Measuring Odour Concentration with an Electronic Nose

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In order to evaluate odour reduction technologies, or to develop and enforce meaningful odour guidelines and standards, it is necessary to be able to measure odours in a manner that is accurate, precise, and accepted by all interested parties. The currently accepted standard is olfactometry, which relies on the detection of odour by the noses of human panelists to provide a measurement of odour concentration. This method is labour-intensive, expensive, and the equipment is not very portable. Recent advances in odour technology have led to the electronic nose: a device in which an array of sensors responds to the different components in an odour sample to provide an odour 'fingerprint'. This is useful in defining the nature of the odour but, in its current form, does not provide reliable information on odour intensity. The aim of the work described in this paper was to see if electronic nose measurements could be processed to provide an indication of odour concentration.

A data set was developed by evaluating odour samples with both an olfactometer and a commercially available electronic nose. This data set was used to train an Artificial Neural Network (ANN) to convert the measurements from the electronic nose into odour concentrations. By applying the method of principal component analysis, the number of input variables in the data set was reduced from 34 to 3, while still accounting for 99% of the variance. This data preprocessing procedure was crucial to the success of the ANN, which, after training, was able to provide concentration measurements from electronic nose data with about 20% mean average percentage error. This is of the same order as the precision of olfactometer measurements.

Implications: The results show that odour concentration can be measured with an electronic nose. An electronic nose can be transported easily to odour generation sites, is relatively portable, requires only one person to make a measurement, and does not suffer from the variability found amongst even the trained human panelists used in olfactometry. The method described provides the potential for cheaper, faster, more reliable odour measurement.

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