Effects in Accuracy and Computation Cost of Design Parameters of Remote Photopletysmography System

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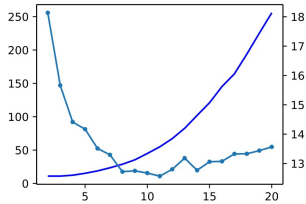
Remote photoplethysmography (RPPG) is a technique in which we measure sub-cutaneous variations in blood flow, usually through a camera, to obtain physiological signals. Studies involving RPPG have increased in the past few years due to its numerous applications including remote healthcare, anti-spoofing, among others.

While there have been many studies on how to increase RPPG's accuracy of biomarkers predictions in a variety of settings, most of them are usually done using workstation computers, yet some of the most promising applications of RPPG probably would be on limited resources, low-power embedded systems.



Time in s (left axis) and RMSE (right), in terms of SW size, for POS algorithm

Therefore, we did an extensive study on the effects of one of the most important design parameters in RPPG systems, sliding window (SW) size, for a variety of algorithms, in order to quantify the trade-off between computational cost in time and accuracy in root-mean-squared-error (RMSE), using a standarized, public database. We also studied how different face detection and region-of-interest selection affected these results.

RMSE for different SW sizes (in s)

Algorithm	3	8	13	18
G [Verkruysse, 2008]	16.5	13.8	12.8	13.3
PCA [Lewandoska, 2011]	16.4	14.3	14.1	14.7
CHROM [de Haan, 2013]	37.6	37.2	29.1	30.2
POS [Wang, 2017]	15.7	12.7	13.2	13.3

Finally, based on these, we came up with a new and simple metric that takes into account both computation and accuracy, as a means to design dynamic systems which make the best out of the available resources. We coined this metric as $RMSE_{lt} = RMSE + \alpha log(t)$, a modification of RMSE which adds a weighted term for the log of the computation time. With correct tuning, we can choose α to reduce computational costs by 47%. In the future, a system could automatically choose and corresponding optimal SW size so as to obtain the best trade-off between computational cost and accuracy.