Ruining Deng

• (629) 999-0161 • r.deng@vanderbilt.edu • https://ddrrnn123.github.io • Current Location: Nashville, TN •

Education

Vanderbilt University, Nashville, TN — Exp. June 2024
Doctor of Philosophy, Computer Science
GPA: 3.89/4.0 Advisor: Dr. Yuankai Huo

China University of Mining & Technology, Beijing, Beijing, China — June 2019
Bachelor of Science, Information Engineering
GPA: 3.99/4.0 (Core GPA: 4.0/4.0) Rank: 1/31

Technical Skills

Languages Python, MATLAB, C/C++, JavaScript, GraphQL, SQL, Verilog, Apex
Frameworks & Tools PyTorch, AWS, Linux, Colab, ImageJ, QuPath, 10x Genomics, sHPC, Docker, Wandb

Professional Experience

Vanderbilt University — Nashville, TN
Research Assistant — Mar 2020 - Present

- Designed a single dynamic network to achieve multi-object and multi-scale segmentation on renal pathology.
  - Segmentation, Semi-supervised Learning, Clinical knowledge learning, Dynamic network
- Infused molecular images with pathological images to democratize AI pathology using only lay annotators.
  - Molecular-empowered learning, multimodal learning, cross-modality registration, corrective learning
- Evaluated the zero-shot segmentation performance of the foundation model on representative segmentation tasks.
  - Segment anything model (SAM), Segmentation, Prompt-based fine-tuning, Weakly annotated
- Built an 3D modeling pipeline for large-scale glomerular identification across serial sectioning renal pathology.
  - Large-scale registration, Multi-object Detection and Associations, 3D Reconstruction and Quantification
- Combined a cross-scale attention mechanism into a single model to achieve pathological image classification.
  - Multi-instance Learning, Attention Mechanism, Explainable-AI, Classification, Weakly Supervised Learning
- Integrated genomics knowledge and AI-based morphological knowledge in Assessing Atubular vs. Glumeruli.
  - Multi-model learning, Genetics, Spatial Transcriptomics, Image-omics, Knowledge-infused Learning
- Proposed a novel class-aware codebook for diffuse protein region segmentation on duodenum pathological images.
  - GANs, VQ-VAE, Weakly Supervised Learning, Segmentation
- Collaborated with pathologists and clinicians to analyze digital data with Computer-Aided Design.
- Mentored 10+ undergraduate/gradaute students on independent research and conference paper writing.
- Reviewer for IEEE TMI, MedIA, IEEE JBHI, JMI, MELBA, AIM, PR, MICCAI, MIDL, ISBI.

Roche — Santa Clara, CA
Imaging Scientist Intern — May - Aug 2023

- Proposed a cross-modality attention-based multimodal fusion pipeline for patient survival prediction.
- Submitted one paper and extended one patent (increased c-index from 0.58 to 0.65 by using images and omics).
- Conducted data preprocessing and embedding for deep learning model training.
- Utilized Wandb to manage all experiments and used GitLab for code organization; leveraged shared High-Performance Computing (sHPC) for model training.
- Investigated various survival loss functions and multi-stage learning approaches for survival prediction.

Bridge Investment Group — Charlotte, NC
Software Engineer Intern — May - Aug 2020

- Developed three web apps in Svelte (JavaScript) for property management and real-time data visualization.
- Worked closely with property managers to design web apps and property data analysis services.
- Wrote 10+ scripts in Python for investment data maintenance on S3 Bucket.
- Configured an AWS API Gateway and Lambda to deploy the apps and data maintenance scripts.
- Cleaned and managed data using SQL Workbench and Apex in Salesforce.
- Used GraphQL data structure to replace previous property data from SQL and MongoDB.

Guangdong Provincial Cardiovascular Institute — Guangzhou, China
Research Staff — Jun - Aug 2019

- Built two end-to-end deep learning classifiers to predict pre-excitation syndrome from printed ECG images.
- Built a curve extractor in MATLAB to solve curve intersection and coincidence on printed ECG images.
- Developed a classifier by using the clinical curve's features for the pre-excitation syndrome prediction.
- Received two copyrights for the developed software whose diagnosis accuracy was over 80%.
- Worked closely with doctors to helped analyze cardiac sounds and ECG from patients.

University of Notre Dame — South Bend, IN
Visiting Student (Advisor: Dr. Yiyu Shi) — Jul - Sep 2018

- Implemented k-U-Net and a Convolutional LSTM Network for multi-modality medical image segmentation.
- Received Outstanding Graduate Award and Outstanding Final Project and Graduation Thesis Award (top 8%).

Ruining Deng

• (629) 999-0161 • r.deng@vanderbilt.edu • https://ddrrnn123.github.io • Current Location: Nashville, TN •

Work Experience

Vanderbilt University Nashville, TN
Teaching Assistant Aug 2020 - May 2021

- Helped teach courses in Deep Learning, Modeling and Machine Learning, and Image Processing.
- Designed homework for Data Regression, NNs, CNNs, Transfer Learning, Object Recognition on Google Colab.
- Gained practice communicating technical concepts to students and helped them debug code in office hours.

McTyeire International Program Chinese hall Nashville, TN
Language Program Staff member Aug 2021 - May 2023

- Coordinated daily dinners and weekly study breaks to help students increase their target language fluency.
- Helped organize fireside events by language faculty members of the University.
- Reviewed the progress and participation of students on your hall using evaluation questionnaires.

Presentations & Talks

- Multimodal Learning & Cross-modality Attention-based Multimodal Fusion Patient Survival Prediction
  Knowledge Sharing Workshop, Roche Diagnostics Solutions, Santa Clara, CA, 2023
- Knowledge-infused Efficient Learning For Giga-pixel Virtual Microscopy Image.
  CAMCA AIxMed Seminar, Massachusetts General Hospital and Harvard Medical School, Boston, MA, 2022

Awards & Honors

- SPIE Medical Imaging Best Student Paper Award Finalist (2 paper) Feb 2024
- SPIE Medical Imaging Student Conference Travel Grant Feb 2023
- Graduate School Travel Award Feb 2022, Feb 2023, Feb 2024
- First-class Scholarship of the University (top 2%) Nov 2016, Nov 2017

Selected First Author Publication

[J1] **Deng, R.,** Yang, H., Jha, A., Lu, Y., Chu, P., Fogo, A.B. and Huo, Y., *Map3D: Registration-Based Multi-Object Tracking on 3D Serial Whole Slide Images.* IEEE transactions on medical imaging, 2021. 40(7): p. 1924-1933.

[J2] **Deng, R.,** Cui, C., Remedios, L.W., Bao, S., Womick, R.M., Chiron, S., Li, J., Roland, J.T., Lau, K.S., Liu, Q. and Wilson, K.T., 2023. *Cross-scale Multi-instance Learning for Pathological Image Diagnosis*. Medical Image Analysis, 2024 Accepted.

[J3] **Deng, R.,** Liu, Q., Cui, C., Yao, T., Long, J., Asad, Z., Womick, R.M., Zhu, Z., Fogo, A.B., Zhao, S. and Yang, H., 2023. *Omni-seg: A scale-aware dynamic network for renal pathological image segmentation.* IEEE Transactions on Biomedical Engineering.

[C1] **Deng, R.,** Liu Q.,Cui C., Yao T., Yue J., Xiong J., Yu L., Wu Y., … & Huo, Y. (2024). PrPSeg: Universal Proposition Learning for Panoramic Renal Pathology Segmentation. Computer Vision and Pattern Recognition Conference (CVPR) accepted.

[C2] **Deng, R.,** Li, Y., Li, P., Wang, J., Remedios, L.W., Agzamkhodjaev, S., Asad, Z., Liu, Q., Cui, C., Tang, Y. and Yang, H., 2023. *Democratizing Pathological Image Segmentation with Lay Annotators via Molecular-empowered Learning*. In International Conference on Medical Image Computing and Computer-Assisted Intervention, 2023

[C3] **Deng, R.,** Shaikh, N., Shannon, G., Nie, Y., 2023. *Cross-modality Attention-based Multimodal Fusion for Non-small Cell Lung Cancer (NSCLC) Patient Survival Prediction.* SPIE Medical Imaging 2024.

[C4] **Deng, R.*,** Li, X.*, Tang, Y., Bao, S., Yang, H. and Huo, Y., 2023. Leverage Weakly Annotation to Pixel-wise Annotation via Zero-shot Segment Anything Model for Molecular-empowered Learning. SPIE Medical Imaging 2024.

[C5] **Deng, R.*,** Cui, C.*, Liu, Q.*, Yao, T., Remedios, L.W., Bao, S., Landman, B.A., Wheless, L.E., Coburn, L.A., Wilson, K.T. and Wang, Y., 2023. *Segment anything model (sam) for digital pathology: Assess zero-shot segmentation on whole slide imaging.* Medical Image with Deep Learning short paper track, 2023.

[C6] **Deng, R.,** Liu, Q., Cui, C., Asad, Z., Yang, H. and Huo, Y., *Omni-Seg: A Single Dynamic Network for Multi-label Renal Pathology Image Segmentation using Partially Labeled Data.* Medical Image with Deep Learning, 2022.

[C7] **Deng, R.,** Yang, H., Asad, Z., Zhu, Z., Wang, S., Wheless, L.E., Fogo, A.B. and Huo, Y., *Dense multi-object 3D glomerular reconstruction and quantification on 2D serial section whole slide images.* In SPIE Medical Imaging 2022. 12039: p. 83-90.

[C8] **Deng, R.,** Cui, C., Remedios, L.W., Bao, S., Womick, R.M., Chiron, S., Li, J., Roland, J.T., Lau, K.S., Liu, Q. and Wilson, K.T., *Cross-Scale Attention Guided Multi-instance Learning for Crohn's Disease Diagnosis with Pathological Images.* In International Workshop on Multiscale Multimodal Medical Imaging, 2022: p. 24-33.

[C9] **Deng, R.*,** Leng, H.*, Asad, Z., Womick, R.M., Yang, H., Wan, L., and Huo, Y., *An Accelerated Pipeline for Multi-label Renal Pathology Image Segmentation at the Whole Slide Image Level.* In Medical Imaging 2023: Digital and Computational Pathology (Vol. 12471, pp. 174-179). SPIE.

[C10] **Deng, R.*,** Li, P.*, and Huo, Y., *An End-to-end Pipeline for 3D Slide-wise Multi-stain Renal Pathology Registration.* In Medical Imaging 2023: Digital and Computational Pathology (Vol. 12471, pp. 96-101). SPIE.