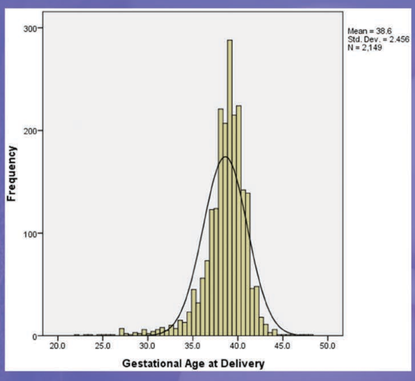
NON-INTRUSIVE INFANT SLEEP APNEA DETECTION

Problem

Sleep Apnea is a sleeping disorder caused by the interruption of breathing during sleep. An affected individual may stop breathing for a short time. Repetitive occurrence will result in low blood oxygen content which can lead to other short term and long term complications.

Infant sleep apnea is common when the baby is born before 40 weeks



More than 15%
Among infants born before 35 weeks

5% to 7%
Among infants born between 36 - 38 weeks

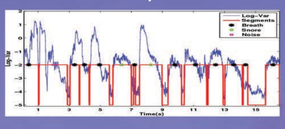
Effects

Available solutions

Pulse oxymetry

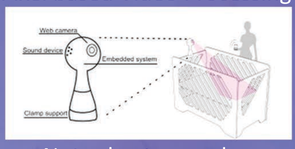
Invasive

Acoustics analysis



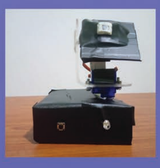
low SNR, Low accuracy

Pixel based Video Processing



Not robust enough

Proposed solution



- A portable low power consuming device.
- Mounted camera on a robotic arm to follow the infant.
- Intelligent video processing algorithms to detect the breathing pattern, identify anomalies and generate reports.

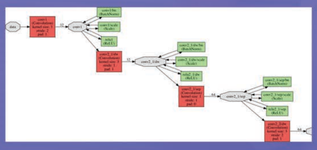
Logic Flow

Infant detection
↓
Turn the camera
↓
Detect the breathing pattern
↓
Check anomalies

Infant detection

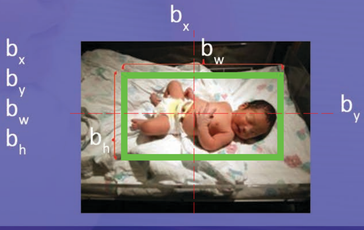
Neural Network Architecture

Google's MobileNet architecture



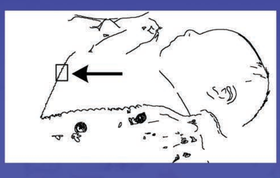
- Efficient
- Less memory
- Fast

Output from the neural network



Breathe cycle detection

Novel Edge Detection based solution

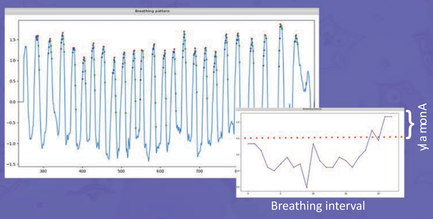


- ROI identification
- Edge detection
- COG tracking
- Subspace filtering
- Finding peaks

"Starfish" Algorithm

- ROI identification
- Color gradient analysis
- Adaptive filtering
- Sensor fusion
- Cycle detection

Anomaly detection and results



Breathing pattern

Conclusion

- The aforementioned algorithm performs better compared to other similar solutions.
- The novel "star fish" algorithm performs comparitivley better in low resolution videos.
- Eventhough the accuracy of the proposed algorithm is lower than the intrusive solutions, it is simpler and comparitively cheaper thus would be suitable for specifc scenarios.
- Futurework- Having a seperate devce to detect sleep apnea would not be feasible. Incorporating it into an existing baby monitor would be preferred

bC

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