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REVIEWER No. 1 : Comments to Authors

Manuscript No. 15

Title : Towards Adaptive Hand Prosthetics
Authors : C. Castellini, E. Gruppioni, A. Davalli, G. Sandini
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Comments to authors: (Please continue on additional sheet if necessary.)

Although the paper does not use any new methodologies, it is interesting due to the experimental paradigm used, the simplicity of the algorithms, and the fact that the subjects were amputees. Most of the papers that deal with a similar problem report about results obtained from able-bodied subjects.
However, this paper requires quite some changes and corrections before it should be published:

0) The Titel "Adaptive Hand Prosthetics" is misleading. The word "adaptive" is used in various ways in signal processing, but just applying machine learning techniques for each subject individually does not justify the use of this word. There are adaptive signal processing methods that can account for the non-stationarity of the EMG signals, but since such methods are not used in this paper, the title is not appropriate.

1) Please label all diagrams!

2) Section I: *Still, as it stands today, it is used in a way that is highly innatural for the patient, allows for a very limited number of grasp types, and enforces no control of the force involved in a grasp.*
That is not true. Force control has been used for several decades in most commercial available products and is called proportional control. For instance, the Otto Bock Sensor Hand provides proportional control.

3) Section II B:
It is not clear why two different electrodes were used. Further, the authors should explain in more detail what technology is used by this electrode and what is the output (dry electrode, bipolar recording, amplification, filter settings, etc). It cannot be assumed that the reader will be familiar with these electrodes.

4) Section II C:
Explain the gripping patterns in more detail. A picture would be ideal, but a few additional sentences should be sufficient as well.
Please specify the order of the modalities and state how often each contraction was repeated and how long it was maintained in average by each subject.

5) Section III, first paragraph:
Please explain how the threshold for identifying the label 0 was determined. This is an important information, and has to be stated! Further, please specify in more detail which low-pass filter was used.

6) Section III:
Somewhere in this paragraph the authors should clearly specify which features were actually used to train and test the system. Currently this information is not well presented.

7) Section III, last sentence:
invesitigating -> investigating

8) Section IV:
The methods for classification, regression, and calculating the classification results should be moved to the methods section

9) Section IV:
Please add a mathematical description of how the performance index is calculated. This should help to assess the results appropriately.

10) Section IV:
The parameters of the classification system have to be determined appropriately to avoid the problem of overfitting. It is correct that SVMs show good generalization of the performance, but only if the parameters are determined correctly. That is, the parameters should be determined by nested cross-validation. In fact, not only the hyperparameters of the SVM but also all other parameters of the system should be determined in that way (e.g. the threshold for level 0 too). The authors should describe the used cross-validation procedure in more detail – in particular in the context of determining the parameters of the system.

11) Section IV:
An SVM is a binary classifier. Obviously, the authors used some technique to extend this basic capability of the SVM to more than just two classes. The authors should state what they used for that.

12) Page 5, second column:
“Consider the Figure, panel a”: Please state the figure number as well.

13) Page 6:
The authors offer some simple means how to improve the performance further. The reader is inclined to wonder, why those simple improvements haven’t been implemented,
tested and presented in this paper already?

14) Page 6:
Please state, why the search grid was not extended, if gamma was found to be best at a border value.

14) Section V:
”.. will be able to feed-forward control it in a natural way”. Using the term “natural way” is quite some exaggeration. I suggest to alleviate this term by saying: “a more natural way”.

15) Section V:
“acceptable performance values”. What are acceptable performance values? The authors should elaborate a little bit on that, such as:
Classification rates between 90 and 96% in a 5 class experiment may be very good in the context of machine learning. However, in the context of a practical application of hand prostheses, such classification rates are not sufficient. Patients certainly prefer higher reliability and less dexterity over higher dexterity and less reliability. It should be kept in

mind that most patients still have a healthy hand which is fully functional and can be used for dexterous manipulation. Thus practical hand prostheses should have accuracies very close to 100%.