Darin Tsui

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Education

Georgia Institute of Technology *Atlanta, GA*

Ph.D. in Electrical and Computer Engineering *Aug. 2023 - Present*

- Advisor: Amirali Aghazadeh

University of California San Diego *San Diego, CA*

Bachelor of Science in Bioengineering *Sept. 2019 - Jun. 2023*

- Advisors: Gert Cauwenberghs and Frank E. Talke

Publications

Tsui, D., Melentyev, C., Rajan, A., Kumar, R., Talke, F., 2023. "An optical tracking approach to computer-assisted surgical navigation via stereoscopic vision". *ASME 2023 32nd Conference on Information Storage and Processing Systems, accepted.*

Tsui, D., Downey, F., Navaneethan, S., Paul, A., Bodily, T, Lee, M., Xu, Y., Lal, R., Cauwenberghs, G.,2023. "A machine learning approach to COVID-19 detection via graphene field-effect-transistor (GFET)". *2023 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), accepted.*

Tsui, D., Jo, M., Nguyen, B., Ahadian, Talke, F., F. 2023. "Optical surgical navigation: a promising low-cost alternative". *2023 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), accepted.*

Awards, Fellowships, & Grants

2023 **Anushka Michailova Memorial Best Undergraduate Poster Award**, Bioengineering Day

2022 **Galvanizing Engineering in Medicine (GEM) Grant**, UC San Diego *$ 10,000*

2021 **Academic Senate Grant**, UC San Diego *$ 15,000*

Presentations

May 2023. *Surgical site localization with non-invasive skin Markers for pain management*. Center for Memory and Recording Research (CMRR) Research Review, San Diego, CA.

May 2023. *Bioelectronic COVID-19 detection via graphene-field-effect-transistor (GFET)*. Bioengineering Day, San Diego, CA.

May 2023. *Machine learning: a gentle introduction to image classification*. IEEE @ UC San Diego Workshop, San Diego, CA.

Feb. 2023. *Cracking the code - machine learning and medical diagnosis*. Biomedical Engineering Society (BMES) Workshop, San Diego, CA.

Feb. 2023. *Hacking the brain: machine learning and human behavior*. IEEE @ UC San Diego Workshop, San Diego, CA.

Research Experience

University of California San Diego - Integrated Systems Neuroengineering Laboratory *San Diego, CA*

Advisor: Gert Cauwenberghs *Jun. 2022 - Jun. 2023*

- Developed feature extraction and machine learning pipeline for bioelectronic COVID-19 detection using scikit-learn.
- Achieved accuracies of 98.5% when detecting COVID-19 proteins, improving classification by 30.1%.

University of California San Diego - Talke Biomedical Device Lab *San Diego, CA*

Advisor: Frank E. Talke *Dec. 2021 - Aug. 2023*

- Designed low-cost vision system for minimally invasive surgery using OpenCV with fiducial markers.
- Developed live platform for filtering and thresholding images for use in stereoscopic vision.
- Implemented Kalman filtering to achieve sub-millimeter error in design-validation testing.

Teaching Experience

Instructional Assistant *San Diego, CA*

Advisor: Robert Sah *Dec. 2020 - Mar. 2021*

- Oversaw two lab sections of 30 students each for BENG 1, an introductory Bioengineering lab course.
- Trained students in the fundamentals of Bioengineering. Topics taught included biomechanics, noninvasive cardiovascular sensing, and spine segmentation.

Professional Experience

Surgalign *San Diego, CA*

Data Engineering Intern *Jan. 2023 - Present*

- Designed an internal MRI image processing application using Python that reduced preprocessing time per sample.
- Assisted in developing ground truth dataset of imaging data to assess the effectiveness of deep learning models.
- Validated deep learning models against surgeon-generated data using Sørensen-Dice coefficient statistical testing.

Johnson & Johnson *Redwood City, CA*

Instruments R&D Intern *Jun. 2022 - Aug. 2022*

- Supported design validation clinical trials through preparation and sterilization of instrument kits.
- Performed root cause analysis on the failure of instrument devices.
- Supported systems investigations towards optical calibration stations and instrumentation platforms.

Projects

Supervised ML Approaches for Predicting Cancer Survival Rate *Apr. 2023 - Jun. 2023*

- Performed feature selection on gene expression data using DESeq2 and XGBoost to classify cancer survival.
- Used Support Vector Machines (SVM) on feature set to achieve 69.05% accuracy.

Brain-Computer Interface (BCI) Signal Classification *Jan. 2023 - Apr. 2023*

- Designed a novel feature extraction algorithm for electroencephalogram (EEG) data by ensembling time-based data.
- mproved state-of-the-art accuracy from 61.04% to 63.16% using PyTorch neural network architecture.

Convolutional Neural Networks (CNN) for Plankton Classification *Jan. 2023 - Apr. 2023*

- Implemented AlexNet for plankton image classification using PyTorch.
- Increased model robustness by synthetically manipulating imaging data, improving the classification accuracy by 27%

Leadership and Service

Leadership

2022-2023 **Institute of Electrical and Electronics Engineers (IEEE) at UC San Diego**, President

2021-2022 **IEEE at UC San Diego**, Outreach Chair

2021-2022 **BMES**, Project Lead

Service and Outreach

2021-2022 **Bioengineering Day**, Committee Member

2019-2021 **Undergraduate Research Symposium**, Committee Member