Ziyang Wang

CONTACT INFORMATION

Ziyang Wang
Ph.D. Candidate
Department of Electrical and Computer Engineering
Rice University, Houston, TX 77005, USA

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EDUCATION

Rice University, TX, USA

    Ph.D., Electrical and Computer Engineering   *8/2020 – Expected 6/2025*
    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*
    Graduate with Schreyer Honors Scholar, Magna Cum Laude Reward
    GPA: 3.96/4.00, Dean's List: 6/6

RESEARCH INTERESTS

Artificial intelligence, Machine learning, Biomolecule and disease sensing, Materials design, Hyperspectral imaging

HONORS AND AWARDS

Rice Synthetic Biology Institute (RSBI) Travel Award	*2024*
Best Abstract Award, Pancreatobiliary Pathology Conference	*2024*
Nittany AI Challenge Phase One Winner	*2022*
Asian Future Innovation Challenge Seattle Winner	*2022*
Best Poster Award, IndustryXchange	*2021*
Schreyer Honors Scholar, Penn State	*2020*
Magna Cum Laude, Engineering College, Penn State	*2020*
Magna Cum Laude, Science College, Penn State	*2020*
Dean's List, Engineering College, Penn State	*2016 – 2020*
FIRST Tech Challenge, Second Prize, 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 **rapid screening of biomarkers** of Alzheimer's disease (AD).
  - Developed interpretable ML algorithms (SVM, LR, XGBoost), elevating the AD diagnosis accuracy from 77% to 98% with graphene enhancement, identifying 3 critical AD biomarkers.

- o Designed a specialized ML algorithm (PSE-LR) for spectral interpretation, achieving a benchmark F1-score of 0.95 with accurate interpretability, outperforming all the conventional ML algorithms.
- o Applied Raman hyperspectral imaging with ML models, enabling label-free mapping of AD biomarkers across brain regions, advancing biomarker detection and distribution analysis.
- o Published in *ACS Nano*; received industryXchange 2021 Best Poster Award and RSBI 2024 Travel Award; one manuscript under review at *ACS Nano*, one manuscript in preparation.

- Developed the **first-of-its-kind deep learning models** to measure optical properties with standard optical microscopes, enabling **in-operando characterization of functional and evolving materials**.
  - o 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.
  - o Published in *2D Materials*; presented at APS March 2023, SCI Summer 2023, and MRS Fall 2022; one manuscript in preparation.

- Designed **convolutional and transformer networks** for **respiratory virus strain identification** and biomolecule recognition, enabling portable virus detection devices.
  - o Achieved 95% accuracy in virus strain identification with a CNN model and developed a spectral transformer for classification of 32 avian coronavirus strains.
  - o Published in *PNAS* and *ISBI*, establishing foundation for advanced portable virus detection systems.

- Employed the **Raman-ML platform** to **diagnose early pancreatic cancer stages**; utilized **unsupervised ML** to reveal **cellular heterogeneity**, enhancing targeted pancreatic cancer treatment.
  - o Designed supervised ML models and achieved 95% accuracy in early cancer stages diagnosis; developed unsupervised ML (kmeans, autoencoder) to identify 8 cancer variations.
  - o Received Best Abstract Award; one manuscript in preparation; collaborating for clinical validation.

PEER-REVIEWED PUBLICATIONS

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

- **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. E 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).
- **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).
- 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).
- J. Ranasinghe, **Z. Wang**, S. Huang, "Unveiling Brain Disorders Using Liquid Biopsy and Raman Spectroscopy," *Nanoscale* 16(25), 11879-11913 (2024).
- 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 PREPARATION

- **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*, Under Review.
- W. Wu, **Z. Wang**, X. Li, Y. Han, J. Kono, S. Huang, "Manufacturing Chip-Scale 2D Monolayer Single Crystals Through Wafer-Bonder-Assisted Transfer," *Nano Letters*, Under Review.
- **Z. Wang**, J. Ranasinghe, A. Gomm, R. Tanzi, C. Zhang, S. Huang, "A Molecularly Defined and Spatially Resolved Atlas of Alzheimer's Disease Whole Mouse Brain Using Raman Spectroscopy and Interpretable Machine Learning," In Preparation.
- **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**, S. Sanders, W. Wu, E. Dimitrov, M. Terrones, A. Alabastri, S. Huang, "Exploring 2D Materials for Noise Engineering of Surface-enhanced Raman Spectroscopy Substrates for SARS-Cov-2 Receptor-Binding Domain Detection," In Preparation.
- T. Liang, **Z. Wang**, J. Ranasinghe, S. Huang, H. Wang, "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 2024, "Machine Learning Interpretation of Optical Spectroscopy Using Peak-Sensitive Logistic Regression," Cambridge, MA, Dec. 2024.
- MRS Fall Meeting 2024, "Structural Control and Design of 2D Layered Materials and Heterostructures Towards Novel Functionalities," Cambridge, 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, "Deep-Learning-Enabled Optical Ellipsometry for Complex Thin Films and 2D Materials," Las Vegas, NV, Mar. 2023.

- MRS Fall Meeting 2022, "EllipsoNet: Deep-Learning-Enabled Optical Ellipsometry for Complex Thin Films," Cambridge, MA, Dec. 2022.

TEACHING AND MENTORING

Mentor for a first-year Ph.D. student	*2024*
Improved an unsupervised spectroscopy analysis approach.	
Mentor for an undergraduate student	*2024*
Developed a neural network for virus strain identification using Raman spectra.	
Mentor for a visiting undergraduate	*2024*
Implemented a Vision Transformer (ViT) for material characterization.	
Mentor for a graduate student	*2022*
Developed an automated data extract, transform, load (ETL) pipeline for web crawling.	
Mentor for a summer undergraduate researcher	*2021*
Implemented a spectral preprocessing pipeline.	
Mentor for an undergraduate student	*2020*
Co-authored publication, *ACS Nano*, 16(4), 6426-6436 (2022).	
Mentor for an undergraduate student	*2020*
Completed undergraduate thesis, "Machine learning classification for Raman Spectra".	
Teaching Assistant for the course "Introduction to the Theory of Computation"	*2019*
Graded exams and held office hours for homework questions.	
Lecturer for UPVC	*2018*
Held lectures on product management principles and marketing strategies.	

SERVICES AND LEADERSHIP

Peer Reviewer, *Journal of Physics: Condensed Matter*	*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, UPVC, 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", awarded $25,000 by the Ken Kennedy Institute Fund	*2024*
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 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 **15,000+ downloads** and **500+ DAU**, simplifying housing rentals and peer-to-peer trading for university students.
    - Led a development team of 4 to develop the app with VUE, SQL, PHP, and AWS; managed an R&D team of 3 to integrate a recommendation system with NLP, boosting ASD by 17.6%.
    - Attained $5 million GMV, winning the 2022 Asian Future Innovation Challenge.

DataCVG   *5/2019 – 7/2019*
Data Analyst, Intern   Shanghai, China
- Designed and built an **automated web crawler** in Python and **extracted 80K+ records** from **5000+ listed companies**, enhancing stockholder decision-making efficiency.
    - Extracted and unstructured companies' reports with Python (Selenium, BeautifulSoup, Pandas, Numpy); applied NLP tools for analyzing financial reports; visualized insights in Power BI.

ATOZ Information Technology   *5/2017 – 7/2017*
Software Engineer, Intern   Shanghai, China
- Developed **AI-powered inspection services** for factory maintenance; created **portable augmented reality demos** on Microsoft HoloLens, showcasing industrial AI applications to stockholders.
    - Calibrated spatial localization algorithms; established a visual inspection images database; trained a convolutional neural network using Microsoft CNTK image recognition services.

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, VScode, Microsoft Office (PowerPoint, Word, Excel), Power BI, LaTeX, CompleteEase, WiRE, COMSOL, Blender, AWS, CNTK, Docker, Git, Linux