TrackBeat

Android app for detecting heart rate

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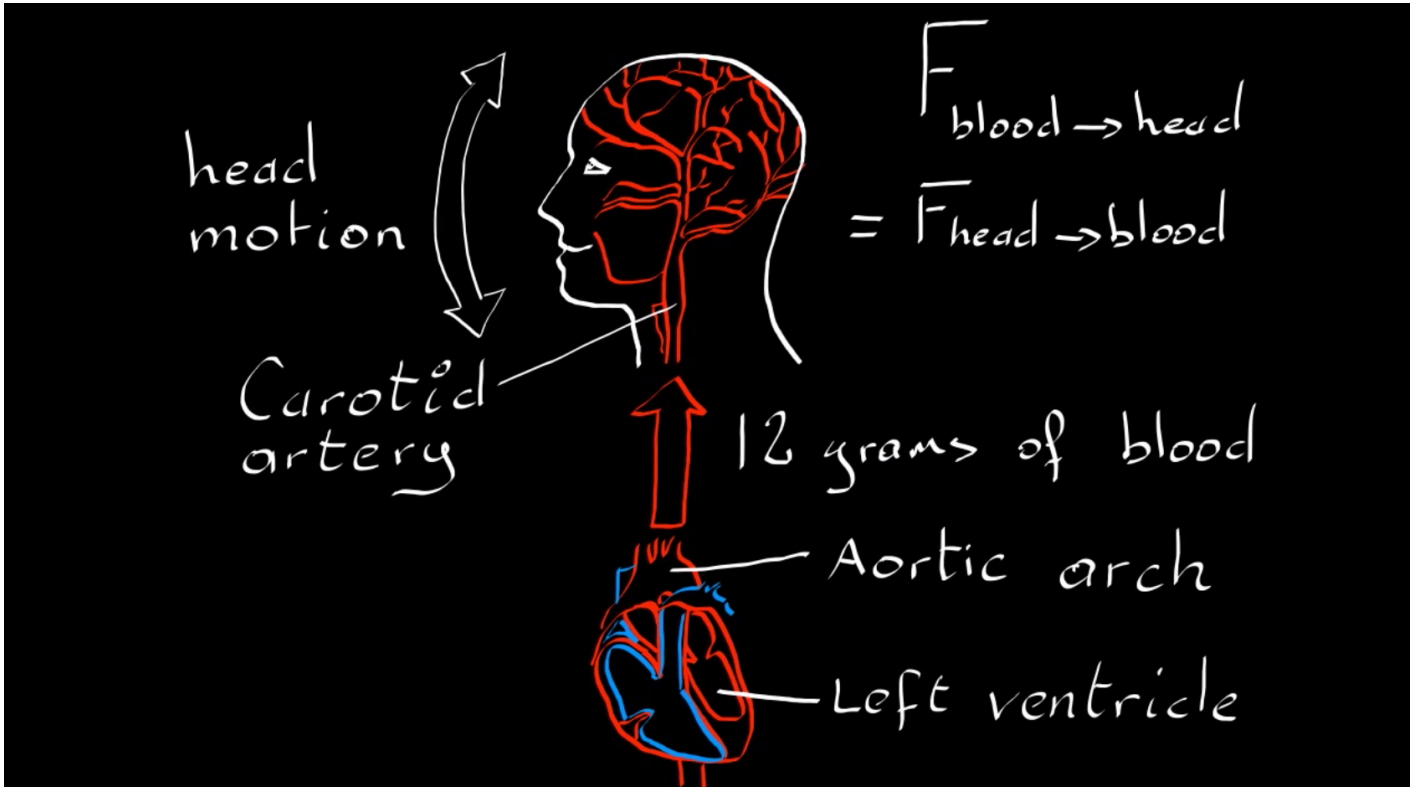
What is TrackBeat?

- Takes a video of the user's face
- Detects heart rate using the video
- Measure heart rate on the go. (frequently)
- Non-invasive procedure → fragile skin → infants, elderly

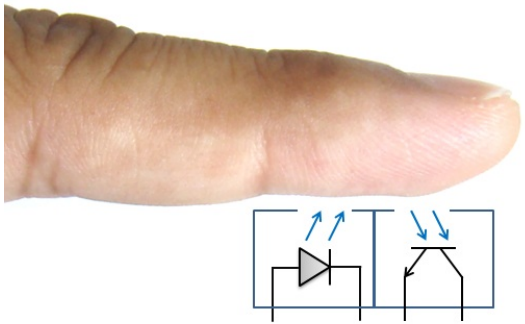
Background

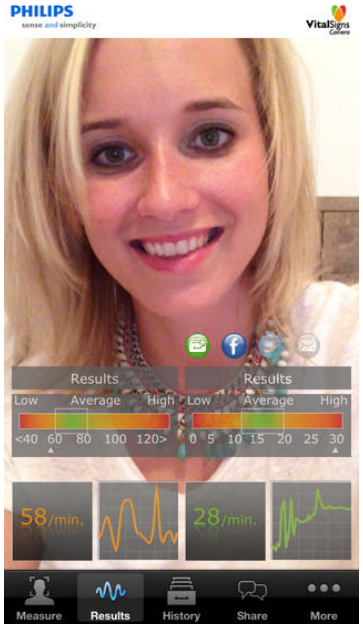

head motion
Carotid artery
$F_{blood \rightarrow head} = F_{head \rightarrow blood}$
12 grams of blood
Aortic arch
Left ventricle

Related Work

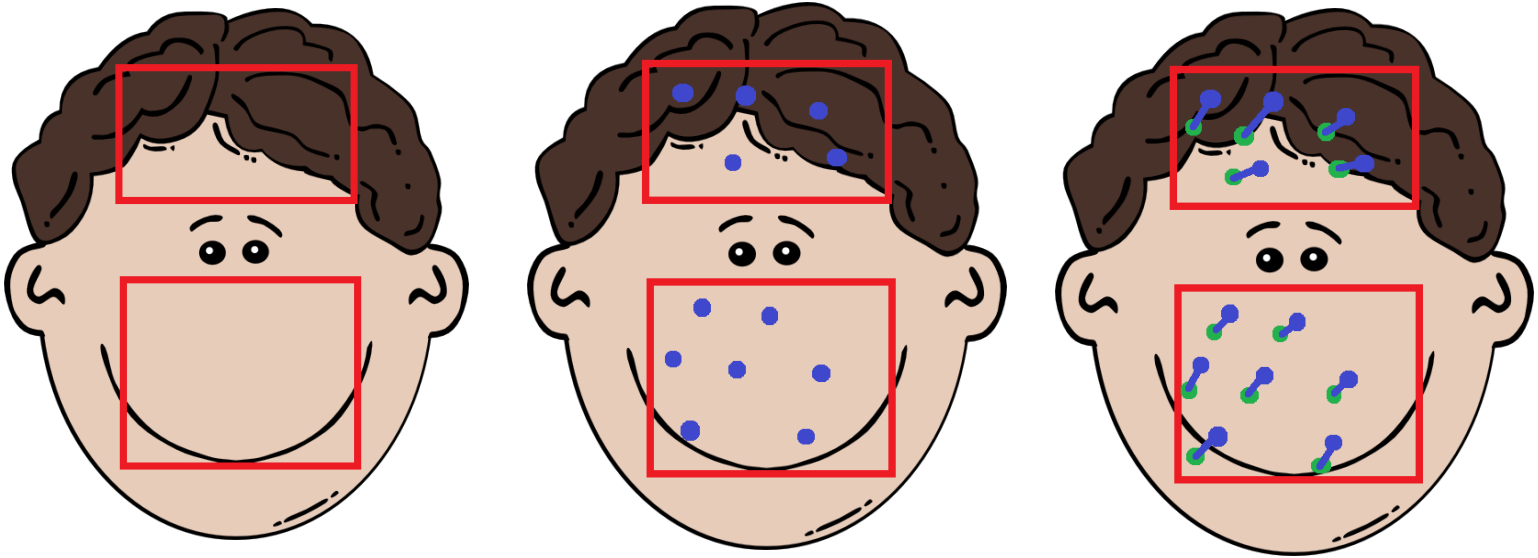
Detecting pulse rate from:

- Subtle changes in face color in a circulatory cycle (Phillips vital signs app)
- Photoplethysmography (PPG)
- Balistocardiogram (BCG)





How does it work?



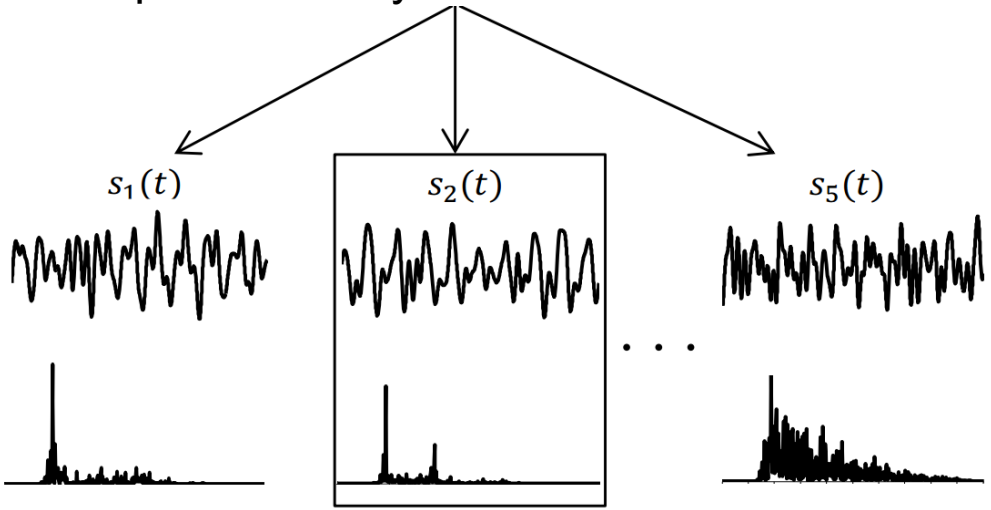
Detect face

Select features

Track features

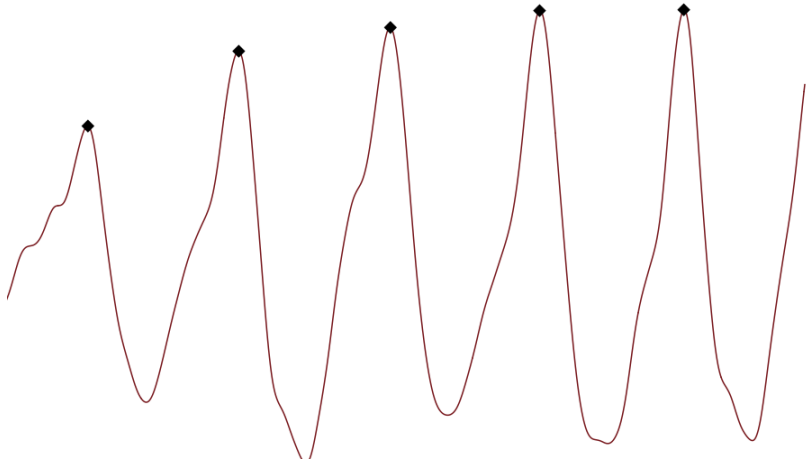
Filtering

- Only movement in “y-direction” or vertical direction is retained
- Need to filter out “unnecessary” movement
- Temporal Bandpass Filtering
- Principal Component Analysis

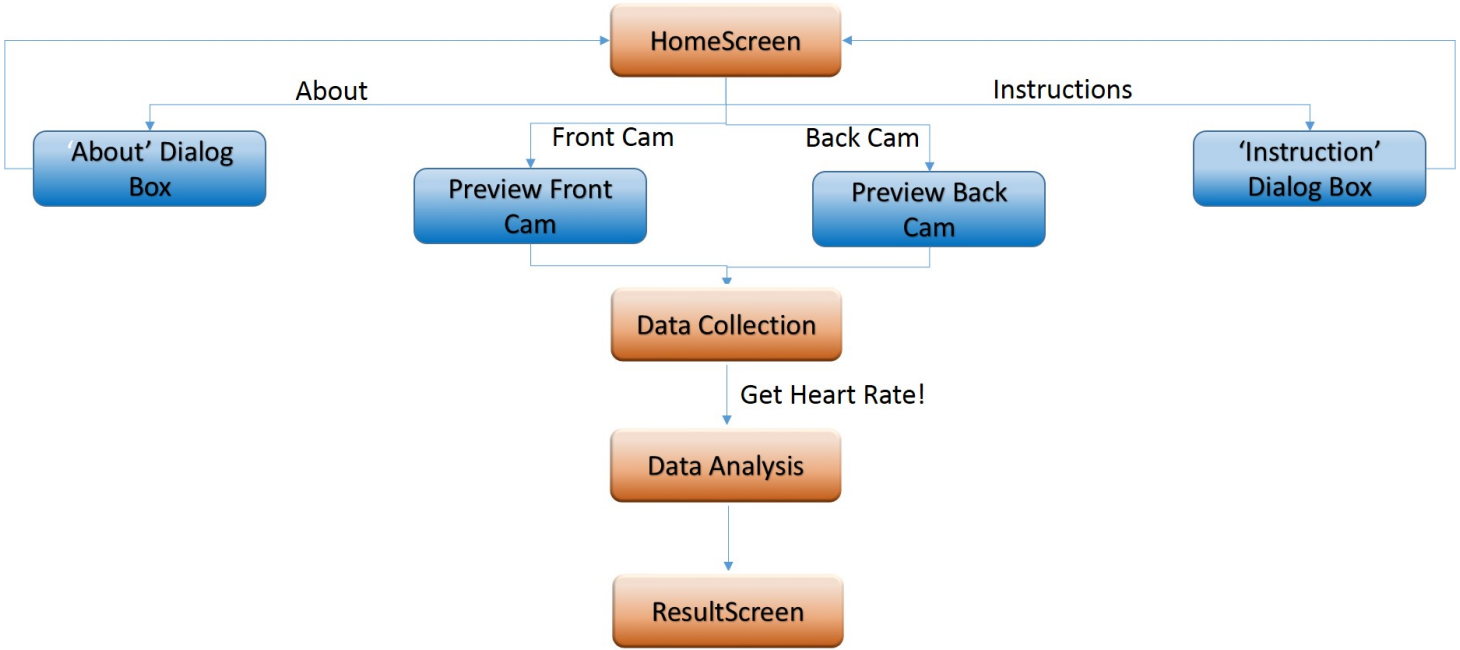


Signal Selection

- Select most periodic component
- Peak detection → Heart beat



App design


HomeScreen
About
Instructions
'About' Dialog Box
Front Cam
Back Cam
'Instruction' Dialog Box
Preview Front Cam
Preview Back Cam
Data Collection
Get Heart Rate!
Data Analysis
ResultScreen

Implementation Details

Libraries used:

- OpenCV 2.4.9 for android. (No NDK used)
- Effecient Java Matrix Library (EJML) v0.26
- JTransforms 3.0

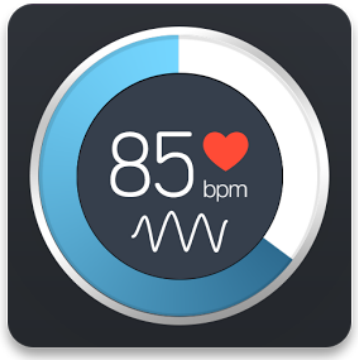
Device:

BLU Studio X, 8MP Back Camera, 2MP Front Camera, 1.3 GHz Quad Core Processor with 1GB RAM, 480*800 res. ,

~8 fps

Results

		ECG	PPG	TrackBeat
Samson	**T1**	47	49	54
	T2	107	95	65
	T3	55	56	58
Rohan	**T1**	63	61	71
	T2	118	83	86
	T3	86	82	91
Praveen	**T1**	73	69	76
	T2	96	90	90
	T3	82	97	88
Christol	**T1**	96	96	83



TrackBeat

Strengths/Weaknesses

Strengths:

- Non-invasive
- Portable/ Accessible
- Less sensitive to bad lighting conditions

Weaknesses:

- Sensitive to camera movement
- Less accurate for higher heart rates. Interference by high respiration rate?
- Requires subject to sit still

The Path Forward

- Make robust enough to commercialize
  - Dynamic Video Stabilization
  - Outlier Rejection within Tracking Points
  - More research on phases of the method:
    - Finding good features to track
    - Feasability of optical flow in Tracking

References

1. Balakrishnan, Guha, Fredo Durand, and John Guttag. "*Detecting pulse from head motions in video.*", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), IEEE, 2013.

2. D. He, "A continuous, wearable, and wireless heart monitor using head ballistocardiogram (bcg) and head electrocardiogram (ecg)", Conference Proceedings, IEEE Eng Med Biol Soc, 2011.

3. M. Poh et al. "Non-contact, automated cardiac pulse measurements using video imaging and blind source separation", Optics Express, 18(10): 10762–10774, 2010.


That's all Folks!