

Ziyang Wang

CONTACT INFORMATION

Ziyang Wang

Ph.D. Candidate

Department of Electrical and Computer Engineering

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EDUCATION

Rice University, TX, USA

Ph.D., Electrical and Computer Engineering

8/2020 – 05/2026

Advisor: **Prof. Shengxi Huang**

M.S., Electrical and Computer Engineering

5/2023

GPA: 4.00/4.00

The Pennsylvania State University, PA, USA

B.S., Computer Science, **B.S.**, Mathematics

8/2016 – 5/2020

Graduated with Schreyer Honors and dual Magna Cum Laude Honors

GPA: 3.96/4.00, Dean's List: 6/6

RESEARCH INTERESTS

AI for Spectroscopy, Molecular Sensing, Automated Experimentation, Physics-informed Modeling, Biomedical Diagnostics, Materials Characterization

HONORS AND AWARDS

MRS Graduate Student Silver Award, Materials Research Society (MRS)

2025

Travel Award, Rice Synthetic Biology Institute (RSBI)

2024

Best Abstract Award, United States and Canadian Academy of Pathology (USCAP)

2024

Phase One Winner, Nittany AI Challenge

2022

Winner, Asian Future Innovation Challenge Seattle

2022

Best Poster Award, IndustryXchange

2021

Schreyer Honors Scholar, Penn State

2020

Magna Cum Laude, College of Engineering, Penn State

2020

Magna Cum Laude, Eberly College of Science, Penn State

2020

Dean's List, Penn State

2016 – 2020

Second Prize, FIRST Tech Challenge, China

2015

RESEARCH EXPERIENCE

ScopeLab, Rice University

8/2020 – Present

Research Assistant

Houston, TX

- Pioneered an **interpretable machine learning (ML) biosensing platform integrating Raman spectroscopy and 2D materials**, enabling label-free molecular analysis of Alzheimer's disease.
 - Built scalable pipelines for Raman spectral analysis using PCA/t-SNE, SVM, XGBoost, and custom interpretable models, **improving AD diagnostic accuracy from 77% to 98%**.
 - Invented the **Peak-Sensitive Logistic Regression (PSE-LR)** algorithm for spectral interpretation ($F1 = 0.93$), enabling detection of low-concentration receptor binding domain proteins and characterizing of heterolayer WSe_2/WS_2 and AD-related molecular biomarkers.
 - Integrated ML with Raman hyperspectral imaging, achieving label-free spatial mapping of AD biomarkers across brain regions, advancing biomarker detection and distribution analysis.
 - Published 2 first-author papers in *ACS Nano*; received the *MRS Graduate Student Silver Award*, *RSBI Award*, and *industryXchange Best Poster Award*; one manuscript under review at *ACS Applied Materials & Interfaces*.
- Developed the **first-of-its-kind deep learning models** to extract optical properties using standard optical microscopes, enabling **in-operando characterization of functional and evolving materials**.
 - Created a benchmark dataset of 2.2 million material stacks via DFT simulations; designed convolutional, recurrent, and transformer neural networks, achieving state-of-the-art PCC of 0.99.
 - Published one first-author paper in *2D Materials*; presented at SCI Summer 2023, APS March 2023, MRS Fall 2022, APS March 2022; one manuscript in preparation.
- Designed **convolutional and transformer networks for respiratory virus strain identification** and biomolecule recognition, enabling portable virus detection devices.
 - Achieved 95% accuracy in virus strain identification using CNN models and developed a spectral transformer to classify 32 avian coronavirus strains.
 - Engineered plasmonic substrates (Au nanostars-AuCNT hybrids) to generate virus-accessible hot spots, enabling rich Raman fingerprints and improving ML-based strain-level viral sensing.
 - Published related work in *PNAS* and *ISBI*, demonstrating an AI-empowered Raman framework that advances rapid, accurate strain-resolved viral detection for public health.
- Applied the **Raman-ML platform for early pancreatic cancer diagnosis**; utilized **unsupervised ML to reveal cellular heterogeneity** and support targeted treatment strategies.
 - Designed supervised ML models, achieving 95% accuracy in early cancer stages diagnosis; applied unsupervised ML to identify 2 cancer variations.
 - Received *USCAP 2024 Best Abstract Award*; one manuscript in preparation; collaborating for clinical validation.
- Developed a **multimodal autonomous AI agent for instrument control and experiment automation**.
 - Implemented an AI-driven system (OpenAI API, OpenCV, PyTorch) for autonomous optical instrument operation, experiment planning, and real-time spectral acquisition.
 - Reduced manual operation by 90%, establishing a platform for AI-enabled autonomous laboratory experimentation.

PEER-REVIEWED PUBLICATIONS

Google Scholar Profile: <https://scholar.google.com/citations?user=HrtXQdoAAAAJ>

- **Z. Wang**, J. Ranasinghe, W. Wu, D. Chan, A. Gomm, R. Tanzi, C. Zhang, N. Zhang, G. Allen, S. Huang, “Machine Learning Interpretation of Optical Spectroscopy Using Peak-Sensitive Logistic Regression,” *ACS Nano*, 19(16), 15457-15473 (2025). [[News](#)] [[Interview](#)]
- **Z. Wang**, J. Ye, K. Zhang, L. Ding, T. Granzier-Nakajima, J. Ranasinghe, Y. Xue, S. Sharma, I. Biase, M. Terrones, S. H. Choi, C. Ran, R. Tanzi, S. X. Huang, C. Zhang, S. Huang, “Rapid Biomarker Screening of Alzheimer’s Disease by Interpretable Machine Learning and Graphene-Assisted Raman Spectroscopy,” *ACS Nano*, 16(4), 6426-6436 (2022). [[News](#)]
- **Z. Wang**, Y. C. Lin, K. Zhang, W. Wu, S. Huang, “Measuring Complex Refractive Index Through Deep-Learning-Enabled Optical Reflectometry,” *2D Materials*, 10(2), 025025 (2023).
- N. Zhang, **Z. Wang***, X. Wang, S. Lin, G. Vázquez-Lizardi, D. Sanchez, N. Lopez, Z. Yu, E. Dimitrov, A. Sredenschek, K. Halanayake, Y. Yeh, J. Mintz, J. Ye, S. X. Huang, D. Hickey, S. Huang, M. Terrones, “Near-infrared Surface-enhanced Raman Spectroscopy for Accurate Virus Strain Identification with Machine Learning Integration,” *arXiv:2509.09851* (2025).
- W. Wu, S. Luo, T. Li, E. Zhai, **Z. Wang**, X. Li, Y. Han, Y. C. Lin, Y. Zhao, J. Kono, S. Huang, “Manufacturing Chip-Scale 2D Monolayer Single Crystals Through Wafer-Bonder-Assisted Transfer,” *Nano Letters*, 25 (39), 14395-14403 (2025).
- A. Jain, A. Bhasin, **Z. Wang**, R. Gieseking, J. Robinson, S. Huang, “Effect of Molecular Configuration in 2D Materials Enhanced Raman Spectroscopy,” *Carbon*, 120576 (2025).
- K. Zhang, **Z. Wang**, H. Liu, N. Perea-López, J. Ranasinghe, G. Bepete, A. M. Minns, R. M. Rossi, S. E. Lindner, X. Huang, M. Terrones, S. Huang, “Understanding the Excitation Wavelength Dependence and Thermal Stability of the SARS-CoV-2 Receptor-Binding Domain Using Surface-Enhanced Raman Scattering and Machine Learning,” *ACS Photonics*, 9(9), 2963-2972 (2022).
- J. Ye, Y.-T. Yeh, Y. Xue, **Z. Wang**, N. Zhang, H. Liu, K. Zhang, R. Ricker, Z. Yu, A. Roder, N. P. Lopez, L. Organtini, W. Greene, S. Hafenstein, H. Lu, E. Ghedin, M. Terrones, S. Huang, S. X. Huang, “Accurate Virus Identification with Interpretable Raman Signatures by Machine Learning,” *Proceedings of the National Academy of Sciences (PNAS)*, 119(23), e2118836119 (2022). [[News](#)]
- J. Ranasinghe, **Z. Wang**, S. Huang, “Unveiling Brain Disorders Using Liquid Biopsy and Raman Spectroscopy,” *Nanoscale* 16(25), 11879-11913 (2024). [[News](#)]
- J. Ranasinghe, **Z. Wang**, S. Huang, “Raman Spectroscopy on Brain Disorders: Transition from Fundamental Research to Clinical Applications,” *Biosensors*, 13(1), 27 (2022).
- J. Ranasinghe, A. Jain, W. Wu, K. Zhang, **Z. Wang**, S. Huang, “Engineered 2D Materials for Optical Bioimaging and Path Toward Therapy and Tissue Engineering,” *Journal of Materials Research*, 37(10), 1689-1713 (2022).

MANUSCRIPTS IN PROCESS

- **Z. Wang**, J. Ranasinghe, D. Chan, A. Gomm, R. Tanzi, C. Zhang, S. Huang, “Machine Learning-Enhanced Hyperspectral Raman Imaging for Label-Free Molecular Atlas of Alzheimer’s Brain,” *ACS Applied Materials & Interfaces*, Under Review.
- J. Ranasinghe, S. Sanders, **Z. Wang**, W. Wu, E. Dimitrov, M. Terrones, A. Alabastri, S. Huang, “Noise Management of Surface-Enhanced Raman Spectroscopy Using Two-Dimensional Materials,” *ACS Sensors*, Under Review.

- Z. Yin, **Z. Wang**, J. Ranasinghe, J. Hu, S. X. Huang, C. Zhang, S. Huang, F. Ma, “Towards Interpretable Predictive Modeling for Detecting Alzheimer’s Disease Using Raman Spectra,” *IEEE 23rd International Symposium on Biomedical Imaging (ISBI)*, Under Review.
- **Z. Wang**, X. Wang, W. Wu, Y. C. Lin, S. Huang, “In-operando Optical Characterization of Evolving 2D Materials Using Recurrent Neural Network,” In Preparation.
- J. Ranasinghe, **Z. Wang***, T. Liang, H. Wang, S. Huang, “Mapping Tumor Heterogeneity and Metabolomics of Pancreatic Ductal Adenocarcinoma Using Raman Hyperspectral Imaging with Machine Learning Interpretation,” In Preparation.

BOOK CHAPTERS

- K. Zhang, A. Jain, W. Wu, J. Ranasinghe, **Z. Wang**, S. Huang, “Optical Properties and Emerging Phenomena of Two-Dimensional Materials,” *Novel Optical Materials* (2023).

CONFERENCE PAPERS

- P. Jin, Y.-T. Yeh, J. Ye, **Z. Wang**, Y. Xue, N. Zhang, S. Huang, E. Ghedin, H. Lu, A. Schmitt, S. X. Huang, M. Terrones, “Strain-Level Identification and Analysis of Avian Coronavirus Using Raman Spectroscopy and Interpretable Machine Learning,” *IEEE 20th International Symposium on Biomedical Imaging (ISBI)*, pp. 1-5 (2023).

CONFERENCE PRESENTATIONS

- MRS Fall Meeting 2025, “High-Resolution Molecular Atlas of Alzheimer’s Brain via Machine Learning-Enhanced Hyperspectral Raman Imaging,” Boston, MA, Dec. 2025.
- MRS Fall Meeting 2025, “Machine Learning Interpretation of Optical Spectroscopy Using Peak-Sensitive Logistic Regression,” Boston, MA, Dec. 2025.
- MRS Fall Meeting 2024, “Machine Learning Interpretation of Optical Spectroscopy Using Peak-Sensitive Logistic Regression,” Boston, MA, Dec. 2024.
- MRS Fall Meeting 2024, “2D Material Facilitated Surface-Enhanced Raman Spectroscopy of SARS-CoV-2 Receptor-Binding Domain,” Boston, MA, Dec. 2024.
- MRS Fall Meeting 2024, “Designer 2D Materials and Machine-Learning Assisted Characterization,” Boston, MA, Dec. 2024.
- Rice Synthetic Biology Institute (RSBI) Retreat, “High-Multiplexity Biosensing: Pancreatic Cancer Cell Heterogeneity Discovery,” Galveston, TX, Oct. 2024.
- SCI Summer 2023 Research Colloquium, “Measuring Complex Refractive Index Through Deep-Learning-Enabled Optical Reflectometry,” Houston, TX, Aug. 2023.
- APS March Meeting 2023, “EllipsoNet: Deep-Learning-Enabled Optical Ellipsometry for Complex Thin Films,” Las Vegas, NV, Mar. 2023.
- MRS Fall Meeting 2022, “EllipsoNet: Deep-Learning-Enabled Optical Ellipsometry for Complex Thin Films,” Boston, MA, Dec. 2022.
- APS March Meeting 2022, “Deep-Learning-Enabled Optical Ellipsometry for Complex Thin Films and 2D Materials,” Online, Mar. 2022

TEACHING AND MENTORING

Mentor, Summer Undergraduate Researcher	2025
Guided project on microplastic detection in mouse brain using ML-enhanced spectroscopy.	
Mentor, Summer Undergraduate Researcher	2025
Led development of a multimodal LLM-based lab agent for microscopy imaging.	
Mentor, Undergraduate Researcher	2025
Directed development of supervised ML for segmentation of brain Raman atlas.	
Mentor, Undergraduate Researcher	2024
Supervised implementation of CNN for high-accuracy virus classification from Raman spectra.	
Mentor, Visiting Exchange Undergraduate	2024
Implemented Vision Transformer (ViT) model for optical material characterization.	
Mentor, Graduate Student	2022
Designed and implemented automated ETL pipeline for data extraction and web crawling.	
Mentor, Summer Undergraduate Researcher	2021
Supervised development of spectral preprocessing pipeline; mentee later admitted to Ph.D. program at University of Delaware.	
Mentor, Undergraduate Student	2020
Co-authored publication in <i>ACS Nano</i> , 16(4), 6426-6436 (2022).	
Mentor, Undergraduate Student	2020
Advised undergraduate thesis titled "Machine Learning Classification for Raman Spectra."	
Teaching Assistant, Introduction to the Theory of Computation	2019
Graded exams and held office hours for student support and problem-solving.	
Lecturer, UPVC, Penn State	2018
Delivered lectures on product management and marketing strategy fundamentals.	

SERVICES AND LEADERSHIP

Peer Reviewer, <i>Biomedical Signal Processing and Control</i>	2025
Peer Reviewer, <i>2026 IEEE 23rd International Symposium on Biomedical Imaging (ISBI)</i>	2025
Session chair, Accelerated Materials Discovery via Data-Driven AI, <i>MRS Fall Meeting</i>	2025
Peer Reviewer, <i>Spectrochimica Acta Part A</i>	2025
Peer Reviewer, <i>Computers in Biology and Medicine</i>	2025
Peer Reviewer, <i>ACS Sensors</i>	2025
Peer Reviewer, <i>Journal of Physics: Condensed Matter</i>	2024
Volunteer Mentor, USTC Visiting Program, Rice University	2024
Volunteer Mentor, ECE Mentorship Program, Rice University	2024
Poster Judge, SCI Summer 2023 Research Colloquium, Rice University	2023
Graduate Student Leader, Nittany AI Challenge, Penn State	2022
Chief Technology Officer, iDeal Technology (Startup), Pennsylvania	2020
Student Lecturer, United Product Vision Club, Penn State	2018
Volunteer Lecturer, Dabie Mountains Region, Anhui, China	2016

GRANTS AND FUNDING

Assisted in writing “Multimodel AI Framework for Biomarker Discovery of Pancreatic Cancer.” 2024
 Awarded \$25,000 by the Ken Kennedy Institute Fund

Assisted in writing “Staging and Understanding Pancreatic Cancer Using Deep-Learning Assisted Raman Spectroscopy.” Submitted to the Provost’s TMC Collaborator Fund 2024

Assisted in writing “AI-Enabled High-Throughput In-Operando Optical Spectro-Microscopy for Emerging Neuromorphic and Quantum Materials Characterization.” Submitted to the National Science Foundation 2024

WORKING EXPERIENCE

iDeal Technology, LLC (Startup) 3/2020 – 8/2020
Chief Technology Officer & Co-founder State College, PA

- **Co-founded and launched a mobile app** on major app stores, achieving **20,000+ downloads** and **500+ DAU**, simplifying housing rentals and peer-to-peer trading for university students.
 - Led a development team of 4 in designing and developing the app with VUE, SQL, PHP, AWS. Managed an R&D team of 3 to implement a recommendation system with NLP encoder, boosting average session duration by 17.6%.
 - Attained \$5 million GMV, winning the 2022 Asian Future Innovation Challenge.

DataCVG 5/2019 – 7/2019
Data Analyst, Intern Shanghai, China

- Developed an **automated Python web crawler** to **extract 80K+ records** from **5000+ listed companies**, enhancing stockholder decision-making efficiency.
 - Extracted and parsed unstructured financial reports using Selenium, BeautifulSoup, Pandas, and NumPy; applied NLP tools to analyze report content; visualized insights using Power BI.

ATOZ Information Technology 5/2017 – 7/2017
Software Engineer, Intern Shanghai, China

- Built **AI-powered inspection services** for factory maintenance and created **AR demos** for Microsoft HoloLens, showcasing industrial AI solutions to stockholders.
 - Calibrated spatial localization algorithms; established a visual inspection images database; trained a convolutional neural network using Microsoft CNTK for industrial defect recognition.

SKILLS

Programming Languages: Python, MATLAB, R, SQL, Vue, HTML, CSS, JavaScript, Java, C, PHP

Libraries: PyTorch, Scikit-learn, NumPy, Pandas, Selenium, BeautifulSoup, Flask, Django

Tools & Software: Jupyter, VS Code, Microsoft Office (PowerPoint, Word, Excel), Power BI, LaTeX, CompleteEase, WiRE, COMSOL, Blender, Shapr3D, AWS, CNTK, Docker, Git, Linux