Shiyuan Duan

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EDUCATION

Northwestern University   Illinois, US
MS of Computer Science   *Dec 2022 – Present*

University of Maryland   Maryland, US
B.S. in Computer Science   *Jun 2017 – Dec 2021*
B.S. in Physics   *Jun 2017 – Dec 2021*

PUBLICATION

- V. Cherepanova, M. Goldblum, H. Foley* and **S. Duan***, J. Dickerson, G. Taylor, T. Goldstein, "LowKey: Leveraging Adversarial Attacks to Protect Social Media Users from Facial Recognition" *International Conference on Learning Representations, 2021*

- K. H. Joo, **S. Duan**, M. N. Teli, "Birds' Eye View: Measuring Behavior and Posture of Chickens as a Metric for Their Well-Being" *arxiv, 2022*

RESEARCH EXPERIENCE

Sleep Analysis using Mechano-Acoustic Sensor and Explainable ML   Illinois, US
Supervised by Prof. John A. Rogers   *Feb 2023 – Sep 2023*

- Pioneered study using wearable Mechano-Acoustic (MA) sensor for sleep pattern analysis.
- Developed signal processing pipelines, extracting vital signs; collaborated with Carle Foundation Hospital, collecting data from **43** subjects.
- Engineered **146** features for machine learning models, achieving **83.76%** accuracy in sleep stage classification. Models showcased **0.69** REM precision, **0.75** awake precision, and **0.87** non-REM precision.
- Interpreted models using gradient method and SHAP, emphasizing respiration rate variability's significance.
- Led sub-study on apnea detection using YOLO, achieving **95%** precision.
- Enhanced skills in signal processing and machine learning; stressed the value of effective cross-disciplinary communication, especially with non-EECS collaborators.

Wearable EXG Device   Illinois, US
Supervised by Prof. John A. Rogers   *Feb 2023 – Present*

- Contributed in the development of a compact wearable 2-channel EXG device (**23mm x 28.5mm**) using serpentine designs for extended electrodes, surpassing traditional EEG limitations. Integrated an IMU for head orientation, improving data accuracy.
- Over **4** iterations, meticulously soldered chips and 0201 components under a microscope for over **10** devices each round, preparing for data collection from 10 subjects per iteration. This dedicated process ensured each device met high data capture standards, facilitating effective collaboration with medical experts.
- Directed data analysis post-collection, applying signal processing algorithms to interpret EEG/ECG data. Compared results meticulously against Natus commercial systems, confirming successful detection of distinct EEG waves including alpha, beta, theta, and delta frequencies.
- This endeavor fostered a profound understanding and expertise in circuit design, signal processing, and comprehensive EEG knowledge. The project underscored the invaluable importance of patience, precision, and the art of seamless collaboration, especially in cross-disciplinary research initiatives.

Implantable ECG Device in Mice   Illinois, US
Supervised by Prof. John A. Rogers   *Feb 2023 – Present*

- Aided in creating a compact, implantable ECG device (**12.5mm x 23.5mm**, extended to **19.6mm** using serpentine) for mice. Design prioritized minimal invasiveness and ensured accurate data by preserving mouse behavior.
- Engineered the device with wireless charging, optimal performance in magnetic fields, and over **40** seconds of signal retention after magnetic exposure.

- Precision-crafted multiple prototypes for all **5** iterations to improve charging efficiency, refine design, and optimize device factors.
- Analyzed extracted data, and employed signal processing to boost data accuracy.
- Developed expertise in Bluetooth SoC and wireless charging circuit design, demonstrating resilience and commitment throughout the research.

Attack on Diffusion Models for Copyright Protection Illinois, US

Supervised by Prof. Qi Zhu *June 2023 – Present*

- Co-initiated a project introducing subtle perturbations to confuse diffusion models thus protecting copyrights.
- Led algorithm design and implementation, delving deeply into generative AI techniques including DDPM and Latent Diffusion Models.

LowKey: Adversarial Attacks for Social Media User Protection against Facial Recognition MD, US

Supervised by Prof. Tom Goldstein *March 2020 – Dec 2020*

- Crafted a black-box adversarial attack to counter facial recognition, shifting feature space representations to impede probe image matching, maintaining image clarity.
- Automated experiment pipelines, including image attack generation, diverse dataset assembly, and testing against commercial APIs such as Amazon Rekognition, and Microsoft Azure.
- Developed testing scripts tailored to varied attack scenarios, enhancing test efficiency by **100x**.
- Introduced a gaussian smoothing layer, resolving attack inconsistencies post-JPEG compression..
- Tested the method against APIs like Amazon Rekognition and Microsoft Azure, decreasing recognition accuracy from **98%** to **1%**, affirming user identity protection.

WORK EXPERIENCE

Thyroid Tumor Detection in Ultrasound Images Fosun AItrox, Shanghai, China

Research Assistant Intern *March 2022 – June 2022*

- Specialized in utilizing target detection algorithms for the identification of thyroid tumors present in ultrasound.
- Enhanced the YOLO model, making it more sensitive to small object detection pertinent to thyroid tumor imagery
- Developed an automated image annotation tool for the team, transforming a week-long task into an accomplishment achievable within an hour.

SKILLS

Programming: Python, C, C++, Java, JavaScript, MATLAB, R, SQL, MySQL, Git, Docker

Libraries: OpenCV, Scikit-Learn, PyTorch, NumPy, Pandas, Matplotlib, Seaborn, ROS, React/React Native, Django