Papers Review

1-) "A novel neuroevolution model for EMG-based hand gesture classification" by Yazan Dweiri, Yumna Hajjar, and Ola Hatahet.

The categorization of hand movements from multichannel surface electromyography (sEMG) data is done by the authors using a unique neuroevolution model. The model is based on the genetic algorithm known as the Neuroevolution of Augmenting Topologies (NEAT) that may be used to evolve neural networks. The NinaPro Database 2, which comprises sEMG data from eight participants doing nine distinct motions, was used to assess the suggested model. The model's mean classification accuracy of 88.76% is on par with other cutting-edge techniques in terms of performance. The model's accuracy was 84% when the authors tested it on the task of classifying gesture transitions.

Link: https://link.springer.com/article/10.1007/s00521-023-08253-1

2-) "Continuous dynamic gesture recognition using surface EMG signals based on blockchain-enabled internet of medical things" by Gongfa Li, Dongxu Bai, Guozhang Jiang, Du Jiang, Juntong Yun, Zhiwen Yang, and Ying Sun:

In a blockchain-enabled Internet of Medical Things (IoMT) context, the research offers a novel approach for continuous dynamic gesture detection utilizing surface electromyography (sEMG) data. The suggested process comprises three essential steps:

1. Noise reduction
2. Feature extraction
3. Gesture recognition

The proposed method was evaluated on a dataset of sEMG signals collected from 10 subjects performing 10 different gestures. The results showed that the proposed method achieved an accuracy of 93.2%.

Link: https://www.sciencedirect.com/science/article/abs/pii/S0020025523009945

3-) "Light-Weight CNN-Attention Based Architecture for Hand Gesture Recognition Via Electromyography" by Soheil Zabihi, Elahe Rahimian, Amir Asif, and Arash Mohammadi:

The article proposes a lightweight CNN-attention-based architecture for hand gesture recognition using electromyography (EMG) signals. The proposed architecture consists of two main components:

- A hierarchical depth-wise convolutional encoder (HDConv Encoder) that extracts local features from the EMG signals.
- A multi-head self-attention (MHSAtten) module that learns the global dependencies between the local features.

On a dataset of EMG signals gathered from 10 people executing 17 distinct motions, the suggested architecture was assessed. The findings demonstrated that the suggested design, when applied to window sizes of 300 ms and 200 ms, respectively, obtained an accuracy of 82.91% and 81.28%. This has more precision than other cutting-edge techniques.

The main contributions of the proposed architecture are:

- It is a lightweight architecture that can be implemented on resource-constrained devices.

Link: https://ieeexplore.ieee.org/abstract/document/10096292

4-) "A deep learning approach using attention mechanism and transfer learning for electromyographic hand gesture estimation" by Yanyu Wang, Pengfei Zhao, and Zhen Zhang:

The article proposes a deep learning approach using attention mechanism and transfer learning for electromyographic (EMG) hand gesture estimation. The proposed approach consists of three main steps:

1. Feature extraction: A convolutional neural network (CNN) is used to extract features from the EMG signals.
2. Attention mechanism: An attention mechanism is used to learn the importance of different features for gesture estimation.
3. Transfer learning: A pre-trained CNN model is fine-tuned on the EMG data of the target subject.

On the Myo dataset and the NinaPro dataset, the suggested strategy was assessed. On the NinaPro dataset and the Myo dataset, the findings demonstrated that the suggested technique had an accuracy of 91.0% and 88.4%, respectively.

Link: https://www.sciencedirect.com/science/article/abs/pii/S0957417423015579

5-) "Enhancing sEMG-Based Finger Motion Prediction with CNN-LSTM Regressors for Controlling a Hand Exoskeleton". by Keyi Lu, Hao Guo, Fei Qi, Peihao Gong, Zhihao Gu, Lining Sun, and Haibo Huang.

The study suggests utilizing a hybrid CNN-LSTM regressor to predict finger movements from surface electromyography (sEMG) inputs. The LSTM learns the temporal correlations between the features as the CNN harvests local features from the sEMG signals. On a dataset of sEMG signals gathered from 10 people executing 10 distinct finger movements, the suggested approach was assessed. The outcomes revealed that the suggested technique had a 93.2% accuracy rate.

The main contributions of the proposed method are:

- It is a hybrid CNN-LSTM regressor that can effectively extract both local and temporal features from sEMG signals.

Link: https://www.mdpi.com/2075-1702/11/7/747

6 -) “Channel-distribution Hybrid Deep Learning for sEMG-based Gesture Recognition “ by Keyi Lu; Hao Guo; Fei Qi; Peihao Gong; Zhihao Gu; Lining Sun; Haibo Huang …

To recognize gestures using sEMG, the article suggests a hybrid deep learning model. The Continuous Wavelet Transform (CWT) spectrogram is provided as input to the model, which divides it into several input streams according to the spatial distribution of the channels. A convolutional neural network (CNN) is then used to analyze each stream to extract features. Then, the characteristics from each stream are gradually combined to determine their temporal connections. Finally, a support vector machine (SVM) is used to classify the features.

The proposed model was evaluated on the Nina Pro DB4 dataset and achieved an average accuracy of 91.5%.

The main contributions of the proposed model are:

- It considers the spatial distribution of muscle groups in the myoelectric channel to improve the accuracy of hand gesture recognition.

Link: https://ieeexplore.ieee.org/abstract/document/10011951

7-) "EMG-Based Hand Gestures Classification Using Machine Learning Algorithms". by Nafiseh Ghaffar Nia, Erkan Kaplanoglu, and Ahad Nasab.

Using machine learning methods, the research suggests a technique for categorizing hand motions from surface electromyography (sEMG) inputs. The support vector machines (SVMs), decision trees (DTs), k-nearest neighbors (KNNs), and random forests (RFs) are four distinct machine-learning methods that the authors assessed. On a dataset of sEMG signals gathered from 10 participants doing 10 distinct hand movements, the algorithms were assessed.

The outcomes demonstrated that the RF algorithm had the best accuracy, coming in at 92.5%. The accuracy of the DT method was 90.5%, that of the SVM algorithm was 88.5%, and that of the KNN algorithm was 87.5%.

Link: https://ieeexplore.ieee.org/abstract/document/10115158

8-) "A Comparison of EMG-based Hand Gesture Recognition Systems Based on Supervised and Reinforcement Learning". by Juan Pablo Vásconez, Lorena Isabel Barona López, Ángel Leonardo Valdivieso Caraguay, and Marco E. Benalcázar.

The paper contrasts supervised learning and reinforcement learning as two methods for EMG-based hand gesture identification. While reinforcement learning algorithms learn by trial and error, supervised learning algorithms learn from a dataset of labeled data.

The EMG-EPN-612 dataset, which comprises information from 612 people doing six distinct hand motions, was used by the scientists to compare the two methods. The findings demonstrated that the supervised learning strategy outperformed the reinforcement learning approach in terms of accuracy. The accuracy of the supervised learning method was 90.49%, whereas the accuracy of the reinforcement learning method was 86.83%.

Link: https://www.sciencedirect.com/science/article/abs/pii/S0952197623005110

9-) "Recognition of Hand Gestures Based on EMG Signals with Deep and Double-Deep Q-Networks" by Ángel Leonardo Valdivieso Caraguay, Juan Pablo Vásconez, and Lorena Isabel Barona López. It is a preprint that has not yet been peer-reviewed.

The article suggests a technique that makes use of deep reinforcement learning to identify hand motions from electromyography (EMG) signals. A normal DQN and a double DQN were the two types of deep Q-networks (DQNs) that the authors employed. The double DQN learns to forecast the best action to take by taking into consideration the expected reward of the following state, in contrast to the normal DQN, which learns to predict the best action to do in a given state.

The EMG-EPN-612 dataset, which comprises information from 612 participants doing six distinct hand gestures, was used by the scientists to assess the two DQNs. The outcomes demonstrated that the double DQN outperformed the conventional DQN in terms of accuracy. The accuracy of the double DQN was 90.37%, whereas that of the standard DQN was 87.83%.

Link: https://www.mdpi.com/1424-8220/23/8/3905

10-) "sEMG-Based Hand Gesture Recognition Using Binarized Neural Network" by Soongyu Kang, Haechan Kim, Chaewoon Park, Yunseong Sim, Seongjoo Lee, and Yunho Jung.

The approach for identifying hand motions from surface electromyography (sEMG) data using a binarized neural network (BNN) is suggested in the paper. Binary weights and activations are used in BNNs, a particular kind of neural network. The NinaPro dataset, which comprises data from 8 participants doing 9 various hand gestures, was used by the authors to assess the suggested approach. The findings revealed that on the NinaPro dataset, the suggested approach had a 92.2% accuracy rate.

Link: https://www.mdpi.com/1424-8220/23/3/1436

11-) "Individual Identification by Late Information Fusion of EmgCNN and EmgLSTM from Electromyogram Signals" by Yeong-Hyeon Byeon and Keun-Chang Kwak.

The approach for identifying people using electromyogram (EMG) data is suggested in the article. A convolutional neural network (CNN) and an LSTM network, two deep learning models, are combined later to create the suggested technique. The EMG signals are processed using the CNN to extract local features and the LSTM to obtain temporal characteristics.

The Myo dataset, which comprises information from 10 participants doing five distinct gestures, was used to assess the suggested technique. The outcomes demonstrated that the suggested strategy outperformed other cutting-edge methods in accuracy, achieving a rate of 95.8%.

Link: https://www.mdpi.com/1424-8220/22/18/6770