TONGAN CAI

College of Information Sciences and Technology
Pennsylvania State University
(734) 239-0723 | cta@psu.edu (tmc6006) | c-t-a.me

EDUCATION

Pennsylvania State University *GPA:3.9/4.0* Anticipated Dissertation: 10/2024 State College, PA
Ph.D. in Informatics. 08/2019 – Present
-Advised by James Z. Wang, Distinguished Professor of IST.

University of Michigan *GPA:3.7/4.0* Ann Arbor, MI
Bachelor of Science and Engineering in Data Science 08/2017 – 05/2019
-Magna Cum Laude

Shanghai Jiao Tong University *GPA:3.6/4.0* Shanghai, China
Bachelor of Science and Engineering in Electrical & Computer Engineering 08/2015 – 08/2019
-Outstanding Graduate-Class of 2019

PATENT

- Wang, J.Z., Yu, M., **Cai, T.**, Huang, X., Wong, K., Volpi, J., Wong, S.T.C.. Systems and methods for assisting with stroke and other neurological condition diagnosis using multimodal deep learning. Pub. No. US 2023/0363679 A1. Filed Sept. 17, 2021. Published Nov. 16, 2023. Patent Pending.

PUBLICATIONS (* INDICATES EQUAL CONTRIBUTIONS)

- **Cai, T.***, Ni, H.*, Ma, Q., Xue, Y., Wong, K., Huang, X., Wang, J.Z., Volpi, J., Wong, S.T.C.. (2024). *SafeScreen*: Facial Video De-identification for AI-Assisted Stroke Screening. Submitted to *International Conference on Medical Image Computing and Computer Assisted Intervention – MICCAI 2024*.

- **Cai, T.**, Wong, K., Wang, J.Z., Huang, X., Yu, X., Volpi, J., Wong, S.T.C.. (2024). M^{3}Stroke: Advancing Stroke Triage with **M**ulti**M**odal **M**obile AI for Accurate and Timely Identification of Mild to Moderate Acute Strokes in Emergency Care. *Npj Digital Medicine* (Under Review)

- Pan, Y., **Cai, T.**, Metha, M., Gernand, A.D., Goldstein, J.A., Mithal, L., Mwinyelle, D., Gallagher, K., Wang, J.Z.. (2023). Enhancing Automatic Placenta Analysis through Distributional Feature Re-composition in Vision-Language Contrastive Learning. In *International Conference on Medical Image Computing and Computer Assisted Intervention – MICCAI 2023.* pp. 116-126.

- **Cai, T.***, Ni, H.*, Yu, M., Huang, X., Wong, K., Volpi, J., Wang, J.Z., Wong, S.T.C.. (2022). *DeepStroke*: An Efficient Stroke Screening Framework for Emergency Rooms with Multimodal Adversarial Deep Learning. *Medical Image Analysis*, Vol. 80. p. 102522. (IF=13.8)

- Wang, J.Z., Yu, M., **Cai, T.**, Huang, X., Wong, K., Volpi, J., Wong, S.T.C. (2023). Systems and methods for assisting with stroke and other neurological condition diagnosis using multimodal deep learning. U.S. Patent 18025974. Filed Sept. 17, 2021. Patent Pending.

- **Cai, T.,** Chen, C., Huang, T. H., Ritter, F. E. (2021). What Makes a Good Reference Manager? A Quantitative Analysis of Bibliography Management Applications. In *Asian CHI Symposium 2021*. pp. 64-69. (Best paper)

- Yu, L.*, **Cai**, **T.***. (2021). Ensemble learning for early identification of students at risk from online learning platforms. *Advances in Data Science & Information Engineering*, Springer. pp. 531-542.

- Yu, M.*, **Cai, T.***, Huang, X., Wong, K., Volpi, J., Wang, J.Z., Wong, S.T.C.. (2020). Toward Rapid Stroke Diagnosis with Multimodal Deep Learning. In *International Conference on Medical Image Computing and Computer Assisted Intervention – MICCAI 2020*. pp. 616–626. (Oral)

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- Golbus, J. R.*, **Cai**, **T.*,** Najarian, D., Trumpower, B., Kao,T., Waljee, A. K., Nallamothu, B. K.. (2019). Determinants of Compensation for US Academic Physicians: Does Gender Matter? *Circulation: Cardiovascular Quality and Outcomes,* Vol. 12. pp. A225.

- **Cai**, **T.,** He, H., Zhang, W.. (2018). Breast Cancer Diagnosis Using Imbalanced Learning and Ensemble Method. *Applied and Computational Mathematics*. Vol. 7, No. 3. pp. 146-154.

RESEARCH INTEREST

Computer Vision, Deep Learning and Data Science methods, especially their applications in medical diagnoses, healthcare, finances, transportation, and education. Broadly interested in computational techniques for data to "talk" for themselves, for models to improve fairness and usability, and for AI to make positive impacts to a better world.

RESEARCH & WORKING EXPERIENCE

The Pennsylvania State University – College of Information Sciences & Technology University Park, PA

Research Assistant – Stroke Project (with Houston Methodist Hospital) 08/2019 – Present

- Advance ER stroke triage for non-obvious stroke patients with mobile AI. Work with audio speech signal, text transcripts, and facial motion videos to construct efficient, novel multi-modal deep learning frameworks.
- Explored 2D/3D computer vision, visual/language/audio transformers, sequence models, adversarial learning, multimodal fusion, generative models, speech/video processing methods. Leading multiple top-tier publications.
- The latest method is deployed on the iOS platform with a core model outperforms traditional stroke triage by over 17% gain in both sensitivity and specificity, surpassing prior models with 8% in AUC, achieving better fairness.

Research Assistant – Placenta Project 03/2023 – 11/2023

- Design and develop an efficient multi-task vision-language contrastive learning framework for placental images.
- Proposed a two-stage text feature re-composition for medical information preservation and data augmentation.
- The proposed method outperforms strong baselines on diagnostic tasks while maintaining computationally efficient.

Research Assistant – Human Bodily Expression of Emotion Project 05/2020 – 03/2024

- Curate a large video dataset (BoLD) with 13k instances and 100k+ frames for public access and AMT labeling.
- Collaborate with external institutes for large-scale Laban Movement Analysis with in-the-wild movie video data.
- Lead the collection of 3D human action videos/audio with Kinect/VICON system. Build and debug API interfaces.

Research Assistant – Applied Cognitive Science Lab 05/2020 – 03/2021

- Designed a quantitative study on bibliography managers (Mendeley, Zotero, EndNote, RefWorks) by evaluating the amount of physical and mental effort users make. Keystrokes and mouse moves were recorded and analyzed.
- Piloted prospective-retrospective survey with tasks to search paper and construct bibliography, revealing preference changes and usability issues. First-authored manuscript received Best Paper in AsianCHI Symposium 2021.

Nationwide Mutual Insurance Company – Enterprise Analytics Office Columbus, OH/Remote

Data Scientist Intern 05/2023 – 08/2023

- Developed an integrated building images detection/segmentation/visualization tool for automated underwriting.
- A multi-sourced building image dataset was collected and accompanied by manual object bounding boxes using LabelMe. A YOLOv8 detection model was fine-tuned with 90%+ accuracy. The Segment Anything model (SAM) was deployed with ONNX to provide masks within minutes, and a GUI interface was fabricated in Python.
- Led team of data scientist interns in presenting an exploratory data analysis (EDA) on a corporate vehicle policy dataset. Drew business insights from geological analysis of vehicle characteristics and premium information.

Tencent America – Medical AI Lab Palo Alto, CA/Remote

Research Scientist Intern 05/2021 – 08/2021

- Proposed an end-to-end 3D-inspired document de-warping model. Designed an OCR text detection loss term with text embedding distance to penalize local distortions and benefit OCR performance. Adopt a parameter-efficient fine-tuning (PEFT) paradigm to improve DewarpNet model performance on the benchmarking dataset doc3D.

University of Michigan - Michigan integrated Center for Health Analytics & Medical Prediction Ann Arbor, MI
Researcher - MiCHAMP 03/2018 – 05/2019

- Build Python pipelines and adopted statistical machine learning models (XGBoost, GBDT, LightGBM, Random Forest, Linear and Logistic Regression) for several medical & clinical data (HALT-C, NHANES, and MEPS).
- Piloted *DocDollars* Nationwide Salary Survey to better understand the demographics-related salary discrepancies for academic physicians. Distribute questionnaires and collect data with RedCap, analyze and visualize data with R.
- Geologically analyzed the Hepatitis C situation in Michigan by contrasting the locations of doctors with individuals to identify potential barriers to Hepatitis C medication allocation and delivery.

Zhejiang University of Finance & Economics – School of Information Hangzhou, Zhejiang, China
Researcher – Anomaly Detection for Credit Scoring Project 05/2018 – 07/2018

- Developed an imbalance learning (SMOTE) and stacking ensemble methods for credit scoring dataset anomaly detection, validated on a Breast Cancer Dataset. First-authored paper *Breast Cancer Diagnosis Using Imbalanced Learning and Ensemble Method* published on *Applied and Computational Mathematics*. Vol. 7, No. 3, 2018.

SELECTED AWARDS AND HONORS

- AsianCHI 2021 Best Paper Award 2021
- Outstanding Graduate – Class of 2019 – Shanghai Jiao Tong University 2019
- Undergrads Excellence Scholarship - Shanghai Jiao Tong University 2018, 2017, 2016
- Dean's List - University of Michigan 2019,2018,2017
- Dean's List - Shanghai Jiao Tong University 2017, 2016, 2015

ADDITIONAL INFORMATION

Professional Service

- Invited reviewer for npj Digital Medicine Journal, *Springer* (IF=15.2)
- Invited reviewer for Medical Image Analysis Journal, *Elsevier* (IF=13.8)
- Invited reviewer for IEEE Journal of Biomedical and Health Informatics (JBHI), *IEEE* (IF=7.7)
- Invited reviewer for Artificial Intelligence in Medicine (AIIM) Journal, *Elsevier* (IF=7.5)
- Invited reviewer for Computerized Medical Imaging and Graphics (CMIG) Journal, *Elsevier* (IF=5.7)
- Invited reviewer for Innovation and Research in BioMedical engineering (IRBM) Journal, *Elsevier* (IF=4.8)
- Invited reviewer for Computer Vision and Image Understanding (CVIU) Journal, *Elsevier* (IF=4.5)
- Invited reviewer for IEEE Access, *IEEE* (IF=3.9)
- Invited reviewer for The Journal of Supercomputing, *Springer*
- Invited reviewer for Quantitative Imaging in Medicine and Surgery (QIMS)
- Invited reviewer for Computational Intelligence and Neuroscience Journal, *Hindawi*
- Reviewer for European Conference on Computer Vision (ECCV)
- Reviewer for Medical Image Computing and Computer Assisted Intervention Conference (MICCAI)

Technical Skills

- Domain Expertise: Computer Vision (Medical Image, Object Detection/ Recognition, Segmentation, Human Body and Facial Motion Recognition and Tracking, Multimodal, 3D Reconstruction, Contrastive Learning, Generative Models), Natural Language Processing (Sentiment Analysis, Speech Recognition, Prompt Tuning, NER, Transformers), Data Mining (Structured & Unstructured Data, Graph, Spatiotemporal, Medical EHR), Data Science (Visualization, Management, Map-Reduce, A/B Testing, AWS, GCP, Math Modeling)
- Coding: Python, R, HTML/CSS, LaTeX, SQL, C++/C, Java, MATLAB, SAS, Swift, Shell Script, Verilog
- Technical: OOP, MLOps, CI/CD, Web crawling/develop, Android/iOS develop, Math/Scientific Programming
- Platform: PyTorch, TensorFlow, AWS (SageMaker, S3, EC2), Git, Linux, Windows, Mac OS, MS Office

Certificates

- Social and Behavioral Human Subjects Research (IRB) Certified – Penn State University.