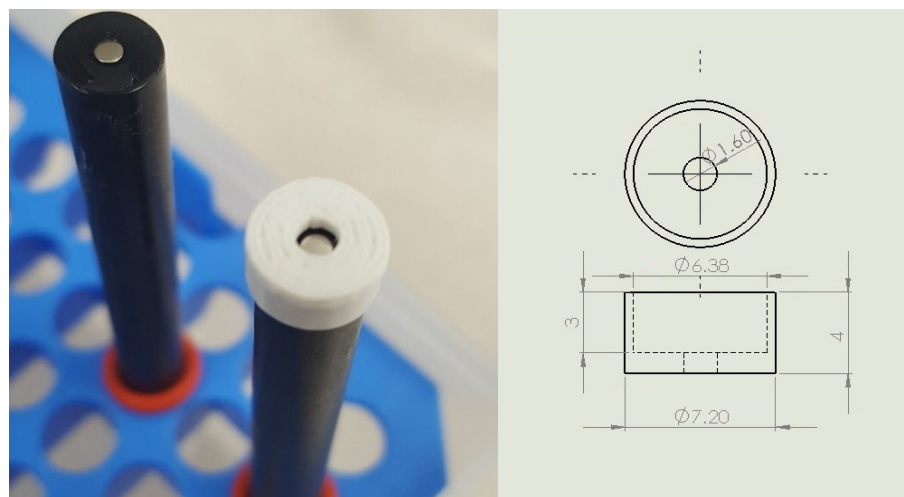


## SUPPLEMENTAL

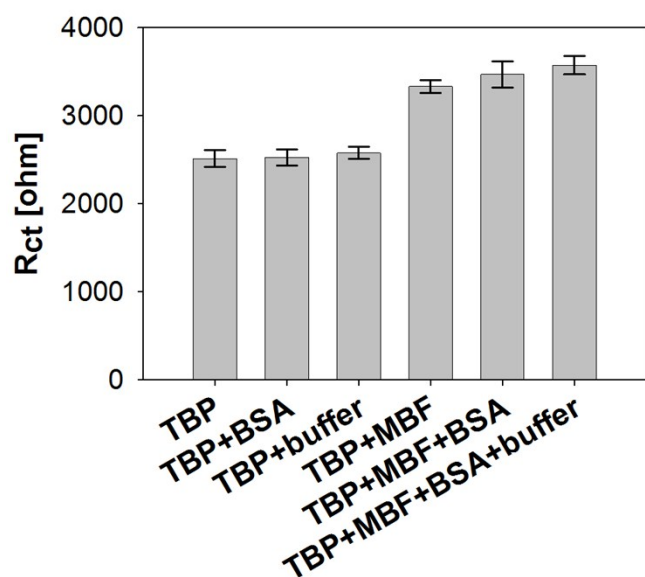
**Table S1.** Randles-Ershler equivalent circuit analysis results for TBP-MBF binding and TBP-TATA<sup>1</sup> binding.

Binding	Circuit element	Value (ohm)	Standard deviation
TBP	$R_s$	265.73	0.38
	$R_{ct}$	2021.65	45.63
	$Z_w$	1.80E-04	6.38E-07
	$C_{dl}$	5.10E-07	4.58E-10
TBP-MBF	$R_s$	266.50	1.78
	$R_{ct}$	2640.88	52.30
	$Z_w$	1.80E-04	1.85E-06
	$C_{dl}$	4.91E-07	8.03E-09
TBP-TATA1	$R_s$	328.45	2.78
	$R_{ct}$	3395.19	302.53
	$Z_w$	1.41E-04	1.46E-05
	$C_{dl}$	5.85E-07	2.75E-08

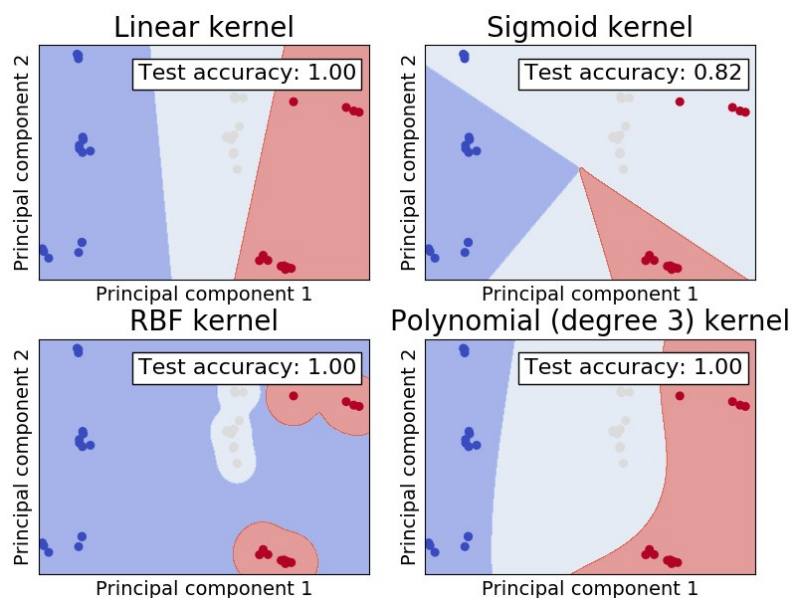


**Figure S1.** Picture of a

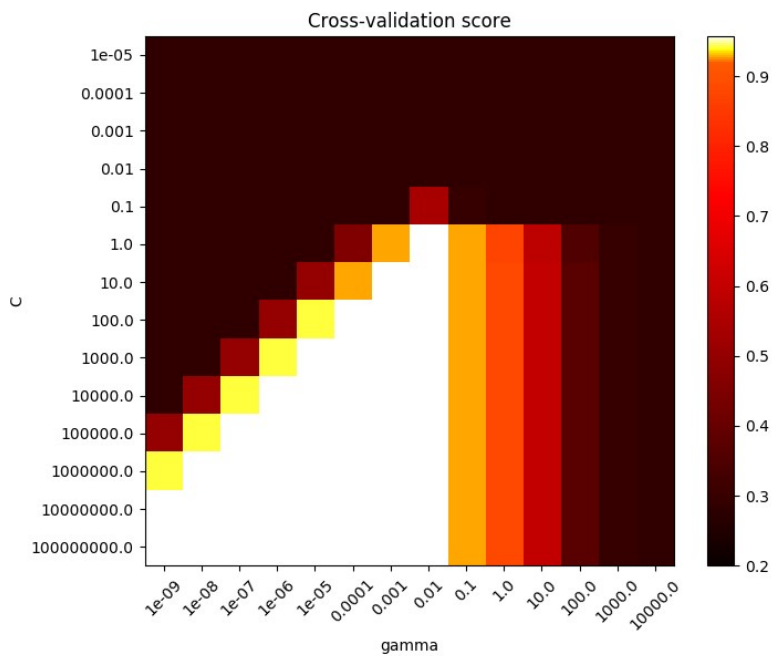
3D printed plastic cap fitted onto standard Basip Pt/Ir electrode, and engineering drawing design of the cap.



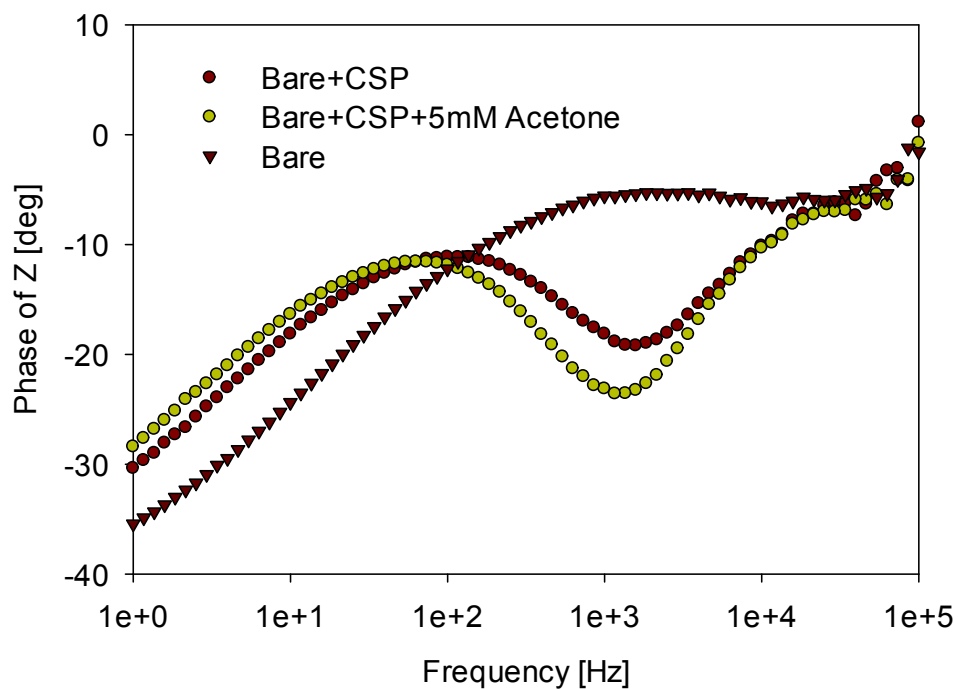
**Figure S2.** Charge transfer resistance ( $R_{ct}$ ) from a Randel's model for addition of BSA or buffer to TBP coupled electrodes and TBP-MBF coupled electrodes.



**Figure S3.** SVM results for TBP, TBP+MBF and TBP+TATA<sup>1</sup> classification with common kernels.



**Figure S4.** Representative SVM parameter tuning result for TBP, TBP+MBF and TBP+TATA<sup>1</sup> classification with RBF kernel.



**Figure S5.** Representative phase plot of CSP-acetone interactions in the presence and absence of 5mM acetone.

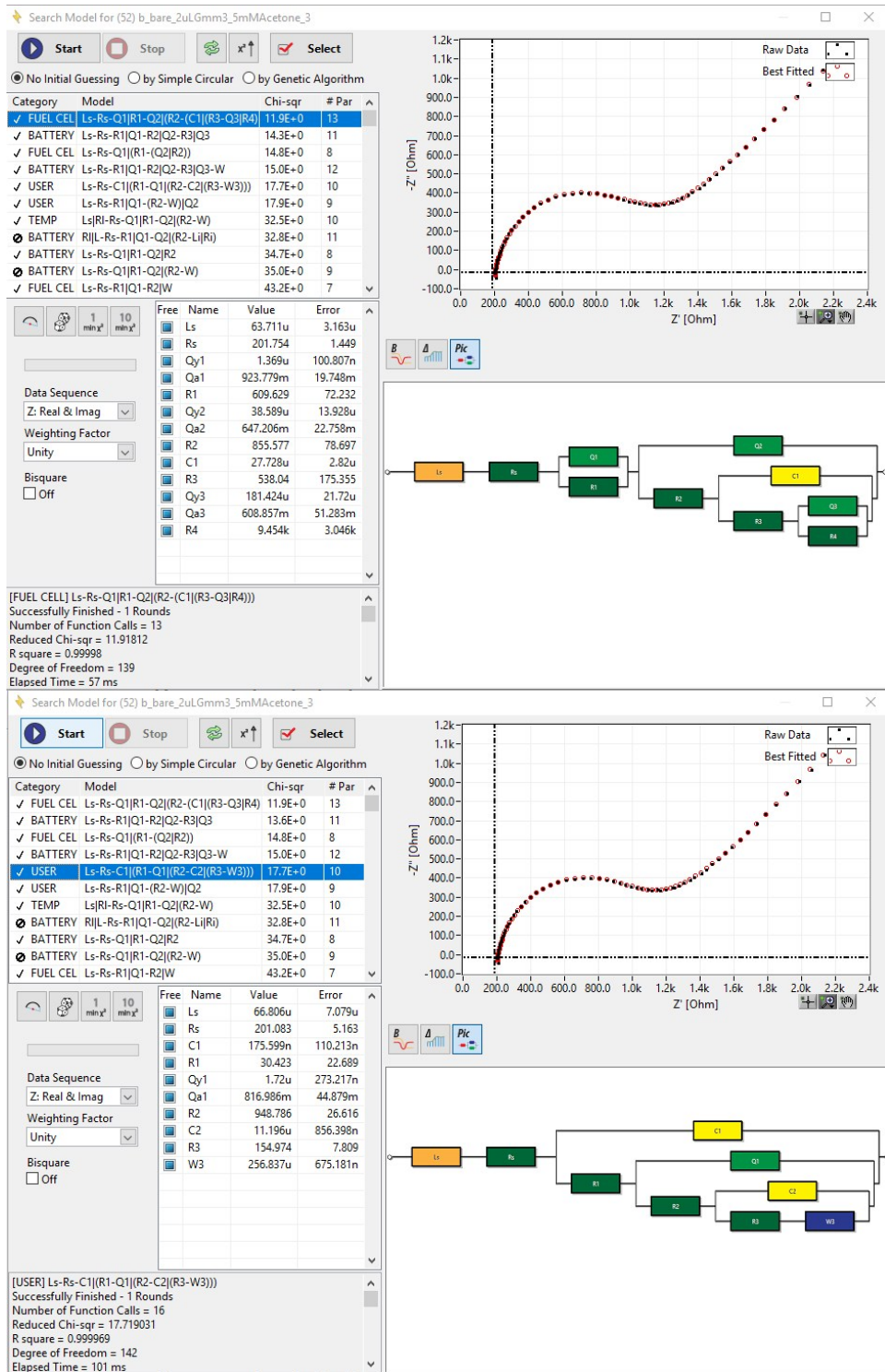
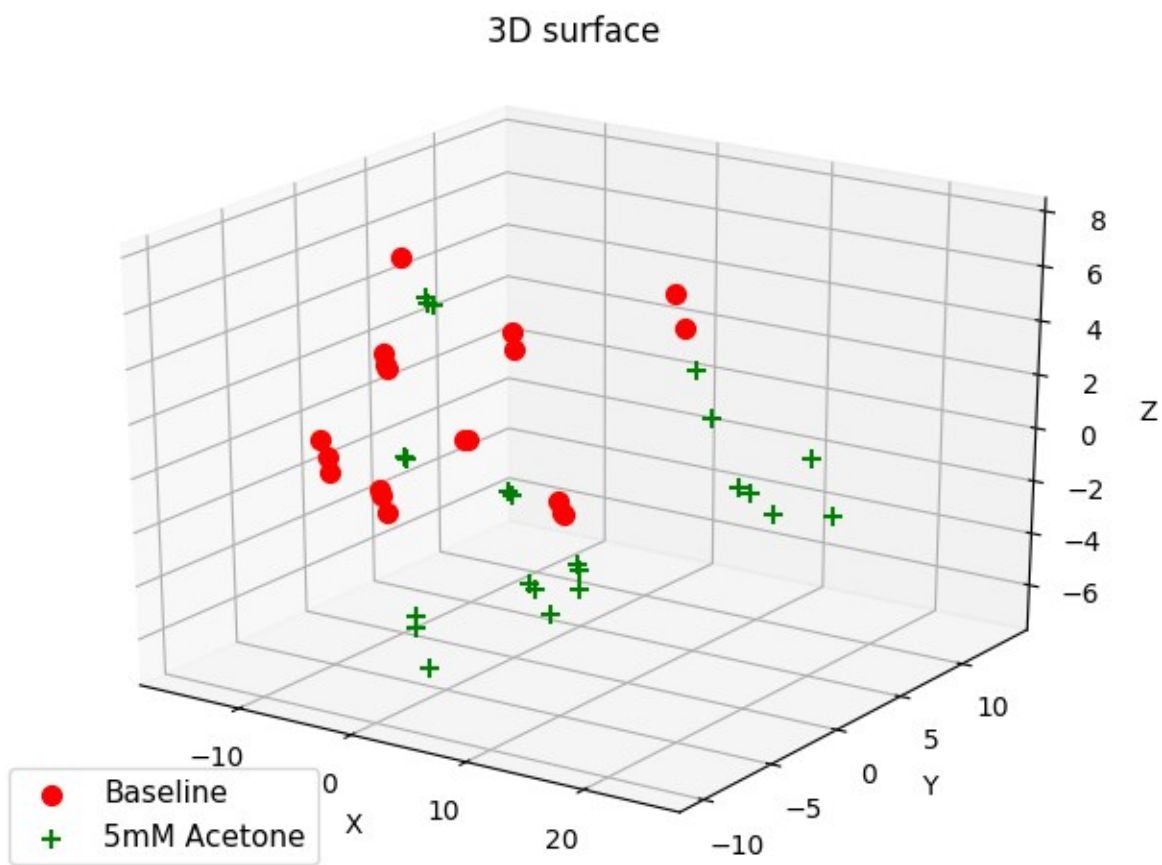
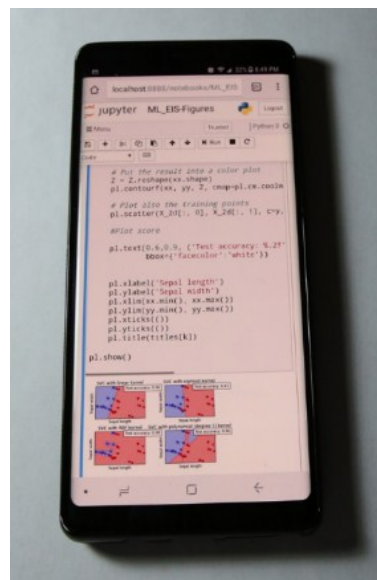


Figure S6. Representative equivalent circuit models tested with model search function in ZMAN software.



**Figure S7.** 3D data representation for data analyzed with three principal components. Red dots represented baseline signals of Gmm CSP biosensor, green plus represented 5mM acetone detection signals.



**Figure S8.** Support vector machine learning software installed on Android phone with small molecule using mobile detection and analysis systems. Screenshot showed Jupyter notebook running a SVM kernel selection code.