving LLM integration across Amazon products, enhancing AI-driven functionalities to improve user experience and operational efficiency.

Applied Scientist Intern June 2024 - Sept 2024
Amazon *Seattle, WA*

- Advanced a 1-billion parameter foundational model by integrating temporal and heterogeneous graph embeddings, significantly boosting fraud detection precision.
- Developed a novel cross-attention mechanism to fuse temporal graph and foundational model embeddings, achieving superior AUC performance over traditional tree-based methods.

Applied Scientist Intern June 2023 - Sept 2023
Amazon *Seattle, WA*

- Explored causal discovery algorithms and applied them to enhance buyer risk prediction.

· Developed unsupervised causal discovery algorithms to uncover structural causal models within features, improving model explainability and feature selection.
· Implemented causal structure learning to improve cross-domain generalization of supervised classification, resulting in a significant 12% increase in AUC.

Research Assistant Jan 2019 - May 2019
UIUC *Urbana, IL*

· Developed and evaluated computer vision models for action understanding and video scene recognition, achieving state-of-the-art accuracy using ConvLSTM architectures and decision layers.
· Built an adversarial scenery dataset by web-crawling synthesized images and enhanced cross-domain robustness through weakly supervised classification techniques.

Research Assistant July 2018 - Dec 2018
Jcube *Syosset, NY*

· Designed a ConvLSTM-based action understanding algorithm for pose interaction anomaly detection.
· Improved state-of-the-art video scene recognition accuracy and cross-domain robustness by introducing decision layers and weakly supervised classification methods.

Technology Intern June 2017 - Aug. 2017
Ekistic Ventures *Chicago, IL*

· Implemented a Region CNN model for illegal items recognition, adjusted to variant surveillance videos.
· Decreased false positive rate by adding multi-phase architecture to predict body-item relations.
· Designed a region labelling interface, and built a real-time tool, which is an end-to-end pipeline accepting video streams and outputting recognition results.

RESEARCH EXPERIENCE

Deep-Learning-based Neutrino Kinematic Reconstruction Ongoing
University of California, Irvine *Prof. Pierre Baldi*

· Developed 2D and 3D CNN-based models for energy and direction regression of leptons (electron and muon) produced from neutrino interactions to reconstruct the neutrino momentum.
· Implemented Sub-manifold Sparse CNN models to improve the computation and memory efficiency when processing high-dimensional data.

3D Surgical Tool Dataset for Retinal Eye Surgeries Ongoing
University of California, Irvine *Prof. Pierre Baldi*

· Introduced the first dataset from videos recorded during eye surgeries for surgical tool detection and classification in eye surgeries in 3 dimensions.
· Developed two models based on YOLOv8 for the tool tip detection and tool depth classification to facilitate computer-assisted interventions and surgical skill assessment.

Geometry-aware Sparse Autoregressive Models for Multi-layer Calorimeter Shower Simulation Feb. 2022 - Nov. 2023
University of California, Irvine *Prof. Pierre Baldi*

· Built autoregressive models using machine learning algorithms to provide fast and high-quality calorimeter shower simulated data generation for high-energy physics.
· Designed a framework allowing the autoregressive model to adaptively generate multi-layer calorimeter data of different geometries.

SELECTED PUBLICATIONS

Domain-Adaptive ML for Surface Roughness Predictions in Nuclear Fusion
Shashank Galla, Antonios Alexos, Jay Phil Yoo, **Junze Liu**, Kshitij Bhardwaj, Sean Hayes, Monika Biener, Pierre Baldi, Satish Bukkapatnam, Suhas Bhandarkar
NeurIPS Workshop on Machine Learning and the Physical Sciences, Vancouver, Canada, Dec 10, 2024

Nuclear Fusion Diamond Polishing Dataset
Antonios Alexos, **Junze Liu**, Shashank Galla, Sean Hayes, Kshitij Bhardwaj, Alexander Schwartz, Monika Biener, Pierre Baldi, Satish Bukkapatnam, Suhas Bhandarkar
NeurIPS, 2024

Fast multi-geometry calorimeter simulation with conditional self-attention variational autoencoders
Dylan Smith, Aishik Ghosh, **Junze Liu**, Pierre Baldi, Daniel Whiteson
arXiv, 2024

Annotation of Surgical Tool Depth in Vitreoretinal Surgical Videos: Agreement and Performance Between Vitreoretinal Surgeons vs. Non-Surgeon Graders
Jason Dagoon, Pierre Baldi, Sherif Abdelkarim, **Junze Liu**, Mohammad Riazi, Marisabel Andrade, Amr Azzam, Parsa Esfahani, Steven Chang, Andrew Browne
Investigative Ophthalmology & Visual Science, 2024

Machine Learning-Enhanced Prediction of Surface Smoothness for Inertial Confinement Fusion Target Polishing Using Limited Data
Antonios Alexos, **Junze Liu**, Akash Tiwari, Kshitij Bhardwaj, Sean Hayes, Pierre Baldi, Satish Bukkapatnam, Suhas Bhandarkar
AIM 2024: Machine Learning Simulations, Cleveland, OH, United States, June 20, 2024

Generalizing to new geometries with Geometry-Aware Autoregressive Models (GAAMs) for fast calorimeter simulation
Junze Liu, Aishik Ghosh, Dylan Smith, Pierre Baldi, Daniel Whiteson
Journal of Instrumentation, 2023

Vitreoretinal surgical instrument tracking in 3-Dimensions using Deep Learning
(* indicates equal contribution)
Sherif Abdelkarim*, Marialejandra Diaz Ibarra*, **Junze Liu***, Josiah K. To*, Pierre F. Baldi, Anjali Herekar, Baruch D. Kuppermann, Andrew W. Browne
Translational Vision Science & Technology, 2023

Automated detection of the spatial location of vitreoretinal instruments from retinal images using Deep Learning methods
Marialejandra Diaz Ibarra, Josiah K To, **Junze Liu**, Sherif Abdelkarim, Anjali Herekar, Baruch D Kuppermann, Pierre Baldi, Andrew Browne
Investigative Ophthalmology & Visual Science, 2022

Deep-Learning-Based Kinematic Reconstruction for DUNE
Junze Liu, Jordan Ott, Julian Collado, Benjamin Jargowsky, Wenjie Wu, Jianming Bian, Pierre Baldi
NeurIPS Workshop on Machine Learning and the Physical Sciences, Vancouver, Canada, Dec 11, 2020

Calorimetry with deep learning: particle simulation and reconstruction for collider physics
(Primary contribution - authors are listed in alphabetical order as per the standard in particle physics)
Dawit Belayneh, Federico Carminati, Amir Farbin, Benjamin Hooberman, Gulrukh Khattak, Miaoyuan Liu, **Junze Liu**, Dominick Olivito, Vitória Barin Pacela, Maurizio Pierini, Alexander Schwing, Maria Spiropulu, Sofia Vallecorsa, Jean-Roch Vlimant, Wei Wei, Matt Zhang
The European Physical Journal C, 2020

High-Salt Diet-Induced Gastritis in C57BL/6 Mice is Associated with Microbial Dysbiosis and Alleviated by a Buckwheat Diet
Ya Li, Wen Li, Xiao Wang, Chao Ding, **Junze Liu**, Yan Li, Wenjuan Li, Yundong Sun
Molecular Nutrition Food Research, 2020

Hydrogen sulfide-mediated resistance against water avoidance stress-induced gastritis by maintenance of gastric microbial homeostasis
Yingnan Han, Ya Li, Zhekai Hu, Xiao Wang, **Junze Liu**, Xue Ren, Yanbo Yu, Yan Li, Wenjuan Li, Yundong Sun
MicrobiologyOpen, 2019

PUBLICATIONS AFFILIATED WITH FERMILAB

First Measurement of the Total Inelastic Cross-Section of Positively-Charged Kaons on Argon at Energies Between 5.0 and 7.5 GeV
A. Abed Abud, et al. (DUNE Collaboration)
Physical Review D, 2024

Doping liquid argon with xenon in ProtoDUNE Single-Phase: effects on scintillation light
A. Abed Abud, et al. (DUNE Collaboration)
Journal of Instrumentation, 2024

Performance of a modular ton-scale pixel-readout liquid argon Time Projection Chamber
A. Abed Abud, et al. (DUNE Collaboration)
Instruments, 2024

The DUNE Far Detector Vertical Drift Technology, Technical Design Report
A. Abed Abud, et al. (DUNE Collaboration)
Journal of Instrumentation, 2024

Reconstruction of interactions in the ProtoDUNE-SP detector with Pandora
A. Abed Abud, et al. (DUNE Collaboration)
European Physical Journal C, 2023

Impact of cross-section uncertainties on supernova neutrino spectral parameter fitting in the Deep Underground Neutrino Experiment
A. Abed Abud, et al. (DUNE Collaboration)
Physical Review D, 2023

Highly-parallelized simulation of a pixelated LArTPC on a GPU
A. Abed Abud, et al. (DUNE Collaboration)
Journal of Instrumentation, 2023

DUNE Offline Computing Conceptual Design Report
A. Abed Abud, et al. (DUNE Collaboration)
arXiv, 2022

Separation of track-and shower-like energy deposits in ProtoDUNE-SP using a convolutional neural network
A. Abed Abud, et al. (DUNE Collaboration)
The European Physical Journal C, 2022

Scintillation light detection in the 6-m drift-length ProtoDUNE Dual Phase liquid argon TPC
A. Abed Abud, et al. (DUNE Collaboration)
The European Physical Journal C, 2022

Design, construction and operation of the ProtoDUNE-SP Liquid Argon TPC

A. Abed Abud, et al. (DUNE Collaboration)
Journal of Instrumentation, 2022

Low exposure long-baseline neutrino oscillation sensitivity of the DUNE experiment
A. Abed Abud, et al. (DUNE Collaboration)
Physical Review D, 2022

A Gaseous Argon-Based Near Detector to Enhance the Physics Capabilities of DUNE
B. Abi, et al. (DUNE Collaboration)
arXiv, 2022

Snowmass Neutrino Frontier: DUNE Physics Summary
B. Abi, et al. (DUNE Collaboration)
arXiv, 2022

Design, construction and operation of the ProtoDUNE-SP Liquid Argon TPC
B. Abi, et al. (DUNE Collaboration)
Journal of instrumentation, 2022

Searching for solar KDAR with DUNE
A. Abed Abud, et al. (DUNE Collaboration)
Journal of Cosmology and Astroparticle Physics, 2021

Deep underground neutrino experiment (DUNE) near detector conceptual design report
A. Abed Abud, et al. (DUNE Collaboration)
Instruments, 2021

Supernova neutrino burst detection with the Deep Underground Neutrino Experiment
B. Abi, et al. (DUNE Collaboration)
The European Physical Journal C, 2021

Prospects for beyond the Standard Model physics searches at the Deep Underground Neutrino Experiment
B. Abi, et al. (DUNE Collaboration)
The European Physical Journal C, 2021

Experiment simulation configurations approximating DUNE TDR
B. Abi, et al. (DUNE Collaboration)
arXiv, 2021

Searching for solar KDAR with DUNE
B. Abi, et al. (DUNE Collaboration)
Journal of Cosmology and Astroparticle Physics, 2021

First results on ProtoDUNE-SP liquid argon time projection chamber performance from a beam test at the CERN Neutrino Platform
B. Abi, et al. (DUNE Collaboration)
Journal of Instrumentation, 2020

Neutrino interaction classification with a convolutional neural network in the DUNE far detector
B. Abi, et al. (DUNE Collaboration)
Physical Review D, 2020

Long-baseline neutrino oscillation physics potential of the DUNE experiment
B. Abi, et al. (DUNE Collaboration)
The European Physical Journal C, 2020

Volume IV. The DUNE far detector single-phase technology
B. Abi, et al. (DUNE Collaboration)
Journal of Instrumentation, 2020

Volume III. The DUNE far detector single-phase technology
B. Abi, et al. (DUNE Collaboration)
Journal of Instrumentation, 2020

Volume I. The DUNE far detector single-phase technology
B. Abi, et al. (DUNE Collaboration)
Journal of Instrumentation, 2020

SELECTED TALKS

Deep-learning Event Reconstruction in DUNE Far Detector — 12th April 2024
The Second Wire-Cell Reconstruction Summit at Brookhaven National Laboratory — *Upton, NY*

AI in Ophthalmology — 7th Februray 2024
Vision Research Mixer at University of California, Irvine — *Irvine, CA*

Deep-learning-based Kinematic Reconstruction for DUNE — 16th March 2021
CFPU SMLI Seminar at Brown University — *Providence, RI*

ACADEMIC SERVICES

Program Committee

- ECML-PKDD: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases — 2024
- Machine Learning and the Physical Sciences Workshop at NeurIPS — 2021-2024

Reviewer

- Synthetic Data for Computer Vision Workshop at CVPR — 2024
- ECML-PKDD: The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases — 2024
- KDD: ACM SIGKDD Conference on Knowledge Discovery and Data Mining — 2023

SELECTED AWARDS / SCHOLARSHIPS

- CS Travel Grants from Donald Bren School of Information and Computer Sciences — 2022 2023 2024
- Dean's Awards from Donald Bren School of Information and Computer Sciences — 2019
- The Second Prize Scholarship, Shandong University — 2013 2014
- Outstanding Overseas Student with Scholarship, Shandong University — Dec 2013