

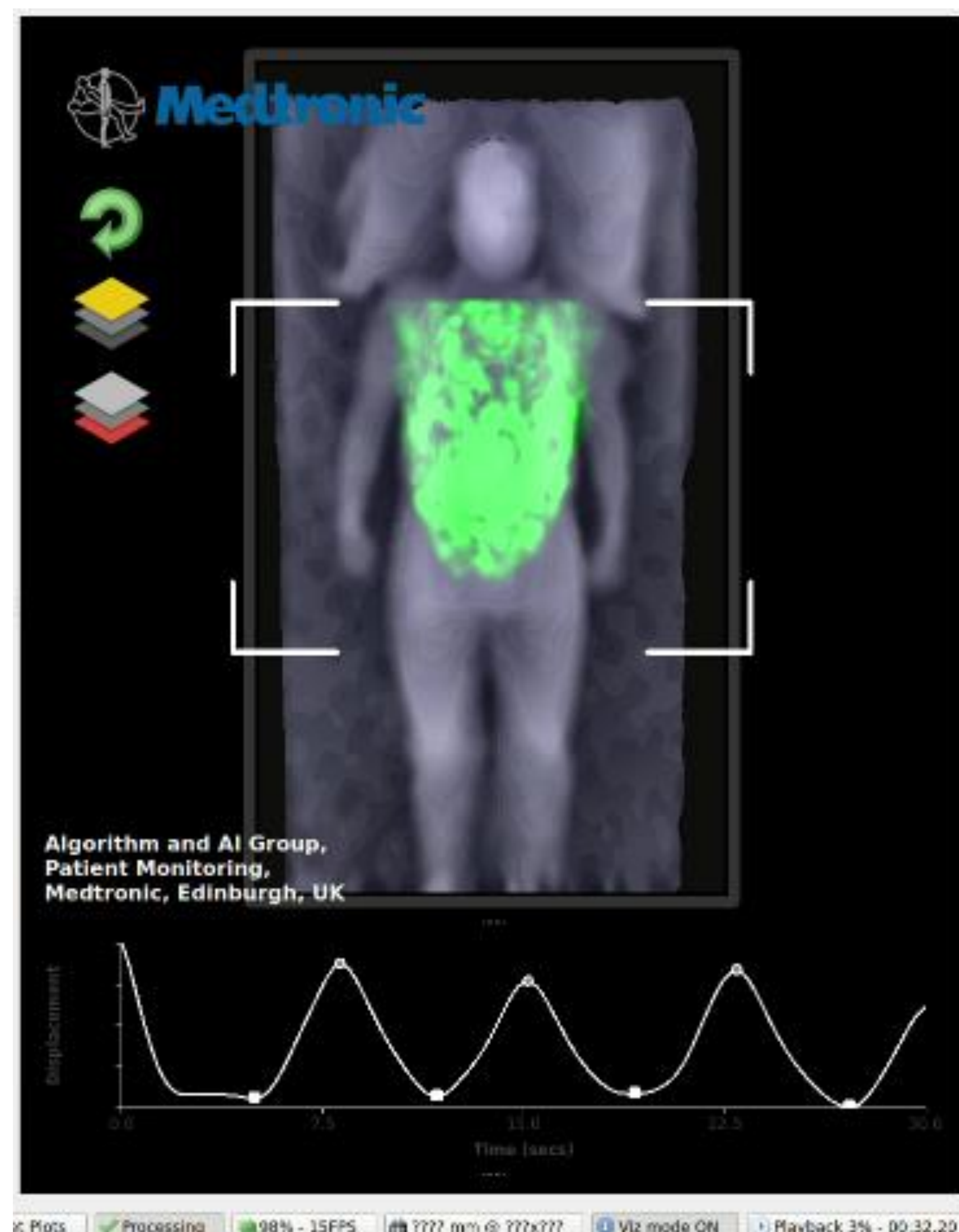
THE DEVELOPMENT OF NON-CONTACT 'TOUCHLESS' MONITORING OF RESPIRATORY RATE

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INTRODUCTION

The measurement of respiratory physiological parameters is ubiquitous in the hospital setting. Of these, respiratory rate (RR) is the most prevalent and often forms an essential component of many early warning clinical scoring systems [1]. Changes in RR are often one of the earliest and more important indicators that precedes major complications such as respiratory tract infections, respiratory depression associated with opioid consumption, anesthesia and/or sedation, as well as respiratory failure [2–4].

Here, we report on the performance of a depth-sensing camera system [5] for the continuous non-contact 'touchless' monitoring of Respiratory Rate (RR).



METHODS

Six healthy subjects undertook a range of breathing rates from 4 to 40 BrPM. These were set rates of 4, 5, 6, 8, 10, 15, 20, 25, 30, 35 and 40 BrPM. In total, 265 separate rates were captured across a range of conditions including posture (prone, supine, lateral), position (center and edge of bed) and coverings (no sheets, sheets, duvet). An Intel D415 depth camera was used to acquire depth information from a field of view centered on the subject torso. This data was processed to extract the localized depth-changes within the torso region of the subject corresponding to respiratory activity. This was further processed to produce a respiratory rate RR_{depth} output once-per-second from the device. RR_{depth} was compared to a capnograph reference, RR_{capno} .

RESULTS

Figure 1 contains a bubble plot of RR_{depth} versus RR_{capno} for all subjects and tests. An RMSD of 1.74 BrPM (mean bias of -0.13 BrPM) was achieved across the target RR range of 4-40 BrPM.

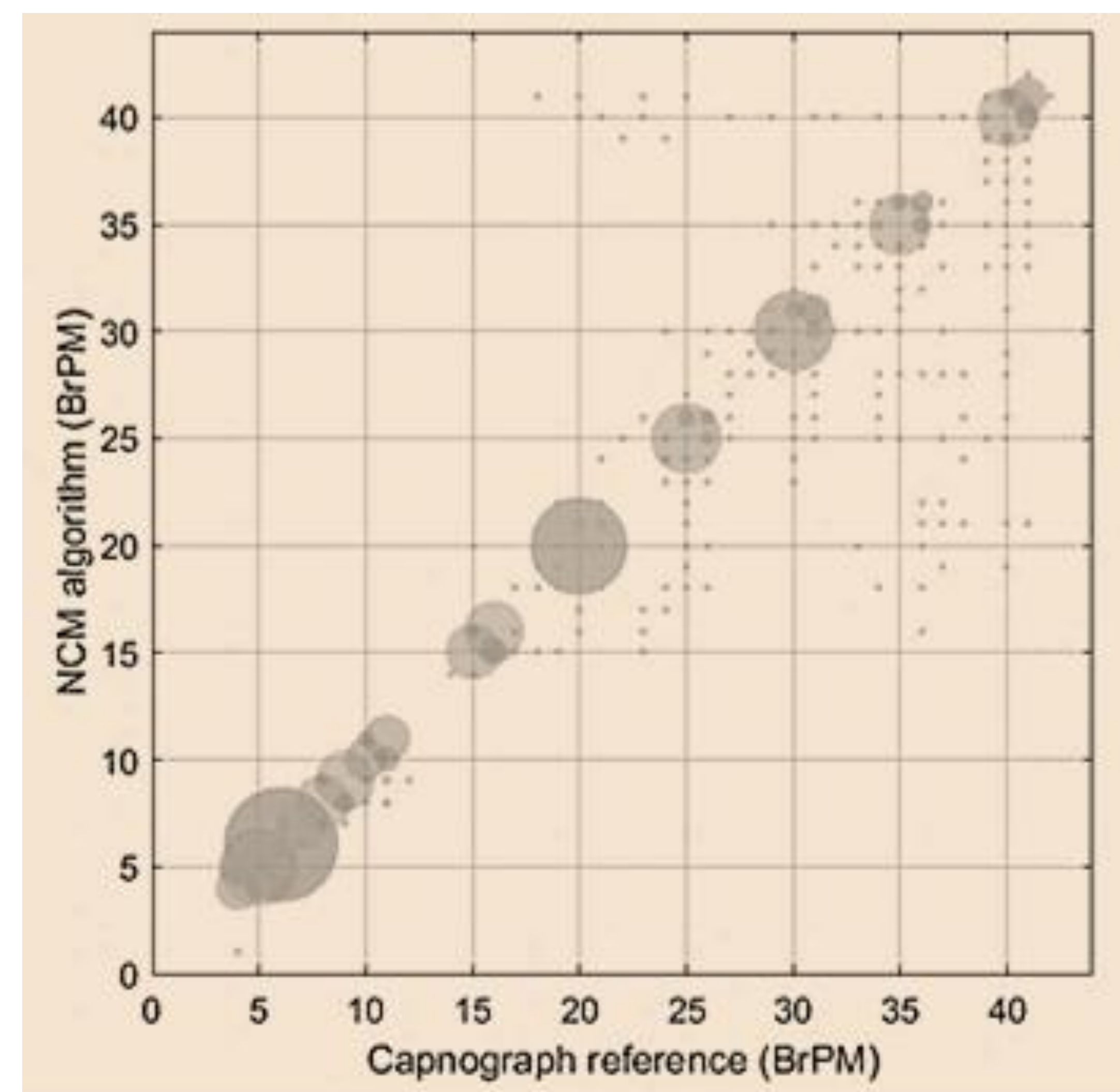


Figure 1: Bubble plot of RR_{depth} vs RR_{capno} . Bubble size is proportional to the number of cases.

CONCLUSIONS

These early-stage results are encouraging and exhibit similar accuracies to earlier studies we have conducted [6,7]. However, the current results extend over a much wider range than those previous studies. We believe that "non-contact", or "touchless", monitoring has great potential for the future. We continue to iterate on our algorithm to improve its performance and robustness.

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