Heart Rate Estimation

- Heart Rate (HR) is a basic parameter of cardiovascular activity.
- HR value is used broadly, its measurement is performed precisely with expensive contact devices (ECG, pulse oximeters, ...).
- Visual HR estimation, i.e. HR estimation from a video, delivers precise measurement using consumer webcams.
- Accuracy of visual HR estimation depends on recording conditions – prior visual HR methods are sensitive to motion and light interference, requiring subject’s cooperation.

ECG-Fitness Dataset

- New, realistic & publicly available dataset of subjects performing physical exercises – 1080p RAW 30fps videos + 100Hz ECG recording.
- 207 videos – 17 subjects, 6 videos per subject, 2 cameras.
- HR (bpm) – min: 56, max: 159, mean: 108.96, std: 23.33.

Facial images from a rowing session video of a subject from the ECG-Fitness dataset. Pink - the subject’s position, blue - the camera.

Dataset challenges: (i) large subject’s motion, (ii) motion blur, (iii) facial expressions, (iv) glasses, (v) non-uniform lighting, (vi) light interference, (vii) atypical non-frontal camera angles.

Proposed Method

- **HR-CNN**: a two-step convolutional neural network.
  
  1. **Extractor** is run over an image sequence of faces.
  2. **Estimator** predicts the HR from the output of the Extractor.

Grad-Cam heatmaps of the four Output example of the HR convolutional layers, left to right. estimatorforachallengingvideo.

- **HR-CNN** was tested on three publicly available datasets against three published methods achieving state-of-the-art HR prediction.
- Challenging publicly available dataset ECG-Fitness with 60 second videos of subjects performing physical exercises was introduced.
- The proposed HR-CNN method yields significantly the best on the realistic ECG-Fitness dataset.

http://cmp.felk.cvut.cz/~spetlrad/ecg-fitness/