# Myoelectric arm using artificial neural networks to reduce cognitive load of the user

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**Deskriptoren**
Sensorsystem; neuronales Netz; Prothese; obere Extremitäten; Regelarmatur; Steuereinrichtung; Prädiktor; Ultraschallsensor; Direktsteuerung; Muskelkontraktion; Niveauregulierung; intelligente Regelung; Prozessdaten; Prothesensteuerung; Behinderter

**Freie Begriffe**
gedankliche Belastung; neural network predictor; Hilfstechnologie

**Abstract**
Today’s multiple degree-of-freedom myoelectric prosthesis relies only on direct control by the processed electromyographic signal. However, it is difficult for the wearer to learn unnatural muscle contractions in order to wield more than three DoFs of the arm. This makes it almost impossible to use more complex prostheses with a larger number of actuators. Methods based on sensor–actuator loop and artificial intelligence may reduce cognitive load of the user by removing low level control, and an intelligent control system would make it needless to micromanage every action. For this purpose, sensor system for body segments motion capture was developed, as well as sensor system for prosthetic limb’s environment motion capture. Neural networks were designed to process data from the sensor systems. For the identification of the knee angle, orientation trackers were used. Neural network predictor of arm positions predicts the shoulder angle using the information about movement of the lower limb. In the case of the periodic/cyclic movements of the legs, such as walking, the control unit uses typical movement patterns of the healthy upper limb. Ultrasonic range sensors are used to create 3D map of objects in the environment around the arm. Neural network predictor of object positions predicts collisions. If the potential collisions are identified, the control unit stops arm movement. The new methods were verified by MATLAB and are designed as a part of assistive technology for disabled people and are to be understood as an original contribution to the investigation of new prosthesis control units and international debate on the design of new myoelectric prostheses.

**Autor**
Kutilek, Patrik; Mares, Jakub; Hybl, Jan; Socha, Vladimir; Schlenker, Jakub; Stefek, Alexandr

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