Ruige Kong

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Education

University of Washington Seattle, WA

PhD in Mechanical Engineering (AI Institute In Dynamic Systems) *Sept. 2025 – Present*

- Focus: AI4Science, applying deep reinforcement learning to optimal control in fluid mechanics.
- Advisor: **Prof. Stefania Fresca**

University of Cambridge Cambridge, UK

MEng & BA in Information and Computer Engineering *Oct. 2021 – Jun. 2025*

- Specialized in **Machine Learning** (Deep Learning, Probabilistic ML, Computer Vision) and **Computational Science** (PDEs, Data-driven Mechanics, Computational Biology).
- Core curriculum in **Mathematical Methods**, **Inference**, **Control Theory**, and **Statistical Signal Processing**.

Research Experience

Graduate Research Assistant Sept. 2025 – Present

Scientific Computing and Data-driven modeling (SCiDaMa) group *Seattle, WA*

- Developing deep reinforcement learning (DRL) algorithms to solve high-dimensional optimal control problems in fluid mechanics under **Prof. Stefania Fresca**.
- Investigating AI4Science applications to model and discover solutions for complex, nonlinear physical systems.

Machine Learning Researcher (Research Assistant) Oct. 2023 – Jun. 2025

Supervisor: Richard Turner, University of Cambridge *Cambridge, UK*

- Investigated non-local inference in Physics Informed Machine Learning (PIML), focusing on how neural networks infer missing or unseen variables in coarsened physical data.

Deep Learning Researcher (Research Assistant) Aug. 2023 – Jun. 2025

Supervisor: Sibo Cheng, Imperial College London's Data Science Institute *Cambridge, UK*

- Evaluated CNN/Transformer models' performance for next-day wildfire prediction using remote sensing data. **Resulted in a 2nd-author publication in JGR: Machine Learning and Computation.**
- Enhanced model transparency and feature importance using explainability techniques. **SHAP analysis indicated critical features such as "Drought" contributed 35% to overall model decisions**, while **Grad-CAM revealed Swin-Unet focused on vital fire-prone regions 60% more accurately than ResNet.**

Cambridge IGEM Team Drylab Researcher May 2023 – Nov. 2023

Supervisor: Christopher Micklem, University of Cambridge *Cambridge, UK*

- Created group wiki and designed complete genetic expression circuit using Catalyst library in Julia.
- Engineered a synthetic biological circuit, **achieving a 175% increase in biofilm production.**

Publications

Zhou, Y., **Kong, R.**, Xu, Z., Xu, L., Cheng, S. *Comparative and Interpretative Analysis of CNN and Transformer Models in Predicting Next Day Wildfires Using Remote Sensing Data* Journal of Geophysical Research - Machine Learning and Computation, Published

Industry Experience

AI & Data Science/Quantitative Research Intern Jun. 2024 – Aug. 2024

Supervisors: Wei (Victor) Li and Yazann Romahi, JPMorgan, Quantitative Solutions Team *London, UK*

- Designed pipeline with RAG, GPT-API, and transformer models for dynamic sentiment tracking.
- Designed a transformer model on AWS for stock return forecasting using weekly Factiva news, **improving prediction accuracy by over traditional statistical models by 13%.**

Deep Learning Intern Jun. 2023 – Sept. 2023

Supervisor: Nick Goldman, European Bioinformatics Institute *Hinxton, UK*

- Created amino acid photo emission simulator using baseline distributions for synthetic data generation.
- Developed CNN/Transformer architectures for full sequence classification, **improving accuracy by 25%.**

Leadership and Activities

University Badminton Squad Oct. 2021 – Jun. 2025
Cambridge University *Member / Event Organizer*
- Organized friendly matches with local clubs and other universities.
- Coordinated alumni meetups and annual committee votes.

SynBio Society Computational Team Jun. 2023 – Jun. 2024
Cambridge University *Member*
- Led workshops on biological systems modeling using Python/Matlab/Julia.
- Taught deep learning libraries (e.g., PyTorch, Scikit-learn) for biological modeling.

Hackbridge Jan. 2023 – Jun. 2025
Cambridge University *Participant*
- Fine-tuned Stable Diffusion for generating client advertisement images.
- Developed stock selection models using financial social media sentiment analysis.

Medtech Oct. 2021 – May 2022
Cambridge University *Participant*
- Co-developed a nano-scale cardiovascular monitor, securing 2nd place in a competition.

Course Projects

Computational Biology Project: Salmonella Dynamics Modeling | *Python, Matlab* May 2023 – Jun. 2023
- Simulated intracellular dynamics of Salmonella infection using ODE models.
- Analyzed infection spread in macrophages and predicted bacterial load growth.

Software Project: Logic Circuit Simulator | *Python* May 2023 – Jun. 2023
- Developed a logic circuit simulator with support for CLOCK, SWITCH, AND, OR, XOR gates, and flip-flops.
- Integrated a 3D interface for visualizing signal traces and supported multi-language functionality.

Data Analysis Project: Bayesian Estimation | *Python, Matlab* May 2023 – Jun. 2023
- Applied Bayesian methods to audio signal reconstruction and missing data estimation.
- Explored autoregressive models and sinusoidal estimation for real audio data.

Inference Coursework Project: Bayesian Inference | *Python, MATLAB* Oct. 2023 – Dec. 2023
- Applied Bayesian logistic regression with MAP estimation and Laplace approximation, using grid search to optimize hyperparameters (prior variance and bandwidth of radial basis functions), improving uncertainty estimation compared to MAP.

Statistical Signal Processing Project: Non-Uniform Distributions | *Python* Oct. 2023 – Dec. 2023
- Analyzed and simulated random variables using Kernel Density Estimation for applications in signal processing.
- Improved understanding of tail behavior and practical implications in real-world signal processing systems.

Awards

2023 Citadel European Datathon | *2nd Place, $15,000 prize* April 2023
2024 AIGC Hackbridge UK Hackathon | *1st Place, £1,000 prize* March 2024
2023 AIGC Hackbridge UK Hackathon | *1st Place, £1,0*00 prize* March 2023
2023 IGEM Synthetic Biology Competition | *Gold* Jun. – Nov. 2023
2023 IMC Quantitative Trading Competition | *Top 80/8169 Teams* March 2023
Kaggle Competition: Bengali Speech Recognition | *Participation* Jun. – August 2023
Kaggle Competition: Lumbar Spine Degenerative Classification | *Participation* Jun. – August 2024
College Awards | *Engineering Fund Award (£500), The Clough Scholarship (£175), The Trethewey Prize (£175), Vacation Project Award (£500), Student Opportunities Award (£100), Landy Prize for Progress Award (£100)* 2023 – 2024

Technical Skills

Programming Languages: Python, MATLAB, Julia, R, SQL, LaTeX
Languages: English (native), Mandarin (native), Cantonese (beginner), French (beginner), Japanese (beginner)
Tools: Git, Linux, Jupyter, ROS, ROS2, VS Code, PyCharm
Libraries: Pandas, NumPy, TensorFlow, PyTorch, PyTorch Geometric, Scikit-learn, OpenAI Gym, Stable-Baselines3, OpenCV, Plotly, Matplotlib, Seaborn, SciPy