COVID-19 detection and stratification from photoplethysmographic (PPG) analysis

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Argomento: COVID-19

Objective: Coronavirus disease 2019 (COVID-19) targets several tissues of the human body; among those, a serious impact has been observed in the microvascular system. The aim of this study was to verify if photoplethysmographic (PPG) signal can study the microcirculation and if it can detect the presence of modifications in the signals in patients affected by COVID-19 at different levels of severity. with COVID-19 of different severity, classified in relation to the types of ventilatory supports they need, (46: grade 1; 47 grade 2) and in 50 healthy control subjects. A pre-processing step removes the long-term trend and segments of each pulsation in the input signal. Each pulse is approximated with a model generated from a multi-exponential curve, and a Least Squares fitting algorithm determines the optimal model parameters. Using the parameters of the mathematical model, three different classifiers (Bayesian, SVM and KNN) were trained and tested to discriminate among healthy controls and patients with COVID, stratified according to the severity of the disease. Results are validated with the leave-one-subject-out validation method. Main results: Results indicate that the fitting procedure obtains a very high determination coefficient (above 99% in both controls and pathological subjects). The proposed Bayesian classifier obtains promising results, given the size of the dataset, and variable depending on the classification strategy. The optimal classification strategy corresponds to 79% of accuracy, with 90% of specificity and 67% of sensibility. Significance: The proposed approach confirms that photoplethysmographic can study microcirculation. This can be applied to open the possibility of introducing a lowcost and non-invasive screening procedure for the fast detection of COVID- 19 disease, as well as a promising monitoring tool for hospitalized patients, with the purpose of stratifying the severity of the disease.