

TONGAN CAI

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

EDUCATION

- Pennsylvania State University** *GPA:3.89/4.00* State College, PA
 Ph.D. candidate in Informatics. Comp exam: 8/2021. Aug. 2019 – Present
 Advised by Prof. Wang, James Z.
- University of Michigan** *GPA:3.66/4.00* Ann Arbor, MI
 Bachelor of Science and Engineering in Data Science Sept. 2017 – May 2019
 -Magna Cum Laude
- Shanghai Jiao Tong University** *GPA:3.55/4.00* Shanghai, China
 Bachelor of Science and Engineering in Electrical & Computer Engineering Sept. 2015 – Aug. 2019
 -Outstanding Graduate-Class of 2019

PUBLICATIONS (* INDICATES EQUAL CONTRIBUTIONS)

- 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., Nallamotheu, 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 & Data Mining methods on various forms of data and their application in health care & transportation. Broadly interested in other methods & techniques for data to “talk” for themselves.

RESEARCH EXPERIENCE

The Pennsylvania State University – College of Information Sciences & Technology

University Park, PA

Graduate Research Assistant – Stroke project

Aug. 2019 – Present

- Collaborating with Houston Methodist Hospital, we proposed a screening and assessment framework on stroke with unconstrained real-world patient videos in the ER settings. We are leveraging both audio and facial video information to construct a multi-modal deep learning approach to pinpoint 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 the 23rd International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI 2020). We identify our work as the first framework to consider both audio and facial video information in the digitized diagnosis of neurological disorders, and also the first attempt to validate the clinical value of the proposed method with unconstrained, “in-the-wild” patient data in this field.
- 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 Analysis in Aug. 2022. We enhanced our work in MICCAI by adopting multi-level audio/video lateral connection for better feature fusion, an adversarial training scheme to mitigate “face-remembering”, and transfer learning to reduce facial attribute biases.
- Our preliminary baseline was an asymmetry-based approach adopted for a limited amount of clinical data. The framework is able to precisely distinguish facial asymmetry over time at pixel scale, with asymmetry-highlighted frames also provided for the reference of clinicians.
- The framework is undergoing a large-scale clinical trial and is calling for mass collaboration across the U.S. with a 3-D depth video collection application running on mobile phones (currently developing) to construct a large-scale database for various facial paralyzes, and future work is expected to distinguish between facial paralysis with different causes.

Graduate Teaching Assistant

Aug. 2020 – May 2021

- Assigned as teaching assistant for IST597.001 (FA2020) Fraud and Fake by Dr. Lee, Dongwon and DS340W (FA2020, SP2021) Applied Data Sciences by Dr. Wang, James Z. Responsible for providing help to the preparation of class, grading homework and projects, holding office hours and handling students’ requests.

Graduate Research Assistant – Body Emotion project

May. 2020 – Sept. 2020

- Work on the initiation of Laban Movement Analysis of Bodily expression of motion in-the-wild. Processing the pilot study dataset, setup the study goal and collaborated on the labelling process.

Tencent USA – Cloud & Smart Industries Business Group (CSIG)

Palo Alto, CA/Remote

Research Intern – Medical AI Lab

May 2021 – Aug. 2021

- Worked 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. We would like to mitigate document warping with a deep learning approach.
- An end-to-end model was proposed based on the state-of-the-art DewarpNet and an OCR text detection loss term was designed to penalize local distortions in the outputs and benefit the subsequent OCR loss.

University of Michigan - MiCHAMP

Ann Arbor, MI

Researcher - Michigan integrated Center for Health Analytics & Medical Prediction

Mar. 2018 – May 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. Advised by Dr. Waljee, Akbar.
- Piloted nationwide salary survey - DocDollars Survey for the purpose of better understanding the discrepancy in salary for academic physicians. Advised by Dr. Nallamotheu, Brahmajee. Survey publicized in Sep. 2018. Analyzed responses collected. 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 works 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 - UMTRI

Ann Arbor, MI

Research Assistant – University of Michigan Transportation Research Institute

Aug. 2018 – Dec. 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. Flanagan, Carol.

Zhejiang University of Finance & Economics – School of Information

Hangzhou, Zhejiang, China

Researcher – Anomaly Detection for Credit Scoring Project

May. 2018 – July. 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.

University of Michigan – Deep Learning (EECS498 WN2019) Advisor: Honglak Lee/Rada Mihalcea Ann Arbor, MI

- Construct a text and vision-fused framework for reviewing academic paper. The framework extracts texts from the PDF files for a Hierarchical Attention Network and convert pages into “Gestalt” images for a Res-Net, then gives a final suggestion by fusing the outputs of two networks. The framework is the **FIRST** to fuse text vision features of academic papers for acceptance prediction.

University of Michigan – Computer Vision (EECS442 FA2018) Advisor: Jason J. Corso Ann Arbor, MI

- Deploy pipeline of Webcam-image preprocessing-GAN generation for high-efficiency **Facial Expression Generation System**. Train the Generative Adversarial Network on Cohn-Kanade Dataset and Japanese Female Facial Expression (JAFPE) datasets. Customized clawer for Flickr images and match with required image using SIFT descriptor and k-NN.

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 – Tencent USA, Medical AI Lab, Summer 2021
- Teaching Assistant – Penn State DS340W – Applied Data Sciences – Fall 2020, Spring 2021
- Grader – University of Michigan EECS 442 – Computer Vision – Winter 2019

Professional Service

- Invited reviewer for Computerized Medical Imaging and Graphics (CMIG) Journal, *Elsevier*
- Invited reviewer for Computer Vision and Image Understanding (CVIU) Journal, *Elsevier*
- Invited reviewer for Innovation and Research in BioMedical engineering (IRBM) Journal, *Elsevier*
- Invited reviewer for European Conference on Computer Vision (ECCV)

Language Skills

- English: Proficient
- Chinese: Native

Test Scores

- GRE (Aug. 2018): 155 (Verbal) / 170 (Quantitative) / 4.0 (Analytical Writing)
- TOEFL (Sept. 2018): 104 (Reading: 28, Listening: 28, Speaking: 23, Writing: 25)

Certificates

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