Penghao Dong

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Education

State University of New York at Stony Brook, NY Aug 2020 - Current
Ph.D. in Mechanical Engineering

Southeast University, China Aug 2017 - Jun 2020
Master of Engineering in Mechanical Engineering

China University of Mining and Technology, China Sep 2013 - Jun 2017
Bachelor of Engineering in Mechanical Engineering

Skills

- **Data Collection & Signal Processing:** Extensive experience with EMG signal acquisition. Proficient in processing multi-channel time-series data using Python and Matlab. Expertise in machine learning algorithms (e.g., TCN, CNN, SVM).
- **Sensor Array Hardware Prototyping:** Designed and optimized multi-modal wearable devices, including EMG dry and gel electrodes and electrode arrays for neuromotor signal tracking.
- **Human-Computer Interaction:** Applied machine learning models to real-time silent speech recognition and swallow monitoring.
- **Experimental Design:** Hands-on experience in designing IRB-approved experiments involving human subjects, physiological signals (EMG), and behavioral data.

Experience

- **Smart Structures and Soft Electronics Laboratory, Stony Brook University** August 2020 - Current
  Research Assistant - Prof. Shanshan Yao
  - **Lip Reading by Unobtrusive Multimodal Sensors and Machine Learning Algorithms (Sponsored by NSF ECCS-2129673)**
    * Prototype **EMG-based wearable devices** for lip reading including developing sensor array, multi-channel temporal signal acquisition and processing, and real-time applications.
    * Develop EMG sensors and sensor arrays, which are adhesive, **skin-conformal**, and transparent, to track high-fidelity speech-relevant EMG signals.
    * Employ multiple advanced preprocessing and **machine learning** methods to decode EMG signals: Bandpass and notch filters, features in time and frequency domains, temporal convolutional networks (TCN), LDA, SVM, etc.
    * Use multiple **real-time** techniques: signal display (BrainFlow API), signal segmentation and feature calculations, and anomaly detections.
    * Apply trained machine learning models to **AR** and **human-robot collaborations** (assembling and disassembling computer parts) in real-time.
  - **EMG-enabled Swallow Monitoring Wearable Device (Sponsored by NSF ECCS-2238363)**
    * Create a wearable EMG-based system for monitoring **swallowing disorder** (dysphagia). Utilize semi-transparent gel electrodes to capture physiological signals, ensuring comfort and stability during long-term use.
    * Train a **classification** model for distinguishing bolus types and a **regression** model for estimating swallowed liquid volumes. Apply MFCC, SVM, and nerual networks for EMG sensing position selections.

- **Decoding Silent Speech Commands by Soft Magnetic Skin (Sponsored by NSF ECCS-2129673)**
  - Develop a single **soft magnetic skin** discreetly positioned in the ramus-temporal junction area, which enables a socially acceptable wireless silent speech recognition system through precise decoding of articulatory movements.
  - Collect the IMU signals affected by the skin-conformal magnetic skin during the deformation of the ramus-temporal junction area. Utilize the **Kabsch algorithm** to diminish the disturbance due to the geomagnetic field.
  - Use **Digital Image Correlation (DIC)** system to examine skin deformation at the facial skin and ramus-temporal junction skin, aiding in the selection of optimal sensing locations.
  - Demonstrate two promising applications in the field of **assistive technology** and **human-computer interactions**: the use of silent speech-enabled smartphone assistants and silent speech-enabled drone control.

- **Department of Mechanical Engineering, Southeast University** Aug 2017 - Jun 2020
  Research Assistant – Prof. Xing Yan
  - **Simulation, Measurement, and Prediction for Residual Stress**
    - Construct a regression model by the Gaussian Function and **Random Forest** algorithm that predicts cutting forces and residual stress distributions.

Selected Publication

1. **Dong, P.**, Tian, S., Chen, S., et al. Decoding Silent Speech Cues from Muscular Biopotential Signals for Efficient Human-Robot Collaborations. 2024. Under Review.
2. **Dong, P.**, Ives, J., Garcia, E., et al. Conformal EMG Electrodes for Unobtrusive Swallow Monitoring with Machine Learning. 2024. Under Review.
3. Li, Y., **Dong, P.**, Qin, R., et al. An sEMG-based Subject-independent Classification Network for Human-Robot Systems. 2024. Under Review.
4. **Dong, P.**, Song, Y., Yu, S., et al. Electromyogram-Based Lip-Reading via Unobtrusive Dry Electrodes and Machine Learning Methods. Small. 2023, 19 (17), e2205058. DOI: 10.1002/smll.202205058.
5. **Dong, P.**; Li, Y.; Chen, S.; Grafstein, J. T.; Khan, I.; Yao, S. Decoding silent speech commands from articulatory movements through soft magnetic skin and machine learning. Materials Horizons. 2023. DOI: 10.1039/d3mh01062g.
6. Li, Y.; Parsan, A., Wang, B., **Dong, P.**, et al. A multi-tasking model of speaker-keyword classification for keeping human in the loop of drone-assisted inspection. Engineering Applications of Artificial Intelligence. 2023, 117. DOI: 10.1016/j.engappai.2022.105597.
7. Yao, S.; Zhou, W., Hinson, R., **Dong, P.**, et al. Ultrasoft Porous 3D Conductive Dry Electrodes for Electrophysiological Sensing and Myoelectric Control. Advanced Materials Technologies. 2022, 7 (10), 2101637. DOI: 10.1002/admt.202101637.

Relevant Courses

Mathematical Methods, Programming for Scientists/Engineers, Machine Learning Specialization (Coursera), Deep Learning Specialization (Coursera), Mechatronics, Smart Materials and Structures