Electrode Placement on forearm for Korean Finger Number Gesture Recognition using Surface EMG System

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Abstract – *Recently, hand gestures of numeric numbers using surface electromyography (sEMG) are getting more attention as communication method for the hearing-impaired. In many cases, hand gestures of numeric numbers varies significantly in regions. Little research has been carried out for multiple Korean finger gestures of natural numbers. Thus, in this paper, we propose new electrode placements on forearm for multi finger Korean number gesture recognition based on a 4-channel sEMG system. We confined our approach to multi finger Korean number gesture representing the numbers zero to five.*

Keywords: surface electromyography, forearm, multi finger gesture recognition, electrode placement

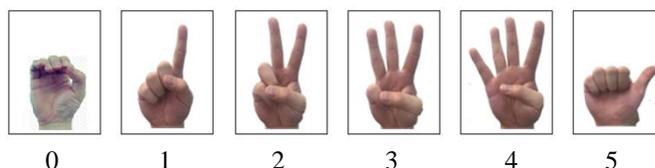

| 0 | 1 | 2 | 3 | 4 | 5 |

Figure 1. Illustration of the Korean number gesture signifying the natural numbers zero to five

based on a 4-channel sEMG system. We confined our approach to multi finger Korean number gesture representing the numbers zero to five. For multi finger Korean number gestures representing the numbers greater than five are left for further research where sEMG system might need sEMG

1 Introduction

In the past, application of surface electromayography (sEMG) signals has been extended from a simple on/off switch to recognition of hand gestures for numeric numbers which requires accurate feature extraction for tens of classification [1-4]. One of recent researches showed that accurate classification of Chinese number gestures from number zero to ten can be done with four pairs of electrodes if muscles are well chosen to extract each features for number gestures [1].

In different regions signs for numbers vary significantly. For example, Korean number gestures are different from Chinese number gestures for number zero and number five. Chinese number gesture for number zero grab a fist strongly but Korean number gesture for the same number has slightly closed fist not in the palm but over the palm [2]. Chinese number gesture and Korean number gesture are quite different to express number five. The Korean number gesture for number five have closed fist except only thumb extended while the Chinese number gesture have all five fingers extended [1]. The electrode placements for finger number gestures may not be applicable to the finger number gestures in different regions. Little research has been carried out for multiple Korean finger gestures of natural numbers.

In this paper, we propose new electrode placements on forearm for multi Korean finger number gesture recognition

2 Proposed electrode placement on forearm for Korean number gestures of numbers from zero to five

In this work, electrode placements on a forearm for 4-channel sEMG system are proposed to extract features for classification of Korean number gestures from number zero to number five. To this end, we makes study of which muscles on a forearm is related to move fingers to make Korean number gestures from numbers zero to five. To get idea which muscles are involved to move specific fingers, anatomy of a forearm is used and depicted in Fig. 2 for convenience purpose. Generally, flexion and extension of the individual fingers from thumb to little fingers are involved to move corresponding fingers.

2.1 Flexor digitorum superficialis muscle

Flexor digitorum superficialis muscle is located in the anterior compartment of the forearm. It involves flxion movement of all fingers except thumb. Thus, it is important muscles for hand gestures

2.2 Flexor policis longus

Flexor policis longus muscle is located in the forearm and involves in flexes of the thumb. Thumb should flexes and extend itself to make hand gestures of six numbers in Fig. 1.
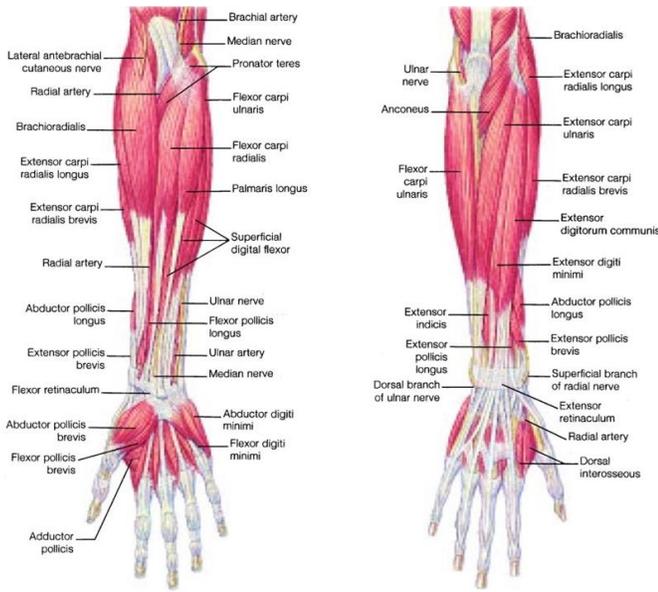
Figure 2.Anatomy of a forearm

2.3   Abductor prolicis longus

Chief function of Abductor prolicis longus muscle is abduct the thumb at the carpometacarpal joint and move thumb anteriorly. This muscle also assists in extending and rotating the thumb. With the anatomical observation of the muscle, high activation of sEMG signal may be measured when hand gestures of number five is made.

2.4   Extensor digitorum

Extensor digitorum muscle is located in posterior forearm and involves separate the fingers as it extends the fingers. Thus, all finger movements make hand gestures. .
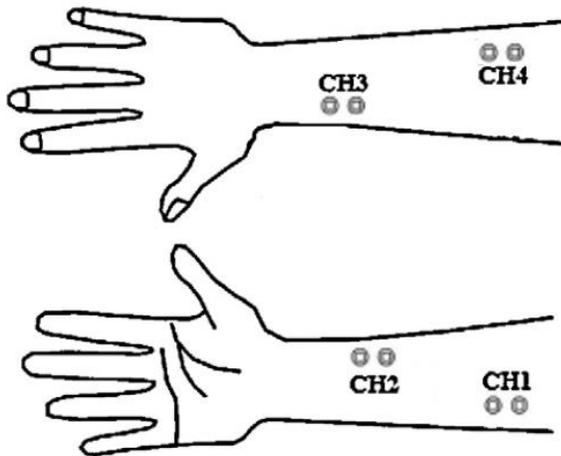

Figure 3. Electrode placements on a forearm for a 4-channel sEMG systems

Table 1. Muscles selected on a forearm for a 4-channel sEMG Systems

	Flexor		Abductor	Extensor
Muscles	Pollicis longus	Digitorum superficialis	Pollicis longus	Digitorum
Channel	CH1	CH2	CH3	CH4

3   Conclusions

Considering the anatomy of forearm and movements of Korean finger number gestures from number zero to number five, four muscles mentioned above may provide good feature extraction to classify the natural numbers from sEMG signals. The electrode placements to obtain sEMG signals from the four muscles selected for six Korean finger number gestures are shown in Fig. 3. The classification of Korean finger number gestures using sEMG signal from four muscles selected in Fig. 3 is left for the further research.

4   Acknowledgement

5   References

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