Dr. Xinyao(Alvin) Sun

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Interests

- **Cybersecurity and Information Security:**
  - Specialized in developing and implementing robust cybersecurity measures.
  - Expertise in threat detection and prevention, incident response, vulnerability management, and security awareness training.
  - Skilled in conducting risk assessments and security audits to identify vulnerabilities and recommend mitigation strategies.
- **Fintech and Blockchain Techniques:**
  - Experienced in creating secure Smart Contracts and enhancing Blockchain Development with a focus on Security.
  - Knowledgeable in Decentralized Finance (DeFi) and Blockchain as a Service (BaaS), providing secure and efficient financial services.
  - Specialized in Cryptography to secure blockchain transactions and ensure data integrity.
- **Computer Vision, Human-Computer Interaction, Remote Sensing, and Machine Learning:**
  - Expertise in Signal Processing, focusing on Object Detection and Tracking, Face Verification, Action Recognition, and Motion Analysis.
  - Proficient in Deep Learning methodologies, including Transfer Learning, Model Conversion, and Optimization techniques.
  - Skilled in developing Recommendation Systems and analyzing User Behavior. .

Education

- **University of Alberta** — Edmonton, AB
  Ph.D. in Computing Science — *Sept. 2017 - May. 2022*
- **University of Alberta** — Edmonton, AB
  M.S. Computing Science, Specialization with Multimedia — *Sept. 2015 - Apr. 2017*
- **University of Alberta** — Edmonton, AB
  B.Sc. Science, Specialization in Computing Science — *Sept. 2010 - Dec. 2015*

Research and Work Experience

- **Computing Science Department, University of Alberta** — Edmonton, AB
  Adjunct Professor — *Jun. 2024 - Present*
  As an Adjunct Professor at the University of Alberta, I am establishing the Decentralized Research Group within the campus, targeting research in cybersecurity and blockchain technology. I have collaborated extensively with faculty members in Computer Science and the School of Business, and engaged in industry discussions on decentralized financial supply chains and data privacy.

- Established the R&D within the campus, targeting research in cybersecurity and blockchain technology.
- Collaborated with faculty members in Computer Science and the School of Business on federated authentication and fully homomorphic encryption on Blockchain.
- Engaged in industry discussions on decentralized financial supply chains and data privacy.

- **Matrix Group Inc** Vancouver & Edmonton, Canada /
  Co-founder & Chair Scientific Officer *Jan. 2021 - Present*
  In my role at Matrix Group Inc., I have spearheaded the development of secure Web3 applications and ensured robust security measures in blockchain technology. My work emphasizes the intersection of information security and fintech, particularly in developing innovative solutions for decentralized finance and digital asset management:

  - Funding and Valuation: In February 2022, secured $5.5M in angel-round funding, positioning the company at a $50M valuation.
  - Developed and implemented advanced security measures to protect Web3 applications. Ensured secure interactions across different blockchains through WORLD3, a 3D Decentralized Application Platform. It also allows users to interact with 3D applications running across different blockchains, resulting in $8 million in primary market sales.
  - Matrix Chainbase: Developed Matrix Chainbase, a cloud-based Web3 Infrastructure as a Service (IaaS) platform. This platform is designed to expedite the development of Web3 DApps by leveraging the elasticity, high availability, and flexibility of cloud computing, supporting projects with a market capitalization of approximately $100 million.
  - Matrix Marketplace: Established a multichain NFT marketplace, ensuring secure transactions and data integrity for digital assets.
  - Matrix Labs has achieved a significant milestone by being recognized as a global success case by Amazon Web Services (AWS). This acknowledgment showcases how Matrix Labs leverages AWS services to pioneer in developing Web 3.0 applications with an extensive global reach and rapid local access. (https://aws.amazon.com/solutions/case-studies/matrixlabs-case-study/)

- **Multimedia Resaerch Centre, UofA** Edmonton, AB
  Wide Area Monitoring Research Team, Tech Lead, Postdoctoral Fellow *May. 2021 - June 2022*
  As the Technical Lead and Postdoctoral Fellow within the Multimedia Research Center, I assist Dr. Irene Cheng to lead the InSAR project research team, which operates in collaboration with 3vGeomatics in Vancouver, Canada. Our team is pioneering the integration of conventional Signal Processing with cutting-edge Artificial Intelligence algorithms to enhance radar image analysis for geospatial applications. Our core initiatives include:

  - Noise Reduction: Implementing advanced techniques to filter noise from radar images, thereby increasing the clarity and usability of the data.
  - Signal Quality Estimation: Developing methods to assess the quality of signals, which is critical for reliable interpretation and application of InSAR data.
  - Ground Deformation Analysis: Decomposing and refining ground deformation signals to update and improve the earth's digital elevation model (DEM), enabling more precise earth surface representation.
  - Benchmarking Tool Creation: Building an ultimate InSAR simulator that serves as a standard benchmark for evaluating the efficacy of various algorithms in the field.

- **3vGeomatics Inc** Vancouver, BC
  Mitacs Accelerate Research Intern *July. 2017 - Aug. 2020*
  Funded by Consortium of Aerospace Research and Innovation in Canada (CARIC) & Natural Sciences and Engineering Research Council of Canada (NESRC)

As a Mitacs Accelerate Research Intern at 3vGeomatics, my role was instrumental in advancing the application of Interferometric Synthetic Aperture Radar (InSAR) technology for the large-scale mapping of ground displacement. My primary achievements included:

- Ground Motion Mapping: Orchestrated the large-scale motion mapping project, utilizing InSAR images to estimate ground displacement with increased accuracy.
- Application of Deep Learning: Deployed deep learning techniques to effectively denoise InSAR images and to provide precise coherence index estimations.
- Algorithm Development: Formulated an evolutionary strategy-based algorithm for estimating ground motion rates and correcting DEM height errors.
- Media Recognition: The significance of our work was highlighted in several news outlets including: TheStar, Journal of Edmonton, GatewayOnline, University of Alberta website.

- **Bi.Link Inc & Bi9.cn Inc** Shanghai, China
  Co-founder *April. 2018 - May. 2019*
  At Bi.Link Inc & Bi9.cn Inc, I focused on building secure and innovative financial technology solutions. My efforts were directed towards creating digital asset management platforms and enhan cing blockchain security through decentralized applications.
  - Bi9.cn helps customers to earn more than $1.5 million profit in 2018
  - Built a Digital asset management platform, contributing to hedge fund strategies by analyzing trading behaviors and environments of multiple Digital Currency Marketplaces.
  - Developed a decentralized digital asset lending platform hosted on EOS and Ethereum public chains, ensuring high network security through non-custodian depository smart contracts.
  - Managed all business logic of EOS smart contracts and corresponding front-end APIs for web apps integration.

- **Boardee Inc** Edmonton, AB
  Co-founder *May. 2016 - Sept. 2017*
  - One of three finalists in TELUC ICT streams in TEC of Edmonton competition 2017
  - Developed and co-designed a front-end cross-platform mobile applications.
  - Co-developed a back-end system for fetching location-awarded social media contents from the Internet.
  - Explored content-based recommendation and user notification strategies based on user's preference via deep recurrent neural networks.

- **TCL Research America, Silicon Valley** San Jose, CA
  Research Engineer Intern *May. 2016 - Expected Jan. 2017*
  - Developed and led team for using the Drone as inter-mediator to enhance human to human communication.
  - Implemented an Android app for tracking human face to control the Parrot Bebop Drone to follow the detected person.
  - Developed a system for human body detection, tracking, and human face detection, verification via deep convolutional neural networks, and built an autopilot framework for UAV devices.
  - First inventor of three patents and co-inventor of one patent on related works.

- **City of Edmonton, IT Department** Edmonton, AB
  Course Project under Dr. Lihang Ying and Dr. Irene Cheng *Jan. 2016 - Apr. 2016*
  - Developed and led the team for feature matching based residential area recommendation system.
  - Designed the three-layers system, developed mobile app and web app, co-developed the back-end business logic service.

- **Orbital Software Solutions Inc** Edmonton, AB
  Research Assistant under Dr. Irene Cheng *Sept. 2015 - Mar. 2016*
  Funde by NSERC
  - Developed a sensor-based Cloud Computing Interface (CCI) - for motion analysis as a performance metric and education Tool.
  - Developed a Multi-Leap Motion Sensor System via Linux Container (LXC) technique, and used machine learning algorithm for motion data fusion to overcome the single vision based sensor's occlusion issue.
- **Surgical Simulation Research Lab, University of Alberta** Edmonton, AB
  Research Assistant under Dr. Bin Zheng and Dr. Anup Basu *Jan. 2015 - Apr. 2015*
  - Developed a Smart Sensor-based Motion Detection system for hand movement training in open surgery by using a statistical model.
- **Multimedia Reserach Center, University of Alberta** Edmonton, AB
  Research Assistant under Dr. Irene Cheng and Dr. Anup Basu *Jan. 2015 - Apr. 2015*
  - Developed a Segmentation Quality Assessment mode for Ground Truth Delineation via medical Image Segmentation based on Local Consistency and Distribution Map Analysis.
- **ShunSoft Ltd** Shanghai, China
  Freelancer, Outsource Developer *Sept. 2014 - Jun. 2015*
  - Developed the iOS version of ShunSoft's stock and futures trading app, which allows users to do transactions, and change the risk management settings of their accounts through iOS devices.
  - Designed and co-develop ShunSoft's back-end dashboard that allows multiple users to make detailed stock auto-transaction and risk management settings simultaneously, which focused on the requirements of security, availability and stability.
- **Game Cloud Ltd** Edmonton, AB
  Co-founder *Jan. 2014 - Sept. 2014*
  - Co-founded a mobile game studio as one of core programmer for creating interesting casual and arcade mobile phone games and reached 500K downloads.

Publications

- N. Zhu, J. Sun, **X. Sun**, S. Zhang I. Cheng. "Blockchain Shield - Advanced Threat Detection & Forensic Analysis Platform." 44th IEEE International Conference on Distributed Computing Systems (ICDCS 2024 Submitted)
- L. Lin, H. Kang, **X. Sun**, W. Cai, "SemNFT: A Semantically Enhanced Decentralized Middleware for Digital Asset Immortality", 32nd ACM International Conference on Multimedia, (Submitted)
- N. Zhu, R. Vyas, **X. Sun**, I. Cheng. "Streamlining Blockchain Transactions: A Cost-Effective Pipeline for Enhanced Security and Integration in Non-Browser Applications." International Conference on Blockchain Research and Applications (BCRA 2024 Accepted)
- Z. Zhou, **X. Sun**, Z. Wang, S. Mukherjee, P. Ghuman, I. Cheng. "GANInSAR: Deep Generative Modeling for Large-Scale InSAR Signal Simulation." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (2024)
- H. Wu, Y. Li, Y. Zhuang, **X. Sun**, W. Cai, "BranchClash: A Fully On-Chain Tower Defense Blockchain Game with New Collaboration Mechanism." In Proceedings of the 31st ACM International Conference on Multimedia, pp. 9385-9387. 2023.

- Z. Lin, H. Duan, J. Li, **X. Sun**, W. Cai, "MetaCast: A Self-Driven Metaverse Announcer Architecture Based on Quality of Experience Evaluation Model." In Proceedings of the 31st ACM International Conference on Multimedia, pp. 6756-6764. 2023.
- S. Vijay Kumar, **X. Sun**, Z. Wang, R. Goldsbury, I. Cheng, "A U-Net Approach for InSAR Phase Unwrapping and Denoising." Remote Sensing 15, no. 21 (2023): 5081.
- C. Zhou, H. Chen, S. Wang, **X. Sun**, AE. Saddik, W. Cai, "Harnessing Web3 on Carbon Offset Market for Sustainability: Framework and A Case Study", IEEE Wireless Communications Magazine 2023
- **X. Sun**, Z. Wang, Ryan Goldsbury, I. Cheng, "Self-supervised Residual Distribution Learning for InSAR Phase Filtering and Coherence Estimation", IEEE International Geoscience and Remote Sensing Symposium (IGARSS) 2023
- **X. Sun**, Y. Lu, J. Sun, B. Tang, K. Rehak, S. Zhang. Matrix Syncer - A Multi-chain Data Aggregator For Supporting Blockchain-based Metaverses, International Conference on Smart Multimedia (ICSM). 2022
- **X. Sun**, X. Wu, S. Zhang. Matrix World - A Programmable 3D Multichain Metaverse, International Conference on Smart Multimedia (ICSM). 2022
- MD. Islam, **X. Sun**, Z. Wang, I. Cheng, (2022). FAPNET: Feature Fusion with Adaptive Patch for Flood-Water Detection and Monitoring. Sensors, 22(21), 8245..
- MD. Islam, **X. Sun**, Z. Wang, P. Ghuman, I. Cheng, "MNET: Semantic Segmentation for Satellite Images Based on Multi-Channel Decomposition." Engineering Proceedings 21.1 (2022): 26.
- **X. Sun**, A. Zimmer, S. Mukherjee, P. Ghuman, I. Cheng, "IGS-CMAES: A Two-Stage Optimization for Ground Deformation and DEM Error Estimation in Time Series InSAR Data", Remote Sens. 2021, 13, 2615
- N. Zhu, F. Yang, M. Zhu, **X. Sun**, I. Cheng, "DATA-ENABLED CRYPTOCURRENCY MARKET ANALYSIS AND VISUALIZATION PLATFORM", 15th International Conference on Interfaces and Human Computer Interaction, 2021
- **X. Sun**, A. Zimmer, N. Kottayil, S. Mukherjee, P Ghuman, I. Cheng, "DeepInSAR: DeepInSAR—A Deep Learning Framework for SAR Interferometric Phase Restoration and Coherence Estimation", Remote Sens. 2020, 12, 2340
- S. Mukherjee, A. Zimmer, **X. Sun**, P Ghuman, I. Cheng, "An Unsupervised Generative Neural Approach for InSAR Phase Filtering and Coherence Estimation". IEEE Geoscience and Remote Sensing Letters (GRSL), 2020, 7
- **X. Sun**, A. Zimmer, N. Kottayil, S. Mukherjee, I. Cheng, "A Benchmark InSAR Simulator for Phase Filtering and Coherence Estimation." Conference of the Arabian Journal of Geosciences (CAJG) 2019.
- S. Mukherjee, N. Kottayil, **X. Sun**, I. Cheng, "CNN-Based Real-Time Parameter Tuning for Optimizing Denoising Filter Performance", International Conference on Image Analysis and Recognition (ICIAR) 2019.
- **X. Sun**, N. Kottayil, S. Mukherjee, I. Cheng, "Adversarial Training for Dual-stage Image Denoising Enhanced with Feature Matching", International Conference on Smart Multimedia (ICSM). 2018
- S. Mukherjee, A. Zimmer, N. Kottayil, **X. Sun**, P Ghuman, I. Cheng, "CNN-Based InSAR Denoising and Coherence Metric" IEEE SENSORS. 2018

- S. Mukherjee, A. Zimmer, N. Kottayil, **X. Sun**, P Ghuman, I. Cheng, "CNN-based InSAR Coherence Classification" IEEE SENSORS. 2018
- N. Kottayil, A. Zimmer, S. Mukherjee, **X. Sun**, P Ghuman, I. Cheng, "Accurate Pixel-Based Noise Estimation for InSAR Interferograms" IEEE SENSORS. 2018
- **X. Sun**, A. Basu, I. Cheng, "Multi-Sensor Motion Fusion Using Deep Neural Network Learning", International Journal of Multimedia Data Engineering and Management (IJMDEM). 2017
- **X. Sun**, S. Byrns, I. Cheng, B Zheng and A. Basu, "Smart Sensor-Based Motion Detection System for Objective Measurement of Hand Movements in Open Surgery", Journal of Medical System, 41.2 (2017): 24.
- **X. Sun**, I. Cheng, A. Basu, "Spatio-Temporal Optimized Multi-Sensor Motion Fusion", IEEE International Symposium on Multimedia (ISM), 2016.
- A.-C. Furtado, **X. Sun**, A. Basu and I. Cheng, "Optimized Per-Joint Compression of Hand Motion Data", IEEE System Man and Cybernetics (SMC), 2016.
- I. Cheng, **X. Sun**, N. Alsufyani, Z. Xiong, P. Major and A. Basu, "Ground Truth Delineation for Medical Image Segmentation based on "Local Consistency and Distribution Map Analysis," IEEE Engineering in Medicine and Biology Conference (EMBC), 2015.

Patents

- **X. Sun**, X.L. Liao, X. Ren and H. Wang. "System and method for vision-based flight self-stabilization by deep gated recurrent Q-networks". Grant 2019 US Patent No.10241520 B2
- X.L. Liao, **X. Sun**, X. Ren and H. Wang. "Method and device for Quasi-Gibbs structure sampling by deep permutation for person identity inference". Grant 2019 US Patent No.10339408 B2
- **X. Sun**, X.L. Liao, X. Ren and H. Wang. "System and method for enhancing target tracking via detector and tracker fusion for unmanned aerial vehicles". Grant 2018, US Patent No.10140719 B2
- **X. Sun**, X.L. Liao, X. Ren and H. Wang. "Face detection, identification, and tracking system for robotic devices". Grant 2018, US Patent No.10068135 B2

Awards

- Awarded Alberta Innovates Graduate Student Scholarship Data-Enabled Innovation (2020)
- Awarded Alberta Graduate Excellence Scholarship (2019)
- Awarded Computing Science Early Achievement PhD (Runner Up) (2019)
- Awarded a University of Alberta Doctoral Recruitment Scholarship (2017)
- Awarded a University of Alberta Academic Excellence Scholarship (2010)
- Awarded an International Student Scholarship (Bridging Program) (2010)

Academic Activities

- Invited Guest Lecture, "Web3 Beyond The Hype: Real-World Case Studies of Web3 Elevating Products and Meeting User Needs" University Of British Columbia (2024)
- Invited Guest Lecture, "Web3 Beyond The Hype: Real-World Case Studies of Web3 Elevating Products and Meeting User Needs" Concordia University of Edmonton (2024)
- Interviewee, "The Future of Digital Entertainment in the Age of AI and Web3" Game Developer News at Game Developer Conference (GDC https://www.gdcvault.com/play/1034888) (2024)
- Panelist, "A Diverse Blend of Web3, AI, and the Metaverse" Standford University (2024)
- Guest Lectures, "Blockchain 101 and Decentralized Application" University of Alberta, Multimedia Master Program (2022, 2023)
- Invited Speaker, "Data-Enabled Multimedia Research Meets BlockChain" BLOCKCHAIN AND MULTIMEDIA DATA SCIENCE (BMDS) SEMINAR (2021)
- Invited Guest Lecture, "Introduction of Decentralized Application" University of Alberta, Multimedia Master Program (2021)
- Invited Guest Lecture, "Blockchain Overview" University of Alberta, Multimedia Master Program (2020)
- Invited Guest Lecture, \Introduction of Deep Learning and Remote Sensing Applications" Institute of Disaster Prevention Science and Technology, China (2019)
- Expert Consultancy, "Using Deep Learning for Radar Signal Filtering and Recognition", Institute of Disaster Prevention Science and Technology, China (2019)
- Web Chair for International Conference on Smart Multimedia (ICSM) 2018, 2019
- Web Chair for IEEE International Conference ON Systems, Man, and Cybernetics (SMC) 2017
- Steering committee, webmaster for IEEE International Conference on Multimedia and Expo (ICME)

R&D Supervision & Mentorship

- Supervising industry intern, Zixian Liu (Master), on Memory-Augmented AI agents with LLM in a 3D game environment. (2024 - present)
- Supervising industry intern, Zichen Gui (Master), on smart contract optimization, in-browser shader optimization, and 3D modeling optimization. (2024 - present)
- Supervising industry intern, Rahul Vyas (Master), focused on optimizing blockchain transactions and leveraging AI in the Web3 metaverse (2023 - present)

- Assisting Dr.Irene Cheng in mentoring Ningbo Zhu (PhD) on quantitative analyses and improvement strategies addressing the blockchain trilemma (2023 - present).
- Assisting Dr.Irene Cheng in mentoring Sachin Vijay Kumar (PhD), on InSAR phase unwrapping and parameter fitting (2022 - present)
- Assisting Dr.Irene Cheng in mentoring MD Samiul Islam PhD, for his project on waterbody detection in radar images (2022-2023)
- Assisting Dr.Irene Cheng to mentoring Joshua Billson, an undergraduate summer research intern, on waterbody extraction and data augmentation (2022 - 2023)

Computer Skills

- **Languages:** C, C++, Python, CUDA, Solidity, Rust, Go, Cadence, Javascript, Java, HTML, CSS, Obj, Obj-C, Matlab, Fortran
- **Tools:** Linux Shell, GNU Maker, Vim/Neovim, Visual Studio, Eclipse, XCode, Qt-Creater, Tensorflow, PyTorch, Caffe, OpenCV, dlib, Qt, Node.js, React, Ionic, EOS, Apache Cordova, Cocoa Touch, Docker, LXC.
- **OS:** Linux, Mac OS and Windows.