

Preliminary results of an exploratory, observational cohort study on smartphone-enabled cough detection in patients with COVID-19

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Introduction

COVID-19 mainly manifests as a respiratory disease, and cough is a major symptom. Age and certain comorbidities are recognized risk factors for severe disease and hospitalization. Mobile technology could help to more precisely predict the course of disease. We set out to detect cough frequencies in hospitalized patients with COVID-19- and non-COVID-19-pneumonia and correlate these data to a variety of clinical parameters.

Methods

Smartphone-enabled detection of coughs technically based on a convolutional neural network-based model was used in 33 patients with COVID-19-pneumonia and 12 patients with non-COVID-19-pneumonia in a non-ICU setting. Clinical data were extracted from medical records and correlated to cough frequencies.

Results

The technology reliably detected coughing events in all COVID-19- and non-COVID-19-patients over extended periods of time (**Figure 1**). Hourly cough counts decreased with hospitalization length (**Figure 2**). In contrast to non-COVID-19, significant positive correlations between cough counts and CRP, body temperature, FiO₂ and breathing rate were found in COVID-19-pneumonia. In contrast, no correlation with markers of clotting or tissue damage was found (**Table 1**).

Figure 1 – case numbers and descriptive statistics

- Patients: 44
 - Deaths: 1 (COCO015)
 - ICU Admission: 1 (COCO045)
 - COCO004: excluded due to background noise



- Counted Coughs: 120'012 coughs

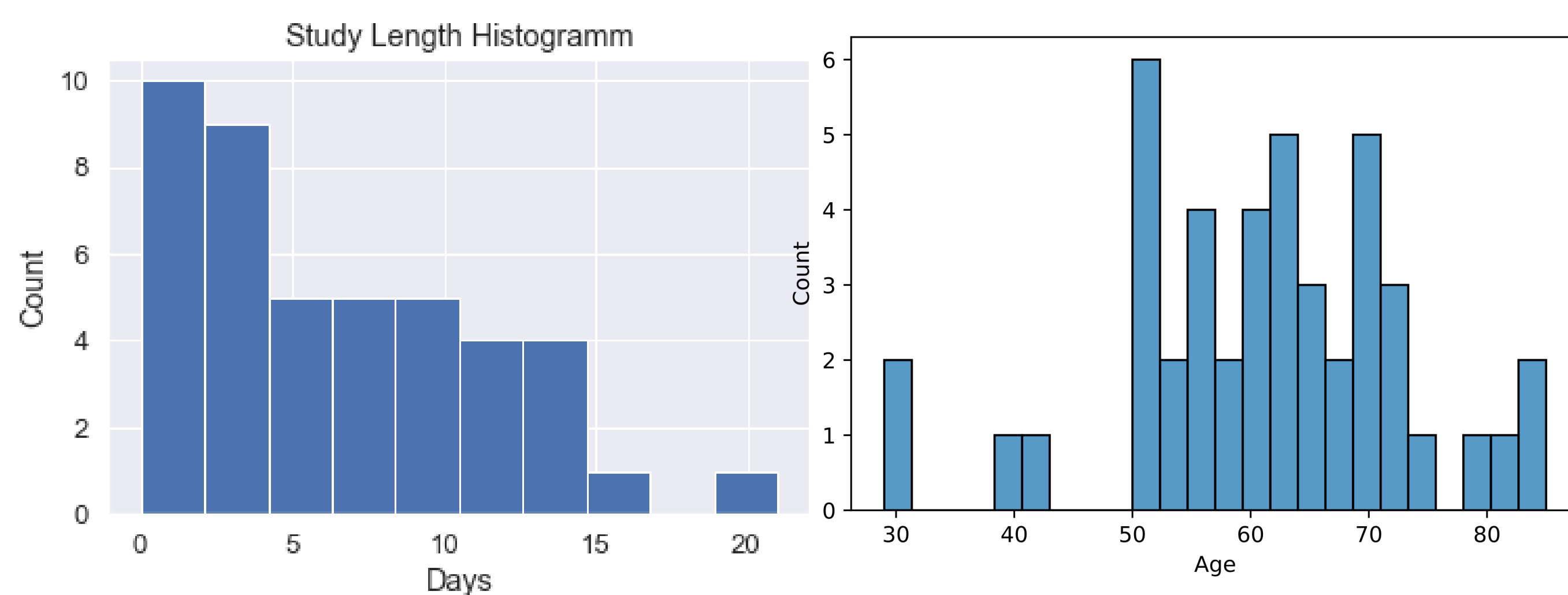


Figure 2 – cough counts decrease with the length of hospital stay both in COVID-19- and non-COVID-19-pneumonia

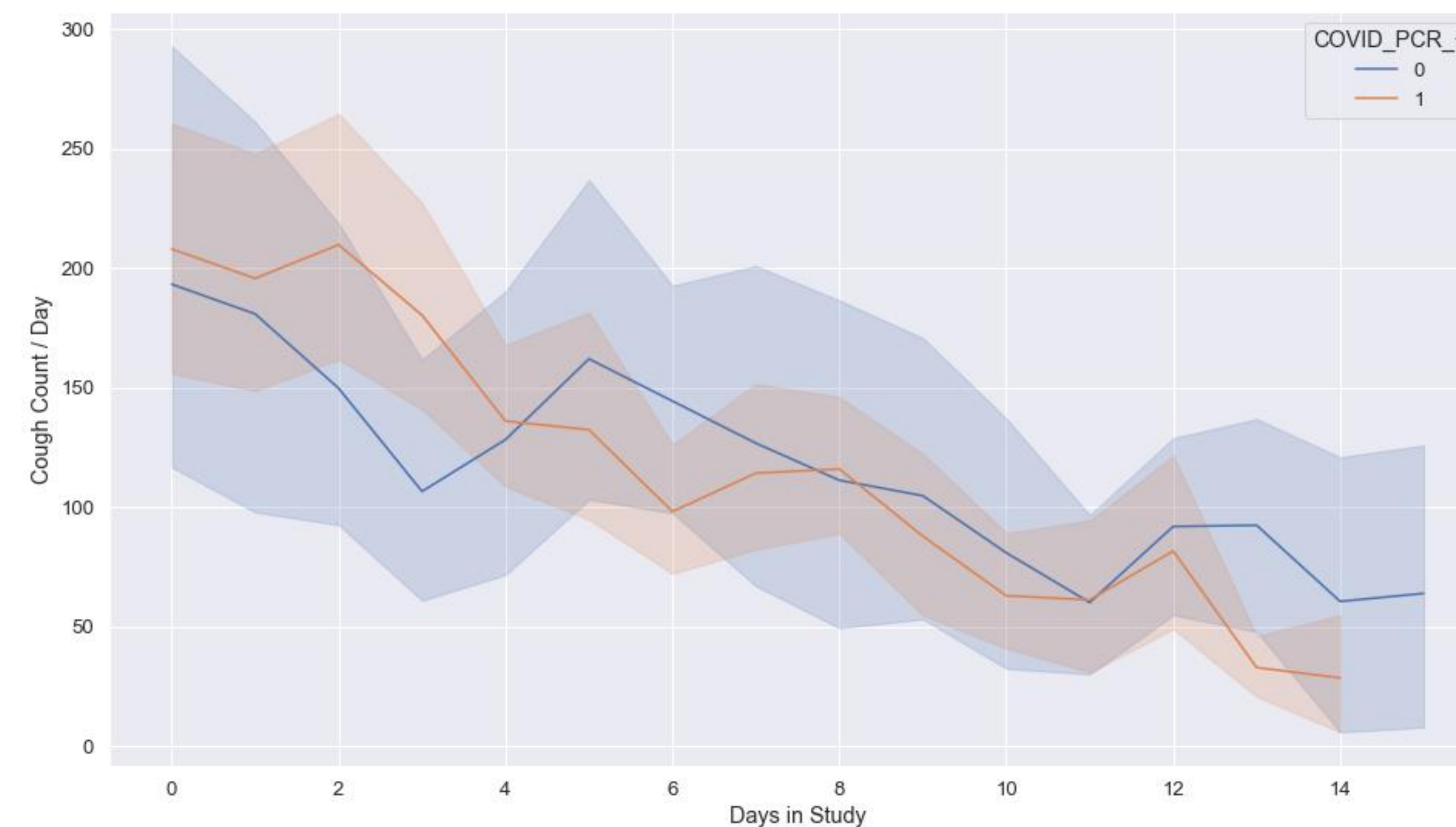


Table 1 – clinical correlates of cough counts in COVID-19

Clinical parameter	Correlation coefficient	Significance level
CRP	0.32	p<0.05
Body temperature	0.21	p<0.01
FiO ₂	0.33	p<0.001
Breathing rate	0.23	p<0.05
D-Dimer	-0.003	n.s.
LDH	0.14	n.s.

Conclusion

Smartphone-enabled quantification of cough is feasible in hospitalized patients with COVID-19- and non-COVID-19-pneumonia. Although cough frequencies varied greatly between individuals, significant associations of cough counts with surrogate markers of COVID-19 disease activity were found. The smartphone-based detection of coughing rates could assist in monitoring and predicting the course of disease.