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Artificial Body Part Control System Using Ultrasonic Imaging

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Description

This novel prosthetic control system uses miniaturized ultrasound imaging transducers and image analysis algorithms. The technology can decode the movement intent of individual digits, different intended grasps, and wrist movements, based on deformation of muscles in the residual limb. It also provides strong control signals that are proportional to muscle activity and does not require extensive training. Therefore, this approach enables more robust, intuitive, and dexterous control compared to current sensing methods, illuminating a path towards improved functionality and usability of advanced prosthetic devices.

Problem Addressed

Upper extremity amputations most commonly occur in working age adults as a result of trauma, and they frequently affect the dominant extremity, significantly impacting daily activities. Despite the enormous investment of resources in the development of new multi-articulated upper limb prosthetics, some upper extremity amputees discontinue the use of their prosthetics, primarily due to limited practical functionality. This technology addresses the user's expectations of increased dexterity and provides intuitive control that is not found in other commercially available devices.

Advantages

- Supports graded control of individual digits, as well as more than a dozen grasps
- Crosstalk between multiple muscle groups is minimized
- Signals can be derived from multiple muscles, including those deep in tissue
- Utilizes both spatial location and timing of muscle contractions, eliminating the need to rely on electrical signals

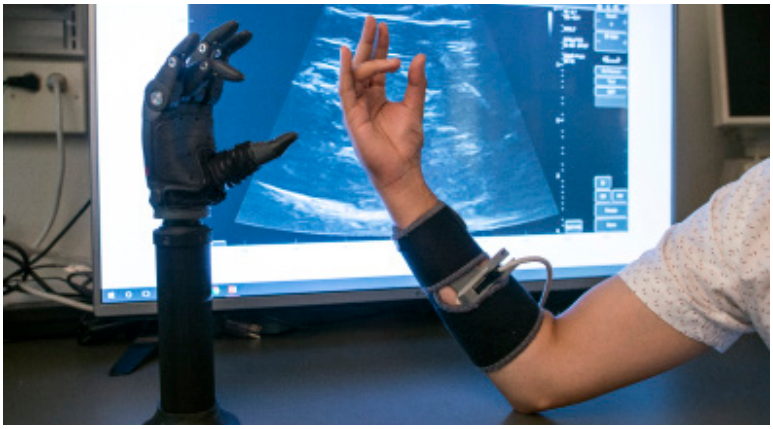

Figure One: A prosthetic hand that utilizes ultrasound to view deep muscular movement.

Recent Publications

- A. Akhlaghi *et al*., Real-time classification of hand motions using ultrasound imaging of forearm muscles. *IEEE Trans Biomed Eng* 63, 1687-1698 (2015).
- S. Sikdar *et al*., Novel method for predicting dexterous individual finger movements by imaging muscle activity using a wearable ultrasonic system. *IEEE Trans Biomed Eng* 22, 69-76 (2013).

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