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

- **Experiments:** Employ a variety of techniques and equipment to prototype wearable devices intended for healthcare and human-machine interactions: Spin Coating, Spray Coating, Drop Casting, Laser Cutting, Ultrasonic Homogenization, Spin Mixing, Impulse Magnetization, Fused Deposition Modeling(FDM), Stereolithography (SLA), Scanning Electron Microscope (SEM), Optical Microscope, Physiological signal (EMG, EEG, ECG) acquisition devices (OpenBCI and PowerLab), Inertial Measurement Unit (IMU) circuit board (MbientLab), Impedance Analyzer, Tensile Stage, Arduino and etc.
- **Software:** Software programs for prototyping wearable devices and the corresponding signal processing: LabChart and BrainFlow (EMG, EEG, ECG acquisition and processing), Visual Studio Code (Python, C), Matlab, MetaWear (IMU signal acquisition), AutoCAD, SolidWorks, FEA (Comsol, Abaqus), 3DS MAX, OriginLab, Overleaf and etc.

Experience

- **Smart Structures and Soft Electronics Laboratory, Stony Brook University** August 2020 - Current
  Research Assistant - Prof. Shanshan Yao
  - **Development of Unobtrusive EMG-based system for Lip Reading (Sponsored by NSF)**
    - Prototype **EMG-based wearable devices** for lip reading including developing flexible and stretchable electrodes, multi-channel temporal signal acquisition and processing, and real-time applications.
    - Develop one dry electrode and one ion gel electrode, which are adhesive, **skin-conformal**, and transparent, to track high-fidelity speech-relevant EMG signals. Utilize an analytical biomechanics method to help achieve conformal contact of the skin-electrode interface.
    - Design and apply detailed IRB-approved experiments involving **human subjects** for EMG database collection.
    - Employ multiple advanced preprocessing and **machine learning** methods to decode EMG signals: temporal convolutional networks (TCN), LDA, SVM, MFCC, etc.(in collaboration with Prof. Petar M. Djuric).
    - Apply trained machine learning models to **human-robot collaborations** in real-time for assembling and disassembling computer parts. (in collaboration with Prof. Minghui Zheng)
  - **Decoding Silent Speech Commands by Soft Magnetic Skin (Sponsored by NSF)**
    - 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.
    - Craft the magnetic skin from a composite polymer film comprising PDMS, Ecoflex, and NdFeB particles, not only boasts impressive conformability to the human skin but also demonstrates a great magnetic signal strength, as substantiated by corresponding **material characterizations**.

  - 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.
- **EMG-enabled Swallow Monitoring Wearable Device (Sponsored by NSF)**
  - Prototype a wearable device used for **dysphagia monitoring** based on an ion gel EMG electrode, providing great unobtrusive appearance and long-term stability.
  - Fabricate electrodes from the solution of PEDOT, ionic liquid, and water-based polyurethane, offering high-fidelity signal tracking while remaining discreet and comfortable for continuous wear. Utilize an analytical model to calculate the skin's normal stress to help achieve **wearing comfort**.

- **Department of Mechanical Engineering, Southeast University** Aug 2017 - Jun 2020
Research Assistant – Prof. Xing Yan
  - **Simulation, Measurement, and Prediction for Residual Stress**
    - Perform a **Finite Element Analysis (FEA)** to simulate the machining process of mechanical components.
    - Utilize the **electrochemical corrosion** method and **X-ray diffraction** method to measure the residual stress along the depth direction.
    - Construct a regression model by the **Random Forest** algorithm that predicts cutting forces and residual stress distributions.

Selected Publication

Google Scholar: https://scholar.google.com/citations?user=XtPt2-QAAAAJ&hl=en

1. **Dong, P.**; Song, Y.; Yu, S.; Zhang, Z.; Mallipattu, S. K.; Djuric, P. M.; Yao, S. Electromyogram-Based Lip-Reading via Unobtrusive Dry Electrodes and Machine Learning Methods. Small. 2023, 19 (17), e2205058. DOI: 10.1002/smll.202205058.
2. **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.
3. Li, Y.; Parsan, A.; Wang, B.; **Dong, P.**; Yao, S.; Qin, R. 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.
4. Yao, S.; Zhou, W.; Hinson, R.; **Dong, P.**; Wu, S.; Ives, J.; Hu, X.; Huang, H.; Zhu, Y. Ultrasoft Porous 3D Conductive Dry Electrodes for Electrophysiological Sensing and Myoelectric Control. Advanced Materials Technologies. 2022, 7 (10), 2101637. DOI: 10.1002/admt.202101637.
5. **Dong, P.**; Peng, H.; Cheng, X.; Xing, Y.; Tang, W.; Zhou, X. Semi-Empirical Prediction of Residual Stress Profiles in Machining IN718 Alloy Using Bimodal Gaussian Curve. Materials 2019, 12 (23). DOI: 10.3390/ma12233864.
6. **Dong, P.**; Peng, H.; Cheng, X.; Xing, Y.; Tang, W.; Zhou, X.; Huang, D. A Random Forest Regression Model for Predicting Residual Stresses and Cutting Forces Introduced by Turning IN718 Alloy. In 2019 IEEE International Conference on Computation, Communication and Engineering (ICCCE). 2019, pp 5-8. DOI: 10.1109/ICCCE48422.2019.9010767.

Relevant Courses

Mathematical Methods, Programming for Scientists/Engineers, Mechatronics, Smart Materials and Structures, Introduction to Engineering Composites, Elasticity, Solid Mechanics, Finite Element Analysis