

# Emotion classification using ECG signals

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## Introduction

Emotions are important part of interactions and communication between humans. Our study tries to classify level of valence and arousal based on ECG signal that can be easily acquired. Such information can enrich medical records or help to develop technologies that fit better to human needs.

## Dataset

As input were selected ECG signals from AMIGOS data set. As an output was selected personal rating made by each participant.

## Signal Preprocessing

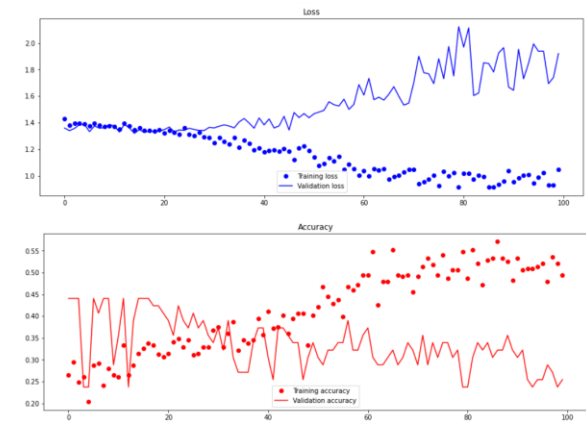
After assignment of each individual signal to each patient and video. Signal for each video was processed in 3 consecutive steps:

- Calculation of the baseline reding as an average over first 5 seconds of the recording.
- Removing 2 seconds from the beginning and the end of each recording (including 5 seconds used for baseline for total of 7 from the start)
- Subtracting baseline from trimmed ECG signal.

Additionally recordings from patients 9, 12, 21, 22, 23, 24, 33 were not used as they were inadmissible. Label of each sample is one-hot encoded and belongs to one out of four classes describing level of valence and arousal either low or high.

## Results

Due to small number of training samples, k-fold cross validation was used to estimate final accuracy of the model. Mean accuracy achieved using 10 folds is equal 26%.



## Neural Network

Used architecture is a CNN-LSTM network consisting of two single dimensional, convolutional layers applied to each second of input signal and single LSTM layer processing the whole flattened sequence. All layers except LSTM layer and the last one use ReLU activation function.

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 48, 128, 1)]	0
time_distributed (TimeDistri	(None, 48, 128, 32)	1632
reshape (Reshape)	(None, 48, 4096)	0
lstm (LSTM)	(None, 128)	2163200
dense (Dense)	(None, 256)	33024
dropout (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 128)	32896
dropout_1 (Dropout)	(None, 128)	0
dense_2 (Dense)	(None, 4)	516
dropout_2 (Dropout)	(None, 4)	0
activation (Activation)	(None, 4)	0
Total params: 2,231,268		
Trainable params: 2,231,268		
Non-trainable params: 0		

## Summary

Emotion classification using ECG signals is difficult task, due to the fact of limited amount of data that can be provided to the neural network. Accuracy of the model can be increased by training the network for more epochs, decreasing the batch size or providing additional input data.