Palmar And Lateral EMG Classification

By Naïve Bayes Classifier

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***Abstract*—Baye's classifier is a simple one but so effective. We use it here to determine if EMG signal represent Palmar or Lateral movements. The code is done using MATLAB. This paper shows the steps of the classifer concerned with EMG classification and our results .**

Keywords—EMG signal, Palmar movement, Lateral movement, Baye's Classifer

I. INTRODUCTION

Electromyography (EMG) is an electrodiagnostic medicine technique for evaluating and recording the electrical activity produced by skeletal muscles. By studying some features for the signal, We can classify between two types of hand movement -Palmar and Lateral movements-. The features used to describe the signal are energy, 4th power, nonlinear energy and curve length.

II. METHODS & MATERIALS

First, We filter the signal from the AC noise by using notch filter at 60 Hz, then classify data into 100 palmar, 100 lateral as training data and 50 palmar, 50 lateral as testing data .

We describe each signal by four features:

$$\text{Energy} = \Sigma\, x_i^2 \quad (1)$$

$$\text{4th Power} = \Sigma\, x_i^4 \quad (2)$$

$$\text{Nonlinear Energy} = \Sigma\, -x_i x_{i-2} + X_{i-1}^2 \quad (3)$$

$$\text{Curve Length} = \Sigma x_i - x_{i-1} \quad (4)$$

We get this features for each signal represented by a row of sample readings . so we could get vectors for class one: F1|C1, F2|C1, F3|C1, F4|C1 and for class two: F1|C2, F2|C2, F3|C2, F4|C2. Then we get the mean and standard deviation of each vector.

$$\text{Mean} = \frac{\Sigma x_i}{n}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum (x_i - M)^2}{n-1}}$$

Testing

Assuming all the used features in the model have Gaussian distribution

for each row of testing data, we calculate four features.

Then we calculate the probability of each feature given each class by this rule:

$$f(x \mid \mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}}\, e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

For each row we calculate:

P(C1|F) = P(C1).P(F1|C1).P(F2|C1).P(F3|C1).P(F4|C1)

P(C2|F) = P(C2).P(F1|C2).P(F2|C2).P(F3|C2).P(F4|C2)

If P(C1|F) > P(C2|F) → This row belong to C1

If P(C1|F) < P(C2|F) → This row belong to C2

If the classifier give the result belonging to palmar (C1) and the true class of the record is C1 then it gives true out . The second case that the classifier gives the result C1 and the true class is Lateral(C2) then it gives false out, same for the classifier out as C2.

III. RESULTS & DISCUSSION

$$\text{Accuracy} = \frac{\text{No. of true out}}{\text{Total no. of testing records}}$$

For classifying total data as 200 training and 100 testing, the resulted accuracy is 79%. This accuracy is good as first trial using simple classifier. It may increase if we classify more percentage of data as training.

IV CONCLUSION

A simple software program can differentiate between Palmar and Lateral movements from the EMG signal acquired. By taking sample of signals for 150 palmar and 150 lateral and using 2/3 data as training and the other third for testing, we get accuracy of 79%.

FUTURE WORK:

Acquire more data describing both signals to get better description of the relation between these features and classification between both movements and use other classifiers like KNN.