[31]	Crackles	14 cannel Sony ECM-44BPT Electrets microphones	Patents with Cystic bronchitis	Lower left lung	Kurtosis, Percentile Frequency f90, Kullback-Liebler Distance and linear discriminant analysis
[10]	Respiratory sounds	18 piezoelectric sensors	82 patients	Posterior to the patient's back	Wilcoxon's signed-ranks test and Mann-Whitney U test

5. Recommendation and Future Scope

Some recommendations we observed are here given with future scope discussed at last.

a) *Type of sensor:*A good comparison of sensors used in computer base respiratory sound analysis is given in Kraman 2006[38]. In most cases, Electret microphones or contact microphone mounted on a stethoscope was used. The most important selection criteria in choosing the sensors should be its ability to acquire wide frequency range (150 to 2,000 Hz) for respiratory sound analysis. Also the sensor should have high selectivity and signal to noise ratio.

b) Sensor position: CORSA (computerized respiratory sound analysis) and RALE (respiratory acoustics laboratory environment) provides standard for positioning the sensor for lung sound acquisition. They also provide data collection procedure that must be followed for faithful auscultation.

c) Removing noise: The main source of noise in lung sound acquisition is heart sound. The heart sound contain the dominant frequency range which is less than 150 Hz, whereas the respiratory sounds dominant frequency range are above 150 Hz and below 2,000 Hz [39]. A well designed band pass filter would be sufficient for removing the heart sound from lung sound.

d) *Signal processing:*There is need to apply advanced signal processing techniques in the respiratory sound analysis .as said earlier previous works have concentrated more on time and frequency domain analysis. As lung sound signals are non stationary there is need to apply time – frequency analysis techniques in this field.

e) *Feature extraction and classification:*Different feature extraction and classification techniques were used by previous researches such as Artificial Neural Network, Gaussian mixture model, Hidden Markov model, and fuzzy logic .As machine learning is gaining importance from last decade [32] there is need to apply artificial intelligence techniques such as support vector machine (SVM), genetic algorithm (GA), and optimization technique such as particle swarm optimization (PSO) in computer based respiratory sound analysis. Some researchers were successful in applying such techniques in the past [33-34] There is also need to apply hybrid model to improve classification.

6. Conclusion

The literature review attempts to summarize different articles in systematic way describing computer based respiratory sound analysis by previous researchers. The research is divided into two groups and then respective approach is briefly explained. The critical factors needed for successful diagnosis of lung disorders are also discussed. The overview provides strong evidence that potential exists in the field of computer based lung sound analysis though the research in this area is been carried out since last three decades there is still lot more scope for improvement. Also there is need to implement this techniques in resource poor regions of word through telemedicine application.

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