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論　文　要　旨
Thesis Abstract

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主論文題名　（Title）A STUDY ON SOFT DEVICES AND RESERVOIR COMPUTING FOR HUMAN MOTION TRACKING

内容の要旨　（Abstract）

The integrations of soft devices and advanced machine learning holds great promise for the advancement in Human-Machine Interaction (HMI). HMI comprises integral components, encompassing activity sensing, motion perception based on hardware, and software integration. The advantages of HMI extend across various domains, including healthcare, sports, robotics, and industries, with applications involving the monitoring of human gestures, behavior, robotic functions, natural phenomena, and climate conditions. In term of HMI, the sensors play a crucial role as the connected receptors for activity and sensing, because they enable the interaction between hardware and software. However, conventional sensors often face challenges with inherent challenges. These include issues related to accuracy, where small discrepancies can lead to significant deviations in measurement. Additionally, excessive signal noise, particularly when applied to the tracking of delicate movements like finger gestures during human motion, presents a formidable obstacle to achieving precise and dependable results. Furthermore, machine learning algorithms encounter difficulties when classifying time-series and dynamic data, as evidenced by datasets associated with general human locomotion. These introduce inaccuracies and uncertainties into the machine leaning classification, especially when applied in real-world scenarios where data is inherently noisy and human behavior.

This study pioneers an interdisciplinary field that seamlessly integrates powerful machine learning algorithms with soft devices and machine learning methodologies. The research unfolds through three distinct phases. The journey commences with the implementation of dynamic data collection by using radar sensors. This facilitates the evaluation of machine learning models in deciphering and categorizing inherently time-series and dynamic data. Subsequently, we delve into soft device development, a phase designed to enhance the capture of human hand motion. Stretchable sensors are used in this application to enhance signal detecting capabilities while increase accuracy and reduce noise-related problems by dietetic elastomer property. The final stage investigates the use of strain sensors, developing conductive textiles emphasizing the capture of fine finger movements with the textiles strain characteristics. This specialized data gathering is essential for classifying complex motions, particularly those that are essential to sign language communication. The research finding found that soft materials and machine learning has ushered in a transformative era in HMI. This harmonious amalgamation holds the potential to revolutionize numerous industries, spanning healthcare, robotics, assistive technologies, and more.

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