

Supplementary Information

Deep Learning Enabled Classification of Real Time Respiration Signals Acquired by MoS₂ Quantum Dots based Flexible Sensor

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Table T1: Rise time and fall time of different breath patterns

S.no	Breath Pattern	Rise time	Fall time
1	Normal Breath	290 msec	3.67 sec
2	Slow Breath	330 msec	4.10 sec
3	Deep Breath	130 msec	5.66 sec
4	Fast Breath	180 msec	1.14 sec

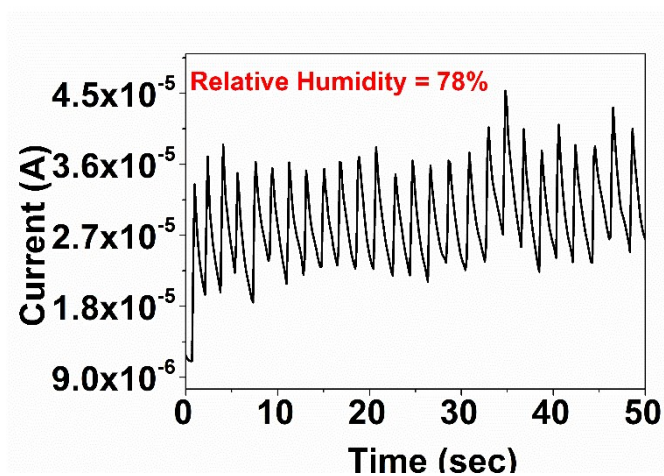


Figure S1: The MoS₂ QDs/PVA sensor detect current peaks under high humidity condition.

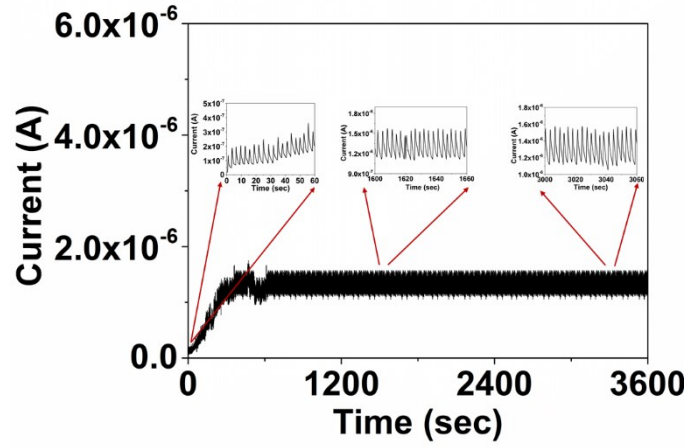
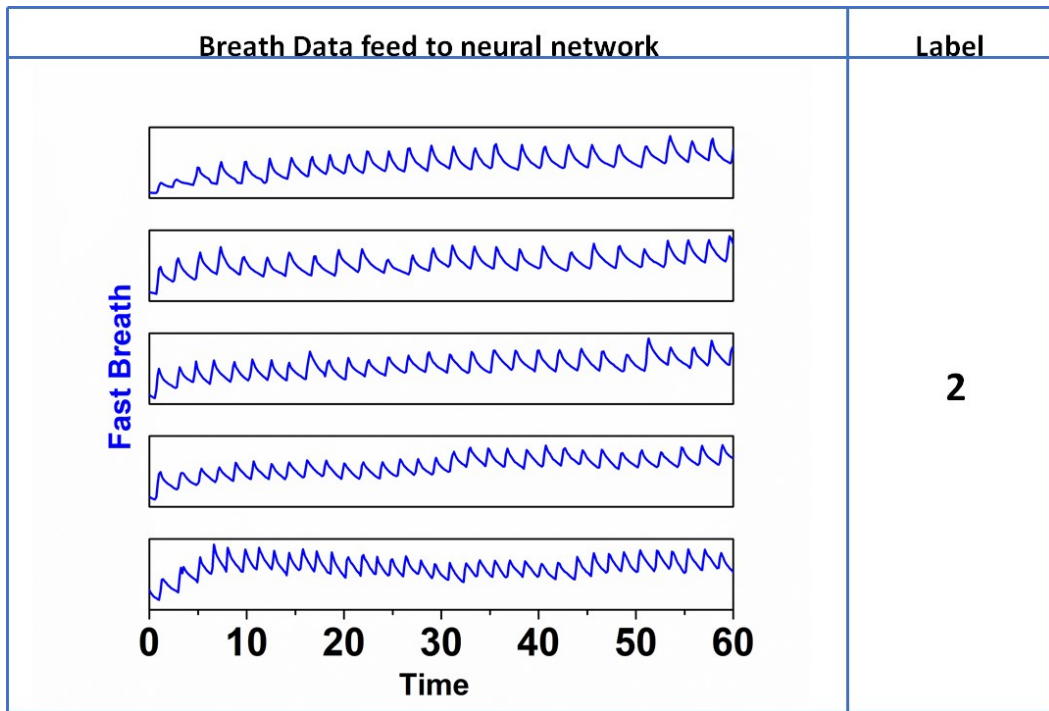
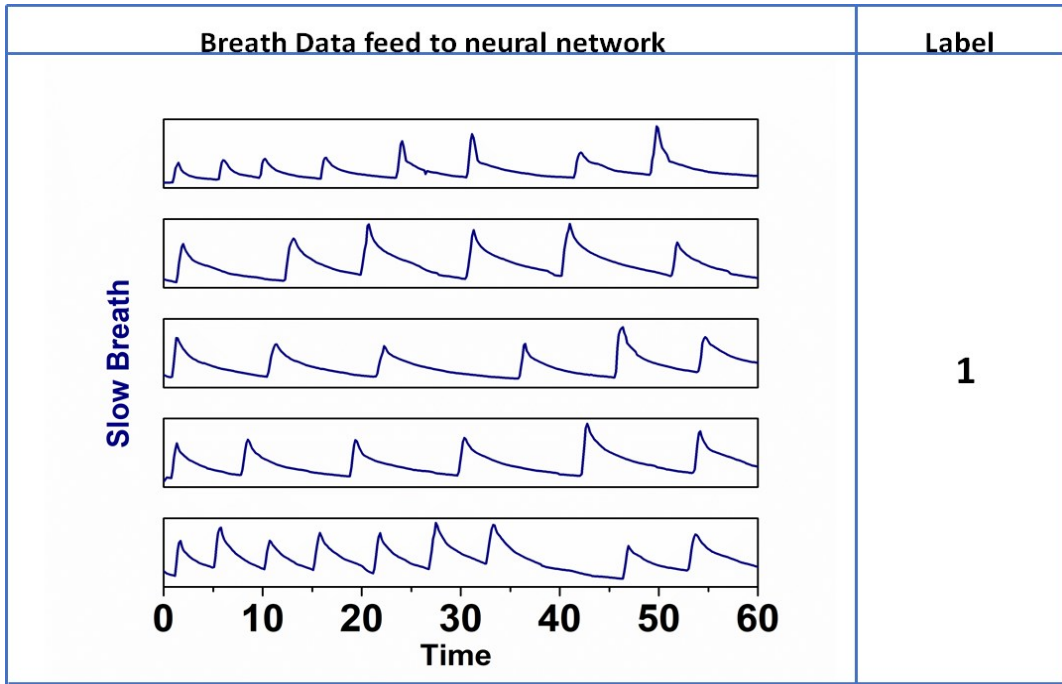


Figure S2: Stability test for the fabricated MoSSe QDs/PVA sensor for one hour

Breath Data feed to neural network		Label
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Normal Breath</p>	<p>0</p>	



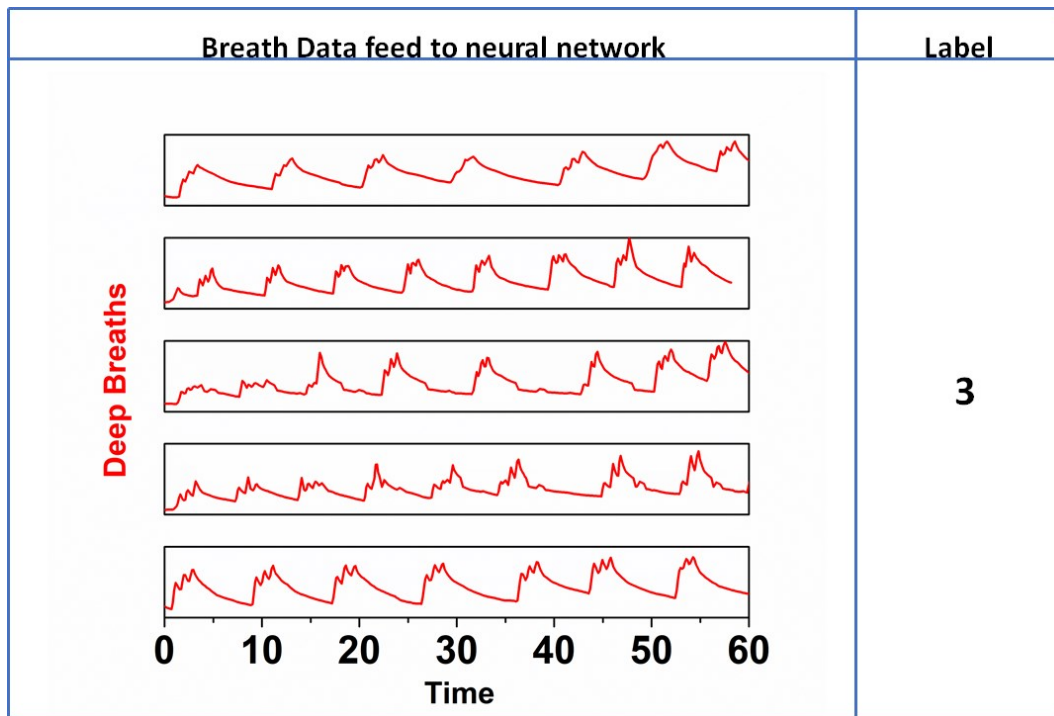


Figure S3: Labelling 0,1,2, and 3 to normal, slow, fast, and deep breaths data for training and testing the 1D-CNN model.

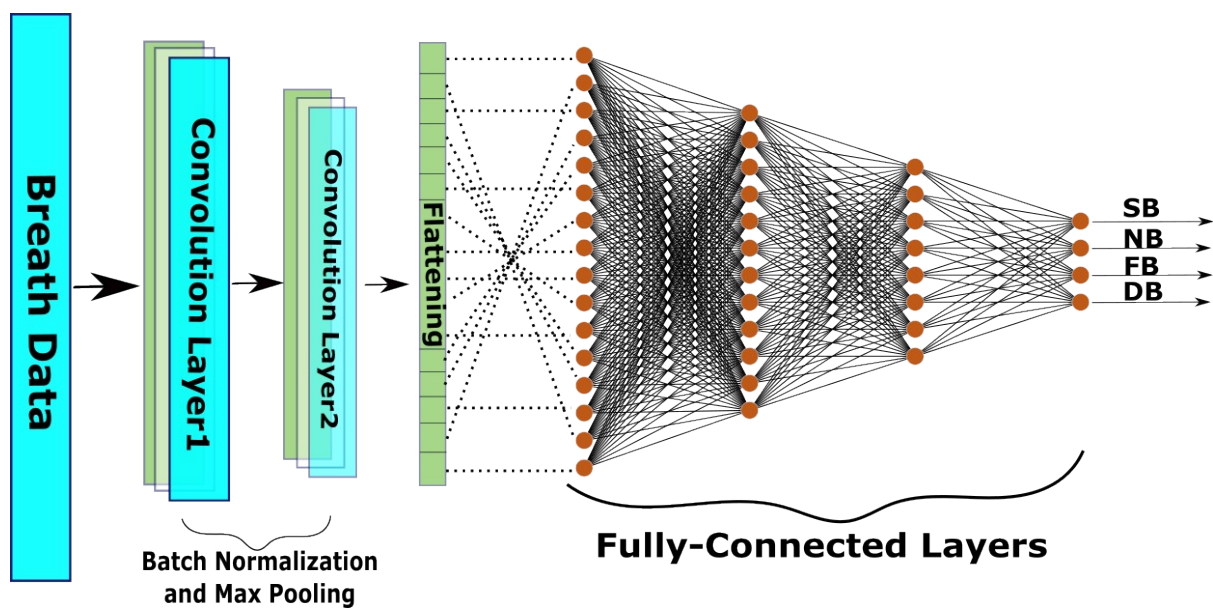


Figure S4: Typical CNN architecture

Table T2: Comparison of 1D-CNN with Different state of art algorithms.

Algorithms	Accuracy (10-fold cross validation)			
	NB	SB	FB	DB
1D-CNN	98.18%	95.25%	98.1%	97.6%
DNN	88%	92%	96%	98%

KNN	75%	89%	94%	88%
SVM	87%	95%	92%	98%
DT	68%	83%	84%	91%
RF	89%	88%	93%	96%

Table T3: Comparison of overall accuracy of 1D-CNN with Different ML algorithms.

Algorithm	Accuracy	F-1 Score	Precision	Sensitivity
1-D CNN	0.96	0.96	0.96	0.97
DNN (extracted features)	0.9386	0.9385	0.9385	0.9385
KNN (raw data)	0.4379	0.43	0.44	0.44
SVM (raw data)	0.71	0.69	0.71	0.76
KNN (extracted features)	0.8771	0.88	0.88	0.88
SVM (extracted features)	0.9385	0.94	0.94	0.94
DT (extracted features)	0.82	0.82	0.84	0.82
RF (extracted features)	0.92	0.92	0.92	0.92

List of extracted features:

For raw signal and 1st derivative: mean, max, min, standard deviation, skewness, kurtosis, interquartile range, median absolute deviation, area under curve, area under squared curve.

Raw signal DFT: mean, max, min, standard deviation, skewness, kurtosis, interquartile range, median absolute deviation, area under curve, area under squared curve, weighted mean frequency, 5 first DFT coefficients, 5 first local maxima of DFT coefficients and their corresponding frequencies.

Jerk DFT: mean, max, min, standard deviation, skewness, kurtosis, interquartile range, median absolute deviation, area under curve, area under squared curve, weighted mean frequency, 5 first DFT coefficients, 5 first local maxima of DFT coefficients and their corresponding frequencies.

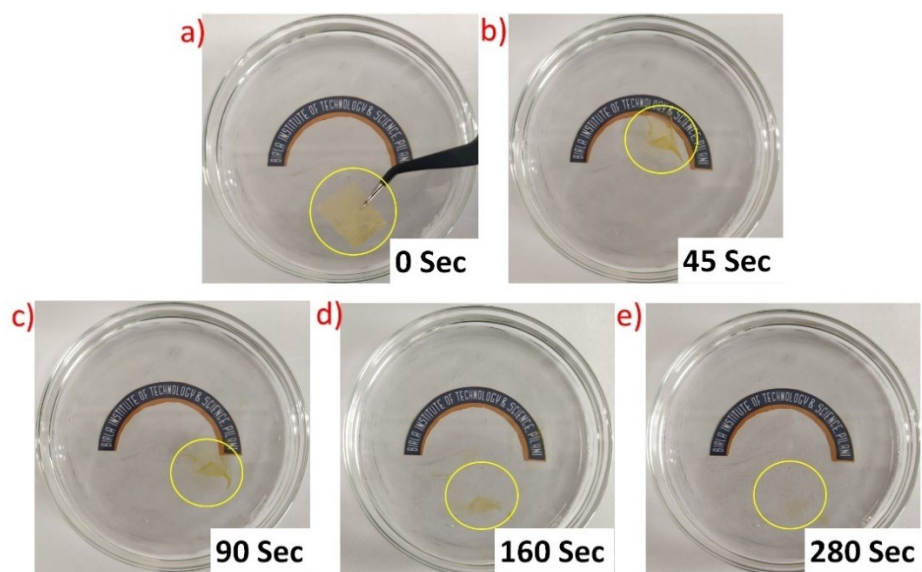


Figure S5: Transience of MoSSe QDs/PVA in DI water a) 0sec b) 45sec c) 90 sec d) 160 sec
e) 280 sec.

Consent statement

The authors declare that informed consent was obtained from all the human participants for the experiments that involved them.