REAL-TIME EVALUATION OF DEEP LEARNING-BASED ARTIFICIAL VISION FOR CONTROL OF MYOELECTRIC HANDS

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ABSTRACT

The loss of any limb, particularly the hand, affects an individual's quality of life profoundly. An artificial arm, or prosthesis, is an example of technology that can be used to help somebody perform essential activities of daily living after a serious injury or health condition that results in the loss of their arm. Assistive technology solutions augmented with computer vision can enhance the quality of care for people with sensorimotor disorders. The goal of this work was to enable two trans-radial amputees to use a simple, yet efficient, computer vision system to grasp and move common household objects with a two-channel myoelectric prosthetic hand. We developed a deep learning-based artificial vision system to augment the grasp functionality of a commercial prosthesis. A convolutional neural network was trained with images of over 500 graspable objects. For each object, 72 images, at 5˚ intervals, were available. Objects were grouped into four grasp classes, namely: pinch, tripod, palmar wrist neutral and palmar wrist pronated. We implemented the proposed framework in studies involving two trans-radial amputee volunteers to control a commercial i-limb Ultra™ prosthetic hand and a Motion Control™ prosthetic wrist. After training, subjects successfully picked up and moved the target objects with an overall success of about 88% in various visual feedback conditions. The use of a deep-learning based computer vision system has the potential to enhance the functionality of the upper-limb prostheses in clinic.