A Smartphone Kit for Point-Of-Care Pulmonary Diagnosis

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Clinical Need
• Pulmonary diseases account for more than 14% of deaths worldwide [1]
• These diseases are also the single largest cause of lost disability adjusted life years [2]
• In many parts of the world, diagnosis is inaccurate because physicians have limited training in pulmonary diseases or diagnosis is made by nurses and health workers
• The machines required to improve diagnosis are expensive (> $50,000) and require trained technicians

Proposed Solution
Use a suite of low-cost, lightweight sensors to capture patient information. Combine this information using signal processing and machine learning implemented on a smartphone to provide diagnostic guidance to a physician or health worker at the point of care

Sensors:
• Electronic stethoscope – Record and automatically identify abnormal lung sounds
• Augmented Reality Peak Flow Meter (AR PFM) – Measure patient lung volumes digitally using a preexisting analog device
• Electronic patient questionnaire – Collect information about patient symptoms and risk factors

Sensors and Results
Sensors

Abnormal Lung Sound Detection
• Discriminated between healthy and wheeze sounds with 87% accuracy in 57 patients [3]
• Validating this algorithm and a crackle detection algorithm on a 500 patient sample

Conclusions and Next Steps
• We have developed a kit for capturing and analyzing pulmonary diagnostic information
• Algorithms can detect wheezes in patient lung sounds
• Augmented reality for the peak flow meter is being validated
• 500+ subject clinical trials are now underway in Pune and Mumbai to develop diagnostic guidance algorithms

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References
[1] “WHO | The top 10 causes of death,” WHO.