

Mutual Adaptation among Human and Machine  
 – Adaptive Control for Individual Characteristics of Human –  
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Surface electromyogram (EMG) is an electrical action potential of muscle detected on the skin surface and it can be recorded by a non-invasive electric measurement. EMG is a bio-signal which includes the information of the motion dynamics, so it is used to estimate the motion intention of an amputee for controls of the prosthetic hand. However, there are several problems on using EMG : High nonlinearity, individual variation and non-stationary. In order to these problems, we have proposed a control method for multi-D.O.F prosthetic hand using adaptive learning as information processing. These methods succeeded to recognize many motion patterns of hand. In the field of this study, we aim to clarify the aspect of mutual adaptation among human and machine by investigating adaptive action of human.

Multi-D.O.F. Hand and Adaptable Control for Individual Characteristics: An input for controlled multi-D.O.F. hand is also a mechanomyogram, muscle tension and so on. Using concept of machine learning, the method for acquiring mapping between EMG and hands motion pattern is effective. We called this method “Adaptable control for individual characteristics” (Fig.1) and have developed.

Bio-Feedback and Adaptive Process in Human: The technology to display tactile and kinesthetic sense has not been commercialized yet in spite of critical problem in prosthetic hand. In general, this technology displays their senses to the stump of limb using electrical stimulation, vibration and pressure. In this study, in order to inspire human sensory perception and aid the adaptive learning of human, tactile feedback using electrical stimulation is employed. In addition, we analyze effect of tactile feedback on human through clinical evaluation using f-MRI, and investigate effectiveness of tactile feedback (Fig.2).

Keywords: EMG, Adaptable Control for Individual Characteristics, FES, Bio-feedback

References

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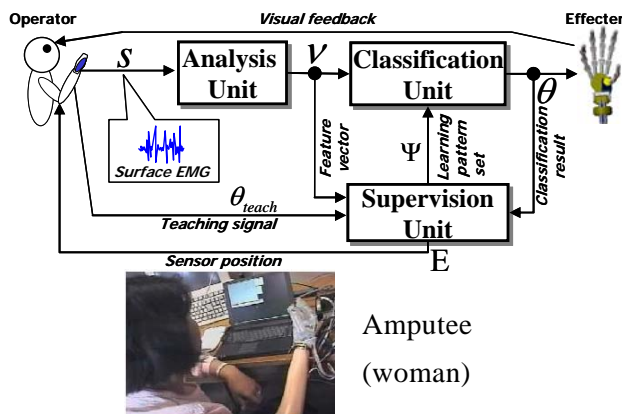


Fig.1 Adaptable control for individual characteristics, and Adaptation to an amputee.

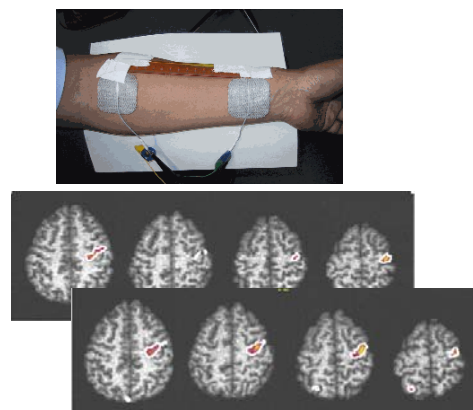


Fig.2 Tactile feedback using FES, and Change in f-MRI image after applied to the EMG prosthetic hand.