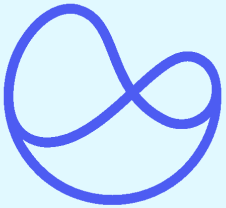

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Data-Driven Healthcare at current health

Annabel Kramer

Data Scientist

currenthealth.com

@current_health

snap40 is now current health!

Outline

- Introduce our device & platform
- Device data
- Challenges & considerations when working with health data
- Published paper: Recognising Cardiac Abnormalities in Wearable Device PPG Waveforms using Deep Learning

snap
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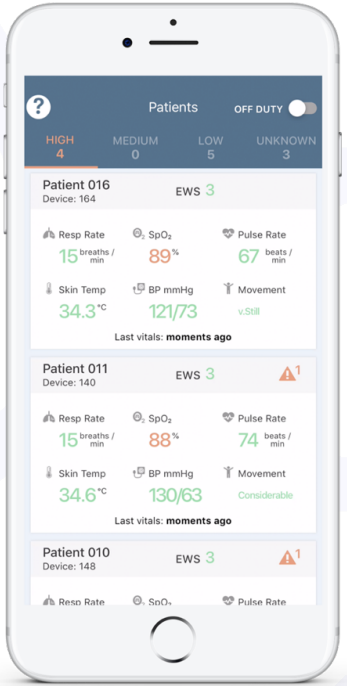
platform


Patients
OFF DUTY
HIGH 4
MEDIUM 0
LOW 5
UNKNOWN 3
Patient 016
Device: 164
EWS 3
Resp Rate 15 breaths / min
SpO2 89%
Pulse Rate 67 beats / min
Skin Temp 34.3 °C
BP mmHg 121/73
Movement v.Still
Last vitals: moments ago
Patient 011
Device: 140
EWS 3
Resp Rate 15 breaths / min
SpO2 88%
Pulse Rate 74 beats / min
Skin Temp 34.6 °C
BP mmHg 130/63
Movement Considerable
Last vitals: moments ago
Patient 010
Device: 148
EWS 3

Temperature

- Skin & ambient temperature sensors
- Detecting hypo-/hyperthermia

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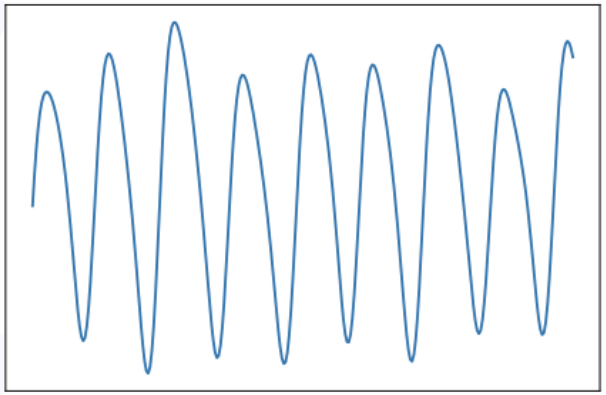
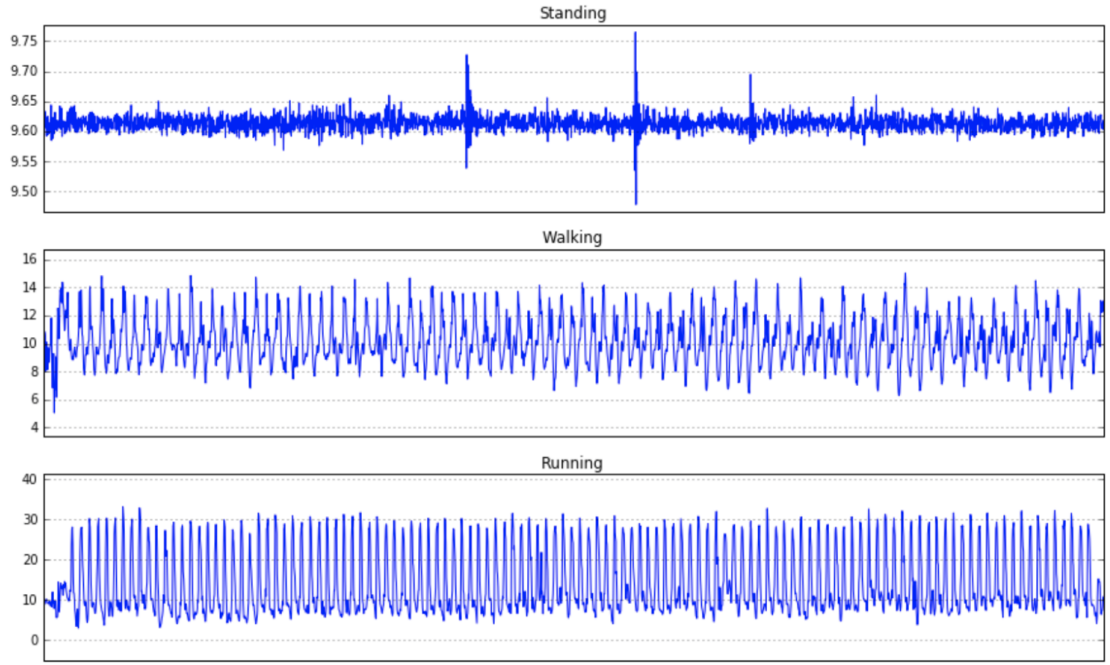




https://github.com/nlathia/pydata_2016/blob/master/Talk/Presentation.pdf

- Triaxial accelerometer and gyroscope
- Useful for contextualising patient vital signs + behaviour
- Many more applications:
  - Fall detection
  - Consciousness/sleep
  - Shiver/cough detection

Respiration Rate
+/- 1 rpm

Pulse Rate
+/- 3bpm

Oxygen Saturation
+/- 2%

Temperature
+/- 0.1°C

Movement and Posture

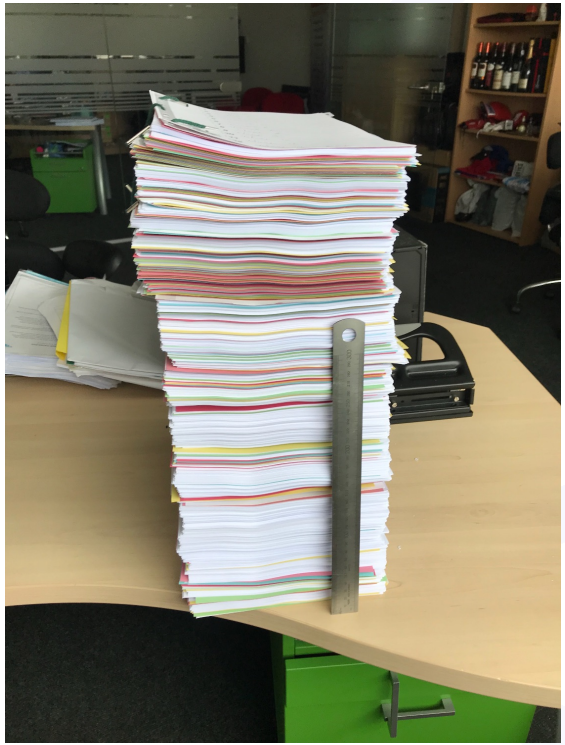
What's the heart rate of a banana?

https://www.macobserver.com/news/check-banana-heart-rate-apple-watch/

Considerations & Challenges

- Provide accurate, meaningful information
  - Reduce alarm fatigue: less false positives
  - Actionable information
- Confounding events
  - What else could have affected what I'm looking at?
- Validation
  - Medical gold standard
  - Population bias & test set distribution
  - Regulatory requirements

Validation: FDA

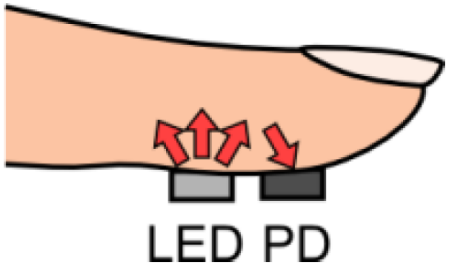


Recognising Cardiac Abnormalities in Wearable Device PPG with Deep Learning

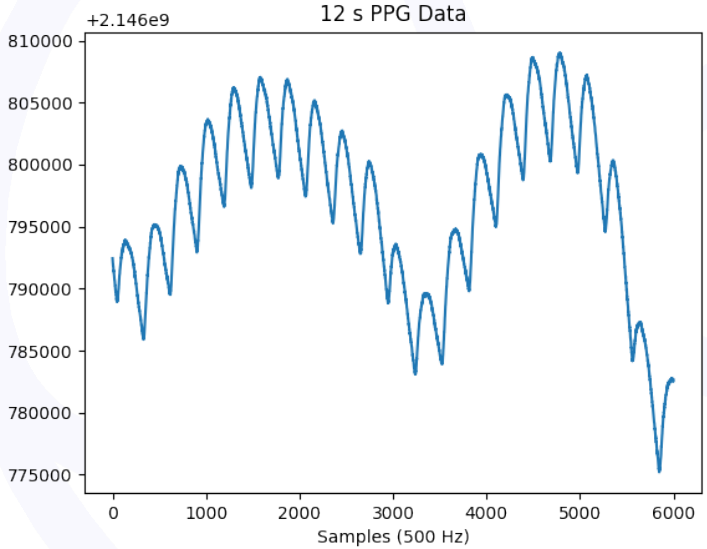
Identify whether a PPG waveform contains any cardiac abnormalities

https://arxiv.org/pdf/1807.04077.pdf

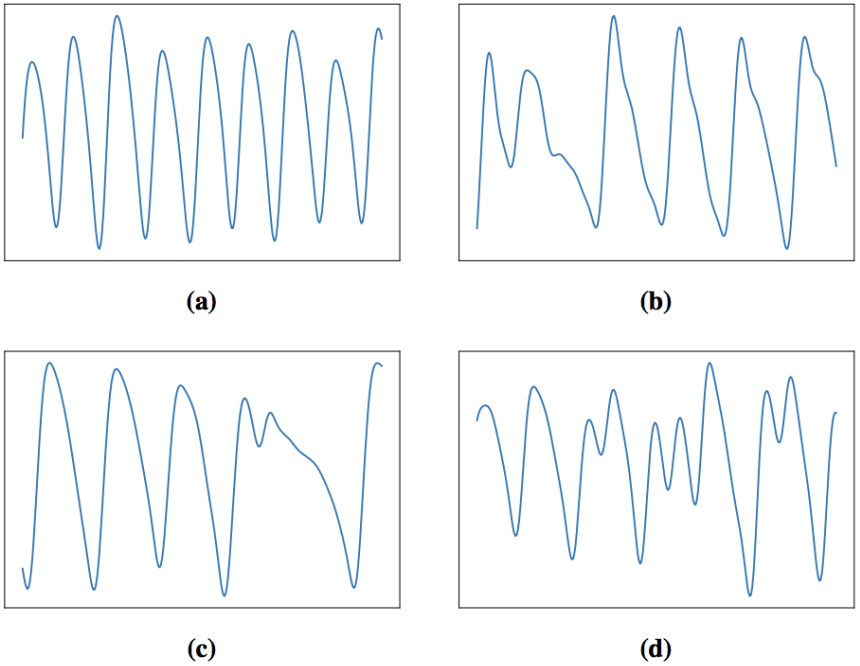
PPG Data



https://www.mdpi.com/2079-9292/3/2/282/htm



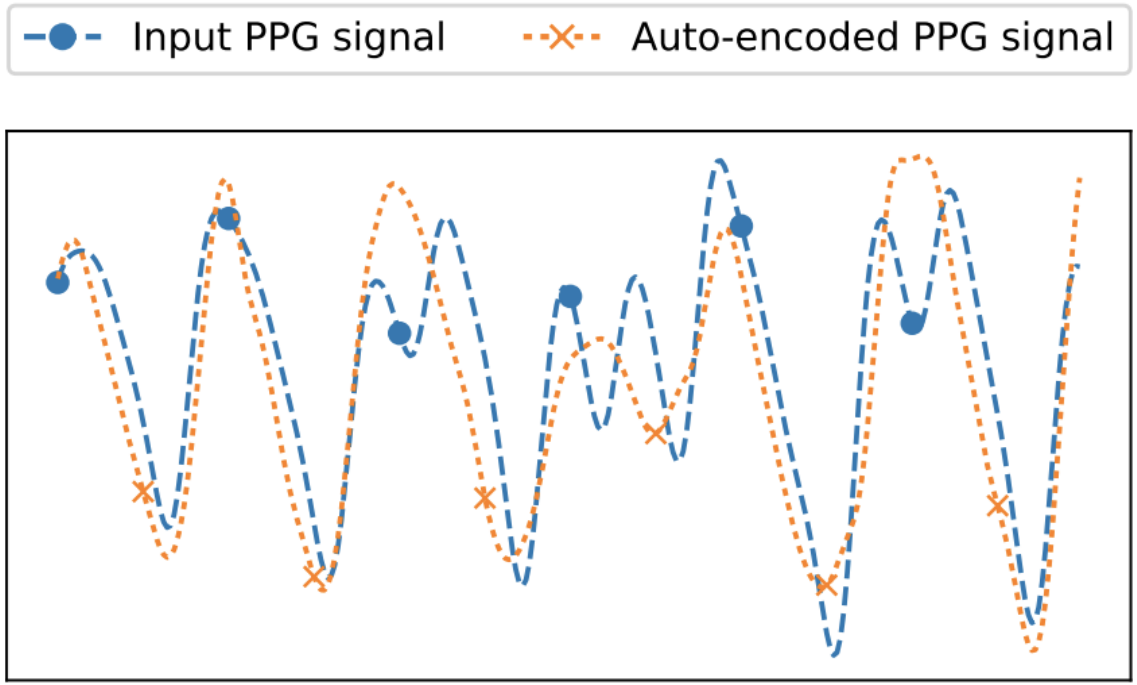
PPG Data

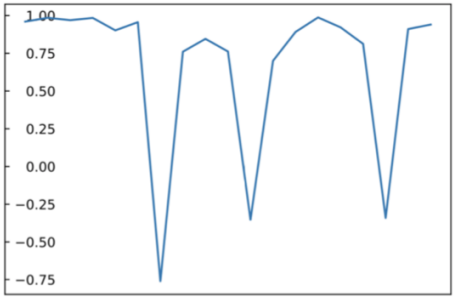


(a) shows a normal PPG waveform, (b)-(d) contain abnormalities

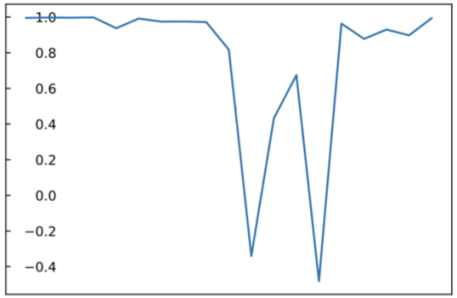
Method

- Train an LSTM autoencoder to reconstruct PPG waveforms
- Measure agreement between original and reconstructed waveform
- Low agreement → abnormality
- Evaluate approach on cross-section of hospital and at-home patients

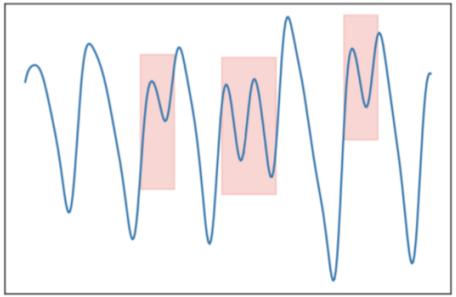

Input PPG signal
Auto-encoded PPG signal



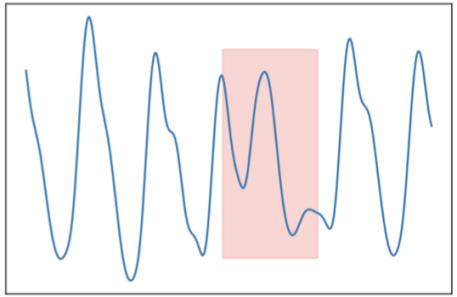
(a)



(b)

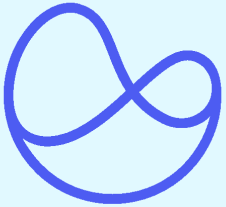


(c)



(d)

- 60% true positives (anomaly detected in PPG, and anomaly present in ECG)
- 23% false positives (anomaly detected in PPG but *not* present in ECG)
- Promising results
- Can we cluster together similar anomalies?



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Thank you!

Questions?

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New website to launch soon!

currenthealth.com

@current_health