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# Electromyography control of robotic systems

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## ABSTRAKT

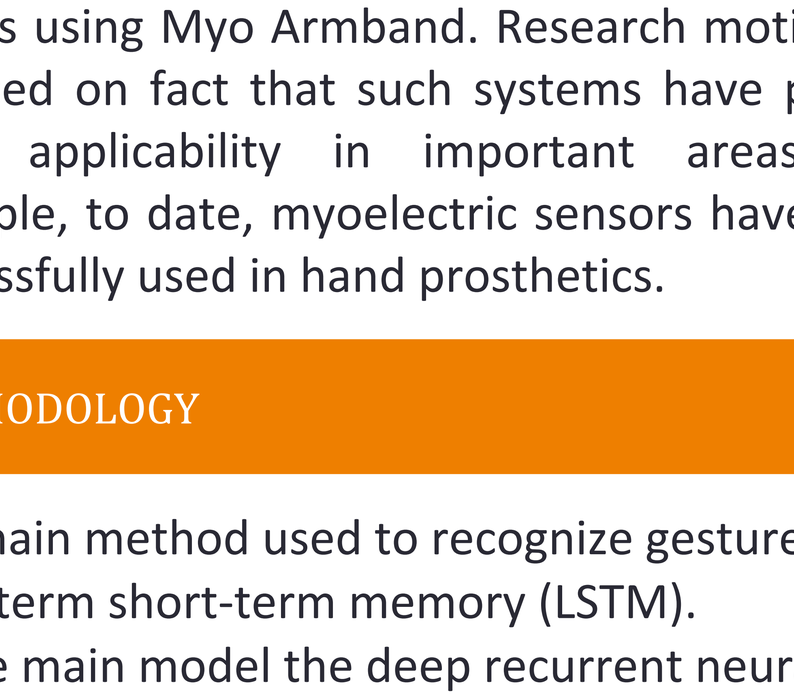
This work describes research of myoelectric interfaces and their application for controlling robotic systems. Hand gesture data collection software has been created. The neural network was designed and trained to recognize various gestures. The accuracy was 0.992 for four gestures and 0.959 for seven gestures. The prototype of myoelectric signals controlled robot with two degrees of freedom was created. Wireless direct control via bluetooth was implemented.

## INTRODUCTION

The ultimate goal of the work is the creation of a robotic system that will be controlled by EMG signals using Myo Armband. Research motivation is based on fact that such systems have proven their applicability in important areas. For example, to date, myoelectric sensors have been successfully used in hand prosthetics.

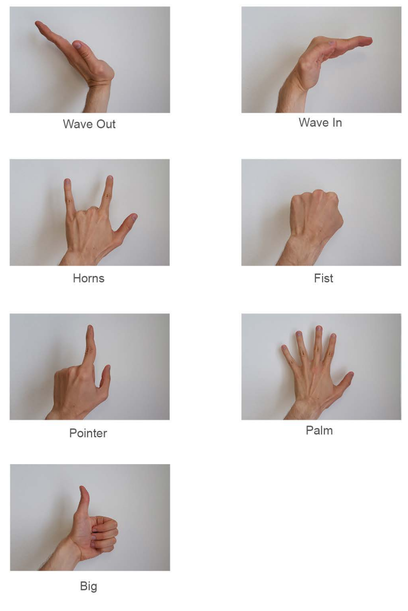
## METHODOLOGY

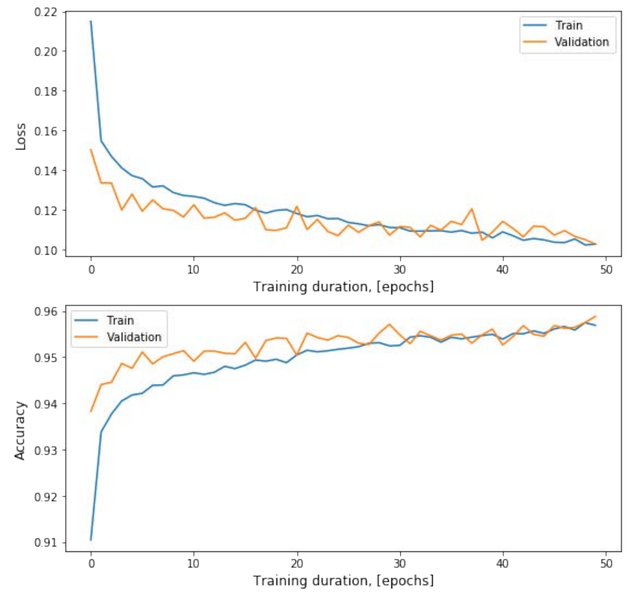
The main method used to recognize gestures was Long-term short-term memory (LSTM).
As the main model the deep recurrent neural network model was used, including two internal LSTM layers of 50 units and one internal normal layer of 64 neurons.




## RESULTS AND DISCUSSION

The results of the gesture recognition models were satisfactory. The model that was used to control the robot is further improved by internal post-processing of the results on the microcontroller.




## REFERENCES

[1] KARABULUT, Derya, Faruk ORTES, Yunus Ziya ARSLAN a Mehmet Arif ADLI, 2017. Comparative evaluation of EMG signal features for myoelectric controlled human arm prosthetics. Biocybernetics and Biomedical Engineering. 37(2), 326-335. ISSN 02085216. DOI: 10.1016/j.bbe.2017.03.001.
[2] KRAUSZ, Nili, Denys LAMOTTE, Iason BATZIANOULIS, Levi HARGROVE, Silvestro MICERA a Aude BILLARD, 2020. Intent Prediction Based on Biomechanical Coordination of EMG and Vision-Filtered Gaze for End-Point Control of an Arm Prosthesis. IEEE Transactions on Neural Systems and Rehabilitation Engineering. ISSN 1534-4320. DOI: 10.1109/TNSRE.2020.2992885. ISSN 1534-4320.
[3] HE, Yunan, Osamu FUKUDA, Nan BU, Hiroshi OKUMURA a Nobuhiko YAMAGUCHI, 2018. Surface EMG Pattern Recognition Using Long Short-Term Memory Combined with Multilayer Perceptron. 2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). IEEE, 2018, 5636-5639. ISBN 978-1-5386-3646-6. DOI: 10.1109/EMBC.2018.8513595.

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