

Principles of Biosignals and Biomedical Imaging

Project

2024/25

Heart rate estimation through rPPG

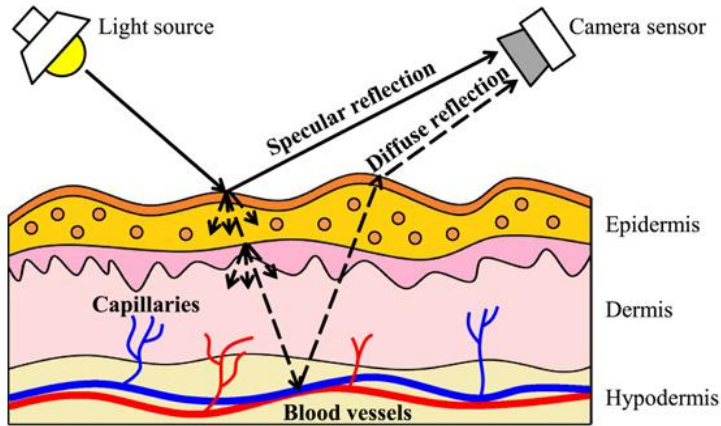


Fig. 1: Skin reflection model that contains both specular and diffuse reflections. Only the diffuse reflection contains pulsatile information.

- Defines a plane orthogonal to the skin (POS) tone in the temporally normalized RGB space for pulse extraction.
- Eliminates intensity variations (caused by lighting changes and motion).

rPPG : remote photoplethysmography

WANG, Wenjin, et al. Algorithmic principles of remote PPG. IEEE Transactions on Biomedical Engineering, 2016, 64.7: 1479-1491.

Methodology



Image Processing

- Selection and extraction of Region of Interest (ROI)



Paleckar/dlib-facetrack (for MATLAB)



Davisking/dlib (for Python)

Signal Processing

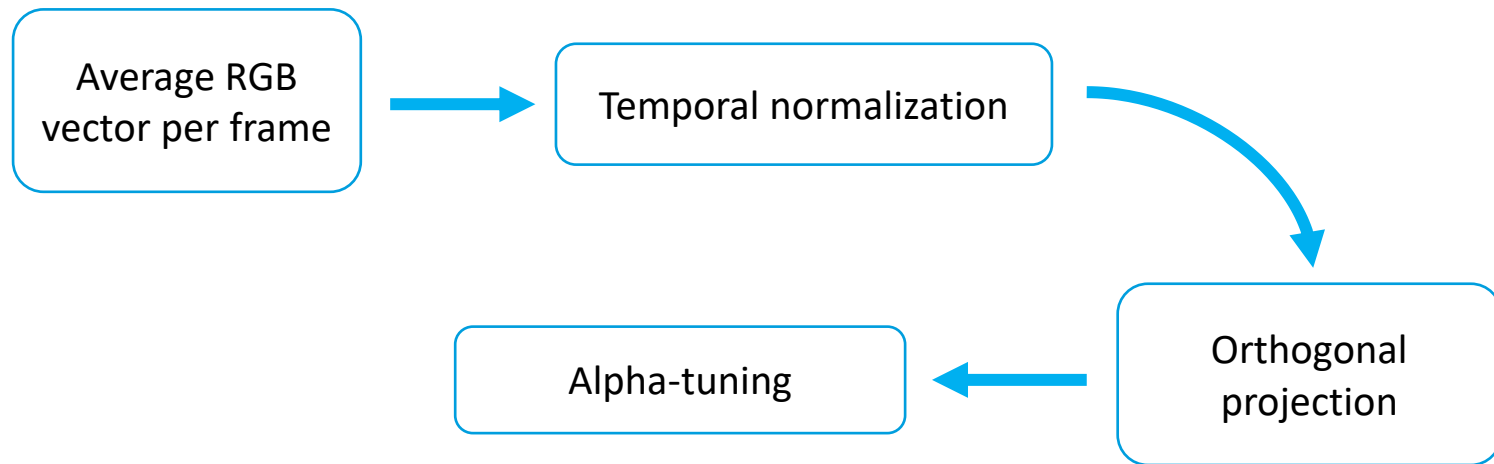
- RGB signal extraction
POS Method
- Pulse signal extraction
- Filtering
- Peak detection



Feature

Heart Rate estimation

Pulse signal extraction



HR estimation

Filtered pulse
signal $h(n)$



Detect every peak
in window w



$$HR_w = 60 / RR_w$$

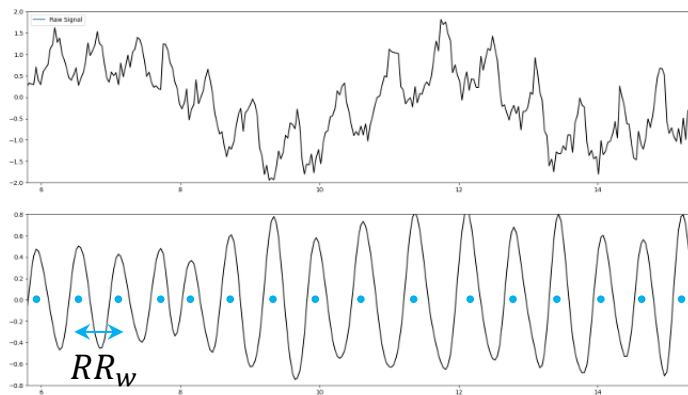


Fig. 4: Example of raw pulse signal extraction via POS method (upper method) and respective filtering (lower panel).

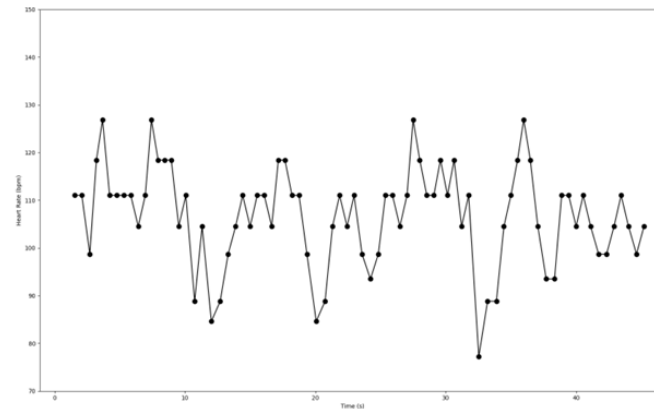


Fig. 6: Example of a RR signal in beats per minute over a time window of 40 seconds.

Deliverables

1

- 10-page report

2

- Project code

3

- Presentation (5 min.)

4



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