Music-Inspired AI for Myoelectric Gesture Recognition

Myoelectric signals (MES) are electrical impulses generated during muscle contractions. Advanced signal processing enables their use for precise prosthesis control in rehabilitation, gaming, interactive simulations, and robotics. The inventions introduce an AI-based method to optimize detection and classification of MES segments for specific gestures, inspired by fuzzy audio search and Convolutional Neural Networks (CNNs), like how music recognition services recognize a song from a short, imperfect snippet!



Advanced MES Processing and Classification

IP RIGHTS
Three patent applications filed (2025, 2025, 2026)

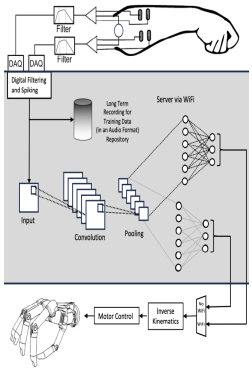
After preprocessing, clean multi-sensor MES are stored long term as training data. Treated as "music" with fuzziness, they are modeled via MFCC and matched in a database to classify new motion signals. Multichannel EMG streams enable robust learning of complex movement patterns.

01 Temporal robustness: classification does not rely on exact MES onset, as fuzzy audio matching can identify gestures from short snippets.

02 Speed robustness: the exact tempo of the gesture is irrelevant to the method.

03 Connection robustness: uses cloud or on-device CNN, selected by Wi-Fi availability.

04 Aggregating gesture data across users enables shared models with better accuracy and adaptability.



System for a myoelectric prosthesis with a CNN embedded in the prosthesis.

REFERENCES:

patent apl. EP4663118A1

Borghoff & Buchenrieder (2025), Springer Nature Switzerland

CHALLENGE

Conventional AI-based MES classification depends heavily on the number of features extracted from recorded signals. Commercial sensors often provide low-resolution data due to hum and noise reduction. Classifiers are usually chosen empirically and require time-consuming training, while online learning during operation is rarely feasible in such frameworks.

INNOVATION

The inventions fuse data from multiple sensors for richer, more reliable MES, treating signals as music and modeling features via Mel Frequency Cepstral Coefficients (MFCC). Fuzzy audio search algorithms classify MES, which can be stored long term and compressed (e.g., MP3) to reduce data. Cloud-based CNN processes multi-user EMG to detect gestures, learn temporal patterns, and exploit cross-user correlations, so each prosthesis benefits from shared transfer learning. With Wi-Fi, powerful cloud CNNs classify; otherwise, an on-device CNN on the prosthesis is used.



01 Basic principles observed · **02** Technology concept formulated · **03** Experimental proof of concept · **04** Technology validated in lab · **05** Technology validated in relevant environment · **06** Technology demonstrated in relevant environment · **07** System prototype demonstrated in operational environment · **08** System complete and qualified

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