An introduction to the ‘Respiratory rate algorithms for wearables’ project

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(views my own)

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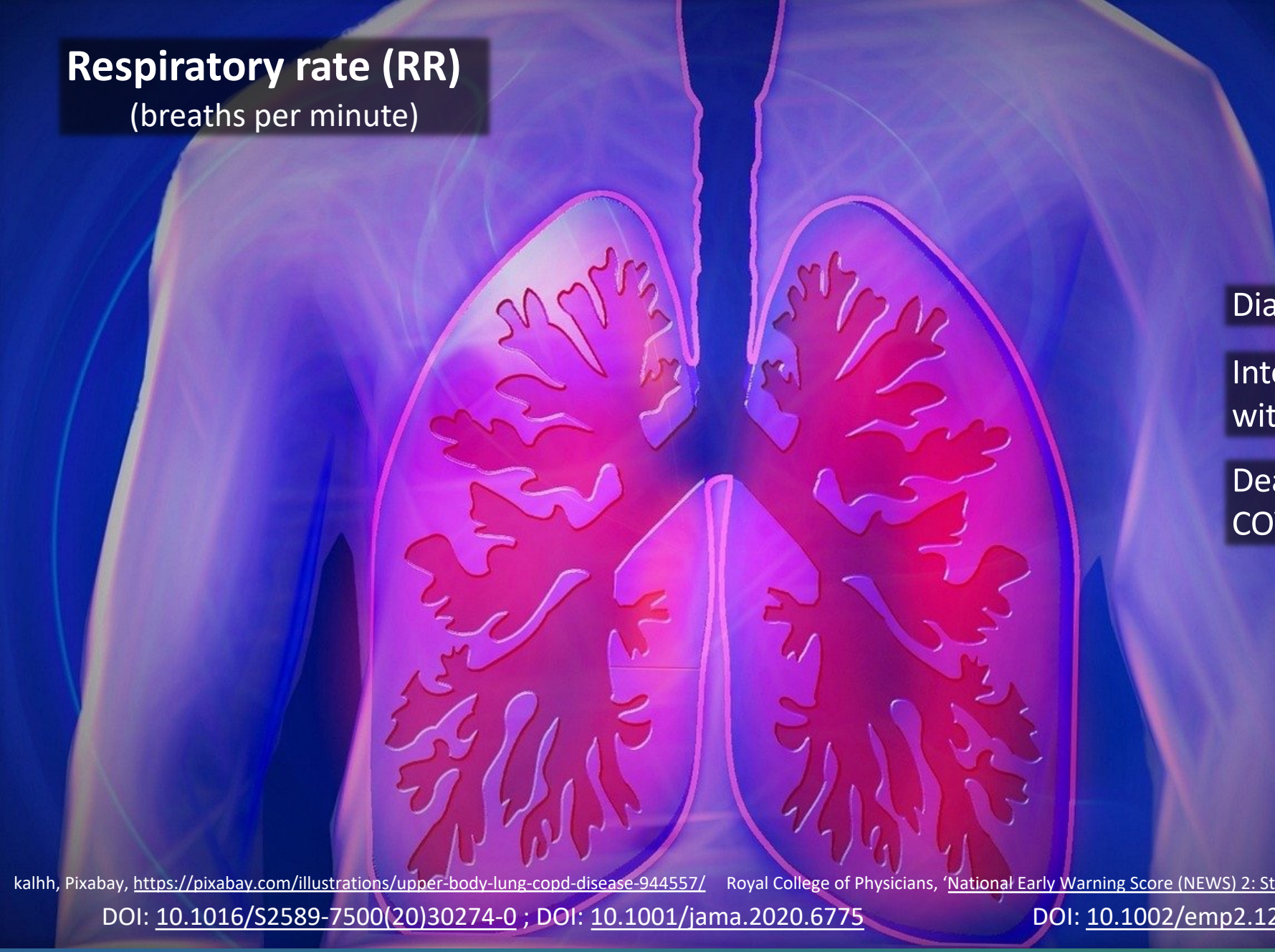
Respiratory rate (RR)

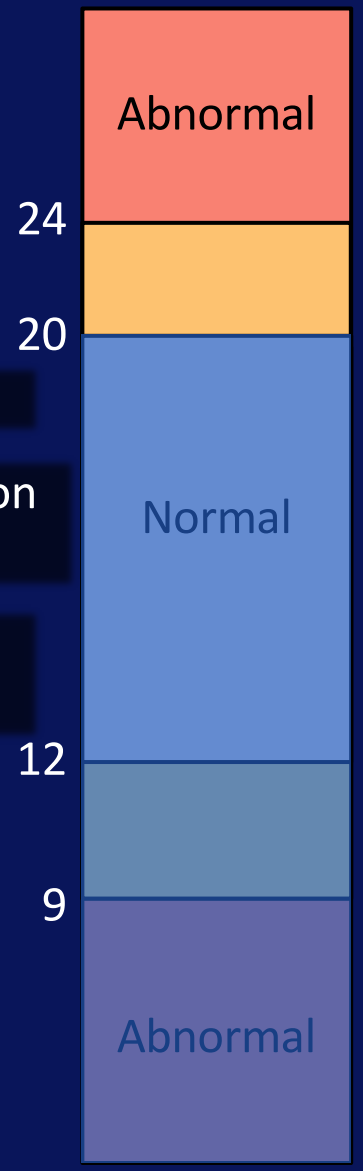
(breaths per minute)



Elevated RR

associated with:

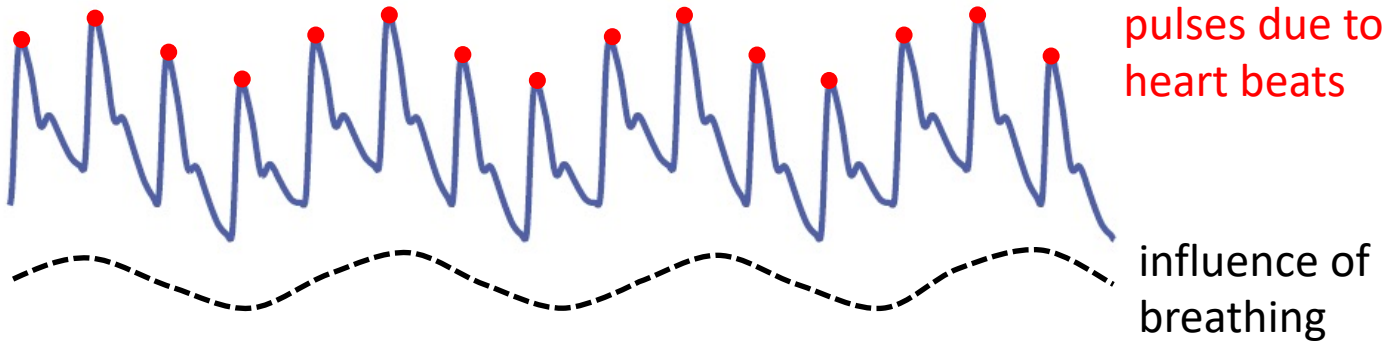
- Diagnosis of COVID-19
- Intensive care admission with COVID-19
- Death in hospital with COVID-19



kalhh, Pixabay, https://pixabay.com/illustrations/upper-body-lung-copd-disease-944557/ Royal College of Physicians, 'National Early Warning Score (NEWS) 2: Standardising the assessment of acute-illness severity in the NHS', 2017

DOI: 10.1016/S2589-7500(20)30274-0 ; DOI: 10.1001/jama.2020.6775 DOI: 10.1002/emp2.12350 DOI: 10.1017/ice.2020.461

Optical signal (photoplethysmogram, PPG):

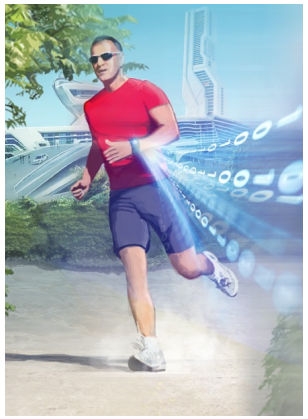


Peter Charlton, Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Max_Health_Band.jpg (CC BY 4.0)

Aim: To verify algorithms to monitor respiratory rate from the photoplethysmogram in daily life

Toolbox of Algorithms

Assess in Daily Life



Create Recommended Algorithm

OpenClipart-Vectors, Pixabay, https://pixabay.com/vectors/toolbox-green-box-grey-closed-575405/

Brother UK, https://www.flickr.com/photos/brother-uk/31501281284/in/photostream/ (CC BY 2.0)

Shafin Al Asad Protic, Pixabay, https://pixabay.com/vectors/code-programming-html-software-6127616/

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Toolbox of Algorithms

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Updating our toolbox of algorithms

http://peterhcharlton.github.io/RRest

Matlab Toolbox

> 2,000 downloads

Last updated 2017

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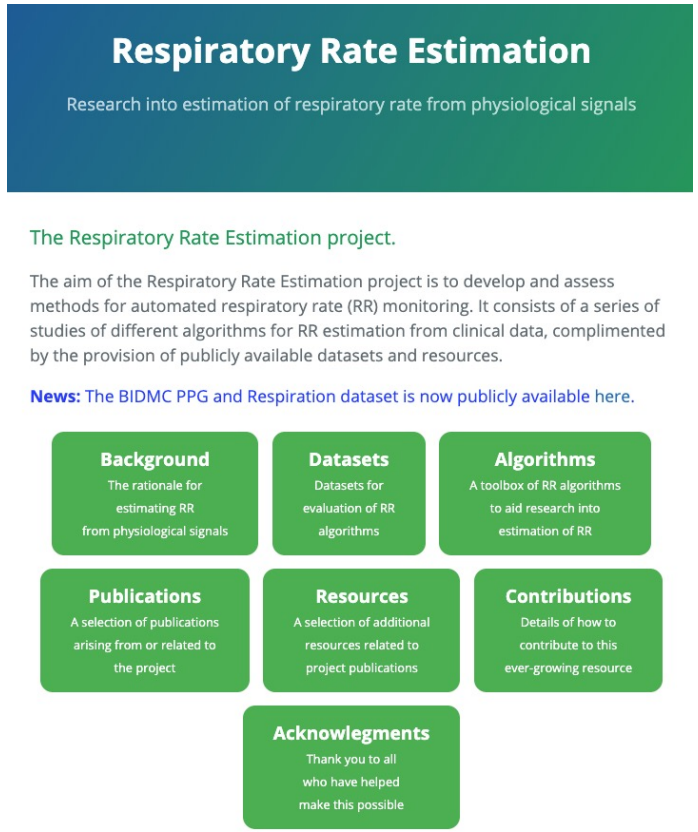
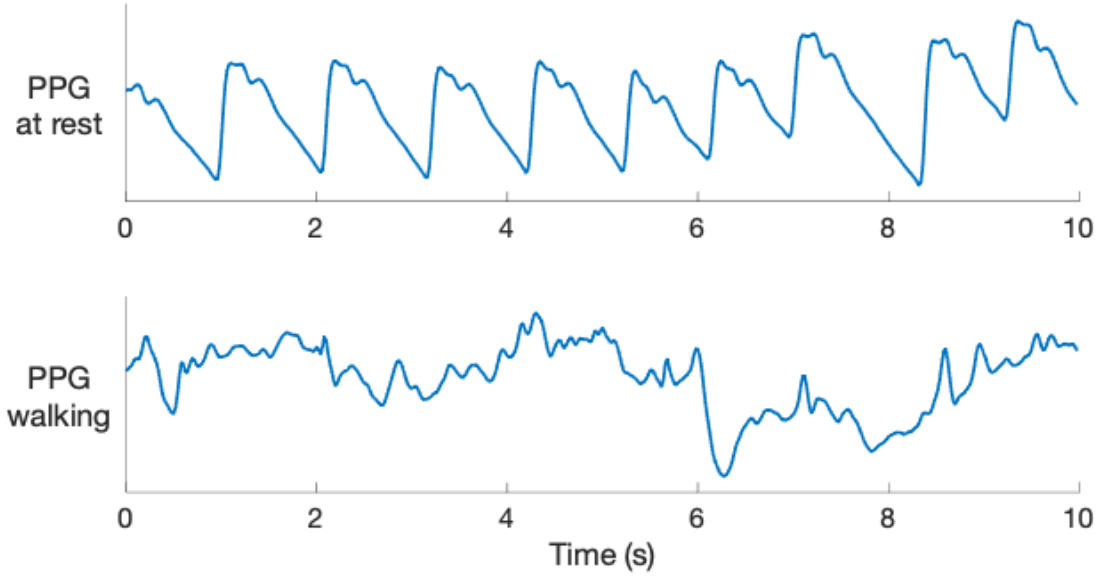
Updating our toolbox of algorithms





Update to incorporate novel approaches proposed in the literature to handle noise.

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Matlab Toolbox

> 2,000 downloads

Last major update 2017

Output 1: Updated Matlab toolbox of algorithms

Peter Charlton, Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Photoplethysmogram_signals_at_rest_and_during_exercise.svg (CC BY 4.0)

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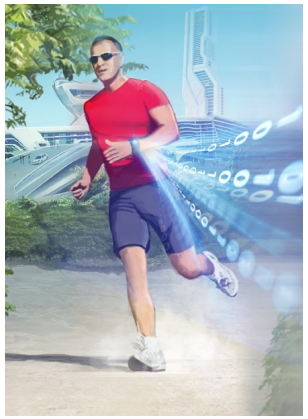
Toolbox of Algorithms

Assess in Daily Life



Create Recommended Algorithm

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Assessing performance in daily life

- 2 publicly available datasets
  - Wearable optical signal (PPG)
  - Reference respiratory signal
- Several activities including:
  - at rest
  - working
  - stair climbing
  - walking

Output 2: Article reporting performance

https://doi.org/10.5281/zenodo.4758898

Toolbox of Algorithms

Assess in Daily Life

Create Recommended Algorithm

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Create recommended algorithm

- Translate from MATLAB code to appropriate language for devices (*e.g.* C)
- Verify performance against MATLAB implementation
- Disseminate code on toolbox website

Output 3: Dissemination of C code for the best-performing algorithm

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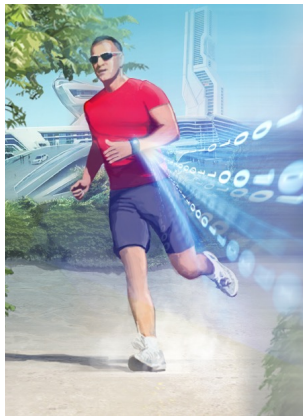
Monitoring respiratory rate in daily life

Toolbox of Algorithms

Assess in Daily Life



Create Recommended Algorithm

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