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Contributions by Yuriy Belov (National Taras Shevchenko University of Kyiv, Department of Cybernetics)

Type:	**Contributed Poster**
Session:	Cross-topic
Date/ Time:	Tue, July 19 AND Thu, July 21 / 19:00 - 22:00
Room:	Poster Gallery, No. 13-1
Title:	Pareto-optimum method of organic vapors pattern recognition
Authors:	Byelov Yu. A., Zavorotny A. L., Koshets I.A.
Abstract:	\footnotesize{Recently much attention has been paid to creation and development of miniaturized, low-cost, smart chemical sensing systems (called "Electronic Nose"), based on various physical and chemical principles, which provide accurate and reliable real-time control of ambient gaseous medium. Usually experimental data obtained on such systems are treated with standard statistical methods such as Principal Component Analyze (PCA), Discriminant Analyze (DA), Neural Network, etc. In the work we present results of pattern recognition of chemical images of several alcohol beverages by means of developed by us new statistical methods, which based on idea of Pareto-optimum calibration [1]. This method consider measurement model as unknown. It stipulates learning phase presence which includes accumulation of series measurements results obtained on different calibration signals or in other words from different known organic vapors. After learning phase it's possible to make pattern recognition of unknown vapors or estimate measurements results of the given vapors by some "Desired Electronic Nose", as though it really existed. Pattern recognition is the result of the decision of two-criterion simultaneous minimization problem. The first criterion is minimization of noise's energy or error dispersion, which is contained in the measurements results's estimation of the given vapors by "Desired Electronic Nose". The second criterion is the average of distribution of the squared norms's sum of difference between "Desired Electronic Nose" measurements of calibration vapors and these measurements's estimations. For measurement results receiving was used QCM measuring technique which is one of mostly used in chemical sensing science as a transuding element for creation sensors and sensors arrays. The basis of QCM technique is the proportionality between mass loaded onto quartz surface and oscillations frequency shift [2]. So, measuring frequency shift, one can easily investigate adsorption-desorption processes occurring onto sensor's surface. Sensitivity of this method is very high ? 1-2 ng/Hz , that allow of detecting very low concentration of organic vapors. 8-channel QCM array with all necessary equipment (gas cell, gas-supplying system and electronic circuits) has been designed in our laboratory. Experiment control and data acquisition were implemented with PC by means of domestic software. Gas-supplying regime chosen for our experiment was non-flow type: after rapidly injected analyte gas cell cats off from pipeline and no gas flow occurs during measuring period. Detailed description of device and gas supplying regime may be found in [3]. Such polymers as polyvinyl acetate (PVA), polybutyl methacrylate (PBMA), polyvinyl formal/ethylal (PVFE), butadiene/styrene rubber (BDSC) and polyvinyl chloride / vinyl acetate (VCL-VAC) have been utilized as a sensitive layer. Spin-coating and dipping methods were used for polymer deposition. Information about morphology and determination of thickness of the layers deposited have been obtained from ellipsometry and AFM measurements.\\ \textbf{Refernces}:\\ [1] Belov Yu. A., Zavorotnyy A. L., Kasyanyuk V. S. "On one approach to problem of processing of measurements using calibration signals based on multicriteria optimization", Journal of Automation and Information Sciences, 5:257-267, 2003. [2].F.

Eichelbaum, R. Borngraber, J. Schroder, R. Lucklum and P. Hauptmann, Interface circuits for QCM sensors, Review of Scientific Instruments, 70, may, 1999. [3] V.I. Kalchenko, I.A. Koshets, E.P. Matsas, O.N. Kopylov, A. Solovyov, B.A. Snopok, Yu.M. Shirshov. Calixarene based acoustical sensors array and its response on volatile organic vapors. Proceedings ISEPOM-4, Lviv, Ukraine, 3-8 June, 2002}

Type: **Contributed Poster**

Session: Neural systems and the brain

Date/ Time: Tue, July 19 AND Thu, July 21 / 19:00 - 22:00

Room: Poster Gallery, No. 6-4

Title: Computer simulation and research of nonlinear hierarchical structure of cooperative neurons and neural ensembles by the example of olfactory sensory system

Authors: Byelov Y., Rabinovich Z., Tkachuk S., Iamborak R.

Abstract: Lately series of papers are dedicated to mathematical modeling of olfactory sensory system. The interest in this object as an object for modeling and research is called by sufficiently detailed investigation by biologists and neurophysiologists of structural-functional organization of olfactory sensory system for today on the one hand and a problem of high quality recognition of odors becomes more actual lately on the other hand. On the basis of analysis and generalization of available experimental materials in the context of interdisciplinary approach in common with specialists of another sciences novel original base conception was developed. Basic formal definitions and composition were defined, also their general properties were formulated. It is important for computer implementation and research of mathematical model. Computer toolbox is developed. It gives an ability to check the base conception on a quantitative level. The toolbox represents a computer program which allows simulating of natural neuronal hierarchical network. For the purpose of checking of adequacy degree of toolbox functionality to biological neuronal networks an olfactory bulb model was built using known experimental data. Correctness of toolbox work was confirmed by reproducing of known psychophysical phenomena held in olfactory bulb. Using of computer modeling confirmed the presence of evoked activity in olfactory bulb. Wide variety of computer experiments was carried out to confirm the base conception verity and to solve new open problems as well.