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LOW-COST SURFACE ELECTROMYOGRAPHY SLEEVE FOR QUICK AND REPEATABLE DECODING OF MOTOR INTENT

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Abstract - Surface electromyography (sEMG) is a noninvasive way to decode motor intent for applications such as prosthetic control, virtual reality, and stroke / spinal cord rehabilitation. State-of-the-art methods of decoding motor intent used in myoelectric prostheses have limited capabilities, partially due to limited sEMG data. Furthermore, frequent changes in electrode alignment restrict the ability to reliably decode motor intent over an extended period of time.

To address these challenges, we developed an easy-to-don, low-cost sleeve that can acquire robust and repeatable sEMG signals from 32 integrated electrodes. Coated brass snaps and grommets were embedded into a neoprene sleeve to serve as dry electrodes and placement markers, respectively.

The sleeve is quick and easy to don: for five subjects, donning the sleeve was faster than a previous prototype (13.86 ± 9.67 s vs. 35.64 ± 19.0 s; $p < 0.01$; paired t-test) and orders of magnitude faster than current clinical approaches (~10–15 minutes). The sleeve was also rated as more comfortable to don (4.25 ± 1.05 vs 3.33 ± 0.65; $p < 0.01$; paired t-test). The high electrode density and consistent donning allow for high degree-of-freedom motor decodes that are stable over time. Signal-to-noise ratio and error in intended movement were comparable to a previous prototype, and cross-talk error was lower (RMSE 0.007 vs 0.014, $p < 0.01$; paired t-test), potentially due to reduced wire movement.

Future work includes optimizing electrode positioning to maximize useful information or reduce electrode count and modifying the design to integrate with a prosthetic socket.