THE MODEL OF ACCURACY OF A LOCAL RADIO NAVIGATION SYSTEM CONSIDERING UNSTABLE PERFORMANCE OF INDIVIDUAL ELEMENTS (p. 4-10)

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A mathematical model of the accuracy of the local radio navigation system was considered, built on the base of a network of pseudolites. It was determined that the key factor influencing the accuracy of determining the vector of status of the consumer is the geometry of the structure.

However, for certain categories of consumers there is a necessity of taking into account a possibility of degradation of the structure because of malfunctioning and possible intentional damage. Existing mathematical models of accuracy do not consider a capacity of change in the topology structure.

It was defined that for the assessment of the accuracy of navigation of specific consumers it is expedient to use a geometric factor that determines the degree of deterioration of finding the location relative to the accuracy of defining the pseudorange from the consumer to the radio-navigation points.

To consider the possibility of failure (destruction) of individual elements of the structure of a local radio navigation system, we introduce a probabilistic model that, on the base of registering the combinations of usable/faulty pseudolites and their relative geometric position, makes it possible to define the process of changing the accuracy of the system. As the main indicator of the accuracy, we use a root mean square deviation of the location definition (the state vector) of the consumer.

As a result of the research we identified and confirmed by simulation that the maximum accuracy (minimum values of geometric factor) can be achieved in the case when a consumer is located in the centre of a regular tetrahedron.

Given the sphericity of the Earth, a minimum value for a ground consumer is achieved when one pseudo satellite is in the zenith and the other three are evenly located in the horizontal plane.

The combination of the base model of accuracy with a stochastic model of reliability/survivability will allow designing spatial structure of local radio navigation systems by the criterion of stable performance.

Keywords: pseudo satellite, radio navigation system, state vector of the consumer, accuracy, navigation parameter, pseudorange.

References
1. Tiwary, K., Behera, S. K., Sharada, G., Singh, A. (2010). Modelling and Simulation of Pseudolite-based Navigation: A GPS-independent Radio Navigation System. Defence Science Journal, 60 (5), 541–550.
2. Cellmer, S., Rapinski, J., Rzepeca, Z. (2011). Pseudolites and their Applications. INGEO 2011 – 5th International Conference on Engineering Surveying, Briuni, Croatia, 269–278.
3. ECC Report 168 (2011). Regulatory Framework for Indoor GNSS Pseudolites. Electronic Communications Committee (ECC). Miesbach, 20.
4. Marathe, T., Daneshmand, S., Lachapelle, G. (2015). Pseudolite interference mitigation and signal enhancements using an antenna array. 2015 International Conference on Indoor Positioning and Indoor Navigation (IPIN), 36–44. doi: 10.1109/ipin.2015.7346961
5. Sultana, Q., Sunehra, D., Ratnam, V. (2007). Significance of instrumental biases and dilution of precision in the context of GAGAN. Indian Journal of Radio & Space Physics, 36, 405–410.
6. Loraine, K. J., Kumar, D., Bhaskar, C. V., Sipora, K. (2014). Analysis of Near-Far Effect and Multipath Mitigation Techniques for Pseudolite Based Positioning Applications. International Journal of Electronics & Communication Technology, 5 (3), 37–41.
7. Gioia, C., Borio, D. (2014). Stand-Alone and Hybrid Positioning Using Asynchronous Pseudolites. Sensors, 15 (1), 166–193. doi: 10.3390/s15010166
8. Cai, C., Gao, Y. (2009). A Combined GPS/GLONASS Navigation Algorithm for use with Limited Satellite Visibility. Journal of Navigation, 62 (4), 671–685. doi: 10.1017/s0373463309990154
9. Kim, C., So, H., Lee, T., Kee, C. (2014). A Pseudolite-Based Positioning System for Legacy GNSS Receivers. Sensors, 14 (4), 6104–6123. doi: 10.3390/s140406104
10. Hwang, S., Yu, D. (2013). Clock Synchronization Algorithm for Pseudolite. Advanced Science and Technology Letters, 44, 36–39. doi: 10.14257/astl.2013.44.09
11. Hwang, S., Yu, D. (2014). Clock Synchronization of Pseudolite Using Time Transfer Technique Based on GPS Code Measurement. International Journal of Software Engineering and Its Applications, 8 (4), 35–40.
12. So, H., Park, J., Song, K. (2013). Performance Analysis of Pseudolite Tropospheric Delay Models Using Radiosonde Meteorological Data. Journal of the Korean GNSS Society, 2 (1), 49–57. doi: 10.11003/jkgs.2013.2.1.049
13. Borio, D., Gioia, C., Baldini, G. (2015). Asynchronous Pseudolite Navigation Using C/N0 Measurements. Journal of Navigation, 69 (03), 639–658. doi: 10.1017/s037346331500082x
14. Angrisano, A., Gioia, C., Gaglione, S. (2013). Performance assessment of aided Global Navigation Satellite System for land navigation. IET Radar, Sonar & Navigation, 7 (6), 671–680. doi: 10.1049/iet-rsn.2012.0224
15. Tarrio, P., Bernardos, A. M., Casar, J. R. (2011). Weighted Least Squares Techniques for Improved Received Signal Strength Based Localization. Sensors, 11 (12), 8569–8592. doi: 10.3390/s110908569

DESIGNING ALGORITHMS FOR OPTIMIZATION OF PARAMETERS OF FUNCTIONING OF INTELLIGENT SYSTEM FOR RADIONUCLIDE MYOCARDIAL DIAGNOSTICS (p. 11-18)

Anatoly Dovbysh, Alyona Moskalenko, Vyacheslav Moskalenko, Igor Shelchov

The influence of the number of complex components of fast Fourier transformation in analyzing the polar maps of radionuclide examination of myocardium at rest and stress on the functional efficiency of the system of diagnostics of pathologies of myocardium was explored, and there were
defined their optimum values in the information sense, which allows increasing the efficiency of the algorithms of forming the diagnostic decision rules by reducing the capacity of the dictionary of features of recognition.

The information-extreme sequential cluster algorithms of the selection of the dictionary of features, which contains both quantitative and category features were developed and the results of their work were compared. The modifications of the algorithms of the selection of the dictionary were suggested, which allows increasing both the search speed of the optimal in the information sense dictionary and reducing its capacity by 40%. We managed to get the faultless by the training matrix decision rules, the accuracy of which is in the exam mode asymptotically approaches the limit. It was experimentally confirmed that the implementation of the proposed algorithm of the diagnosing system training has allowed to reduce the minimum representative volume of the training matrix from 300 to 81 vectors-implementations of the classes of recognition of the functional myocardium state.

**Keywords:** scintigraphy, Fourier transformation, information criterion, machine training, cluster algorithm.

**References**

1. Synefia, S., Sotiropoulos, M., Argyrou, M., et al. (2014). 3D images quantitative perfusion analysis and myocardium polar index for cardiac scintigraphy improvement. e-Journal of Science & Technology, 3 (9), 35–41.

2. Öhlinsson, M. (2004). WeAidU — a decision support system for myocardial perfusion images using artificial neural networks. Artificial Intelligence in Medicine, 30 (1), 49–60. doi: 10.1016/s0933-3657(03)00050-2

3. Wadhonkar, B. M., Tijare, P. A., Sawalkar, S. N. (2015). A data mining approach for classification of heart disease dataset using neural network. International Journal of Application or Innovation in Engineering & Management (IJAEM), 4 (5), 426–433.

4. Velu, C. M., Kashwan, K. R. (2013). Heart disease diagnosis using multiple kohonen self organizing maps. In Proc. of the International conference on advanced research in engineering and technology, 126–130.

5. Sajn, L., Kukar, M. (2011). Image processing and machine learning for fully automated probabilistic evaluation of medical images. Computer Methods and Programs in Biomedicine, 104 (3), e75–e86. doi: 10.1016/j.cmpb.2010.06.021

6. Arsanjani, R., Dey, D., Khachatryan, T., Shalev, A., Hayes, S. W., Fish, M. et. al. (2014). Prediction of revascularization after myocardial perfusion SPECT by machine learning in a large population. Journal of Nuclear Cardiology, 22 (5), 877–884. doi: 10.1007/s12350-014-0027-x

7. Tagil, K., Jakobsson, D., Lomsky, M., et al. (2013). A decision support system for stress only myocardial perfusion scintigraphy may save unnecessary rest studies. Journal of Biomedical Graphics and Computing, 3 (2), 46–53. doi: 10.5430/jbgc.v3n2p46

8. Ciecholewski, M. (2013). Ischemic heart disease detection using selected machine learning methods. International Journal of Computer Mathematics, 90 (8), 1734–1759. doi: 10.1080/00207160.2012.742189

9. Dovbysh, A. S., Rizhova, A. S., Moskalenko, V. V. et al. (2015). Intelligent Decision Support System for Medical Radioisotope Diagnostics with Gamma-camera. Journal of Nano- and Electronic Physics, 7 (4), 04036–1–04036–7.

10. Baydik, T., Kussul, E., Escalante-Estrada, A. (2015). Random Subspace Classifier for Recognition of Pests on Crops. In Proc. 4th International Work Conference Bioinspired Intelligence (IWobi), 21–26.

11. Dovbysh, A. S., Moskalenko, V. V., Rizhova, A. S. (2016). Information-Extreme Method for Classification of Observations with Categorical Attributes. Cybernetics and Systems Analysis, 52 (2), 224–231. doi: 10.1007/s10559-016-9818-1

12. Sipos, R., Fradkin, D., Moerchen, F., Wang, Z. (2014). Log-based predictive maintenance. Proceedings of the 20th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining — KDD’14, 1977. doi: 10.1145/2622330.2622340

13. Dovbysh, A. S., Shelekhov, I. V., Korobchenko, E. V. (2015). Feature set optimization of learning control system. Adaptive automatic control system, 2 (27), 44–50.

14. Sivakov, S., Chandrasekar, C. (2014). Modified PSO Based Feature Selection for Classification of Lung CT Images. International journal of computer science and information technologies, 5 (2), 2095–2098.

15. Dovbysh, A. S., Budnyk, N. N., Moskalenko, V. V. (2012). Information-Extreme Algorithm for Optimizing Parameters of Hyperellipsoidal Containers of Recognition Classes. Journal of automation and information sciences, 44 (10), 35–44. doi: 10.1615/jautomatinfsience.v44.i10.30

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**DEVELOPMENT OF WIRELESS VIBRATION TRANSUDER BASED ON MEMS ACCELEROMETER (p. 18-24)**

Pavlo Oliynik

When monitoring the vibration of heavy rotating machinery, one often has problems with cables of vibration transducers, as those cables are usually long, heavy and prone to damage. This paper is focused on the development of a wireless vibration transducer, based on the MEMS accelerometer, which is free of those problems. Owing to the schematics proposed, developed sensor’s power consumption is low; at that analog filtering of vibration acceleration signal is provided. In the paper, spectral analysis based method of frequency response correction is also proposed. That method can be used for measurement of the vibration RMS and power spectra, while using an MCU with low computational power for data processing. The results of the tests conducted show that the transducer developed is well-behaved and that its precision is comparable to one of industrial piezo-electric transducers. So, the transducer developed can be used instead of the industrial transducers mentioned; at that, moving of the machine condition detection process from the high-level system to the transducer level allows one to decrease network traffic and simplify monitoring system as a whole.

**Keywords:** vibration, MEMS accelerometer, wireless vibration transducer, Wi-Fi, monitoring of rotating machinery.

**References**

1. Thanagasundaram, S., Schlindwein, F. S. (2006). Comparison of integrated micro-electrical-mechanical system and piezo-electric accelerometers for machine condition monitoring. Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 220 (8), 1135–1146. doi: 10.1243/09544062je07405

2. Albarbar, A., Mekid, S., Starr, A., Pietruszkiewicz, R. (2008). Suitability of MEMS Accelerometers for Condition Moni-
toring: An experimental study. Sensors, 8 (2), 784–799. doi: 10.3390/s80207874
3. Albarbar, A., Badri, A., Sinha, J. K., Starr, A. (2009). Performance evaluation of MEMS accelerometers. Measurement, 42 (5), 790–795. doi: 10.1016/j.measurement.2008.12.002
4. Wahid, A., Anuar, K. (2008). Development of tilt and vibration measurement and detection system using MEMS accelerometer as a sensor. Universiti Sains Malaysia, 134.
5. Jagadeesh, P., Umapathy, M., Balachandar, S., Arumugam M., Ramaswamy, S. (2006). Low Cost Vibration Measuring Device Using MEMS Accelerometer. NSTI-Nanotech, 3, 349–352. Available at: http://www.nist.org/publications/Nanotech/2006/pdf/153.pdf
6. Kwon, S. W., Kim, J. Y., Yoo, H. S., Cho, M. Y., Kim, K. J. (2006). Development of wireless vibration sensor using MEMS for tunnel construction and maintenance. Tunneling and Underground Space Technology, 21 (3–4), 318. doi: 10.1016/j.tust.2005.12.033
7. Marne, N. S., Nagmode, M. S., Komati R. D. (2014). Vibration Measurement System with Accelerometer Sensor Based on ARM. International Journal of Emerging Technology and Advanced Engineering, 4, 4, 760–764. Available at: http://www.ijetech.com/volumes/Volume4Issue4/IJETAE_0414_129.pdf
8. Looney, M. (2014). An Introduction to MEMS Vibration Monitoring. Analog Dialogue, 48 (06), 1–3. Available at: http://www.analog.com/library/analogDialogue/cd/vol48n2.pdf
9. Chaudhury, S. B., Sengupta, M., Mukherjee, K. (2014). Vibration Monitoring of Rotating Machines Using MEMS Accelerometer. International Journal of Scientific Engineering and Research, 2 (9), 11. Available at: http://www.ijser.in/archives/v2/9/SjIwMTMzNTg=.pdf
10. Huang, Q., Tang, B., Deng, L. (2015). Development of high synchronous acquisition accuracy wireless sensor network for machine vibration monitoring. Measurement, 66, 35–44. doi: 10.1016/j.measurement.2015.01.021
11. Bruel&Kjaer Product Data. Industrial Accelerometer – Type 8325. Available at: http://www.midebien.com/LiteratureRetrieve.aspx?ID=10405
12. Analog Devices ADXL316. Small, Low Power, 3-Axis ±16 g Accelerometer. Available at: http://www.analog.com/media/en/technical-documentation/data-sheets/ADXL316.pdf
13. Silicon Designs Inc. Model 1510 Vibration Application Analog Surface Mount Accelerometer. Available at: http://media.wix.com/udg/3fcdfc_660fc66100641388bbf1b1e9361fe5b.pdf
14. ST Microelectronics LIS344ALH. MEMS inertial sensor – high performance 3-axis ±2±6g ultracompact linear accelerometer. Available at: http://www.st.com/web/en/resource/technical/document/datasheet/CD00182781.pdf
15. Analog Devices ADXL001. High Performance, Wide Bandwidth Accelerometer. Available at: http://www.analog.com/media/en/technical-documentation/data-sheets/ADXL001.pdf
16. Espressif smart connectivity platform: ESP8266EX. Available at: http://www.fut-elektronics.com/wp-content/uploads/2015/10/ESP8266_12_wifi_datasheet.pdf
17. MIDE Volute Piezoelectric Energy Harvesters. Available at: http://www.mide.com/
18. Badri, A. E., Sinha, J. K., Albarbar, A. (2010). A typical filter design to improve the measured signals from MEMS accelerometer. Measurement, 43 (10), 1425–1430. doi: 10.1016/j.measurement.2010.08.011
19. ISO 10816–1:1995 Mechanical vibration – evaluation of machine vibration by measurements on non-rotating parts – Part1: General guidelines (2012). ISO, Geneve, 12.
20. Serridge, M., Licht, T. R. (1986) Piezoelectric accelerometer and vibration preamplifier handbook. Glostrup, Denmark: Bruel&Kjaer, 187.
21. ISO 5347–393(en) Methods for the calibration of vibration and shock pick-ups – Part 3: Secondary vibration calibration (1993). ISO, Geneve, 8.

METHOD OF STUDYING CORROSION PROCESSES OF METAL ELECTRODES BY SURFACE VOLTAGE FLUCTUATIONS (p. 24-29)

Yurii Striletskyi, Victor Rovinskyi, Olga Yevchuk

The way of study of corrosion processes on the surface of the metal electrode based on the results of observations of voltage fluctuations on it is proposed.

The signal processing device for voltage measured on the surface of the metal electrode is developed. The device comprises a differential amplifier, bandpass filter and amplifier with controllable gain. The method of testing of the developed device is described. The research of the electrical noise voltage of the steel electrode immersed in an electrolyte solution is performed. The occurrence of the spectral component at the frequency of 10–12 Hz during a series of experiments was observed. The search for sustainable criteria for evaluating the presence of corrosion processes in the studied surface area revealed that the most informative parameter in the study of voltage fluctuations associated with corrosion processes on the surface of the metal electrode is the shape of probability distribution of instantaneous values of voltage and evaluation of information entropy. The shape of the probability distribution can be a source of additional information on the progress of electrochemical reactions on the surface because dry electrode signal distribution law was similar in shape to normal. Changing the shape of this distribution with the introduction of additional local maximum shows the influence of extraneous input sources, which can be an electrochemical reaction. Information entropy estimation of instantaneous signal values at lower settlement expenses made it possible to distinguish between the results of different experiments. The changing information entropy of instantaneous values means the changed properties of the sources of electrical signals on the surface of the investigated electrode. The research enables to carry out external monitoring of corrosion processes on the inner surface of metal pipes.

Keywords: electrochemical corrosion, electrical noise voltage shape of probability distribution of instantaneous signal values, information entropy of instantaneous signal values.

References
1. Olkkonen, H. (Ed.) (2011). Discrete Wavelet Transforms – Biomedical Applications. Publisher: InTech, 378.
2. Heselmann, J., Hladky, K., Holdefer, M., Wessels, R. (2013). New Corrosion Monitoring Probe Combines ER, LPR, HDA, Floating B-constant, Electrochemical Noise and Conductivity Measurements. NACE International, Paper No. 2332.
3. Thompson, N. G., Payers, J. H. (1989). DC electrochemical test methods. National Association of Corrosion Engineers, 120.
4. Mansfeld, F. (1990). Electrochemical impedance spectroscopy (EIS) as a new tool for investigating methods of cor-
The studies on minimization of the number of training samples, represented in a binary form of discerning features were carried out. The program “Threat Analyzer” was developed which allows automatic generation of dimensions of training matrix of features of anomalies, cyber threats, or cyber-attacks, without requiring the participation of experts.

It is shown that for the object detection within known classes of cyber threats, attacks, anomalies, the usage in the training matrices of representative sets of 3-4 features long allows maximizing the effectiveness of the algorithm, reaching up to 98%.

**Keywords:** adaptive system of detection of cyber threats, features of a cyber-attack, logical procedures, elementary classifier.

**References**

1. Jyothsna, V., V. Rama Prasad, V., Munivara Prasad, K. (2011). A Review of Anomaly based Intrusion Detection Systems. International Journal of Computer Applications, 28 (7), 26–35. doi:10.5120/3399-4730

2. Baddar, S. A.-H., Merlo, A., Migliardi, M. (2014). Anomaly detection in computer networks: a state-of-the-art review. Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, 5 (4), 29–64.

3. Gyanchandani, M., Rana, J. L., Yadav, R. N. (2012). Taxonomy of anomaly based intrusion detection system: a review. International Journal of Scientific and Research Publications, 2 (12), 1–13.

4. Vincurkar, D. P., Reshamwala, A. (2012). A review of intrusion detection system using neural network and machine learning technique. International Journal of Engineering Science and Innovative Technology (IJEIST), 1 (2), 54–63.

5. Tsai, C.-F., Hsu, Y.-F., Lin, C.-Y., Lin, W.-Y. (2009). Intrusion detection by machine learning: A review. Expert Systems with Applications, 36 (10), 11994–12000. doi:10.1016/j.eswa.2009.05.029

6. Omar, S., Ngadi, A., H. Jebur, H. (2013). Machine Learning Techniques for Anomaly Detection: An Overview. International Journal of Computer Applications, 79 (2), 33–41. doi:10.5120/13715-1478

7. Riadi, I., Istiyanto, J. E., Ashari, A., Subanar (2013). Log Analysis Techniques using Clustering in Network Forensics. International Journal of Computer Science and Information Security, 10 (7), 23.

8. Ranjan, R., Sahoo, G. (2014). A New Clustering Approach for Anomaly Intrusion Detection. International Journal of Data Mining & Knowledge Management Process, 4 (2), 29–38. doi:10.5121ijd.kp.2014.4203

9. Guan, Y., Ghorbani, A. A., Belace, N. (2003). Y-means: a clustering method for intrusion detection. CCECE 2003 – Canadian Conference on Electrical and Computer Engineering. Toward a Caring and Humane Technology (Cat. No.03CH37436), 2, 1083–1086. doi:10.1109/ccece.2003.1226084

10. Li, W., Yi, P., Wu, Y., Pan, L., Li, J. (2014). A New Intrusion Detection System Based on KNN Classification Algorithm in Wireless Sensor Network. Journal of Electrical and Computer Engineering, 2014, 1–8. doi:10.1155/2014/242017

11. Ilgun, K., Kemmerer, R. A., Porras, P. A. (1995). State transition analysis: a rule-based intrusion detection approach. IEEE Transactions on Software Engineering, 21 (3), 181–199. doi:10.1109/32.372146

12. Khan, L., Awad, M., Thuraisingham, B. (2006). A new intrusion detection system using support vector machines and...
hierarchical clustering. The VLDB Journal, 16 (4), 507–521. doi: 10.1007/s00778-006-0002-5
13. Wu, S. X., Banzhaf, W. (2010). The use of computational intelligence in intrusion detection systems: A review. Applied Soft Computing, 10 (1), 1–35. doi: 10.1016/j.asoc.2009.06.019
14. Kabiri, P., Ghorbani, A. A. (2005). Research on intrusion detection and response: a survey. International Journal of Network Security, 1 (2), 84–102.
15. Ameizeane El Hassani, A., Abou El Kalam, A., Bouhoula, A., Abassi, R., Ait Ouahman, A. (2014). Integrity-OrBAC:a new model to preserve Critical Infrastructures integrity. International Journal of Information Security, 14 (4), 367–385. doi: 10.1007/s10207-014-0254-9
16. Al-Jarrah, O., Arafat, A. (2014). Network Intrusion Detection System using attack behavior classification. 2014 5th International Conference on Information and Communication Systems (ICICS), 1–14. doi: 10.1109/icais.2014.6841978
17. Selim, S., Hashem, M., Nazmy, T. M. (2010). Detection using multi-stage neural network. International Journal of Computer Science and Information Security (IJCSIS), 8 (4), 14–20.
18. Pawar, S. N. (2013). Intrusion detection in computer network using genetic algorithm approach: a survey. International Journal of Advances in Engineering Technology, 6 (2), 730–736.
19. Zhou, Y. (2009). Hybrid Model Based on Artificial Immune System and PCA Neural Networks for Intrusion Detection. Asia-Pacific Conference on Information Processing, 1, 21–24. doi: 10.1109/apicp.2009.13
20. Komar, M., Golovko, V., Sachenko, A., Bezobrazov, S. (2013). Development of neural network immune detectors for computer attacks recognition and classification. 2013 IEEE 7th International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS), 2, 665–668. doi: 10.1109/idacs.2013.6663008
21. Heckerman, D. (2008). A tutorial on learning with bayesian networks. Innovations in Bayesian Networks: Theory and Applications, 156, 33–82.
22. Mukkamala, S., Sung, A. H., Abraham, A., Ramos, V. (2006). Intrusion Detection Systems Using Adaptive Regression Splines. Enterprise Information Systems VI, 211–218. doi: 10.1007/1-4020-3675-2_25
23. Zhan, Z., Xu, M., Xu, S. (2013). Characterizing Honeypot-Captured Cyber Attacks: Statistical Framework and Case Study. IEEE Transactions on Information Forensics and Security, 8 (11), 1775–1789. doi: 10.1109/tifs.2013.2279800
24. Rayj, J. (2014). A survey of Cyber Attack Detection Strategies. International Journal of Security and Its Applications, 8 (1), 247–256. doi: 10.14257/ij sia.2014.8.1.23
25. Jasiul, B., Szpyrka, M., Jliwa, J. (2014). Detection and Modeling of Cyber Attacks with Petri Nets. Entropy, 16 (12), 6602–6623. doi: 10.3390/e16126602
26. Peddabachigari, S., Abraham, A., Grosan, C., Thomas, J. (2007). Modeling intrusion detection system using hybrid intelligent systems. Journal of Network and Computer Applications, 30 (1), 114–132. doi: 10.1016/j.jnca.2005.06.003
27. Lahno, V. (2014). Information security of critical application data processing systems. TEKA. Commission of motorization and energetics in agriculture, 14 (1), 134–143.
28. Rid, T., Buchanan, B. (2014). Attributing Cyber Attacks. Journal of Strategic Studies, 38 (1-2), 4–37. doi: 10.1080/01402390.2014.977382
29. Guitton, C., Korzak, E. (2013). The Sophistication Criterior for Attribution. The RUSI Journal, 158 (4), 62–68. doi: 10.1080/03071847.2013.826509

DEVELOPMENT OF ALTERNATIVE DIAGNOSTIC FEATURE SYSTEM IN THE CARDIOLOGY
DECISION SUPPORT SYSTEMS (p. 39-44)

Anatoly Povoroznyuk, Anna Filatova

The trend towards an increase in the production of Ukrainian digital electrocardiographic telemetry systems such as transtelephonic digital 12-channel electrocardiograph complex “Telecard” identified the need to create intelligent automated cardiac decision support systems. The basis of these systems is the morphologic analysis of electrocardiograms, which represent biomedical signals with locally concentrated features.

The system of alternative diagnostic features based on the method proposed by the authors of the morphological analysis of biomedical signals with locally concentrated features to provide additional graphical information in the diagnosis of one of the most common cardiac arrhythmias - ventricular arrhythmia is developed. Representation of the electrocardiogram in two-dimensional space of alternative features, as well as hodograph is proposed. Differences between the ECG-hodographs for normal ECG and ECG with different arrhythmias of right and left ventricles, as well as multifocal ventricular arrhythmia are analyzed. It was found that a graphical representation of an electrocardiogram in the alternative feature space allows the physician to visually perform the classification of different types of ventricular arrhythmia, which in combination with the classical analysis of ECG on the time axis increases the reliability of diagnostics.

Keywords: alternative feature space, electrocardiogram, premature ventricular contractions, hodograph.

References
1. Vladymyrs’kyi, A. V. (2001). Telemedytsyna: monohrafiya. Donetsk, OOO «Tyshrovaia typohrafiya», 437.
2. Fainzylbirger, L. S., Soroka, T. V. (2015). Development of telemedicine system for remote monitoring of heart activity based on fasegraphy method. Eastern-European Journal of Enterprise Technologies, 6 (9 (78)), 37–46. doi: 10.15587/1729-4061.2015.55004
3. Mykoliuk, V. V., Lozovych, V. A. (2010). Pidsumky ekspluatacii ustatkuvannia dystantsiinoi reiestratsii EKH «Kom»: kompleks medychnyi dnychnostnych «Tredexx» za 2009 rik v Mohyliv–Podil’skomu raioni Vinnits’koi oblasti. Ukrains’kyi zhurnal telemedytny ta medychnoi telematyky, 8 (2), 182–186.
4. Vladymyrs’kyi, A. V., Pavlovych, R. V., Mozghovoi, V. V. (2012). Ob’ektyvyzatsiia efektyvnosti telemedytsynskoi sety «Telekard». Ukrainian Journal of Telemedicine and Medical Telematics, 10 (2), 4–12.
5. Hampton, J. R. The ECG Made Easy (2013). Churchill Livingstone, 208.
6. Khöör, S., Keskis, L., Kovács, I., and others (2008). Heart Rate Analysis and Telemedicine: New Concepts & Maths. Acta Polytchnica Hungarica, 5 (1), 136–145.
7. Yokokawa, M., Kim, H. M., Good, E., Chugh, A., Pelosi, F., Alguire, C. et. al. (2012). Relation of symptoms and symptom duration to premature ventricular complex-induced cardiomyopathy. Heart Rhythm, 9 (1), 92–95. doi: 10.1016/j.hrthm.2011.08.015
Abstract and References: Information and controlling system

7. Burtsev, M., Povoroznuk, A., Povoroznuk, O., Filatova, A. (2013). Design of Computer–Based Intelligent Support Decision Systems for Medicine. XII international conferences “The experience of designing and application of CAD systems in microelectronics”, 45–52.

22. Burtsev, M., Povoroznuk, A., Povoroznuk, O., Filatova, A. (2013). Design of Computer-Based Intelligent Support Decision Systems for Medicine. XII international conferences “The experience of designing and application of CAD systems in microelectronics”, 45–52.

23. Povoroznuk, A. (2013). Design of Non-Linear Filter in the Problem of Structural Identification of Biomedical Signals with Locally Concentrated Properties. Science Journal of Circuits, Systems and Signal Processing, 2 (3), 85. doi: 10.11648/j.iass.20130203.12

DEVELOPMENT OF INFORMATION TECHNOLOGY OF TASKS DISTRIBUTION FOR GRID-SYSTEMS USING THE GRASS SIMULATION ENVIRONMENT (p. 45-53)

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An information distribution task technology for GRID-systems based on the use of simulation modeling GRASS environment was proposed. GRASS reproduces the process of functioning over time of elementary events that occur in the GRID-system with maintaining their interaction logic. This solution enables conducting of computational experiments that implement different methods of distribution, with a following selecting of the most effective solution on the basis of the collection, analysis and interpretation of simulation results.

The proposed task of distribution technology using simulation modeling GRASS environment, enables implementing multiple distribution methods and selecting the best distribution environment that increases the efficiency of GRID-systems by reducing the time of the task performance and reducing the downtime of resources in highly related tasks.

GRASS modeling environment has a modular structure, which consists of a core and dynamically loaded modules (plug-ins). Each module performs a highly specialized task, referring if necessary to the other modules of the system. The core provides means of inter-module interaction and provides boot and system configuration.

Keywords: distributed systems, GRID-system scheduler (broker), information technology, GRASS environment, computing resources, allocation policy.

References

1. Aida, K., Casanova, H. (2008). Scheduling mixed-parallel applications with advance reservations. Proceedings of the 17th International Symposium on High Performance Distributed Computing – HPDC ’08, 65–74. doi: 10.1007/s10586-008-9073-3

2. Ando, S., Aida, K. (2007) Evaluation of Scheduling Algorithms for Advance Reservations. Information Processing Society of Japan SIG Notes. HPC-113, 37–42.

3. Elmroth, E., Tordsson, J. (2009). A standards-based Grid resource brokering service supporting advance reservations, co-allocation, and cross-Grid interoperability. Concurrency and Computation: Practice and Experience, 21 (18), 2298–2335. doi: 10.1002/cpe.1441

4. Cafaro, M., Mitro, M., Aloisio, G. (2012). Preference-Based Matchmaking of Grid Resources with CP-Nets. Journal of Grid Computing, 11 (2), 211–237. doi: 10.1007/s10723-012-9235-2

5. Kurowski, K., Nabrzyski, J., Oleksiak, A., Weglarz, J. (2004). Multicriteria Aspects of Grid Resource Management.
international Series in Operations Research & Management Science, 271–293. doi: 10.1007/978-1-4615-0509-9_18
6. Ernemann, C., Hamscher, V., Yahyapour, R.; Feitelson, D. G., Rudolph, L., Schwiegelshohn, U. (Eds.) (2002). Economic Scheduling in Grid Computing, Lecture Notes in Computer Science, 2537, 128–152. doi:10.1007/3-540-36180-4_8
7. Rodero, I., Villegas, D., Bobroff, N., Liu, Y., Fong, L., Sadjadi, S. M. (2013). Enabling Interoperability among Grid Meta-Schedulers, Journal of Grid Computing, 11 (2), 311–336. doi: 10.1007/s10703-013-9232-9
8. Azzedin, F., Maheswaran, M., Arnason, N. (2004). A Synchronous Co-Allocation Mechanism for Grid Computing Systems. Cluster Computing, 7 (1), 39–49. doi: 10.1023/B:CHUS.0000039422.73875.29
9. Castillo, C., Rouskas, G. N., Harfouch, K. (2009) Resource Co-allocation for Large-scale Distributed Environments. 18th ACM International Symposium on High Performance Distributed Computing, ACM, 137–150.
10. Takefusa, A., Nakada, H., Kudoh, T., Tanaka, Y.; Frachtenberg, E., Schwiegelshohn, U. (Eds.) (2010). An Advance Reservation-based Co-allocation Algorithm for Distributed Computers and Network Bandwidth on QoS-guaranteed Grids. Lecture Notes in Computer Science, 6253, 16–34. doi:10.1007/978-3-642-16305-4_2
11. Blanco, H., Gutrado, F., Lérida, J. L., Albornoz, V. M. (2012). MIP Model Scheduling for Multiclusters. Lecture Notes in Computer Science, 7640, 196–206. doi:10.1007/978-3-642-36949-0_22
12. Garg, S. K., Konugurthi, P., Buyya, R. (2011). A linear programming-driven genetic algorithm for meta-scheduling on utility grids. International Journal of Parallel, Emergent and Distributed Systems, 26 (6), 493–517. doi:10.1080/17445760.2010.530002
13. Olteanu, A., Pop, F., Dobre, C., Cristea, V. (2012). A dynamic rescheduling algorithm for resource management in large scale dependable distributed systems. Computers & Mathematics with Applications, 63 (9), 1409–1423. doi:10.1016/j.camwa.2012.02.066
14. Toporkov, V., Toporkova, A., Tselishchev, A., Yemelyanov, D. (2014). Slot selection algorithms in distributed computing. The Journal of Supercomputing, 69 (1), 53–60. doi:10.1007/s11227-014-1210-1
15. Toporkov, V., Toporkova, A., Tselishchev, A., Yemelyanov, D. (2013). Slot Selection Algorithms in Distributed Computing with Non-dedicated and Heterogeneous Resources. Parallel Computing Technologies, 120–134. doi: 10.1007/978-3-642-39958-9_10
16. Toporkov, V. V., Bobchenkov, A. V., Yemelyanov, D. M., Tselishchev A. S. (2014). Metodi i evristiki planirovaniya v raspredelenykh vichislennykh s neotchujdajemymi resursami. Vestnik UUrGU, seriya «Vichislitelnaya matematika i informatika», 3 (2), 43–62.
17. Toporkov, V. V., Yemelyanov, D. M., Toporkova, A. S. (2016). Metaplanirovanie vichislennykh sistem v raspredelenennykh s neotchujdajemymi resursami. Informacionnie tehnologii v nauce, obrazovanii i upravlenii. IT + S&E’16, 22–31.
18. Kostromin, R. O. (2015). Modeli, metodi i sredstva upravleniya vichislennymi s sistemami izhishleniya v integrirovannykh klasterakh. Fundamental’nye issledovaniya, 6, 35–38.
19. Feoktistov, A. G. (2015). Metodologiya konceptualizaci v klassifikacii potokov zadaniy mashtabiruemymi prinzheni v raznorodnoi raspredelennoi vichislitelnoi srede. Sistemi upravleniya, svyazi i bezopasnosti, 4, 1–25.
20. Venugopal, S., Buyya, R., Winton, L. (2006). A Grid service broker for scheduling e-Science applications on global data Grids. Concurrency and Computation: Practice and Experience, 18 (6), 685–699. doi: 10.1002/cpe.974
21. Astrikov, D. U., Kuzmin, D. A., Panacuk, A. I. (2014). Modelirovanie sistemi planirovaniya raspredelennoi visokoproizvoditelnoi vichislitelnoi kompleksa. Dokladi Akademii nauk Vishevykh shkoly Rossiskoi federatsii, 2-3 (23-24), 34–41.
22. Milukov, V. V., Nosovskiy, U. V. (2013). Modelirovaniye fragmentov GRID-sistemi v simulatore GridSim. Optimizaciya virobnichih procesiv, 14, 218–222.
23. Volk, M. A., Gorenkov, A. S., Gridel, R. N. (2010). Arhitektura imitatsionnykh modeli GRID-sistemi osnovannaya na podkluchayemych modulyakh. Sistemi obrobki informatii, 1 (82), 17–20.
24. Filimonchuk, T. V., Tkachev, V. N. (2015). Informatsionnaya tehnologiya raspredeleniya zadaniy na vychislitelnykh resursy v GRID-sistemah. Informatika, matematicheskoye modelirovaniye, ekonomika, 1, 204–209.
25. Volk, M. A. (2009). Struktura programmnogo kompleksa imitatsionnogo modelirovaniya elementov GRID-sistemy nauchnykh issledovaniy. Sistemi obrobki informatii, 3 (77), 125–128.
26. Volk, M. A., Filimonchuk, M. A., Filimonchuk, T. V. (2012). Modul raspredelenyi zadaniy v GRID-sistemah. Sistemi obrobki informatii, 2 (100), 177–182.
27. Volk, M. A., Filimonchuk, T. V. (2013). Obobschennyiy kriteriy otseki zadaniya dlya tehnologii planirovaniya zadaniy v GRID. In 3 volumes. Vol. 2. Informatika, matematicheskoye modelirovaniye, ekonomika, 172–176.