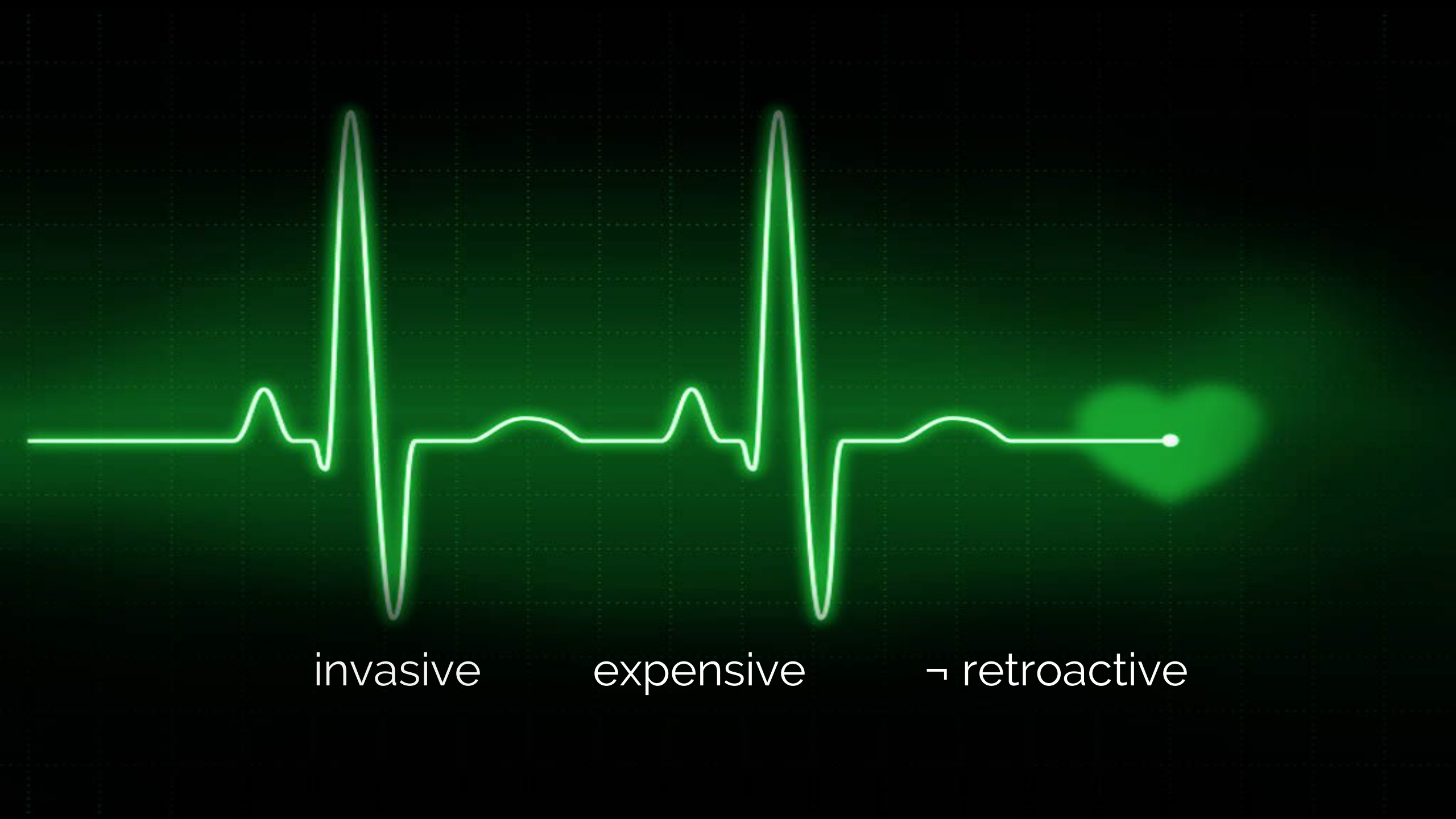

invasive
expensive
¬ retroactive

Introducing

P♥LPITATE

Group 24

Biosignal Analysis

Microsoft how-old.net → age estimation from pictures

Project Oxford → emotions from facial expressions

Lack of research concerning face and voice

Palpitate → heart rate from audio/video

What are we?

A research project estimating heart rate from video and audio

A product with applications in medicine, sports and television

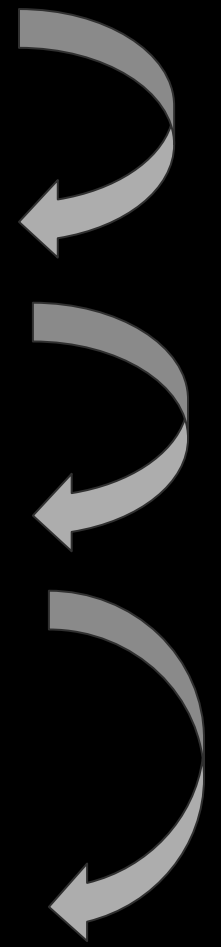
How it works

User uploads video/audio file

Relevant features are extracted

Heart rate is estimated using machine learning on a database

Video is streamed back with superimposed heart rate values



Project **Management**

Group Management

Research

Results

Meetings

Scrum

Slack

Product

Deadlines

Group Management

Research:

Audio 

Video 

Product:

Back-end 

Front-end 

Data Preparation - HeartAV

Data Preparation

44 subjects - talking in front of a camera, with heart rate measured.

Times in video must be the same for each ML method

Spectrograms for audio

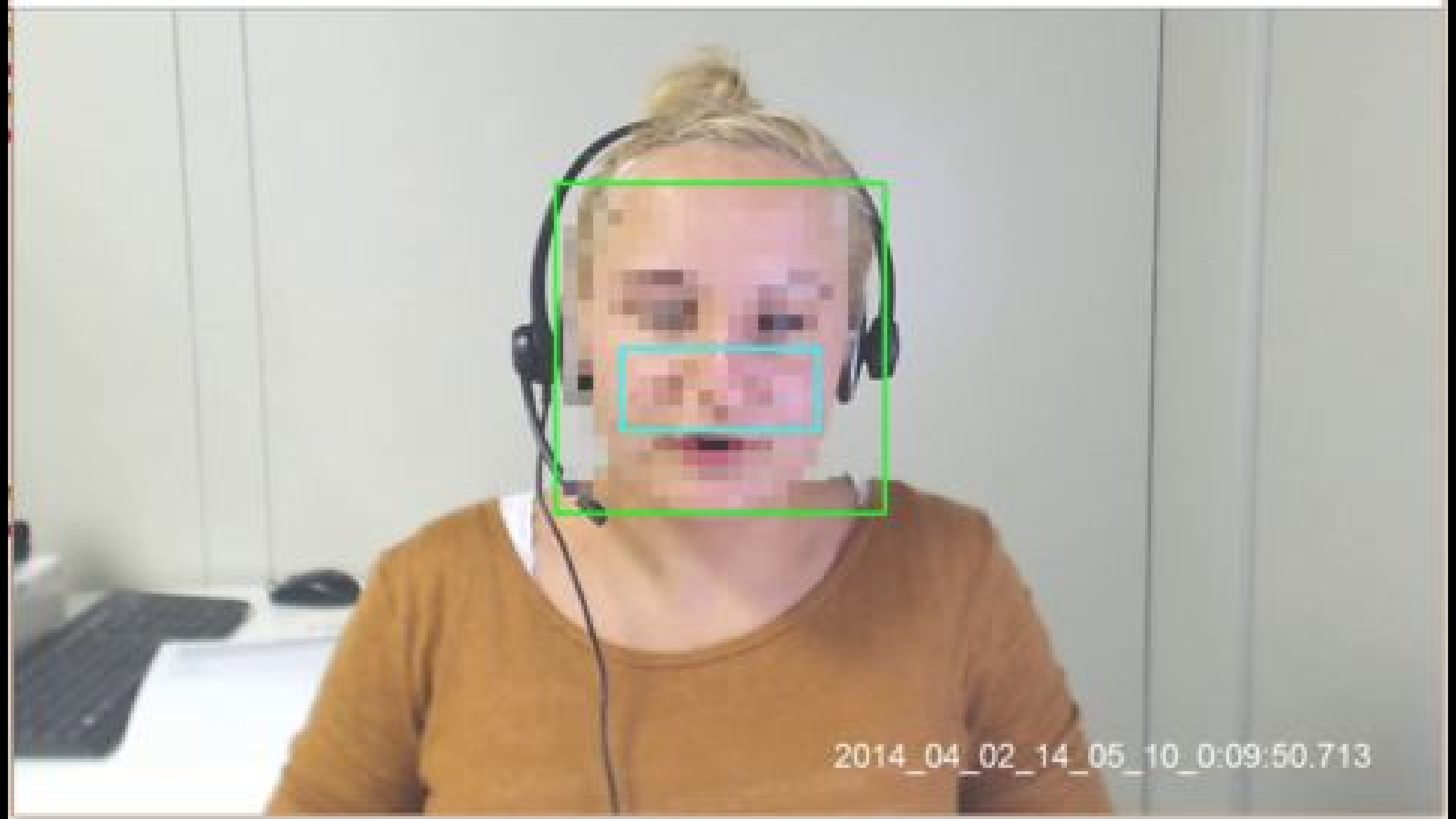
Green intensity of the face for video

Face Tracker

Fail hard

Real Time

Smooth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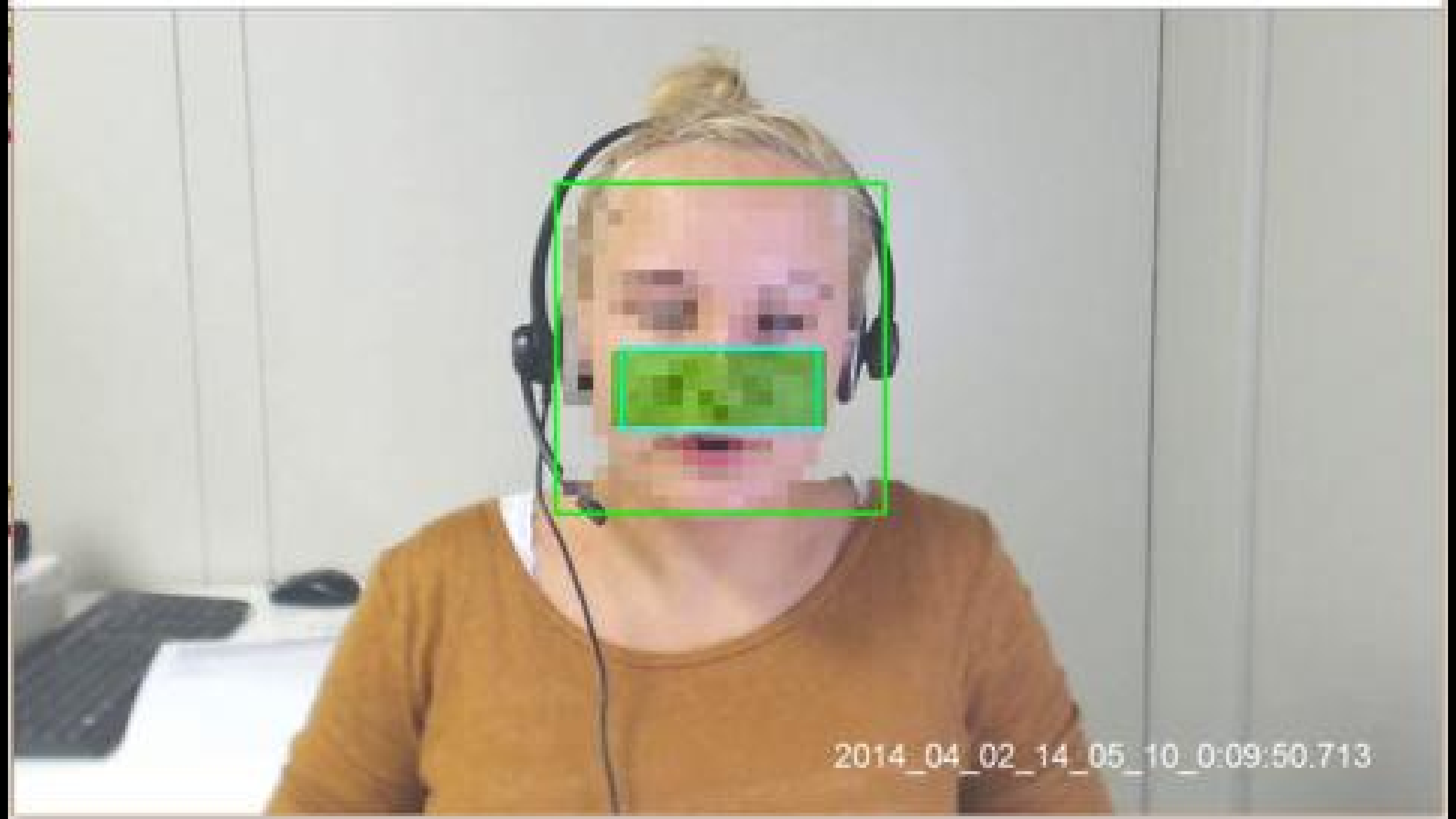
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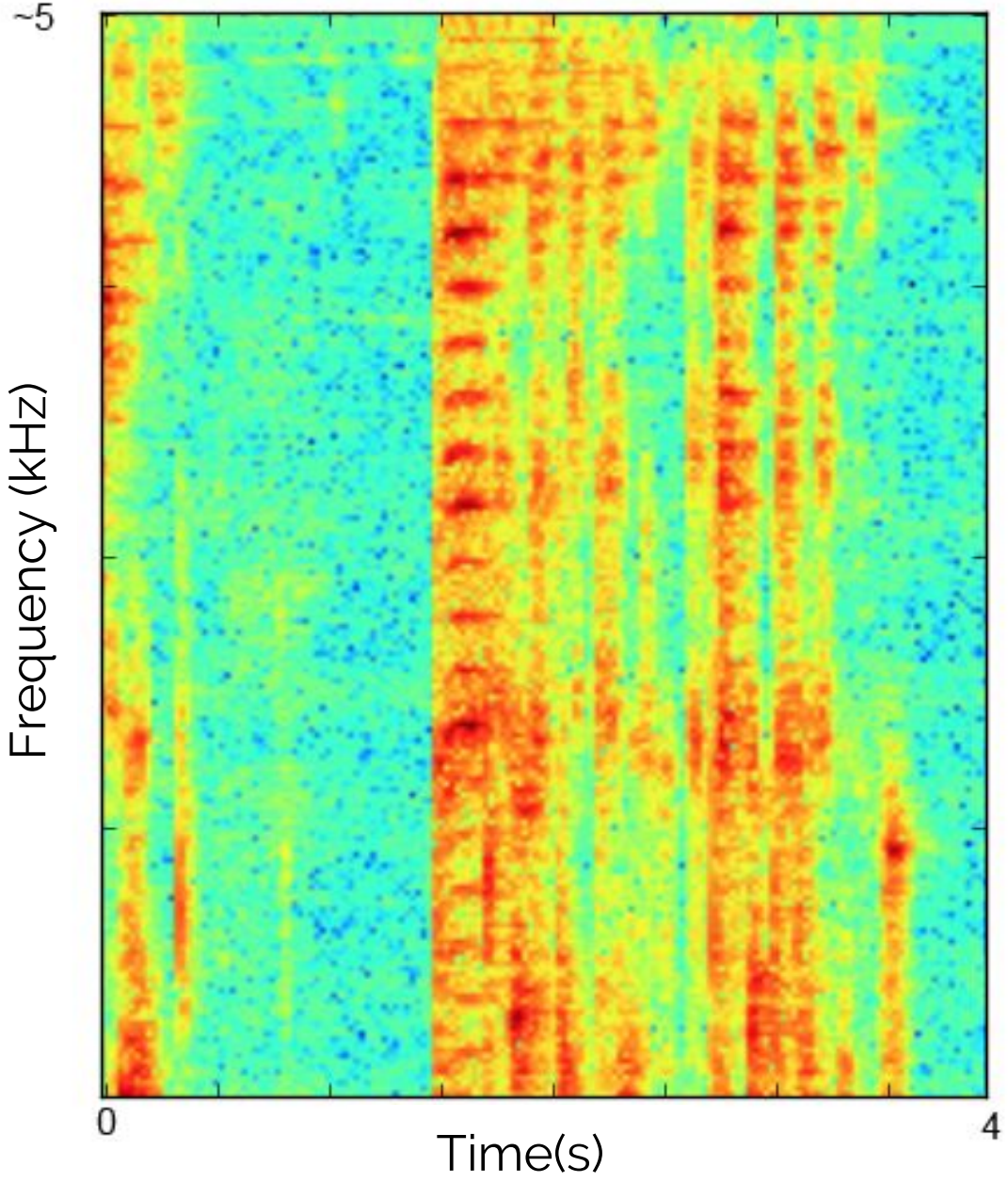
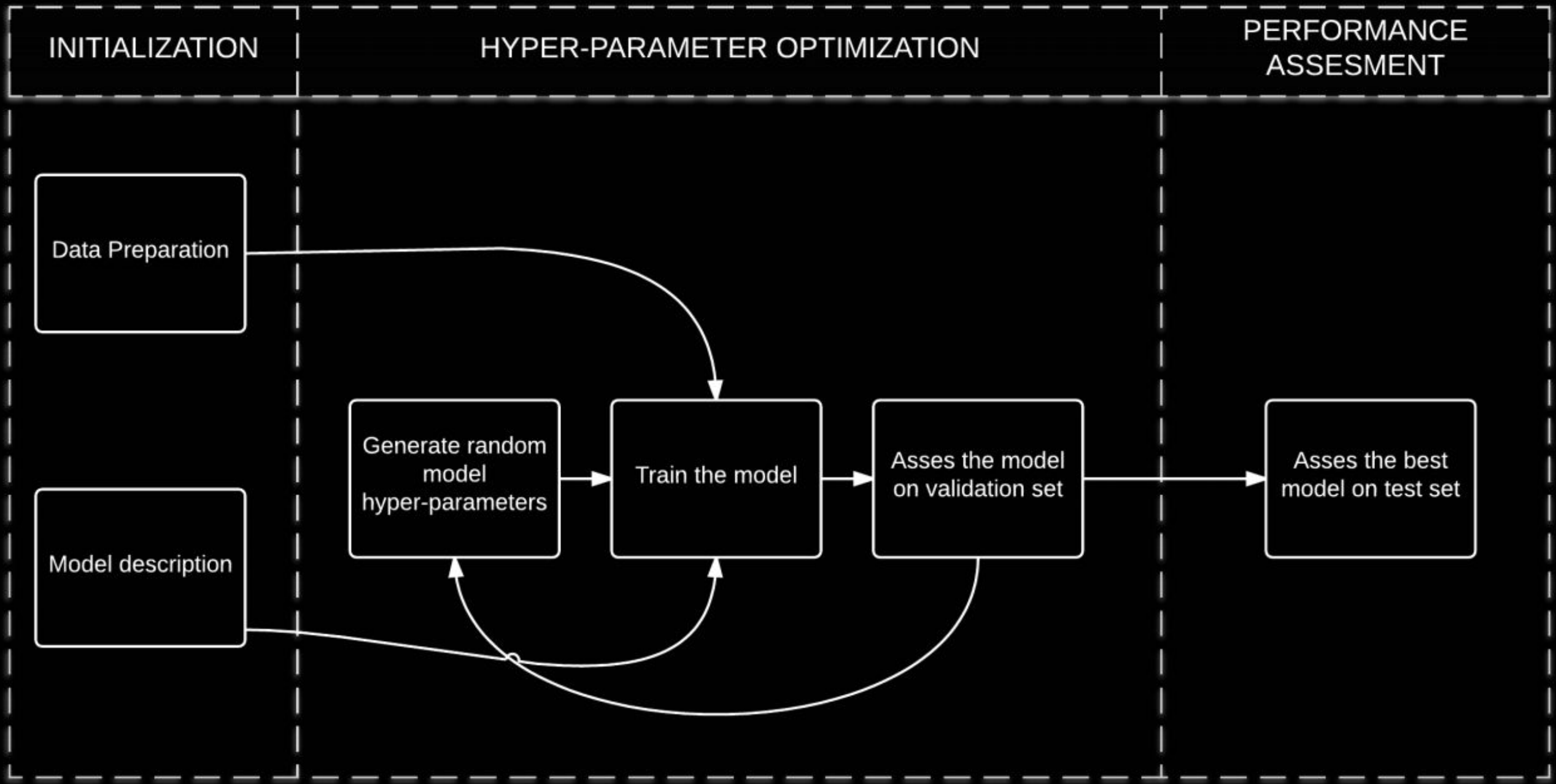
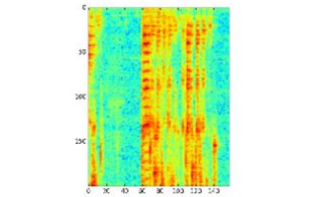

~5
Frequency (kHz)
0
4
Time(s)

Machine Learning


INITIALIZATION
HYPER-PARAMETER OPTIMIZATION
PERFORMANCE ASSESMENT
Data Preparation
Model description
Generate random model hyper-parameters
Train the model
Asses the model on validation set
Asses the best model on test set

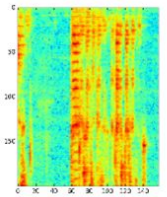


Convolutional + Pooling

Convolutional + Pooling

Fully connected

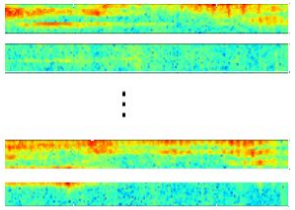
CNN



Fully connected

Fully connected

2-Layer Feedforward NN

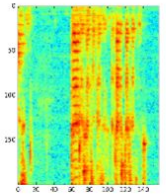


LSTM

LSTM

Fully connected

RNN



Convolutional + Pooling

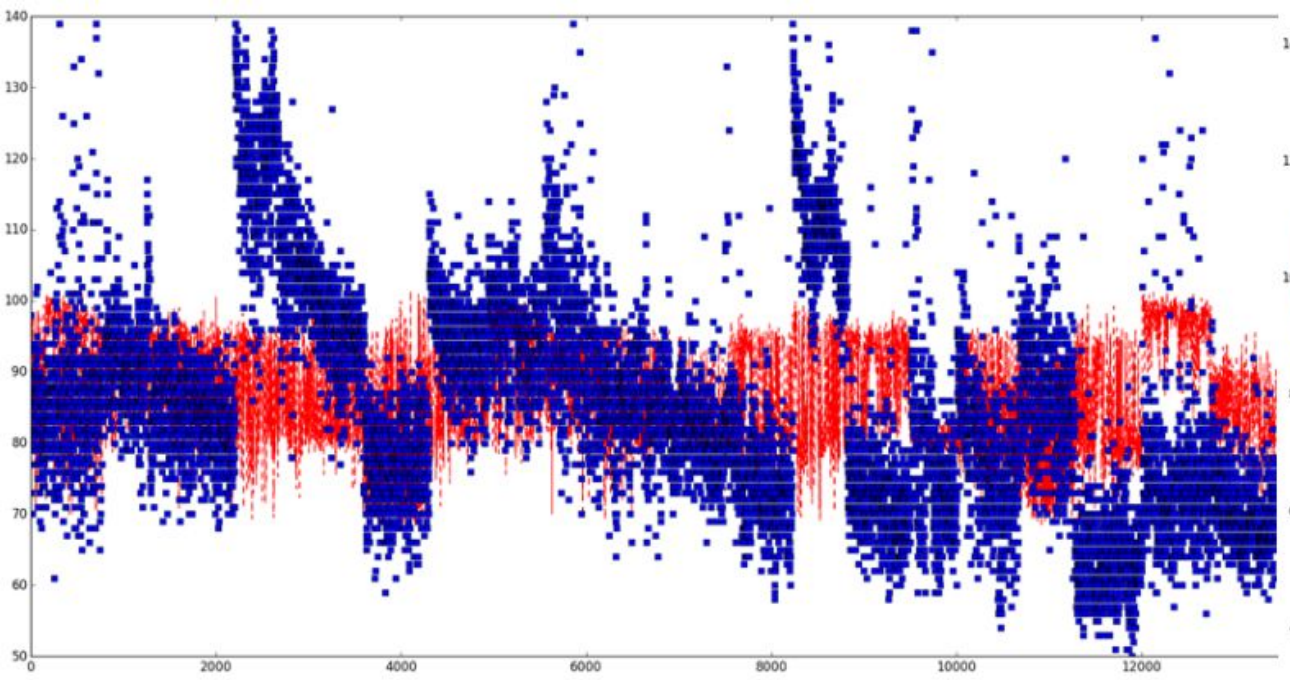
Convolutional + Pooling

LSTM

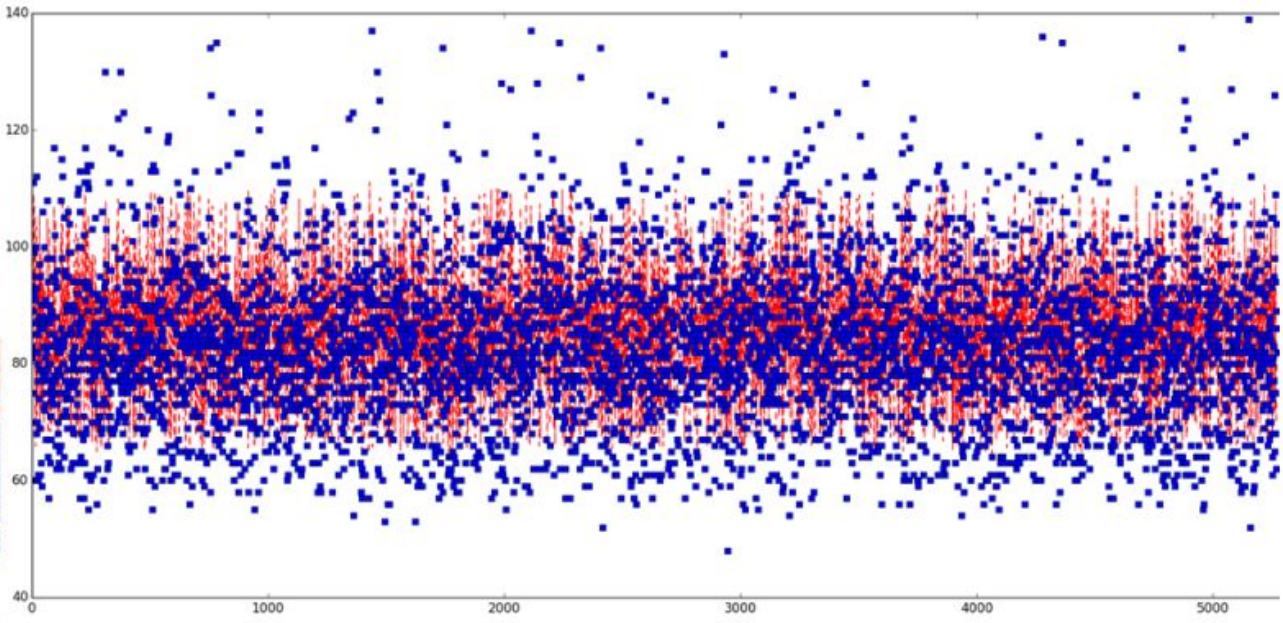
Fully connected

Convolutional Recurrent NN

Results: Subject Dependent Audio Models

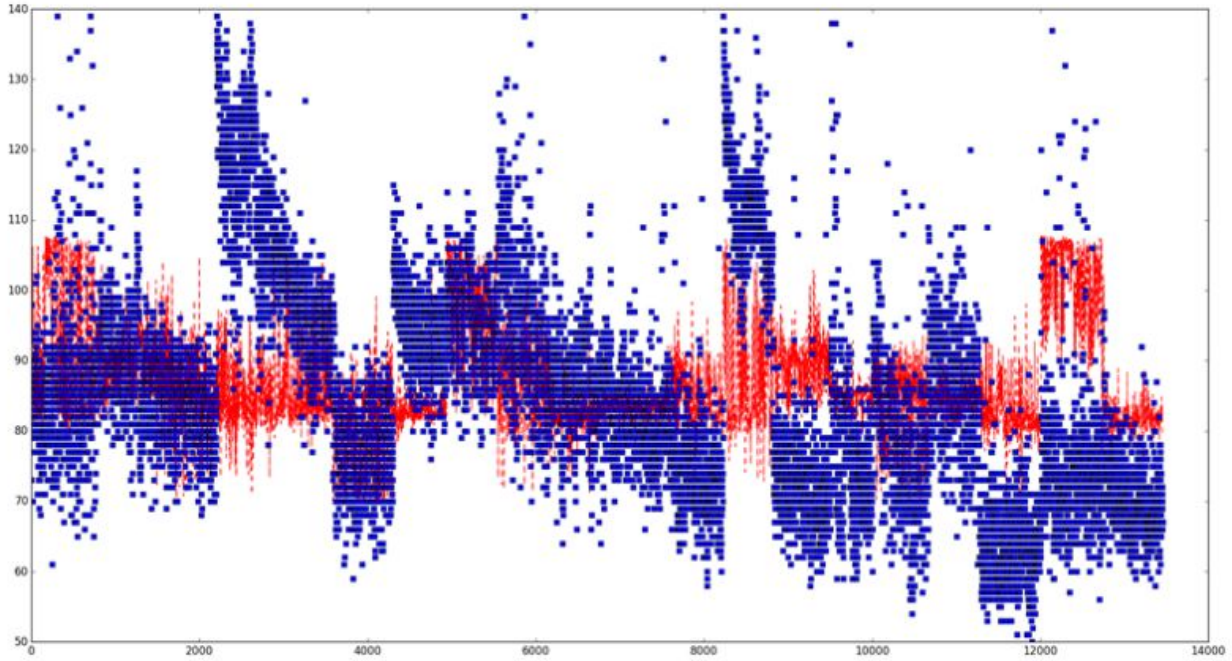


(a) unseen subjects test set

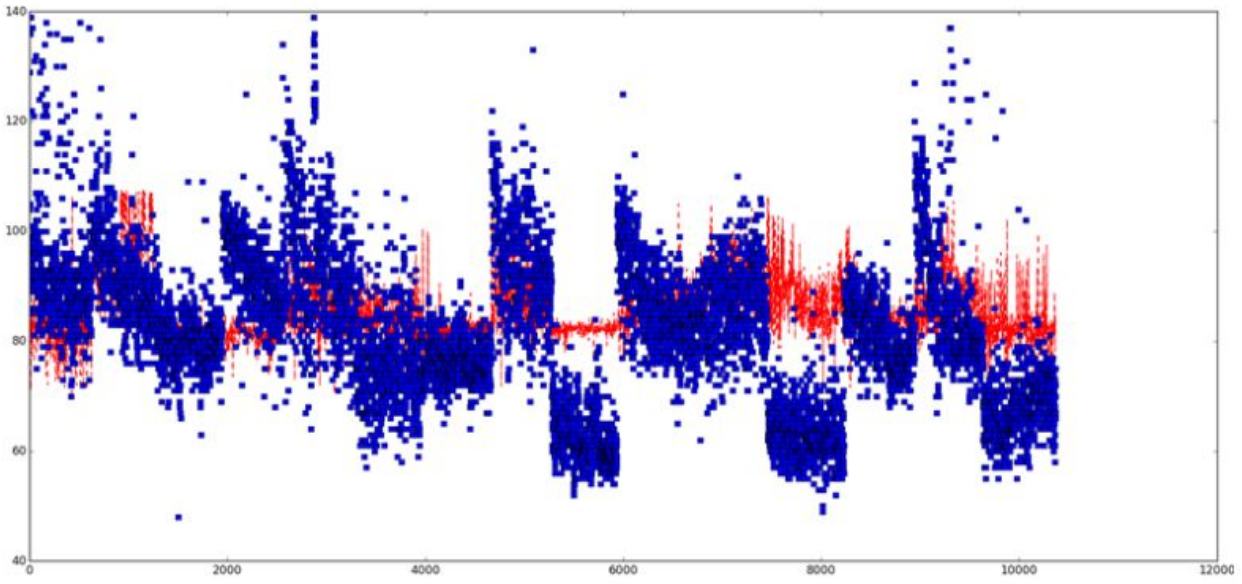


(b) seen subjects test set

Results: Subject Independent Audio Models

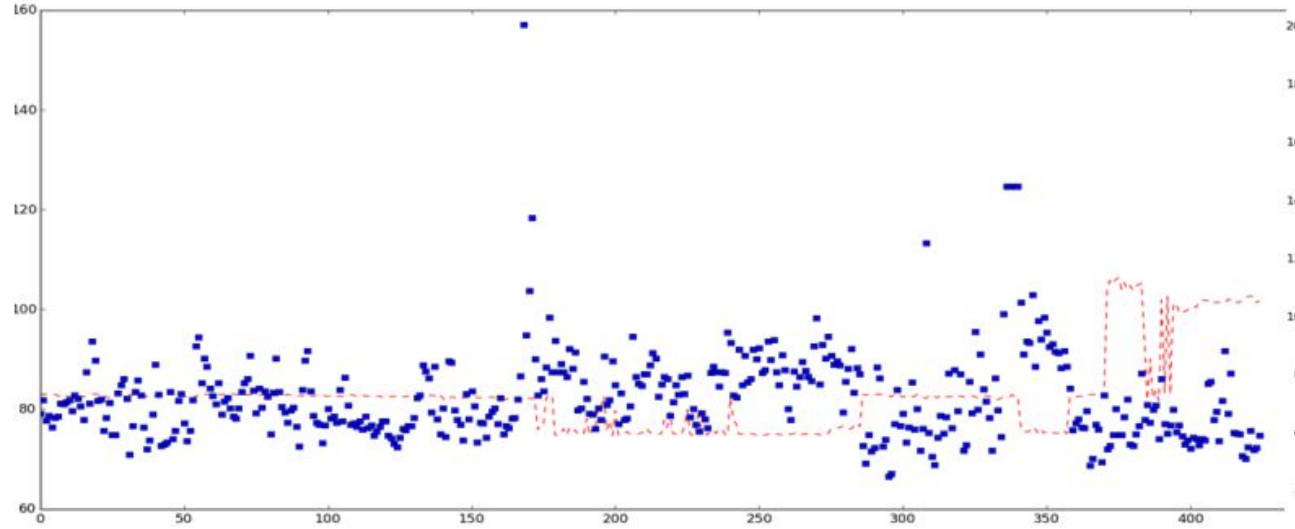


(a) test set

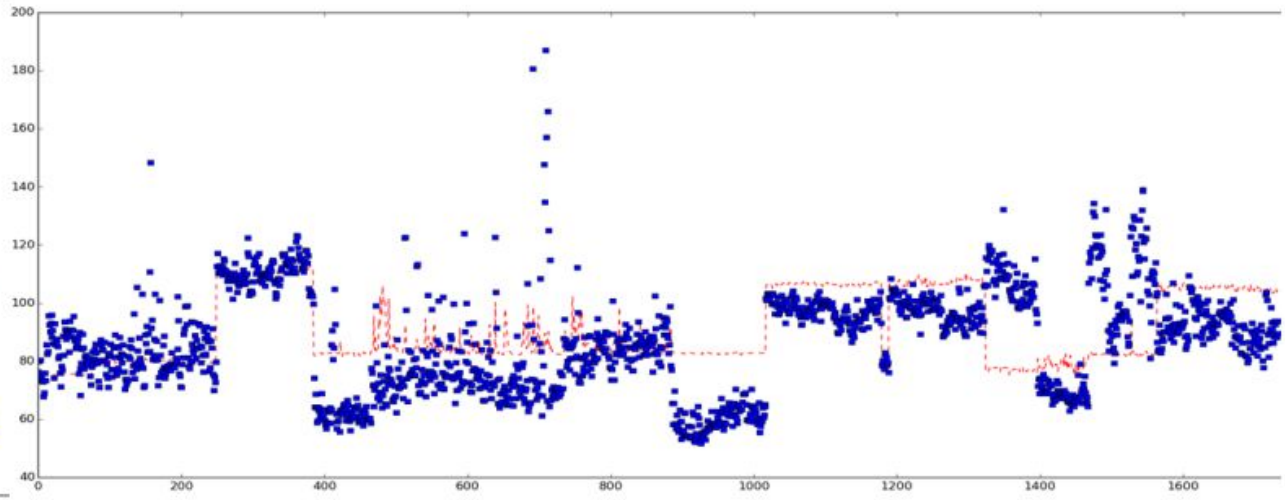


(b) validation set

Results: Video Models



Test set



Validation set

Results

model type	r	rmse
Audio: Convolutional - Recurrent network - subject independent	-0.04	1.38
Audio: Convolutional - Recurrent network - subject dependent	0.68	0.75
Audio: Recurrent network - subject independent	0.05	1.33
Audio: Recurrent network - subject dependent	0.62	0.81
Audio: Convolutional - Recurrent network with data augmentation	NaN	1.19
Video: Convolutional - Recurrent network	0.52	1.18
Video: Convolutional - Recurrent network with data augmentation	0.48	1.28

Architecture Superimposing, Streaming, Serving

Medical Use Case

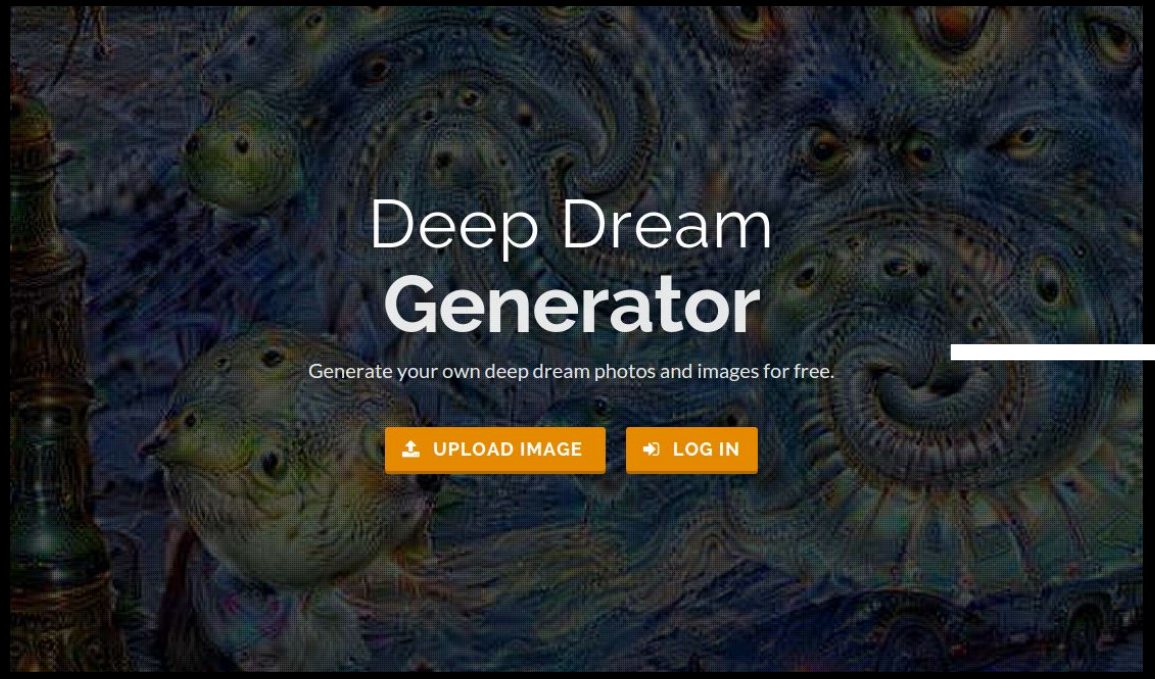
Maximum heart rate

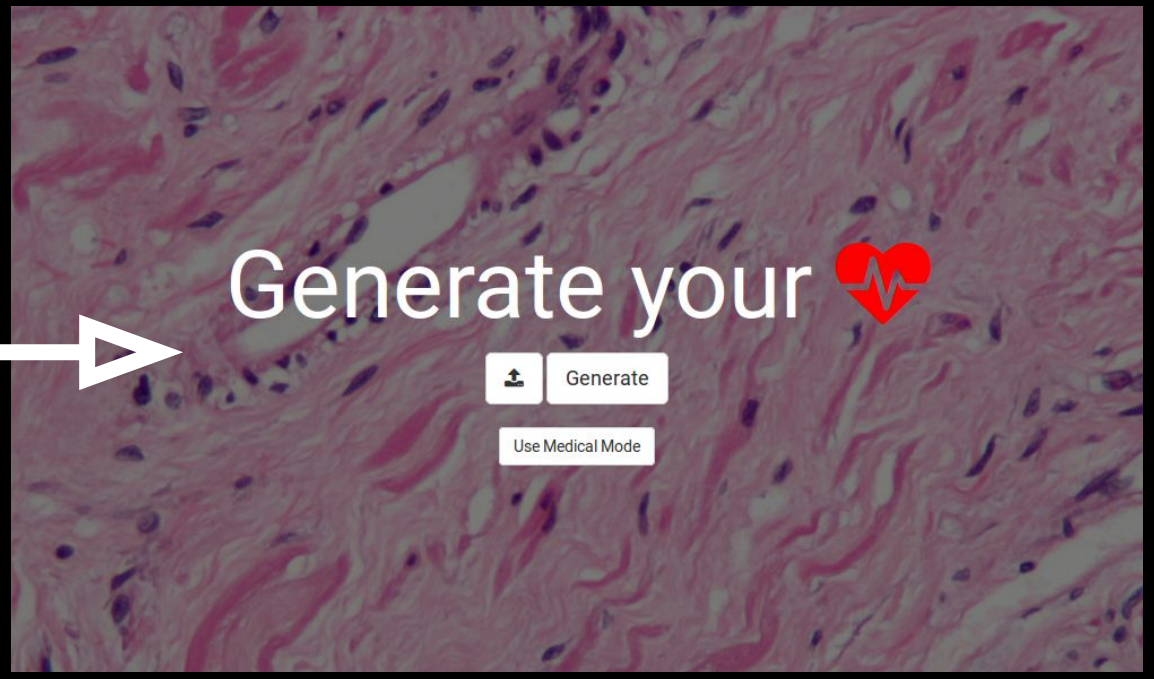
Intensity

Current min/max heart rate

Require age and sex

Design





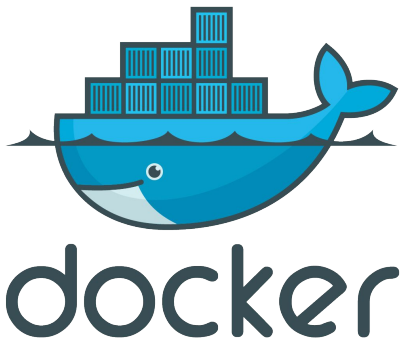
Attractive and minimal


K
Keras

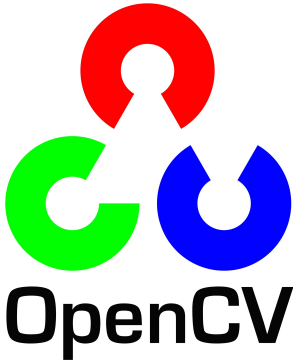

Flask


FFMPEG


Travis CI


docker


ØMQ


OpenCV

Appendix

- Maximum Heart Rate (MHR) for men = $203.7 \div (1 + e^{(0.033 \times (Age - 104.3))})$
- Maximum Heart Rate (MHR) for women = $190.2 \div (1 + e^{(0.0453 \times (Age - 107.5))})$