TONGAN CAI

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EDUCATION

- **Pennsylvania State University** *GPA:3.89/4.00* State College, PA
  Ph.D. candidate in Informatics. Comp exam: 08/2021. Anticipated Dissertation: 12/2024 08/2019 – Present
  Advised by James Z. Wang, Distinguished Professor of IST.

- **University of Michigan** *GPA:3.66/4.00* Ann Arbor, MI
  Bachelor of Science and Engineering in Data Science 08/2017 – 05/2019
  -Magna Cum Laude

- **Shanghai Jiao Tong University** *GPA:3.55/4.00* Shanghai, China
  Bachelor of Science and Engineering in Electrical & Computer Engineering 08/2015 – 08/2019
  -Outstanding Graduate-Class of 2019

PUBLICATIONS (* INDICATES EQUAL CONTRIBUTIONS)

- **Cai, T.**, Wong, K., Wang, J.Z., Huang, X., Yu, X., Volpi, J., Wong, S.T.C.. (2024). An AI Mobile Triage Tool for Improving Mild or Moderate Acute Stroke Detection in Emergency Rooms. *Nature 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)

- **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)

- 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. (Abstract)

- **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 in understanding and representing different mechanisms of the world, especially their applications in health care, finances, transportation, and education. Broadly interested in other AI and computational techniques for different modalities of data to "talk" for themselves and make positive impact to a better world.

RESEARCH & WORKING EXPERIENCE

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

Graduate Research Assistant 08/2019 – Present

- Collaborating with Houston Methodist Hospital on a screening and assessment framework for stroke with unconstrained real-world patient videos in the ER settings. Audio speech and facial motion video information are leveraged to construct several multi-modal deep learning approaches to pinpoint non-obvious stroke subjects among those patients with suspicion of a stroke to accommodate for the common situations where the weighted diffusion MRI and neurologists for stroke are not available.
- The manuscript as co-first author "Toward Rapid Stroke Diagnosis with Multimodal Deep Learning" is accepted by *MICCAI* 2020. The manuscript as co-first author "*DeepStroke*: An Efficient Stroke Screening Framework for Emergency Rooms with Multimodal Adversarial Deep Learning" is published in the journal of *Medical Image Ana*lysis in August 2022.
- Our latest method outperforms traditional stroke triage with over 17% gain in both sensitivity and specificity, surpassing preliminary models with 8% in AUC. The work is submitted to Nature Medicine for peer review.
- Novel 2D/3D computer vision, visual/language/audio transformers, sequence models, adversarial deep learning, multimodal fusion, speech/video processing methods have been explored, adopted, and deployed. A mobile collection protocol for 3D facial videos is developed.

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

Data Scientist Intern 05/2023 – 08/2023

- Identify the need of automated and standard pipeline for building underwriting process with the company stakeholders. Gather available data sources, functional expectations, and computation resources to design the scope of PoC and future extensions.
- Developed a computer vision-based object detection/segmentation tool for street-view and building images. The pipeline covers private dataset collection, manual bounding box labeling, state-of-the-art object detection (YOLO) fine-tuning and segmentation (SAM) model customization, and the development of a user interface based on PySimpleGUI. The customized model can achieve 90%+ accuracy in identifying common objects that underwriters usually investigate and can provide segmentation masks/crop-outs within minutes. The pipeline is expected to provide better consistency to the underwriting process and has the potential to be expanded to achieve automated building underwriting.
- Lead team of data scientist interns in presenting an exploratory data analysis (EDA) on a corporate vehicle policy dataset. Analyzed and correlated vehicle characteristics and geographic information to premium info.

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

Research Scientist Intern 05/2021 – 08/2021

- Researched on camera-based document de-warping algorithms with deep learning. Medical documents in a hospital can often be messy and document images captured by a camera are usually warped, which harms the OCR result. The proposed method aims to revert warped documents with a deep learning approach.
- An end-to-end model was proposed based on the state-of-the-art DewarpNet trained on a synthetic 3D-inspired warped document dataset. An OCR text detection loss term was designed to penalize local distortions in the outputs and benefit the subsequent OCR loss.

University of Michigan - Michigan integrated Center for Health Analytics & Medical Prediction Ann Arbor, MI

Researcher - MiCHAMP 03/2018 – 05/2019

- Adopt machine learning models and statistical methods for manipulation of medical & clinical data, including Chronic Hepatitis C (HALT-C), National Health and Nutrition Examination Survey (NHANES), Medical Expenditure Panel Survey (MEPS), Inflammatory Bowel Diseases.
- Piloted nationwide salary survey - DocDollars Survey for the purpose of better understanding the discrepancy in salary for academic physicians. The survey was published with RedCap and collected data was analyzed with Python. Abstract as co-first author *"Determinants of Compensation for U.S. Academic Physicians: Does Gender Matter?"* accepted by the AHA Journal *Circulation: Cardiovascular Quality and Outcomes*.
- Help with geological analytic work in the Hepatitis C situation in Michigan. Compare the locations of doctors who can treat Hepatitis C with individuals who have chronic Hepatitis C to identify potential barriers to treatment. for efficiently allocating much needed and prohibitively expensive Hepatitis C medication.

University of Michigan - University of Michigan Transportation Research Institute Ann Arbor, MI

Research Assistant – UMTRI 08/2018 – 12/2019

- Collaborating with statistical learning models (BART, RF, SuperLearner, etc.), mining the relationship between vehicle damage dataset from NHTSA and the corresponding passenger injury level.
- Through processing vehicle collision images from NHTSA, analyze the damage detail of the vehicle, including the angle of collision and severity of the damage, and predict the injury of passengers. Directed by Prof. Flannagan, Carol.

Zhejiang University of Finance & Economics – School of Information Hangzhou, Zhejiang, China

Researcher – Anomaly Detection for Credit Scoring Project 05/2018 – 07/2018

*(Under project *"Personalized recommendation, self-adaptive composition and optimization of resource services for mass collaboration"* supported by National Natural Science Foundation of China)

- Develop high-performance model adopting imbalance learning idea and stacking ensemble methods for anomaly detection, demonstrated it through public data sets—Wisconsin Breast Cancer Datasets for cancer classification and prediction. SMOTE algorithm and stacking method are adopted and studied comparatively.
- Conference paper as first author *"Breast Cancer Diagnosis Using Imbalanced Learning and Ensemble Method"* accepted by 2018 3rd International Symposium of Mathematics and Computer Science, recommended and published on *Applied and Computational Mathematics*. Vol. 7, No. 3, 2018.

OTHER SELECTED PROJECTS

The Pennsylvania State University – HCI (IST521 FA2019) *Advisor: Frank Ritter/Kenneth Huang* University Park, PA

- We piloted a quantitative study to evaluate the reference managers by the amount of physical and mental effort users make in using bibliography management applications. The proposed quantitative analysis adopts a keystroke and mouse move logger---RUI to record and analyze the user's mouse and keyboard activities. Subjects are first asked with a pre-study survey about their favorite reference manager and their thoughts about the usability of reference management applications and then perform a specific task to search, collect and construct a bibliography list.
- Four common bibliography management applications---Mendeley, Zotero, EndNote, and RefWorks across both Windows and OS X operating systems. The process is also simulated with Cogulator to model the mental effort that the user is making. A retrospective survey is asked if the subject will prefer another reference manager and if they are now aware of the usability issues.
- Our project won the Fred Loomis best project paper award. First-authored manuscript "What Makes a Good Reference Manager? A Quantitative Analysis of Bibliography Management Applications" is accepted by Asian CHI 2021 conference and is awarded Best Paper.

The Pennsylvania State University – Data Mining (STAT 557 FA2019) *Advisor: Jia Li* University Park, PA

- We propose an ensemble learning framework for the early identification of students who are at risk of dropping or failing a course. The framework first fuses student demographics, assessment results and daily activities as the total learning statistics, and then enables the slicing of data regarding timestamps. A stacking ensemble classifier is built upon eight base machine learning classification algorithms for the students' learning statistics.
- The proposed method is validated on the Open University Learning Analytics Data and achieves 94.94% classification precision and maintained 90.56% recall for the identification of students at risk using full available data. The proposed method also achieves the goal of "early identification", that achieves higher than 85% accuracy with only half of the data incorporated, indicating that the proposed framework can correctly identify students who are at risk around the mid-term of the course.
- The work "Ensemble learning for early identification of students at risk from online learning platforms" is published in a Springer Proceeding *Advances in Data Science & Information Engineering*.

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

Working

- Research Intern – Nationwide, Enterprise Analytics Office, Summer 2023
- Research Intern – Tencent America, Medical AI Lab, Summer 2021
- Teaching Assistant – Penn State DS305 – Algorithmic Methods and Tools–Spring 2024
- Teaching Assistant – Penn State DS340W – Applied Data Sciences – Fall 2020, Spring 2021
- Teaching Assistant – Penn State IST597 – Fraud and Fakes –Spring 2021
- Grader – University of Michigan EECS 442 – Computer Vision – Winter 2019

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 The Journal of Supercomputing, *Springer*
- 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)

Language Skills

- English: Fluent
- Chinese: Native

Technical Skills

- Domain Expertise: Computer Vision (Medical Image Analysis, Object Detection, Recognition, Segmentation, Human/Facial Movement Recognition and Tracking, Multi-modal representation, 3D Reconstruction, OCR), Natural Language Processing (Prompt Tuning, Sentiment Analysis, Speech Recognition, Medical Text, NER), Data Mining (Structured & Unstructured, Graph, Spatiotemporal, EHR Mining), Data Science (Prediction & Classification, Ensemble, Visualization, Management, Map-Reduce)
- Coding: Python, R, HTML/CSS, LaTeX, SQL, C++/C, Java, MATLAB, SAS, Swift, Shell Script
- Platform: Linux, PyTorch, TensorFlow, AWS, GCP, Android/IOS development, Windows, Mac OS, MS Office
- Project Experience: User Behavioral Analysis, Cyber-security, Network Analysis, Math Modeling, Learning Analytics, A/B Testing

Certificates

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