Yen-Tung (Tracy) Liu

PHD CANDIDATE · BIOMEDICAL ENIGINEERING · UNIVERSITY OF TEXAS AT AUSTIN

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EDUCATION

PHD – BIOMEDICAL ENGINEERING, UNIVERSITY OF TEXAS AT AUSTIN (expected) July 2025

MS – BIOMEDICAL ENGINEERING, UNIVERSITY OF TEXAS AT AUSTIN May 2022
- Thesis: Needs assessment of breast cancer patients using 3D imaging, quantitative and qualitative research, validated quality-of-life instruments, and algorithm development for custom garments
- Advisor: Dr. Mia K. Markey
- GPA: 3.89/4.0

MS – ELECTRICAL ENGINEERING, NATIONAL TSING HUA UNIVERSITY June 2019
- Advisor: Dr. Kea-Tiong Tang
- GPA: 3.98/4.0

BS – BIOMEDICAL ENGINEERING, NATIONAL TSING HUA UNIVERSITY June 2017
- Advisor: Dr. Chih-Kuang Yeh
- GPA: 3.5/4.0

ACADEMIC INTERESTS

- Machine learning
- Deep learning
- Biodesign
- Medical AI
- Medical image analysis
- Quantitative and qualitative research
- Biomedical informatics

ACADEMIC APPOINTMENTS

GRADUATE STUDENT RESEARCHER, UNIVERSITY OF TEXAS AT AUSTIN January 2021–Present
Department of Biomedical Engineering

GRADUATE STUDENT RESEARCHER, UNIVERSITY OF TEXAS MD ANDERSON CENTER January 2022–Present
Department of Plastic Surgery

GRADUATE TEACHING ASSISTANT, UNIVERSITY OF TEXAS AT AUSTIN Fall 2020, Spring 2024
Department of Biomedical Engineering

RESEARCH ASSISTANT, ACADEMIA SINICA January–June 2020
Institute of Statistical Science

GRADUATE STUDENT RESEARCHER, NATIONAL TSING HUA UNIVERSITY September 2017–June 2019
Department of Electrical Engineering

UNDERGRADUATE STUDENT RESEARCHER, NATIONAL TSING HUA UNIVERSITY September 2015–June 2016
Department of Biomedical Engineering

RESEARCH EXPERIENCE

GRADUATE STUDENT RESEARCHER, UNIVERSITY OF TEXAS AT AUSTIN January 2021–Present
Department of Biomedical Engineering|Advisor: Dr. Mia K. Markey

GRADUATE STUDENT RESEARCHER, UNIVERSITY OF TEXAS MD ANDERSON CENTER January 2022–Present

Department of Plastic Surgery│Advisor: Dr. Gregory P. Reece

Project: Needs assessment of breast cancer patients using 3D imaging, quantitative and qualitative research, validated quality-of-life instruments, and algorithm development for custom garments

- Performed statistical analysis on demographics, medical records, and 3D body images of breast reconstruction patients to investigate pre- and post-operative body measurement changes within a surgery type (i.e., paired t-test, Wilcoxon signed-rank test) and between different surgery types (i.e., Mann-Whitney U test) [3, 4, 9]
- Predicted possible post-operation changes using regression models (i.e., Mixed-effects models, General estimating equation and Robust regression) with pre-operation measurements, age, and BMI as independent variables [3, 4]
- Assessed the needs of breast cancer survivors through quantitative and qualitative data, such as surveys and focus groups [1, 8, 10]
- Conducted surveys and interviews with physician assistants at MD Anderson to understand breast cancer patient care immediately after surgery
- Applied thematic analysis to qualitative data such as focus groups and interviews, identified patterns and developed themes [1, 8, 10]
- Assessed pre- and post-reconstruction changes in garment-related experiences using patient-reported outcome measures (BREAST-Q, ASI-R, and BIS) in breast cancer patients undergoing autologous or implant-based reconstruction [7]
- Analyzed patient-reported outcomes using paired t-tests, Wilcoxon signed-rank tests, and robust regression, revealing significant improvements in garment-related outcomes post-reconstruction, with greater improvements in the autologous group [7]
- Contributed to manuscript preparation, including literature review, data analysis, and scientific/technical writing and editing
- Extensive experience with NIH R01 grant proposals, including developing aims, drafting research strategy sections, recruitment and retention plans, biographical sketches, preparing figures and tables, and responding to reviewers' comments in amendments

GRADUATE STUDENT RESEARCHER, UNIVERSITY OF TEXAS AT AUSTIN   June 2023–Present

Department of Biomedical Engineering│Advisor: Dr. James Tunnell

Project: Single color virtual H&E staining with In-and-Out Net

- Developed deep learning models (GAN-based) for virtual H&E staining, enabling enhanced medical imaging workflows [2]
- Trained the model with virtual H&E labels featuring two fluorescence channels eliminates the need for image registration and provides pixel-level ground truth [2]
- Conducted comparative analysis to demonstrate performance of the proposed network versus state-of-the-art models (i.e., Pix2PixHD, VSGD-Net) [2]
- Prepared and enhanced images including noise reduction, normalization, and edge detection for boundary map segmentation [2]
- Utilized MSE, PSNR, SSIM, FSIM, and MS-SSIM to evaluate models, with In-N-Out Net outperforming the others in all evaluation metrics except PSNR [2]

RESEARCH ASSISTANT, ACADEMIA SINICA   January–June 2020

Institute of Statistical Science│Advisor: Dr. Ker-Chou Li

Project: Cellular heterogeneity of cancer cells under different pressure (i.e., hypoxia, acid, combined)

- Performed single-cell RNA sequencing analysis using R and statistical packages. Processed raw gene expression data, reduced to lower dimensions, clustered into cell populations, and compared across clusters to identify genes with significant differential expression

GRADUATE STUDENT RESEARCHER, NATIONAL TSING HUA UNIVERSITY   September 2017–June 2019

Department of Electrical Engineering│Advisor: Dr. Kea-Tiong Tang

Project: Next Generation Early Lung Cancer Screening System by Combination of Gas Sensing and Image Recognition

- Designed an E-Nose system for early diagnosis of lung cancer by applying machine learning algorithms (feature extraction/selection, classification, i.e., PCA, SVM, KNN) to make classification on the exhaling breath of patients and healthy participants [5, 6, 11, 12]
- Designed a feature selection method that improved gas classification accuracy on two open-access datasets by 5% and 10% better than another competitive feature selection method, SVM-RFE [5]
- Obtained 90% prediction accuracy for whether participants have lung cancer or not [5, 6, 11]

UNDERGRADUATE STUDENT RESEARCHER, NATIONAL TSING HUA UNIVERSITY   September 2015–June 2016

Department of Biomedical Engineering│Advisor: Dr. Chih-Kuang Yeh

Project: Gesture Recognition System by Ultrasound Technology

- Designed an ultrasound gesture recognition system to help surgeons control medical devices without touch during surgery through machine learning methods (K-means, Hidden Markov Model)
- Applied K-means to cluster gesture data into different clusters, then used those clusters to construct a Hidden Markov Model for gesture identification
- Achieved 90% classification accuracy of two gestures (i.e., clockwise and counterclockwise rotation).

TEACHING EXPERIENCE

GRADUATE TEACHING ASSISTANT, UNIVERSITY OF TEXAS AT AUSTIN   Spring 2024

Introduction to Biomedical Engineering Design

Department of Biomedical Engineering

- Guided 50 students through lab sessions, enhancing their understanding of experimental procedures and expected outcomes
- Graded lab reports, quizzes, essays and provided feedback on how to improve with the essay writing
- Provided materials for students to learn how to use tools (i.e., Excel, MATLAB) and provided guidance when needed

GRADUATE TEACHING ASSISTANT, UNIVERSITY OF TEXAS AT AUSTIN   Fall 2020

Biomedical Engineering Signals and System Analysis

Department of Biomedical Engineering

- Graded and prepared multiple exams, quizzes, homework, also the corresponding solutions
- Hosted review sessions before each exam/quiz to help 120 students go through key concepts

MENTORING EXPERIENCE

Thao Huynh, Undergraduate student, UT Austin   Fall 2024–Present
(current: Undergraduate student, UT Austin)

- Mentored Thao in data collection and summary research skills, providing guidance and support for her first poster presentation at BMES 2024

Athena Louise Lopez, Graduate student, UT Austin   2024–Present
(current: Ph.D. Candidate, UT Austin)

- Mentored Athena, providing guidance and support that contributed to her successful completion of the PhD qualifying exam

Fadeel Khan, Graduate student, UT Austin   Fall 2023
(current: Ph.D. Candidate, UT Austin)

- Mentored Fadeel on his research topic, which became the focus of his PhD qualifying exam, leading to his successful completion

Nova Khan, Undergraduate student, Equal Opportunity in Engineering TREX program, UT Austin   Fall 2021–2023
(current: Design quality engineer)

- Mentored Nova to award a Texas Research Experience stipend ($3,000)

- Co-authored two journal articles [1, 3] and three posters [8, 9, 10], showcasing collaborative success and skill development

PUBLICATONS

Note that the trainees under my supervision have names with <u>underlines</u>

A. JOURNAL ARTICLES

[1]. **Liu, Y. T.**, <u>Khan, N. H</u>, Nicklaus, K. M, Bravo Moix, M. K., Liu, C., Reece, G.P., Francis, A. M., Roubaud, M. J., Markey, M. K. (2024). Undergarment Needs and Challenges for Breast Cancer Survivors: A Qualitative Study. Scientific Reports, under review

[2]. Chen, M., **Liu, Y.T.**, <u>Khan, F.S.</u>, Fox, M.C., Reichenberg, J.S., Lopes, F.C., Sebastian, K.R., Markey, M.K. and Tunnell, J.W. (2024). Single color virtual H&E staining with In-and-Out Net. Computerized Medical Imaging and Graphics, 118, 102468

[3]. **Liu, Y. T**., <u>Khan, N. H</u>., Bordes, M. C., Reece, G. P., Francis, A. M., Chen, T. A., Bravo, K., Markey, M. K. (2024). Impact of autologous breast reconstruction on bra fit. Supportive Care in Cancer, 32(2), 105

[4]. Nicklaus, K. M., **Liu, Y. T**., Liu, C., Chu, J., Jewett, E., Bravo, K., Bordes, M. C., Liu, J., Reece, G.P., Hanson, S. E., Merchant, F., Markey, M. K. (2023). Impact of implant-based breast reconstruction on bra fit. Egonomics 66:10, 1521-1533

[5]. **Liu, Y. T.**, & Tang, K. T. (2020). A minimum distance inlier probability (MDIP) feature selection method to improve gas classification for electronic nose systems. IEEE Access, 8, 133928-133935

B. CONFERENCE PROCEEDINGS PAPERS

[6]. **Liu, Y. T.**, & Tang, K. T. (2019, May). A minimum distance inliers probability (MDIP) feature selection nethod to enhance gas classification for an electronic nose system. IEEE International Symposium on Olfaction and Electronic Nose (ISOEN) (pp. 1-3)

C. CONFERENCE PRESENTATIONS

[7]. **Liu, Y. T.**, Chopra, D., Bravo Moix, M. K., Chen, T. A., Reece, G. P., Markey, M. K., Roubaud, M. J. (2024, October). Garment-related patient-reported outcomes: comparison of autologous and implant-based breast reconstruction. Biomedical Engineering Society (BMES) Annual Meeting, Baltimore, MA, USA. **Oral** presentation

[8]. <u>Khan, N. H.,</u> **Liu, Y. T.**, Nicklaus, K. M., Bravo, K., Liu, C., Reece, G. P., Francis, A., Markey, M. K. (2023, October). Bra characteristics that breast cancer survivors associate with their sense of normality after surgery. Biomedical Engineering Society (BMES) Annual Meeting, Seattle, WA, USA. **Oral** presentation

[9]. **Liu, Y. T.**, <u>Khan, N. H.,</u> Bordes, M. C., Reece, G.P., Francis, A., Merchant, F., Markey, M. K. (2022, October). Quantitative imaging to assess the impact of autologous breast reconstruction on bra fit. Biomedical Engineering Society (BMES) Annual Meeting, San Antonio, TX, USA. **Poster** presentation

[10]. <u>Khan, N. H.,</u> **Liu, Y. T.**, Nicklaus, K. M., Bravo, K., Liu, C., Reece, G. P., Markey, M. K. (2022, April). The Qualitative Analysis of the Comfortability of Bras Worn After Mastectomy and Reconstructive Surgery. The University of Texas at Austin's Longhorn Research Poster Session, Austin, TX, USA. **Poster** presentation

[11]. **Liu, Y. T.**, & Tang, K. T. (2019, May). A minimum distance inliers probability (MDIP) feature selection method to enhance gas classification for an electronic nose system. In 2019 IEEE International Symposium on Olfaction and Electronic Nose (ISOEN) (pp. 1-3). IEEE. Fukuoka, Japan. **Oral** presentation

[12]. Wong, D. M., **Liu, Y. T.**, Chiu, S. W., Wu, C. C., & Tang, K.T. (2019, April). A lung cancer fast screening system based on breath analysis. International Conference on Biomedical and Health Informatics (ICBHI), Taipei, Taiwan. **Poster** presentation

INVITED TALK

- **Liu, Y. T.** (2022, April 27). Towards algorithms for automated knitting of a custom surgical bra. Spring 2022 Center for Computational Oncology (CCO) Seminar series, The University of Texas at Austin

HONORS AND AWARDS

University Graduate Continuing Fellowship, UT Austin ($36,000 award)   2024-2025

Taiwan Scholarship to Study Abroad, Taiwan Ministry of Education ($32,000 award)   2023-2024
Less than 30% of applicants are approved annually

Cockrell School of Engineering Fellowship, UT Austin ($2,500 award)   2020-2021

Travel Award, Taiwan National Science and Technology Council (NSTC) ($650 award)   2019

College Student Research Scholarship, Taiwan NSTC ($2,400 award)   2016
Less than 25% of applicants are approved annually

Taiwanese Society of Biomedical Engineering Creative Competition semi-finals   2016

PROFESSIONAL AND COMMUNITY SERVICE

Peer Reviewer, Ergonomic Journal   2024

Publicity Manager, Biomedical Engineering Graduate Student Society, UT Austin   2022–2023

Volunteer, BME Recruitment Activities, UT Austin   2021–2023

Director, BME Annual Performance, National Tsing Hua University   2016

Volunteer, Taiwan Hsinchu juvenile prison and local social welfare center   2013–2015

PROFESSIONAL MEMBERSHIP

Member, Biomedical Engineering Society (BMES)   2022–Present

Member, Taiwan Engineering Medicine Biology Association (TWEMBA)   2019–Present

SKILLS

Programming: Python, R, MATLAB

ML & statistics: Deep learning, CNN, regression, random forest, SVM, KNN, k-means, PCA, hypothesis testing

Tools & platforms: PyTorch, Tensorflow, pandas, scikit-learn, matplotlib, dplyr, ggplot2, Linux, jupyter

Languages: English, Mandarin (native)

CERTIFICATIONS

CITI Program – Good Clinical Practice - Clinical Trials with Investigational Drugs and Medical Devices

CITI Program – Human Research - Biomedical Researchers

CITI Program – Responsible Conduct of Research for Engineers

The University of Texas at Austin, Statistics and Data Sciences – Data Science and Applied Machine Learning

The University of Texas at Austin, Statistics and Data Sciences – Questionnaire Design and Survey Analysis

American Breast Care – Pre-certified Mastectomy Fitters

REFERENCES

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Karen Bravo Moix, M.A.

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