Robotics & Cobotics

EIDIA
Ecole d'Ingénierie Digitale
et d'Intelligence Artificielle

Bionic Arm

Sommaire

Introduction

- An innovative and functional bionic arm
- Natural movements of the human arm through the use of electromyography (EMG) signals

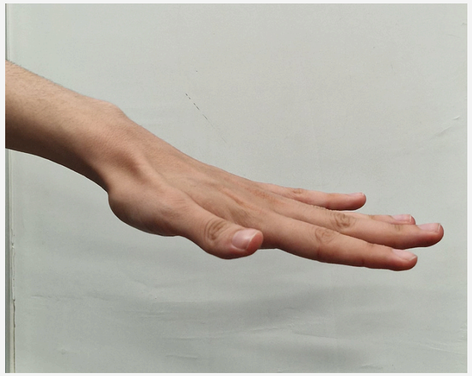
Back to Agenda Page

Data collection:

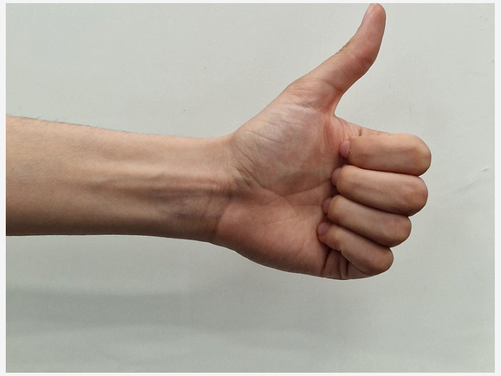
Question N	Questions	Possible Answers
1	What is your name?	String value
2	What is your gender?	• Female • Male
3	What is your age?	Numeric value
4	Do you have any muscle disease?	• Yes • No
5	Do you use any muscle related medication?	• Yes • No
6	Have you used any stimulus in the last 24 h? (Alcohol etc.)	• Yes • No
7	What is your dominant hand?	• Right • Left • Both

Data collection

Data collection

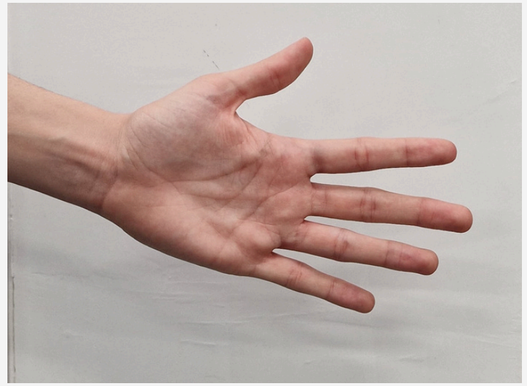


Pronation



Like

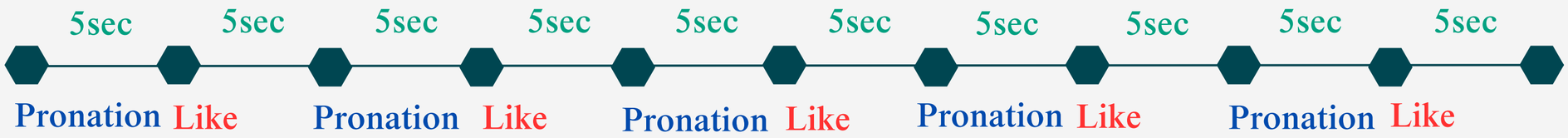
Handshake



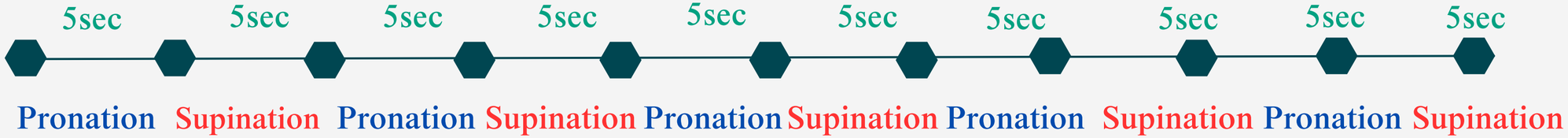
Supination

Data collection

Cycle 1:



Cycle 2:



Cycle 3:

Preprocessing

Fast Fourier Transform (FFT)

to determine cutoff frequencies for filtering.

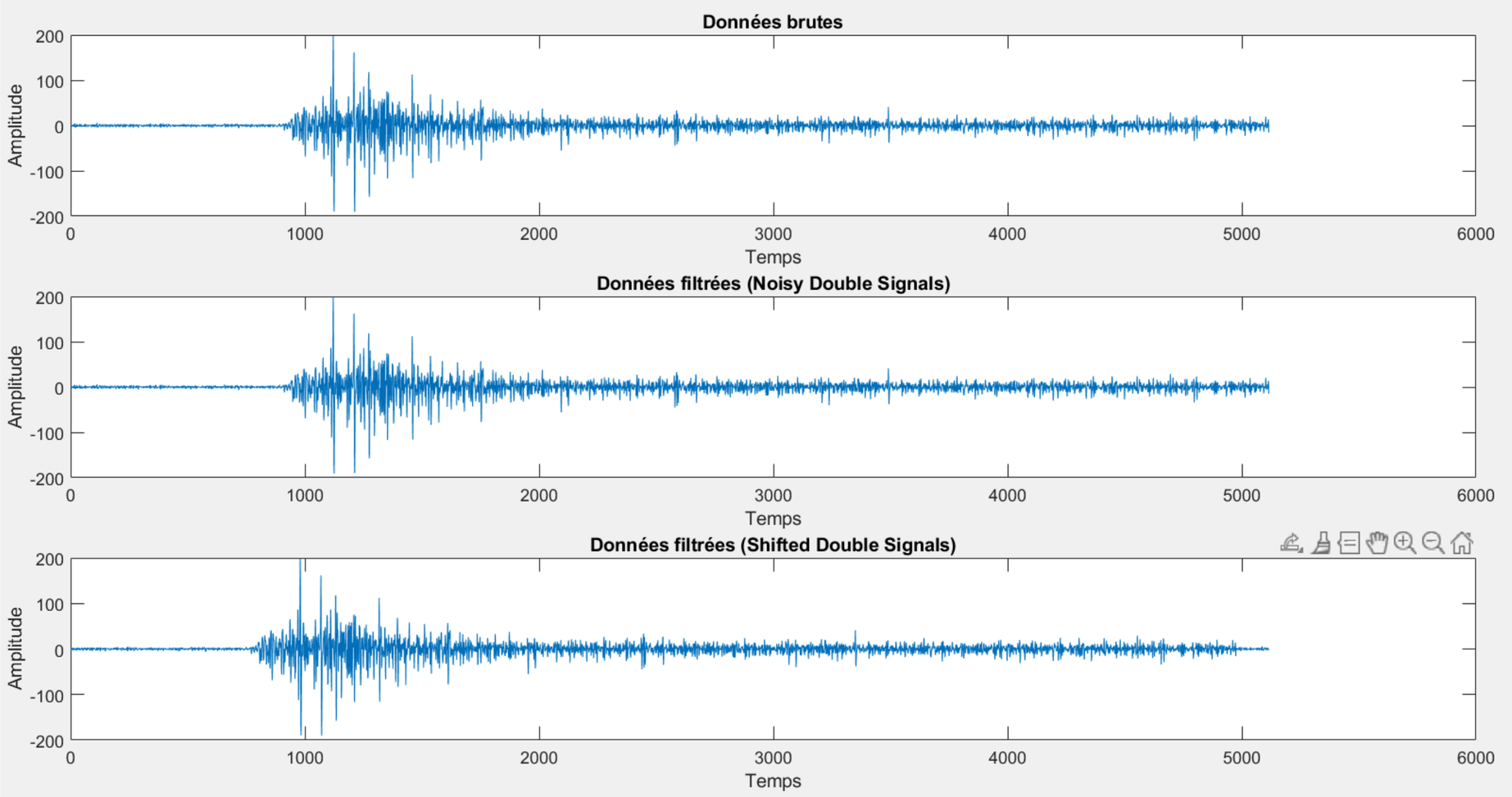
A bandpass Butterworth filter

is designed and applied to filter the EMG signal.

Data Augmentation

two data augmentation techniques - the Gaussian noise method and the time shifting technique.

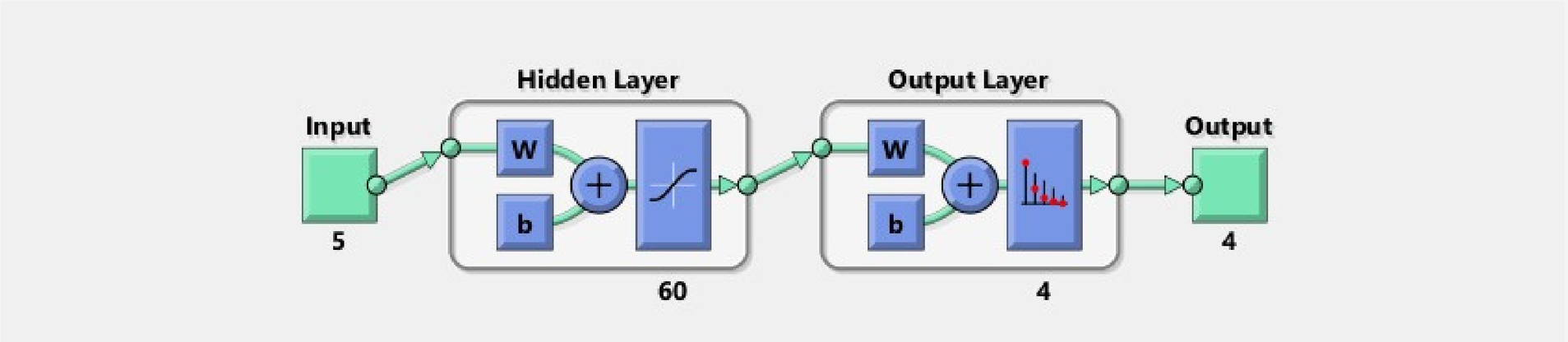
Data Augmentation

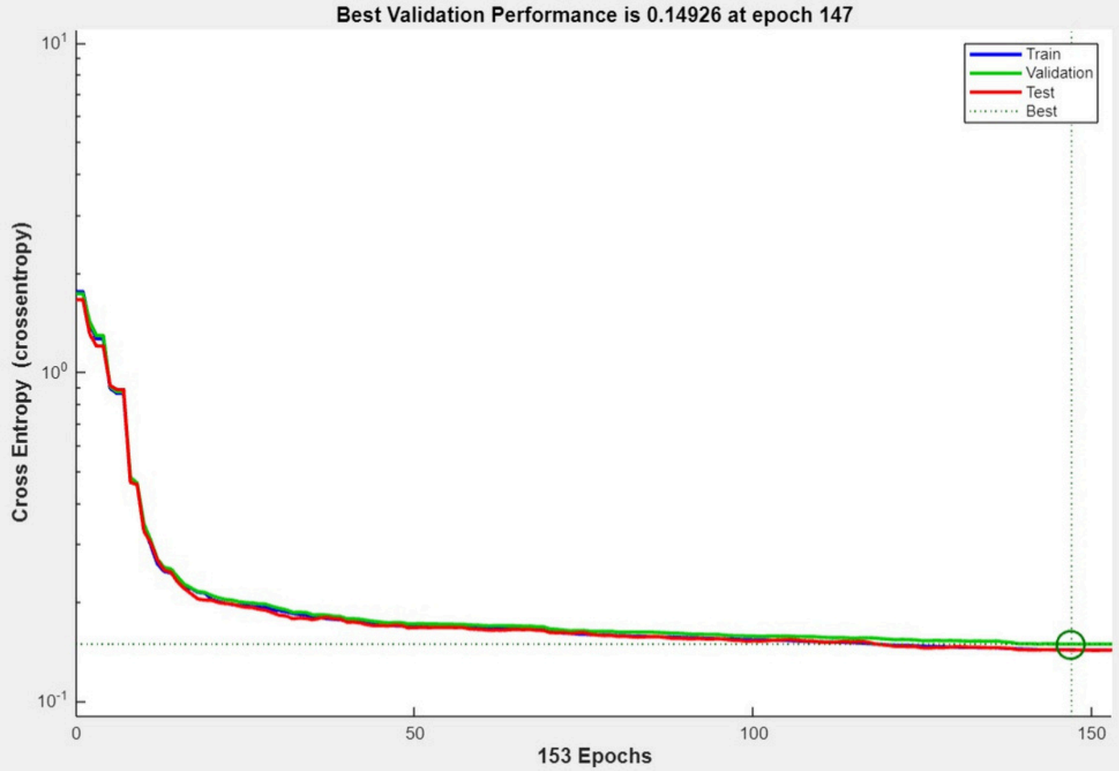


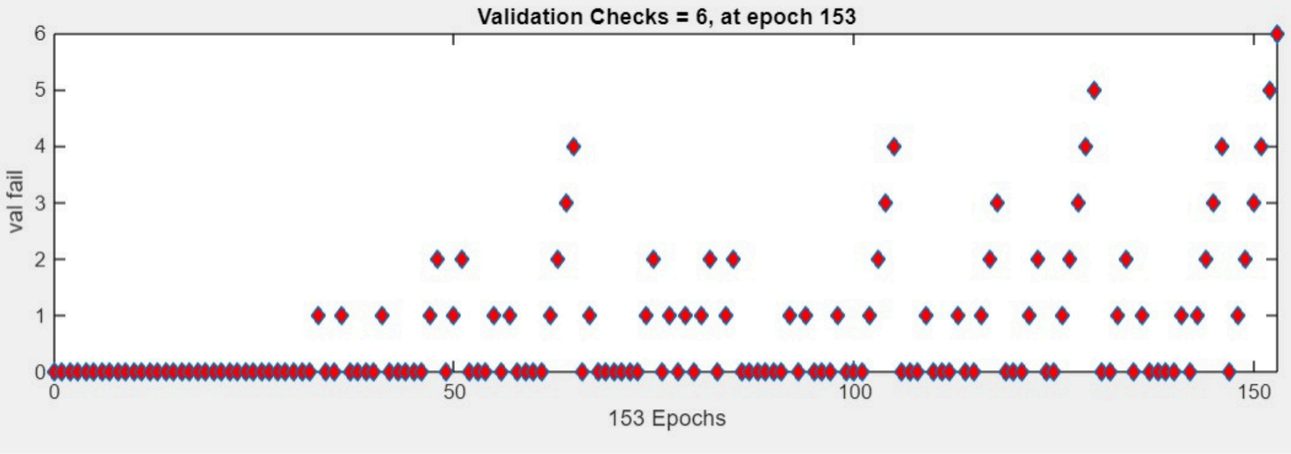
Feature extraction:

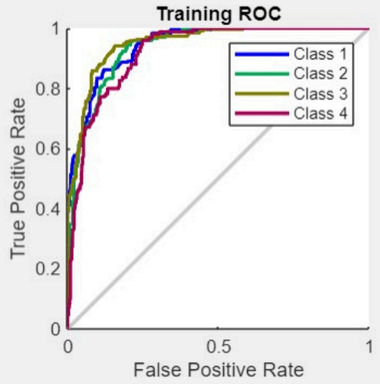
No.	Name of the feature	Equation
1	Mean absolute value (MAV)	$\mathrm{MAV} = \frac{1}{N}\sum_{i=1}^{N}\lvert x_i \rvert$
2	Root mean square (RMS)	$\mathrm{RMS} = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2}$
3	Standard Deviation (STD)	$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$
4	Variance (VAR)	$\mathrm{VAR} = \frac{1}{N-1}\sum_{i=1}^{N} x_i^2$
5	Waveform length (WL)	$\mathrm{WL} = \sum_{i=1}^{N-1}\lvert x_{i+1} - x_i \rvert$

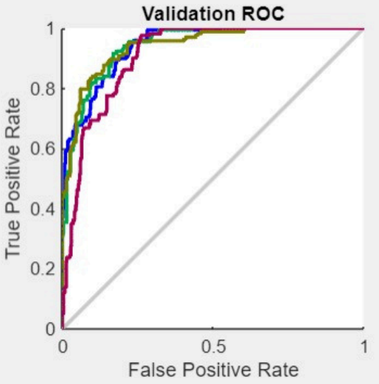
Classification:

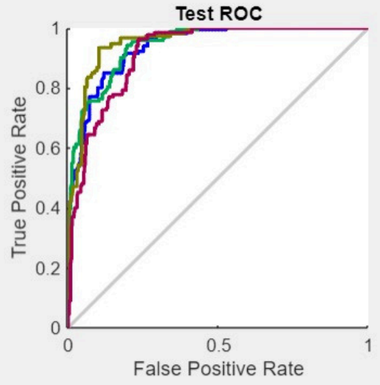


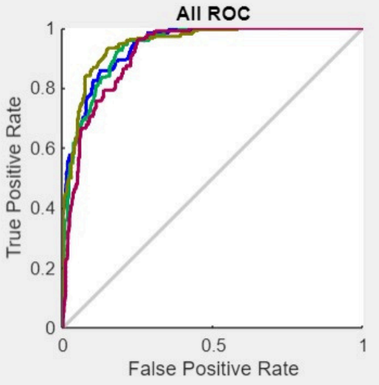

Best Validation Performance is 0.14926 at epoch 147
Train
Validation
Test
Best
Cross Entropy (crossentropy)
153 Epochs


Validation Checks = 6, at epoch 153
val fail
153 Epochs


Training ROC
Class 1
Class 2
Class 3
Class 4
True Positive Rate
False Positive Rate


Validation ROC
True Positive Rate
False Positive Rate


Test ROC
True Positive Rate
False Positive Rate


All ROC
True Positive Rate
False Positive Rate

Classification: