Responses to the comments

In “Five typical stenches detection using electronic nose” authors investigate the possibility to correctly identify five different “stenches”, namely vapors which produce a discomfortable sensation in people. The main goal of the manuscript is to investigated the capability of a gas sensor array to replace panelists for detecting the presence of bad smells in the environment. The five chemicals utilized for the scope are 2-phenylethyl alcohol, isovaleric acid, methylcyclopentanone, γ-undecalactone, 2-methylindole. Authors utilized an array composed by 16 commercial sensors and extracted 3 different feature to the signal coming from each of them. Finally, different classification algorithms (such as random forest, support vector machines, backpropagation neural network, PCA and LDA) are used to evaluate the performance of the proposed array. Despite the aim of paper is surely of a great interest for both the scientific community and the health care, in the reviewer opinion the manuscript is not very clear in many parts and some data are lacking. The missing parts make difficult to completely understand the impact of the work. Reviewer suggests to deeply revise the manuscript considering the following observations/comments:

1. Concerning the compounds measured:

- Reviewer thinks that the correct name for one of the compound is γ-undecalactone rather than γ-unsecalactone

Thank you for the comment.I have checked the spell γ-undecalactone.

- 2-methylindole melting point is 57-59 °C from literature so it seems to be solid rather than viscous (1- methylindole is liquid at room temperature).
- Thank you for the comment. In the experiment,2-methylindole is solid.In order to control experimental conditions,we put the 2-methylindole into 30ml water.
- Usually it is convenient to specify the concentration of vapors of samples in terms of part per million (ppm). In this context it is not clear how the sample vapor concentration in the head space is produced (is the liquid heated? is it just let evaporating?). Furthermore, even if the concentration in liquid is known, it is not reported which is the concentration of analyte vapour in the headspace.
- Thank you for the comment.
- Firstly, we set the temperatures of the thermostatic chest and thermostatic cup to 38 centigrade and we set the sampling time to 120 seconds. Secondly, we will put the beaker with the solution into the thermostatic cup after the real temperature of the thermostatic cup reaches 38 centigrade. Thirdly, the lift device will move up to let the needle pierce silica gel to sample the odor. Fourthly, a micro vacuum pump extracts gas with 500ml / s. Finally, we get a 1200x9 array to represent the odor.

  So we ensure the concentration of the solution.And we use a micro vacuum pump to ensure the speed of sampling gas. In fact, the experiment in GBT 14675 also ensures the concentration of the solution.

- In case of 2-methylindole, the concentration utilized is higher than the standard one. Why the authors do not perform a further dilution in water in order to obtain the desired concentration?
- Thank you for the comment. Because of the low concentration of 2-methylindole, a further dilution in water may cause that some concentrations of 2-methylindole are much higher than odors. So in the experiment, we directly configure the concentration of all solutions.
- From what reviewer understands, each sample is measured multiple times. Did the authors measure all the repetition of the same sample consecutively or did they randomly measured the sample alternating the different compounds?
- Thank you for the comment. The authors measure all the repetition of the same sample consecutively.For example,we prepare six beakers.Each beaker has a different chemical.We try to find the label of chemical for each beaker.

Please note that vapour concentration is crucial information in case of gas sensors. Most of the compounds investigated have a very low saturated vapour pressure and concentrations in water are indeed very low.

2.Concerning the aim of the manuscript, actually the system was tested considering only one concentration for each compound. Despite this approach is utilized to standardize the odour recognition, in a real scenario, analytes are usually present in a range of concentrations rather than at a fixed concentration. This condition makes the detection and recognition of odours even more challenging since the increasing of concentration can produce the overlapping of classes during the classification. In the reviewer opinion the effect of concentrations must be considered in this kind of applications to provide robust outcomes and performances.

Thank you for the comment.I very agree with you.In the real application environment, we need a big data base.In this paper, we can see that some curves of different odors have different trends of curves.LDA will contribute to the classification of odors.The standard odor recognition will contribute to future research. In this paper, we only focus on the five typical concentrations of odors.

3.Concerning data analysis and classifications, please specify which features have been used in the cases described.

Thank you for the comment.”2.3. The Composition of Dataset and Feature Extraction”shows that.(line 91)

- Authors utilized 5-fold validation algorithm. How many times authors ran this algorithm? Since the composition of training and test dataset change each time a large number of iteration should be performed. Furthermore mean and standard deviation of classification rates obtained during the different runs of cross-validation algorithm should be both reported.

Thank you for the comment.

Then we use the grid search method to find the best penalty parameter and kernel parameter gamma for the SVM using RBF kernel. The specific multi-classification tool is

SVMs using libsvm function in Matlab. We use 5-fold cross validation ten times to get the training set accuracy and testing set accuracy.The standard deviation of classification rate is the average of 10 times of 5-fold cross-validation.(line 179)

The data set is consisted of 15 samples of 2-phenylethyl alcohol, isovaleric acid, methylcyclopentanone, 2-methylindole and 25 samples of γ-undecalactone.All samples is a 1x28 matrix and the twenty-eighth column shows the stench label. So the data set is a 100x28 matrix.(line 233)

All algorithm add standard deviation of classification rates.(line 173)

- Figure 9 reports an Out of bag classification error equals to 0.15. How do authors can justify this value with the accuracies reported in the manuscript?

Thank you for the comment.The last version of paper worry uses the cross-validation method.I redo the experiment.I add the standard deviation of classification rate.It will shows the balance of the accuracy10 times of 5-fold cross-validation.

For example:

	1	2	3	4	5	6	7	8	9	10
1	85	80	82.5000	80	88.7500	90	81.2500	87.5000	85	87.5000
2	87.5000	90	88.7500	82.5000	87.5000	85	86.2500	86.2500	86.2500	90
3	87.5000	86.2500	90	88.7500	82.5000	81.2500	87.5000	87.5000	85	85
4	85	82.5000	81.2500	85	81.2500	83.7500	81.2500	81.2500	82.5000	83.7500
5	85	87.5000	78.7500	85	86.2500	85	81.2500	85	87.5000	77.5000

Std=[1.3693 3.9922 4.8894 3.2596 3.2355 3.1869 3.1125 2.5921 1.8540 4.7104]

The standard deviation of classification rate is sum(std)/10= 3.2202.

- LDA percentage for LD1 and LD2 should be reported (figure 7 a) and b)) in other to understand the significativeness of results.

Thank you for the comment.When we use LDA to reduce the data dimension, the eigenvalues of samples which are sampled from 1 to 60 seconds are [0.9979,0.9674,0.9158,0.8644,0.3126]. When we use LDA to reduce the data dimension, the eigenvalues of samples which is sampled from 60 to 120 seconds are [0.9926,0.9760,0.9104,0.8596,0.3754]. So we reduce the dimension of data to four dimensions.(line 192)

4. Authors utilized as features the responses in the 60-120s period. In this particular condition, authors considered the response value at t=60s as zero. Reviewer wouldlike to make some considerations about this strategy:

   - First of all subtracting value very close each other increases enormously the noise/signal noise. Than this approach is not recommended when the variation of response is close to zero since data are largely affected by noise and lose of significativeness.

   Thank you for the comment.The data from 60s to 120s use the raw data in the new version of paper.

   - Secondly the transient responses depends on the concentration profile of analyte and flow. When features not related only to the steady state are used, authors must verify and

specify that the flow rate was kept constant during the whole experiment and that the concentration of analytes in the measuring chamber is constant too for the whole measuring period (120 s). Otherwise systematic errors can influence or bias the results obtained.

Thank you for the comment.We use a micro vacuum pump to extract gas with 500ml / s. During the experiment,we have a constant temperature. Sampling with automatic equipment keeps consistent sampling and air cleaning time.

Sensors in the array have high responses but the main discrimination power seems to be enclosed in the very small variations obtained close to the steady state. In the reviewer opinion this condition undermines the robustness of results obtained; then this part should be taken higher in consideration and investigated more in details.

Thank you for the comment.Some papers only use the steady-state to get the feature.Some papers focus on the information from 1 to 60 seconds.So the new version of the paper compares these two viewpoints to find out the answer.