CHENYU GAO

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TECHNICAL SKILLS

Areas of Expertise	Multimodal Representation Learning, Generative Models, Medical Image Analysis, Computer Vision
Languages	Python, Bash
Frameworks	PyTorch, TensorFlow, Scikit-learn, Hugging Face, NumPy, Pandas, Polars
DevOps & Cloud	Git, Docker, Singularity, HPC/Slurm, AWS (S3, EC2), Weights & Biases

INTELLECTUAL PROPERTY

IP1. **Chenyu Gao**, Bennett A. Landman, Michael E. Kim. System and Method of Brain Age Identification for Predicting Neuro-Degenerative Disease. U.S. Non-provisional Patent Application filed September 2025 (claims priority to U.S. Provisional App. No. 63/701,861, filed Oct 1, 2024)

EXPERIENCE

Data Science and Machine Learning Intern   South San Francisco, CA
insitro   *June 2025 – Aug 2025*

- Designed and implemented a multimodal framework applying natural language processing (NLP) to encode DNA sequencing data, guiding self-supervised learning (SSL) on images to extract robust features for gene discovery.
- Collaborated with research scientists to design model architecture and partnered with software engineers to use and help debug infrastructure pipelines for large-scale computing.
- First-authored a technical paper, currently pending internal review for its potential to accelerate drug discovery by identifying new gene targets.

Graduate Research Assistant   Nashville, TN
Vanderbilt University   *July 2022 – Present*

- Engineered a cascaded diffusion model for a privacy red-team attack, reconstructing high-fidelity 3D facial geometry from defaced MRI data to quantify and expose critical re-identification risks. [Blog]
- Designed a first-of-its-kind system for brain age estimation from multi-modal MRI to enable early detection of neurodegenerative diseases, resulting in a provisional patent. [GitHub]
- Architected a scalable data processing pipeline using Singularity, local and HPC to ingest, harmonize, and quality-assure 100,000 MRI scans from 40+ datasets for the world's largest diffusion and structural MRI database.
- Implemented a conditional GAN in PyTorch to synthetically extend the MRI field-of-view, rescuing previously incomplete scans and increasing effective dataset size by an estimated 10-15%.

Graduate Research Assistant   Baltimore, MD
Johns Hopkins University   *Dec 2020 – May 2022*

- Extended the application of a lifelong learning algorithm from vision to speech tasks and validated its omnidirectional knowledge transfer on a spoken digit benchmark, contributing to a publication in the top-tier journal *IEEE TPAMI*. [GitHub]
- Developed and benchmarked a suite of deep learning and classical computer vision algorithms for MR image analysis, establishing performance baselines that guided subsequent research on MRI defacing.

Teaching Assistant   Baltimore, MD
Johns Hopkins University   *Jan 2022 – May 2022*

- Co-designed homework and projects, held office hours for the course Medical Image Analysis.

Education

Vanderbilt University   Nashville, TN
Doctor of Philosophy in Electrical & Computer Engineering   *July 2022 – Nov 2026 (expected)*
- **Research Focus:** Applying multimodal representation learning and generative models to solve challenges in medical image analysis and computer vision.
- **Honors:** Graduate School Travel Grant (2023), ECE Day best poster (2025)

Johns Hopkins University   Baltimore, MD
Master of Science in Biomedical Engineering   *Aug 2020 – May 2022*

Sun Yat-sen University   Guangzhou, China
Bachelor of Science in Biomedical Engineering   *Aug 2016 – June 2020*

Journal Articles

J1. **C Gao***, K Xu*, et al. "Pitfalls of defacing whole-head MRI: re-identification risk with diffusion models and compromised research potential." *Computers in Biology and Medicine*. 2025.

J2. **C Gao**, et al. "Brain age identification from diffusion MRI synergistically predicts neurodegenerative disease." *Imaging Neuroscience*. 2025.

J3. **C Gao**, et al. "Field-of-view extension for brain diffusion MRI via deep generative models." *Journal of Medical Imaging*. 2024.

J4. **C Gao**, et al. "Characterizing patterns of diffusion tensor imaging variance in aging brains." *Journal of Medical Imaging*. 2024.

J5. **C Gao**, BA Landman, JL Prince, A Carass. "Reproducibility evaluation of the effects of MRI defacing on brain segmentation." *Journal of Medical Imaging*. 2023.

J6. JT Vogelstein, J Dey, . . . , **C Gao**, et al. "Simple Lifelong Learning Machines." *IEEE Transactions on Pattern Analysis and Machine Intelligence*. 2025.

J7. ME Kim, **C Gao**, et al. "Scalable quality control on processing of large diffusion-weighted and structural magnetic resonance imaging datasets." *PLoS One*. 2025.

J8. C Peter, . . . , **C Gao** (ADSP-PHC Analyst Team), et al. "White Matter Abnormalities and Cognition in Aging and Alzheimer Disease." *JAMA neurology*. 2025.

J9. AM Saunders, ME Kim, **C Gao**, et al. "Comparison and calibration of MP2RAGE quantitative T1 values to multi-TI inversion recovery T1 values." *Magnetic Resonance Imaging*. 2025.

J10. A Lorenz, . . . , **C Gao**, et al. "The effect of Alzheimer's disease genetic factors on limbic white matter microstructure." *Alzheimer's & Dementia*. 2025.

J11. KG Schilling, . . . , **C Gao**, et al. "Head Motion in Diffusion Magnetic Resonance Imaging: Quantification, Mitigation, and Structural Associations in Large, Cross-Sectional Datasets Across the Lifespan." *Human Brain Mapping*. 2025.

J12. R Zhang, . . . , **C Gao**, et al. "Enhancing Clinical Data Management through Barcode Integration and REDCap: Innovations in Scalability and Adaptability." *JMIR Formative Research*. 2025.

J13. A Peterson, . . . , **C Gao**, et al. "Sex and APOE-$\varepsilon 4$ allele differences in longitudinal white matter microstructure in multiple cohorts of aging and Alzheimer's disease." *Alzheimer's & dementia*. 2024.

J14. P Kanakaraj, . . . , **C Gao**, et al. "Deepn4: learning N4ITK bias field correction for T1-weighted images." *Neuroinformatics*. 2024.

J15. ME Kim, **C Gao**, et al. "Empirical assessment of the assumptions of ComBat with diffusion tensor imaging." *Journal of Medical Imaging*. 2024.

Conference Publications

C1. **C Gao**, et al. "Predicting age from white matter diffusivity with residual learning." *Medical Imaging 2024: Image Processing*. 2024.

C2. **C Gao**, L Jin, JL Prince, A Carass. "Effects of defacing whole head MRI on neuroanalysis." *Medical Imaging 2022: Image Processing*. 2022.

C3. E Topolnjak*, **C Gao***, et al. "Assessment of subject head motion in diffusion MRI." *Medical Imaging 2024: Image Processing*. 2024.

C4. E McMaster, L Puglisi, **C Gao**, et al. "A technical assessment of latent diffusion for Alzheimer's disease progression." *Medical Imaging 2025: Image Processing*. 2025.

C5. ME Kim, K Ramadass, **C Gao**, et al. "Scalable, reproducible, and cost-effective processing of large-scale medical imaging datasets." *Medical Imaging 2025: Imaging Informatics*. 2025.

C6. Y Chang, L Xu, **C Gao**, et al. "Bundle-wise functional connectivity density and fractional amplitude of low-frequency fluctuations decrease in white matter in preclinical Alzheimer's disease and are associated with $A\beta$ levels and cognition." *Medical Imaging 2025: Clinical and Biomedical Imaging*. 2025.

C7. K Ramadass, Y Liu, ME Kim, **C Gao**, et al. "Investigating effects of air quality and weather on human brain volumes." *Medical Imaging 2025: Clinical and Biomedical Imaging*. 2025.

C8. Z Li, ..., **C Gao**, et al. "Approximate diffusion tractography from FLAIR MRI and anatomical context using recurrent neural networks." *Medical Imaging 2025: Image Processing*. 2025.

C9. S Bao, ..., **C Gao**, et al. "Quantitative analysis of colonic epithelial cell aging in a cell-cycle-like model: changes in nucleus and cytoplasm along the crypt axis." *Medical Imaging 2025: Digital and Computational Pathology*. 2025.

C10. AR Krishnan, K Xu, T Li, **C Gao**, et al. "Inter-vendor harmonization of CT reconstruction kernels using unpaired image translation." *Medical Imaging 2024: Image Processing*. 2024.

C11. T Yu, Y Li, ME Kim, **C Gao**, et al. "Tractography with T1-weighted MRI and associated anatomical constraints on clinical quality diffusion MRI." *Medical Imaging 2024: Image Processing*. 2024.

C12. H Xu, NR Newlin, ME Kim, **C Gao**, et al. "Evaluation of mean shift, ComBat, and CycleGAN for harmonizing brain connectivity matrices across sites." *Medical Imaging 2024: Image Processing*. 2024.

C13. ME Kim, HH Lee, K Ramadass, **C Gao**, et al. "Characterizing low-cost registration for photographic images to computed tomography." *Medical Imaging 2024: Clinical and Biomedical Imaging*. 2024.