Comparison between Using Linear and Non-linear Features to Classify Uterine Electromyography Signals of Term and Preterm Deliveries

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ABSTRACT

The main objective of this paper is to predict preterm deliveries at an early gestation period using uterine electromyography signals (EMG). Detecting such uterine signals can yield a promising approach to determine and take actions to prevent this potential risk. Previous classification studies use only linear methods as classic spectral analysis to classify the uterine EMG that does not give clinically useful results. On another hand some studies make linear and non-linear analysis for the uterine EMG and find that the non-linear parameters can distinguish the preterm delivery uterine EMG from the term one. In this research, two ways will be taken combining the two previous ideas; the first way is to take some uterine EMG linear parameters as features to a suitable neural network and the second one is to take some uterine EMG non-linear parameters as features to the same neural network. Then, the two ways' results are compared using ROC analysis which proves that the chance of correctly classification increases markedly when applying the non-linear methods.

Keywords: *Uterine EMG signals, Term-Preterm deliveries prediction, Linear signal processing techniques, Non-linear signal processing techniques, ROC curves analysis.*

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References

[1] (2012) The iPredict website. [Online]. Available: http://www.ipredict.it/Methods/PrincipalComponentAnalysis.aspx.
[2] M. O. Diab, A. El-Merhie, N. El-Halabi and L. Khoder, "Classification of uterine EMG signals using supervised classification method," *J. Biomedical Science and Engineering*, 3, 837(6)-842, 2010.
[3] H. Leman, C. Marque and J. Gondry, "Use of the electrohysterogram signal for characterization of contractions during pregnancy," *IEEE Trans Biomed Eng*, 46(10):1222–1229, 1999.
[4] W. L. Maner and R. E. Garfield, "Identification of human term and preterm labor using artificial neural networks on uterine electromyography data," *Ann Biomed Eng*, 35(3):465–473, 2007.
[5] M. O. Diab, C. Marque and M. A. Khalil, "Classification for Uterine EMG Signals: Comparison Between AR Model and Statistical Classification Method," *INTERNATIONAL JOURNAL OF COMPUTATIONAL COGNITION*, VOL. 5, NO. 1, 2007.
[6] R. E. Garfield , W. L. Maner, L. B. MacKay, D. Schlembach and G. R. Saade, "Comparing uterine electromyography activity of antepartum patients versus term labor patients," *Am J Obstet Gynecol*, 193(1):23–29, 2005.
[7] H. Maul, W. L. Maner, G. Olson, G. R. Saade and R. E. Garfield, "Non-invasive transabdominal uterine electromyography correlates with the strength of intrauterine pressure and is predictive of labor and delivery," *J Matern Fetal Neonatal Med*, 15(5):297– 301, 2004.
[8] M. Hassan, J. Terrien, A. Alexandersson, C. Marque and B. Karlsson, "Nonlinearity of EHG signals used to distinguish active labor from normal pregnancy contractions," *32nd Annual International Conference of the IEEE EMBS*, 2010.
[9] G. Fele-Žorž, G. Kavšek, Ž. Novak-Antolič and F. Jager, "A comparison of various linear and non-linear signal processing techniques to separate uterine EMG records of term and pre-term delivery groups," *Med Biol Eng Comput*, 46(9):911-922, 2008.
[10] M. Akay, *Nonlinear biomedical signal processing*, vol II. Dynamic analysis and modeling. IEEE Inc., New York, 2001.
[11] I. Verdenik, M. Pajntar and B. Leskosek, "Uterine electrical activity as predictor of preterm birth in women with preterm contractions," *Eur J Obstet Gynecol Reprod Biol*, 95(2):149–153, 2001.

[12] H. Maul, W. L. Maner, G. Olson, G. R. Saade and R. E. Garfield, "Non-invasive trans-abdominal uterine electromyography correlates with the strength of intrauterine pressure and is predictive of labor and delivery," *J Matern Fetal Neonatal Med*, 15(5):297– 301, 2004.
[13] P. Carre, H. Leman, C. Fernandez and C. Marque, "Denoising of the uterine EHG by an undecimated wavelet transform," *IEEE Trans Biomed Eng*, 45(9):1104–1113, 1998.
[14] D. Devedeux, C. Marque, S. Mansour, G. Germain and J. Duchene, "Uterine electromyography: a critical review," *Am J Obstet Gynecol*, 169(6):1636 1653, 1993.
[15] G. Kavsˇek, "Electromyographic activity of the uterus in threatened preterm delivery," Master's Thesis, University of Ljubljana, Medical faculty, Ljubljana, 2001.
[16] (2010) Frequency signal analysis-BIOPAC Systems Inc. website. [Online]. Available: www.biopac.com.
[17] J. Terrien, T. Steingrimsdottir, C. Marque, and B. Karlsson, "Synchronization between EMG at different uterine locations investigated using time-frequency ridge reconstruction: Comparison of pregnancy and labor contractions," *EURASIP Journal on Advances in Signal Processing*, 2010.
[18] (2007) The Royal Academy of Engineering website. [Online]. Available: http://www.kpsec.freeuk.com/acdc.htm.
[19] T. Schreiber and A. Schmitz, "Surrogate time series," Phys. D, vol. 142, pp. 346-382, 2000.
[20] S. M. Pincus, "Approximate entropy as a measure of system complexity," Proc. Natl. Acad. Sci. U S A, vol. 88, pp. 2297-301, 1991.
[21] J. Theiler, S. Eubank, B. Galdrikian, A. Longtin and D. J. Farmer, "Testing for nonlinearity in time series: the method of surrogate data," *Physica D*, 58: 77-94, 1992.
[22] M. Rosenstein, J. Collins and C. De Luca, "A practical method for calculating largest lyapunov exponent from small data sets," Tech rep, Boston University, Neuromuscular research center, Boston, 1992.
[23] N. K. Myung, "Singular Spectrum Analysis," Master's Thesis, UNIVERSITY OF CALIFORNIA, Los Angeles, 2009.
[24] A. Jovic and N. Bogunovic, "Feature extraction for ECG time-series mining based on chaos theory," Proceedings of the ITI 2007 29th Int. Conf. on Information Technology Interfaces, June 25-28, 2007, Cavtat, Croatia, 2007.
[25] N. H. Packard, J. P. Cruchfield, J. D. Farmer and R. S. Shaw, "Geometry from a Time Series," Physical Review Letters 45: 712-715, 1980.
[26] F. Nielsen, "Neural Networks – algorithms and applications," Niels Brock Business College, 2001.
[27] S. Goyal and G. Kumar Goyal, "Cascade and Feedforward Backpropagation Artificial Neural Network Models For Prediction of Sensory Quality of Instant Coffee Flavoured Sterilized Drink," *Canadian Journal on Artificial Intelligence*, Machine Learning and Pattern Recognition, Vol. 2, No. 6, 2011.
[28] H. Demuth, M. Beale and M. Hagan, *Neural Network Toolbox User's Guide*, The MathWorks, Inc., Natrick, USA, 2009.
[29] K. Lee (2012) File exchange-Mathworks website. [Online]. Available: http://www.mathworks.com/matlabcentral/fileexchange/35784-sample-entropy.
[30] B. Moslem, M. Diab, M. Khalil and C. Marque, "Combining data fusion with multiresolution analysis for improving the classification accuracy of uterine EMG signals," *EURASIP Journal on Advances in Signal Processing*, doi:10.1186/1687-6180-2012-167, 2012.
[31] A. Diab, M. Hassan, C. Marque and B. Karlsson, "Quantitative performance analysis of four methods of evaluating signal nonlinearity: Application to uterine EMG signals", 2012.
[32] (2010) PhysioBank website. [Online]. Available: http://www.physionet.org/pn6/tpehgdb/#ref3.

A robust speech disorders correction system for Arabic language using visual speech recognition

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Keywords: **Speech Processing, Visual Speech, Arabic Speech Recognition, Speech Disorders Classification and Lips Detection.**

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Abstract

In this Paper, we propose an automatic speech disorders recognition technique based on both speech and visual components analysis. First, we performed the pre-processing steps required for speech recognition then we chose the Mel-frequency cepstral coefficients (MFCC's) as features representing the speech signal. On the other hand, we studied the visual components based on lips movements analysis. We propose a new technique that integrates both the audio signal and the video signal analysis techniques for increasing the efficiency of the automated speech disorders recognition systems. The main idea is to detect the motion features from a series of lips images. A new technique for lips movement detection is proposed. Finally we use the multi-layer neural network as a classifier for both speech and visual features. We propose a new technique for speech disorders correction systems, especially for Arabic language. Practical experiments showed that our system is useful when dealing with Arabic language speech disorders.

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References

1. Stork DG, Hennecke ME, Speech reading by Humans and Machines, Berlin, Germany: Springer, 1996.
2. Teissier P, Robert-Ribes J, Schwartz JL, and A. Guerin-Dugue A. Comparing models for audiovisual fusion in a noisy-vowel recognition task," IEEE Transactions on Speech and Audio Processing, 7(6): 629-642, 1999.
3. Dupont S, Luettin J, "Audio-visual speech modeling for continuous speech recognition," IEEE Transactions on Multimedia , Volume 2, Issue (3), pp.141-151, 2000.
4. Massaro DW, Stork DG. "Speech recognition and sensory integration," American Scientist, Volume 86, Issue (3), pp. 236-244, 1998.
5. [5] H. McGurk and J.W. MacDonald, "Hearing lips and seeing voices," Nature, 264:746-748, 1976 .
6. A.Q. Summerfield, "Some preliminaries to a comprehensive account of audio-visual speech perception," In Dodd, B. and Campbell, R. (Eds.), Hearing by Eye: The Psychology of Lip-Reading. Hillside, NJ: Lawrence Erlbaum Associates, pp. 97-113. 1987 .
7. W. H. Sumby and I. Pollack, "Visual contributions to speech intelligibility in noise," Journal of the Acoustical Society of America, 26:212–215, 1954.
8. T. Giannakopoulos, "Study and application of acoustic information for the detection of harmful content, and fusion with visual information," Ph.D. dissertation, Dpt of Informatics and Telecommunications, University of Athens, Greece, 2009.

Defining a Measure of Cloud Computing Elasticity

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Abstract

Cloud computing has gathered great attention recently as a method for eliminating or at least reducing expensive setup and maintenance cost of computing resources. Cloud computing has many key characteristics such as reliability, multi-tenancy and rapid elasticity. However, these characteristics suffer from the lack of clear and quantitative measures. In this paper, we provide a preliminary work that can help in providing a set of benchmarks for a cloud computing performance. More specifically, we provide an approach for measuring the elasticity of a cloud. Elasticity of a cloud computing system refers to its ability to expand and contract overtime in response to users' demands. The work presented in this paper is inspired by the definition of elasticity that is used in physics. This definition is adopted to represent the basic features of a cloud computing environment and its parameters that are related to elasticity. Case study shows the adoption methodology and highlights some of the basic parameters affecting elasticity as measured by the proposed approach.

Keywords- cloud computing; elasticity; computing capacity.

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References

[1] R. Geiger, B. Fluri, H. C. Gall, and M. Pinzger, "Relation of code clones and change couplings", 9th International Conference of Fundamental approaches to Software Engineering, pp. 411–425, 2006.
[2] E. Duala-Ekoko, and M.P. Robillard, "Tracking Code Clones in Evolving Software", In Proceedings of 29th International Conf. Software Engineering, ICSE, pp. 158 – 167, 2007.
[3] M.A. Vouk, "Cloud computing — Issues, research and implementations,"30th International Conference on Technology Interfaces, pp.31-40, June, 2008.
[4] D. Nurmi, R. Wolski, C. Grzegorczyk, G. Obertelli, S. Soman, L. Youseff and D. Zagorodnov, " Eucalyptus: A Technical Report on an Elastic Utility Computing Architecture Linking Your Programs to Useful Systems," UCSB Computer Science Technical Report Number 2008-10, August, 2008.
[5] J. Varia, Cloud Computing: Principles and Paradigms, chapter 18: Best Practices in Architecting Cloud Applications in the AWS Cloud, pp 459-490. Wiley Press, 2011.
[6] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M.i Zaharia, "Above the Clouds: A Berkeley View of Cloud Computing," Technical Report EECS-2009-28, EECS Department, University of California, Berkeley.
[7] R. N. Calheiros, R. Ranjan, A. Beloglazov, C. A. F. De Rose, and R. Buyya, "CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments and Evaluation of Resource Provisioning Algorithms," Software: Practice and Experience (SPE), Vol. 41, No. 1, pp 23-50, USA, January, 2011.
[8] V. Chang, G. Wills, and D. De Roure, "A Review of Cloud Business Models and Sustainability," IEEE 3rd International Conference on Cloud Computing, pp.43-50, July, 2010.
[9] A. Iosup, S. Ostermann, M.N. Yigitbasi, R. Prodan, T.Fahringer and D.H.J. Epema, "Performance Analysis of Cloud Computing Services for Many-Tasks Scientific Computing," IEEE Transactions on Parallel and Distributed Systems, vol.22, no.6, pp.931-945, June, 2011.
[10] L. Badger, T. Grance, R. P.-Comer and J. Voas, "Draft cloud computing synopsis and recommendations," National Institute of Standards and Technology, Special Publication 800-146, May 2011.
[11] L. Youseff, M. Butrico, and D. Da Silva, "Toward a Unified Ontology of Cloud Computing," Grid Computing Environments Workshop, pp.1-10, Nov., 2008.
[12] Elasticity (physics). March 6, 2012, http://en.wikipedia.org/wiki/Elasticity_(physics).
[13] G. Wang and T.S.E. Ng, "The Impact of Virtualization on Network Performance of Amazon EC2 Data Center," Proceedings of IEEE INFOCOM, pp.1-9, March, 2010.

[14] A. C. M. Assuncao and R. Buyya, “Evaluating the cost-benefit of using cloud computing to extend the capacity of clusters,” 11th IEEE International Conference on High Performance Computing and Communications, 2009.
[15] A. Li, X. Yang, S. Kandula, and M. Zhang, “Cloudcmp: comparing public cloud providers,” in Proceedings of the 10th Annual Conference on Internet Measurement, Melbourne, Australia, 2010.
[16] Z. Li, M. Zhang, Z. Zhu, Y. Chen, A. Greenberg, and Y.-M. Wang, “Webprophet: Automating performance prediction for web services,” in Proceedings of the 7th USENIX Symposium on Networked Systems Design and Implementation (NSDI), 2010.
[17] S.K. Garg, S. Versteeg and R. Buyya, “SMICloud: A Framework for Comparing and Ranking Cloud Services,” Fourth IEEE International Conference on Utility and Cloud Computing (UCC) , pp.210-218, Dec., 2011.
[18] J. Schad, J. Dittrich, and J. Quiane-Ruiz, “Runtime measurements in the cloud: observing, analyzing, and reducing variance,” Proceedings of the VLDB Endowment, vol. 3, no. 1-2, pp. 460-471, 2010.
[19] A. Iosup, N. Yigitbasi, and D. Epema, “On the performance variability of production cloud services,” Proceedings of IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing, CA, USA, 2011.
[20] S. K. Garg and R. Buyya, “ NetworkCloudSim: Modelling Parallel Applications in Cloud Simulations,” Proceedings of the 4th IEEE/ACM International Conference on Utility and Cloud Computing, Australia, Dec., 2011.

Left Ventricle Segmentation in Cardiac MRI Images

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Abstract Imaging of the left ventricle using cine short-axis MRI sequences, considered as an important tool that used for evaluating cardiac function by calculating different cardiac parameters. The manual segmentation of the left ventricle in all image sequences takes a lot of time, and therefore the automatic segmentation of the left ventricle is main step in cardiac function evaluation. In this paper, we proposed an automatic method for segmenting the left ventricle in cardiac MRI images. We applied pixel classification method by using number of features and KNN classifier for segmenting the left ventricle Cavity, and from its output we can get the endocardial contour. Then, we transformed image pixels from Cartesian to polar coordinates for segmenting the epicardial contour. This method was tested on large number of images, and we achieved good results reached to 95.61% sensitivity, and 98.9% specificity for endocardium segmentation, and 93.32% sensitivity, and 98.49% specificity for epicardium segmentation. The results of the proposed method show the availability for fast and reliable segmentation of the left ventricle.

Keywords Cardiac MRI, Segmentation, Pixel Classification

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References

[1] World Health Organization of cardiovascular diseases, [on-line], www.who.int/cardiovascular_diseases/en.
[2] J.S. Suri. Computer vision, pattern recognition and image processing in left ventricle segmentation: the last 50 years. Pattern Analysis and Applications, 3(3):209-242, 2000.
[3] Caroline Petitjean, Jean-Nicolas Dacher, "A review of seg-mentation methods in short axis cardiac MR images", Medi-cal Image Analysis 15, 2011, pp.169–184.
[4] Katouzian, A., Konofagou, E., Prakash, A., 2006. A new automated technique for left and right-ventricular segmenta-tion in magnetic resonance imaging. Conf. Proc. IEEE Eng. Med. Biol Soc. 1, 3074–3077.
[5] Yeh, J., Fua, J., Wua, C., Lina, H., Chaib, J., 2005. Myocar-dial border detection by branch-and-bound dynamic pro-gramming in magnetic resonance images. Comput. Methods Programs Biomed. 79 (1), 19–29.
[6] Cousty, J., Najman, L., Couprie, M., ClTment-Guinaudeau, S., Goissen, T., Garot, J., 2010. Segmentation of 4D cardiac MRI: automated method based on spatiotemporal watershed cuts. Image Vis. Comput. 28, 1229–1243.
[7] Pednekar, A., Kurkure, U., Muthupillai, R., Flamm, S., 2006. Automated left ventricular segmentation in cardiac MRI. IEEE Trans. Biomed. Eng. 53 (7), 1425–1428.
[8] Lynch, M., Ghita, O., Whelan, P., 2006. Automatic segmen-tation of the left ventricle cavity and myocardium in MRI data. Comput. Biol. Med. 36 (4), 389–407.
[9] Stalidis, G., Maglaveras, N., Efstratiadis, S., Dimitriadis, A., Pappas, C., 2002. Modelbased processing scheme for quan-titative 4-D cardiac MRI analysis. IEEE Trans. Inf. Technol. Biomed. 6 (1), 59–72.
[10] Ranganath, S., 1995. Contour extraction from cardiac MRI studies using snakes. IEEE Trans. Med. Imag. 14 (2), 328–338.
[11] Santarelli, M., Positano, V., Michelassi, C., Lombardi, M., Landini, L., 2003. Automated cardiac MR image segmenta-tion: theory and measurement evaluation. Med. Eng. Phys. 25 (2), 149–159.
[12] Mitchell, S., Lelieveldt, B., van der Geest, R., Bosch, J., Reiber, J., Sonka, M., 2001. Multistage hybrid active ap-pearance model matching: segmentation of left and right ventricles in cardiac MR images. IEEE Trans. Med. Imag. 20 (5), 415– 423.
[13] Zambal, S., Hladuvka, J., Bühler, K., 2006. Improving seg-mentation of the left ventricle using a two-component statis-tical model. In: Proceedings of Medical Image Computing and Computer-Assisted Intervention (MICCAI). LNCS, pp. 151–158.

[14] Lorenzo-Valdés, M., Sanchez-Ortiz, G., Mohiaddin, R., Rueckert, D., 2002. Atlas-based segmentation and tracking of 3D cardiac MR images using non-rigid registration. In: Pro-ceedings of Medical Image Computing and Computer- As-sisted Intervention (MICCAI). LNCS, Tokyo, Japan, pp. 642–650.
[15] Zhuang, X., Hawkes, D., Crum, W., Boubertakh, R., Uribe, S., Atkinson, D., Batchelor, P., Schaeffter, T., Razavi, R., Hill, D., 2008. Robust registration between cardiac MRI images and atlas for segmentation propagation. In: Society of Pho-to-Optical Instrumentation Engineers (SPIE) Conference, p. 691408.
[16] Gering, D., 2003. Automatic segmentation of cardiac MRI. In: Proceedings of Medical Image Computing and Comput-er-Assisted Intervention (MICCAI). LNCS, vol. 1, pp. 524–532.
[17] M. Hadhoud, M. Eladawy, A. Farag, " Automatic Global Localization of The Heart From Cine MRI images", 2011 IEEE International Symposium on IT in Medicine & Educa-tion (ITME), 2011, pp. 35-38.
[18] M. Hadhoud, M. Eladawy, A. Farag, "Left Ventricle Cavity Segmentation from Cardiac Cine MRI ", accepted in Interna-tional Journal of Computer Science Issues (IJCSI), March 2012, Vol. 2, pp. 398-402.
[19] Cardiac MRI Dataset, [online],http://www.cse.yorku.ca/~mridataset/.
[20] R. C. Gonzalez, and R. E. Woods, "Digital Image Processing", Upper Saddle River, New Jersy: Prentice-Hall, 2002.

Heart Localization from Magnetic Resonance Images Sequence

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Abstract: Problem statement: Heart localization is an important step in cardiac Magnetic Resonance Images (MRI) analysis. This study aims to locate the moving heart region from MRI sequence of images. **Approach:** The idea is to use the motion detection techniques to isolate the heart region from the background image and then apply morphological operations to construct a moving heart region mask. The mask is then applied to the MRI image to separate the Region Of Interest (ROI) that includes the heart. The K-means clustering algorithm is applied to the ROI to segment the heart walls. **Results:** Experimental results have shown that the performance of the proposed technique is superior to other MRI heart segmentation techniques in both complexity and accuracy. **Conclusion:** The proposed technique can be used as a pre segmentation step in any other future heart segmentation techniques to increase their accuracy through the localization of the moving heart region. The presented technique is fully automated technique and superior compared to other segmentation techniques.

Key words: Heart segmentation, K-means, morphological operations

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References

Allender, S., P. Scarborough, V. Peto, M. Rayner and J. Leal *et al*., 2008. European cardiovascular disease statistics. Eur. Heart Netw.

Brunet, N., F. Perez and F.D.L. Torre, 2009. Learning good features for active shape models. Proceedings of the IEEE 12th International Conference on Computer Vision Workshops, Sept. 27-Oct. 4, IEEE Xplore Press, Kyoto, pp: 206-211. DOI: 10.1109/ICCVW.2009.5457699

Deserno, T.M., 2011a. Biomedical Image Processing. Biol. Med. Phys. Biomed. Eng. DOI: 10.1007/978- 3-642-15816-2

Deserno, T.M., 2011b. Biomedical Image Processing. Ist Edn., Springer, Berlin, ISBN-10: 3642158153, pp: 595.

Dougherty, G., 2011. Medical image processing techniques and applications. Biol. Med. Phys. Biomed. Eng. DOI: 10.1007/978-1-4419-9779-1

Fonseca, C.G., M. Backhaus, D.A. Bluemke, R.D. Britten and J.D. Chung *et al*., 2011. The Cardiac Atlas Project-an imaging database for computational modeling and statistical atlases of the heart. Bioinformatics, 27: 2288-2295. DOI: 10.1093/bioinformatics/btr360

Gerard, O., T. Deschamps, M. Greff and L.D. Cohen, 2002. Real-time interactive path extraction with on-the-fly adaptation of the external forces. Comput. Vision, 2352: 239-266. DOI: 10.1007/3- 540-47977-5_53

Hamarneh, G. and T. Gustavsson, 2000. Combining snakes and active shape models for segmenting the human left ventricle in echocardiographic images. IEEE Comput. Cardiol, 27: 1-4.

He, L., Z. Peng, B. Everding, X. Wang and C.Y. Han *et al*., 2008. A comparative study of deformable contour methods on medical image segmentation. Image Vision Comput., 26: 141-163. DOI: 10.1016/j.imavis.2007.07.010

Jayadevappa, D. S.S. Kumar and D. Murty, 2009. A new deformable model based on level sets for medical image segmentation. IAENG Int. J. Comput. Sci., 36: 1-9.

Jonge, G.J.D., P.A.V.D. Vleuten, J. Overbosch, D.D. Lubbers and M.C.J.V.D. Weide *et al*., 2011. Semiautomatic measurement of left ventricular function on dual source computed tomography using five different software tools in comparison with magnetic resonance imaging. Eur. J. Radiol., 80: 755-766. DOI: 10.1016/j.ejrad.2010.10.002

Lelieveldt, B.P.F., S.C. Mitchell, J.G. Bosch, R.J. Van Der Geest and M. Sonka *et al*., 2001. Quantification of cardiac ventricular function using Magnetic Resonance Imaging (MRI) and Multi Slice Computed Tomography (MSCT). Proceedings of the Information Processing in Medical Imaging, (IPMI' 01), Davis, CA, USA, pp: 446-452.

Lloyd-Jones, D., R.J. Adams, T.M. Brown, S. Dai and G.D. Simone *et al*., 2010. Executive summary: Heart disease and stroke statistics-2010 update. Am. Heart Assoc., 121: 948-954. DOI: 10.1161/ CIRCULATIONAHA.109.192666

Mazonakis, M., E. Grinias, K. Pagonidis, G. Tziritas and J. Damilakis, 2010. Development and evaluation of a semiautomatic segmentation method for the estimation of LV parameters on cine MR images. Phys. Med. Biol., 55: 1127-1127. DOI: 10.1088/0031-9155/55/4/015

Mitchell, S.C., B.P.F. Lelieveldt, R.J.V.D. Geest, H.G. Bosch and J.H.C. Reiber *et al*., 2001. Multistage hybrid active appearance model matching: Segmentation of left and right ventricles in cardiac MR images. IEEE Trans. Med. Imag., 20: 415-423. DOI: 10.1109/42.925294

Narin, B., A. Arman, D. Arslan, M. Simsek and A. Narin, A. 2010. Assessment of cardiac masses: Magnetic resonance imaging versus transthoracic echocardiography. Anadolu Kardiyol Derg., 10: 69-74.

Neubauer, A. and R. Wegenkitl, 2003. A skeletonbased inflation model for myocardium segmentation. Proceedings of the Vision Interface, (VI' 03), Plonetm, pp: 56-67.

Petitjean, C. and J.N. Dacher, 2011. A review of segmentation methods in short axis cardiac MR images. Med. Image Anal., 15: 169-184. DOI: 10.1016/j.media.2010.12.004

Rogers, M. and J. Graham, 2002. Robust active shape model search. Comput. Vision-ECCV, 2353: 289- 312. DOI: 10.1007/3-540-47979-1_35

Reis, I.M.S., J.M.R.S. Tavares and R.M.N. Jorge, 2008. An introduction to the level set methods and its applications. Proceedings of the 5th European Congress on Computational Methods in Applied Sciences and Engineering, Jun. 30-Jul. 5, Venice, Italy, pp: 1-2.

Santarelli, M.F., V. Positano, C. Michelassi, M. Lombardi and L. Landini, 2003. Automated cardiac MR image segmentation: Theory and measurement evaluation. Med. Eng. Phys., 25. 149-159. DOI: 10.1016/S1350-4533(02)00144-3

Spreeuwers, L. and M. Breeuwer, 2003. Detection of left ventricular epi- and endocardial borders using coupled active contours. Int. Cong. Seri., 1256: 1147-1152. DOI: 10.1016/S0531-5131(03)00312-1

Stegmann, M.B., 2000. Active Appearance Models: Theory, Extensions and Cases. 2nd Edn., Informatics and Mathematical Modelling, Technical University of Denmark, DTU, Denmark, pp: 262.

Umbaugh, S.E., 1997. Computer Vision and Image Processing: A Practical Approach using CVIPtools. Ist Edn., Prentice Hall PTR, Upper Saddle River, ISBN-10: 0132645998 pp: 504.

Zambal, S., J. Hladuvka and K. Buhler, 2006. Improving segmentation of the left ventricle using a two-component statistical model. Med. Image Comput. Comput.-Assi. Interv., 4190: 151-158. DOI: 10.1007/11866565_19

Zhang, H., A. Wahle, R.K. Johnson, T.D. Scholz and M. Sonka, 2010a. 4-D cardiac MR image analysis: left and right ventricular morphology and function. IEEE Trans. Med. Imag, 29: 350-364. DOI: 10.1109/TMI.2009.2030799

Zhang, K., H. Song and L. Zhang, 2010b. Active contours driven by local image fitting energy. Patt. Recog., 43: 1199-1206. DOI: 10.1016/j.patcog.2009.10.010

Scaffold Development and Characterization Using CAD System

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Abstract
Morphology and mechanical properties of scaffolds seeded with osteoblastes cells used for bone and cartilage repair are the critical factors in bone tissue engineering. In this work, adding CMC and controlling temperature for nano-hydroxyapatite (HA)-b-tricalcium phosphate (b-TCP) scaffold using Polymeric sponge method provide suitable properties. A developed computer system was used to determine properties of scaffold. Porosity, shape and connectivity of pores were analysed based on image processing method. Cells were seeded on scaffold and the differentiation rate was calculated using image analysis. The fabricated sample showed high porosity (nearly 61%) and high compressive strength (nearly 16 MPa), as well as having a well pore size of 200 μm and more. Comparing to Archimedes method, the image result was more accurate. Internal porosity was more than surface porosity due to skin effect.

Keywords: Biomaterial, computer aided system, interconnection, porosity, morphology.

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References

1. D. Mohn, S.K.Misra, T.J. Brunner, A.R. Boccaccini, W.J. Stark, Nano- versus Micron-sized Bioactive Glass Reinforcement of P(3HB) – Are Nano-fillers the Way Forward, European Cells and Materials, Vol. 16., (page 8), ISSN 1473-2262, 2008.
2. Hirotaka Maedaa, Toshihiro Kasugaa,, Masayuki Nogamia, Minoru Ueda, Preparation of bonelike apatite composite for tissue engineering scaffold, Science and Technology of Advanced Materials 6 (2005) 48–53. DOI: 10.1016/j.stam.2004.07.003
3. Zhihong Dong, Yubao Li, Qin Zou, Degradation and biocompatibility of porous nano-hydroxyapatite/polyurethane composite scaffold for bone tissue engineering, Applied Surface Science 255 (2009) 6087–6091. DOI: 10.1016/j.apsusc.2009.01.083
4. Wang M, "Developing bioactive composite materials for tissue replacement," Biomaterials, vol.24, pp. 2133-2151, 2003. DOI: 10.1016/S0142-9612(03)00037-1
5. Liuyun Jiang, Yubao Li, Xuejiang Wang, Li Zhang, Jiqiu Wen, Mei Gong,Preparation and properties of nano-hydroxyapatite/chitosan/ carboxymethyl cellulose composite scaffold, Carbohydrate Polymers 74 (2008) 680–684. DOI: 10.1016/j.carbpol.2008.04.035

6. W. Sun, B. Starly, J. Nam, A. Darling, Bio-CAD modeling and its applications in computer-aided tissue engineering, Computer-Am. J. Biomed. Sci. 2011, 3(4), 268-277; doi: 10.5099/aj110400268

Aided Design 37 1097–1114, (2005). DOI: 10.1016/j.cad.2005.02.002
7. Lin C L, Miller J D., "Network analysis of filter cake pore structure by high resolution X-ray microtomography," J. Chemical Engineering Journal, vol. 77-7, pp. 79−86, 2000.
8. Coskun S B, Wardlaw N C., "Influences of pore geometry, porosity and permeability on initial water saturation: an empirical method for estimating initial water saturation by image analysis, "J. Petroleum Science and Engineering, vol. 12-4, pp. 295−308, 1995. DOI: 10.1016/0920-4105(94)00051-5
9. R.Ziel , A. Haus, A. Tulke, "Quantification of the pore size distribution (porosity profiles) in microfiltration membranes by SEM, TEM and computer image analysis," Journal of membrane science, vol. 323, pp. 241-246, 2008. DOI: 10.1016/j.memsci.2008.05.057

A Feature Selection Method Using Misclassified Patterns

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Feature selection (FS) is a key step in the data mining process. In FS, the objective is to select the smallest subset of features that reduces complexity and ensures generalization. In this paper, we present a combined filter-wrapper feature selection approach using misclassified data. The learning process starts with only one feature, which gives a large number of misclassified patterns. Only these patterns are used to select the next best feature which is added to the first one. By focusing on the misclassified patterns, the learner is undistracted and hence, it can select the relevant features more effectively and faster. The process continues until the classification results are within the required accuracy. The approach is applied to three datasets with high dimensional features using a variety of selection models and search strategies. Experimental results demonstrate the efficiency of the proposed approach in the two-class classification tasks.

Keywords : Feature selection, misclassified patterns, pattern classification.

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References

[1] I. Inza, P. Larranaga, R. Blanco, and A. J. Cerrolaza, " Filter versus wrapper gene selection approaches in DNA microarray domains," *Artificial Intelligence in Medicine*, vol. 31, pp. 91-103, 2004.
[2] G. Forman, "An extensive empirical study of feature selection metrics for text classification," *Machine Learning Research*, vol. 3, pp. 1289-1305, 2003.
[3] D. L. Swets and J. J. Weng, "Efficient content-based image retrieval using automatic feature selection,"*IEEE International Symposium On Computer Vision*, pages 85-90, 1995.
[4] W. Lee, S. J. Stolfo, and K. W. Mok, "Adaptive intrusion detection: A data mining approach," *AI Review*, vol. 14, no.6, pp. 533- 567, 2000. [5] L. Yu, C. Ding, and S. Loscalzo, "Stable feature selection via dense feature groups," In Proceedings of the 14th ACM SIGKDD International Conference on knowledge Discovery and Data Mining, 2008.
[6] C. Ding and H. Peng, "Minimum redundancy feature selection from microarray gene expression data," In *Proceedings of the Computational Systems Bioinformatics conference (CSB'03)*, pp. 523-529, 2003.
[7] Z. Zhao and H. Liu, "Multi-source feature selection via geometry-dependent covariance analysis," *JMLR Workshop and Conference Proceedings*, vol. 4, pp. 36-47, 2008.
[8] Z. Zhao, J. Wang, H. Liu, J. Ye, and Y. Chang, "Identifying biologically relevant genes via multiple heterogeneous data sources," *In Proceedings of the Fourteenth ACM SIGKDD International Conference On Knowledge Discovery and Data Mining*, 2008.
[9] K. Coombes, "Pre-processing mass spectrometry data," In Fundamentals of Data Mining in Genomics and Proteomics, M. Dubitzky, Ed., Boston: Kluwer, 2007,pp. 79–99.
[10] C. Ding, and H. Peng, " Minimum redundancy feature selection from microarray gene expression data," *In Proceedings of the IEEE Conference on Computational Systems Bioinformatics*, pp. 523–528, 2003.
[11] NIPS 2003 workshop on feature extraction and feature selection challenge, http://clopinet.com/isabelle/Projects/NIPS2003/. [12] Y. Cai, J. He, and L. Lu, "Predicting Sumoylation Site by Feature Selection Method," *Bimolecular Structure and Dynamics*, vol. 28, no. 5, pp. 797-804, 2011.
[13] G. John, and R. Kohavi, "Wrappers for feature subset selection," *Artificial Intelligence*, vol. 97, no.1-2, pp. 272-324. 1997.. [14] M. A. Hall, " Benchmarking attribute selection techniques for data mining," Department of Computer Science, University of Waikato, Tech. Rep. Working Paper 00/10, 2000.
[15] K. Kira and L. Rendell, "A practical approach to feature selection," *In Proceedings of the Ninth International Conference on Machine Learning*, D. Sleeman and P. Edwards, Eds., pp. 249–256,1992.
[16] I. Kononenko, "Estimating attributes: Analysis and extensions of relief," In Proceedings of the 1994 European Conference on Machine Learning, pp. 171–182, 1994.
[17] H. Alumualim and T. G. Dietterich, "Learning Boolean concepts in the presence of many irrelevant features," *Artificial Intelligence*, vol. 69, no. 1-2, pp. 279–305, 1994.

[18] M. Hall, "Correlation-based feature selection for machine learning," Ph.D. dissertation, Department of Computer Science, University of Waikato, 1998.
[19] Y. Saeys, I. Inza and P. Larranaga, "A review of feature selection techniques in bioinformatics", *Bioinformatics*, vol. 23, no. 19, pp. 2507–2517., 2007.
[20] S. B. Kotsiantis, "Supervised Machine Learning: A Review of Classification Techniques", *Informatica*, vol. 31, pp. 249-268, 2007.
[21] T. Elomaa, and J. Rousu, "General and Efficient Multisplitting of Numerical Attributes," *Machine Learning*, vol. 36, pp. 201–244, 1999.
[22] P. Kristin Bennett, "Decision tree construction via linear programming," In *Proceedings of the 4th Midwest Artificial Intelligence and Cognitive Science Society Conference*, pp. 97-101, 1992.
[23] S. Schwartz, J. Wiles, I. Gough, and S. Philips, "Connectionist, rule-based and bayesian decision aids: An empirical comparison," London, Chapman and Hall, 1993, pp. 264-278.
[24] B. Saul Gelfand, C. S. Ravishankar, and J. Edward Delp, "An iterative growing and pruning algorithm for classification tree design," *IEEE Transaction on Pattern Analysis and Machine Intelligence*, vol. 13, no. 2, pp. 163-174, 1991.
[25] D. E. Rumelhart, G. E.Hinton, and R. J. Williams, "Learning internal representations by error propagation" in *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*, D. E. Rumelhart, and J. L. McClelland et al., Eds, Cambridge, MA: MIT Press, vol. 1, 1986, pp. 318-362.
[26] L. S. Camargo, and T. Yoneyama, "Specification of Training Sets and the Number of Hidden Neurons for Multilayer Perceptrons," *Neural Computation*, vol. 13, pp. 2673–2680, 2001.
[27] C. Neocleous, and C. Schizas, "Artificial Neural Network Learning: A Comparative Review," LNAI 2308, Springer-Verlag Berlin Heidelberg, pp. 300–313, 2002.
[28] Zhang, G. , "Neural networks for classification: a survey," in *IEEE Transactions on Systems*, vol. 30, no. 4, pp. 451-462, 2000.
[29] C. Cores, and V. N. Vapnik, "Support Vector Networks," *Machine Learning*, vol. 20, pp. 273-29, 1995.
[30] I. Guyon, and A. Elissee, "An introduction to variable and feature selection", *Machine Learning Research, Special Issue on Variable and Feature Selection*, vol. 3, pp. 1157-1182, 2003.
[31] I. Guyon, J. Weston, S. Barnhill, and V. Vapnik, "Gene selection for cancer classification using support vector machines", *Machine Learning*, vol. 46, pp. 389-422, 2002.
[32] J. Platt, "Using sparseness and analytic QP to speed training of support vector machines", in *Advances in neural information processing systems*, M. Kearns, S. Solla, and D. Cohn, Eds., MIT Press, 1999.
[33] C. Burges, "A tutorial on support vector machines for pattern recognition," *Data Mining and Knowledge Discovery*, vol. 2, no. 2, pp.1-47, 1998.
[34] G. Guo, H. Wang, D. Bell, Y. Bi, K. Greer, " KNN Model-Based Approach in Classification," *Lecture Notes in Computer Science*, vol. 2888, pp. 986 – 996, 2003.
[35] I. Guyon, "Design of experiments of the NIPS 2003 variable selection benchmark. http: // www.nipsfsc.ecs.soton.ac.uk/papers/Datasets.pdf, 2003.
[36] S. Lee, "Mistakes in validating the accuracy of a prediction classifier in high-dimensional but small-sample microarray data", *Statistical Methods in Medical Research*, vol.17, pp. 635–642, 2008.

Modeling Clones Evolution in Open Source Systems Through Chaos Theory

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Abstract: A code clone is a code fragment that is identical or similar to another according to a certain similarity definition. Usually, it is a result of certain programmer's practices. Unjustified cloned codes can cause an increase in maintenance effort. In addition, they are –sometimes-a sign of poor design. This paper presents an approach for modeling clones evolution in open source systems. It adapts chaos theory for predicting clones in new versions of a software system. The number of clones in each version is identified and analyzed as a time series data. The existence of chaos is tested through the calculation of Lyapunov exponent and correlation dimension. Experimental results show that clones evolution in open source systems is a chaotic process. Thus, prediction in new versions can be done with high prediction accuracy using chaos theory.

Keywords- chaos theory; clones evolution; clones detection.

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References

[1] R. Geiger, B. Fluri, H. C. Gall, and M. Pinzger, "Relation of code clones and change couplings", 9th International Conference of Fundamental approaches to Software Engineering, pp. 411–425, 2006.
[2] E. Duala-Ekoko, and M.P. Robillard, "Tracking Code Clones in Evolving Software", In Proceedings of 29th International Conf. Software Engineering, ICSE, pp. 158 – 167, 2007.
[3] C. Hilborn, Chaos and Nonlinear Dynamics: An Introduction for Scientists and Engineers, 2nd Ed. Oxford University Press, Oxford,ISBN 0-19-850723-2, 2001.
[4] S. Schulze, M. Kuhlemann, "Advanced Analysis for Code Clone Removal", Workshop Software-Reengineering, 2009.
[5] T. Kamiya, S. Kusumoto, and K. Inoue, "CCFinder: A Multilinguistic Token-Based Code Clone Detection System for Large Scale Source Code," IEEE Trans. Soft. Eng., pp. 171-183, 2002.
[6] R. Tairas and J. Gray, "An Information Retrieval Process to Aid in the Analysis of Code Clones", Empir Software Eng., 14:33–56, DOI 10.1007/s10664-008-9089-1, Springer Science and Business Media, LLC 2008.
[7] E. Juergens, F. Deissenboeck, B. Hummel and S. Wagner, " Do Code Clones Matter?,"Proc. IEEE 31st International Conference on Software Engineering (ICSE), pp. 485-495, 2009.
[8] A. Lozano, M. Wermelinger and B. Nuseibeh, "Evaluating the Harmfulness of Cloning: A Change Based Experiment," Proc. Fourth Intl. Workshop Mining Software Repositories (MSR'07:ICSE Workshops 2007), pp.18-21 , 2007.
[9] R. Koschke, "Survey of Research on Software Clones,"Proc.of Dagstuhl Seminar 06301: Duplication, Redundancy and Similarity in Software, p. 24ff, 2006.
[10] C. Roy and J. Cordy, "A Survey on Software Clone Detection Research," School of Computing, Queen's University at Kingston, Tech. Rep. 2007-451, 2007.
[11] C. K. Roy and James R. Cordy, " An Empirical Study of Function Clones in Open Source Software," Proc. 15th Working Conf. Reverse Engineering, pp.81-90, 2008.
[12] R. Tiarks, R. Koschke and R. Falke, " An Assessment of Type-3 Clones as Detected by State-of-the-Art Tools," Proc. Ninth IEEE Intl. Working Conf. Source Code Analysis and Manipulation (scam), pp.67-76, 2009.
[13] Z. Liu, "Chaotic Time Series Analysis", Mathematical Problems in Engineering, doi:10.1155/2010/720190, pp. 1-31, 2010.
[14] D.R. Mandel, "Chaos theory, sensitive dependence, and the logistic equation," American Psychologist,pp. 106-107, 1995.
[15] L. Wang, X. Xing and Z. Chu, "On Definitions of Chaos in Discrete Dynamical System",Proc. of International Conference for Young Computer Scientists, pp.2874-2878, Nov. 2008.
[16] Y.C. Lai, "Recent developments in chaotic time series analysis", International Journal of Bifurcation and Chaos, Vol 13, No. 6, pp.1383-1422, 2003.
[17] N. Packard, J. Crutchfield, J. D. Farmer and R. Shaw, "Geometry from a time series", Physical Review Letters, Vol. 45, No. 9, pp. 712- 716, 1980.

[18] F. Takens, “Detecting strange attractors in turbulence,” in Dynamical systems and turbulence ed. Rand, D.A. & Young L.-S., Lecture notes in mathematics, Vol. 898, Berlin: Springer, pp. 366 – 381,1981.
[19] M. Casdagli, S. Eubank, J.D Farmer, and J. Gibson, “State space reconstruction in the presence of noise.” Physica D, Vol. 51, pp. 52- 98, 1991.
[20] A.M. Fraser and H.L. Swinney, “Independent coordinates for strange attractors from mutual information.” Phys. Rev. A, Vol. 55, pp. 1134- 1140, 1986.
[21] H.S. Kim, R. Eykholt, and J.D. Salas, “Nonlinear dynamics, delay times, and embedding windows.” Physica D, Vol. 127, pp. 48-60, 1999.
[22] W. Liebert and H. G. Schuster, “Proper choice of the time delay for the analysis of chaotic time series,” Physics Letters A, vol. 142, pp. 107-111, 1989.
[23] T. Shinbrot, C. Grebogi, E. Ott, and J. A. Yorke, “Using small perturbations to control chaos,” Nature, vol. 363, pp. 411–417, 1993.
[24] CloneDR, a tool for detecting clones, http://www.semdesigns.com.
[25] S. Bellon, R. Koschke, G. Antoniol, J. Krinke, and E. Merlo,”Comparison and Evaluation of Clone Detection Tool,” IEEE Trans. Software Engineering, Vol. 33, No.9, 2007.
[26] K. Ramasubramanian and M.S. Sriram, “A Comparative study of computation of Lyapunov spectra with different algorithms,” Physica D, Vol. 139, pp 72-86, 2000.
[27] A. Wolf, J. B. Swift, H. Swinney and J. Vastano, “ Determining Lyapunov Exponents From A Time Series,”, Physica D, Vol. 16, pp. 285-317,1985.
[28] A. Henry , “ Analysis of Observed Chaotic Data,” Spinger-Verlag, New York. 1996.
[29] M.P. Hanias and L.Magafs, “ Application of Physics Model in Prediction of the Hellas Euro Election Results,” Journal of Engineering Science and Tecnology Review, Vol. 2, No. 1, pp. 104- 111, 2009.
[30] FileZilla, http://filezilla-project.org/.
[31] VLC Player, http://www.vlcmediaplayer.org/.
[32] J. Harder and N. Göde, “Modeling clone evolution,” in Workshop Proceedings of the 13th European Conference on Software Maintenance and Reengineering, pp. 17–21, 2009.
[33] L. Aversano, L. Cerulo, and M. Di Penta, “How clones are maintained: An empirical study,” in Proceedings of the 11th European Conference on Software Maintenance and Reengineering, pp. 81–90, 2007.
[34] J. Krinke, “A study of consistent and inconsistent changes to code clones,” in Proceedings of the 14th Working Conference on Reverse Engineering, pp.170–178, 2007.
[35] Nils Göde, "Evolution of Type-1 Clones," Ninth IEEE International Working Conference on Source Code Analysis and Manipulation, pp.77-86, 2009.
[36] T. Bakota, R. Ferenc, and T. Gyimothy, “Clone smells in software evolution,” in Proceedings of the 23rd International Conference on Software Maintenance, pp. 24–33, 2007.

An Approach for Assessing Similarity Metrics Used in Metric-based Clone Detection Techniques

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Abstract: Similarity is an important concept in information theory. A challenging question is how to measure the amount of shared information between two systems. A large number of metrics are proposed and used to measure similarity between two computer programs or two portions of the same program. In this paper, we present an approach for assessing which metrics are most useful for similarity prediction in the context of clone detection. The presented approach uses clustering to identify clone candidates. In the experiments conducted, we applied clustering using all possible permutations of a subset of the metrics used in metric-based clone detection literature. Precision and recall are calculated in every experiment. Experimental results show that the order of the metrics used affects the results dramatically. This suggests that the used metrics are of variable relevance.

Keywords-*similarity metrics; clustering; clone detection.*

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References

[1] D. Lin, "An Information-Theoretic Definition of Similarity," Proc. 15th Intl. Conf. Machine Learning, pp. 296-304, 1998.
[2] R. Koschke, "Survey of Research on Software Clones,"Proc.of Dagstuhl Seminar 06301: Duplication, Redundancy and Similarity in Software, p. 24ff, 2006.
[3] C. Roy and J. Cordy, "A Survey on Software Clone Detection Research," School of Computing, Queen's University at Kingston, Tech. Rep. 2007-451, 2007.
[4] S. Schulze, M. Kuhlemann, "Advanced Analysis for Code Clone Removal", Workshop Software-Reengineering, 2009.
[5] T. Kamiya, S. Kusumoto, and K. Inoue, "CCFinder: A Multilinguistic Token-Based Code Clone Detection System for Large Scale Source Code," IEEE Trans. Soft. Eng., pp. 171-183, 2002.
[6] R. Tairas and J. Gray, "An Information Retrieval Process to Aid in the Analysis of Code Clones", Empir Software Eng., 14:33–56, DOI 10.1007/s10664-008-9089-1, Springer Science and Business Media, LLC 2008.
[7] E. Juergens, F. Deissenboeck, B. Hummel and S. Wagner, " Do Code Clones Matter?,"Proc. IEEE 31st International Conference on Software Engineering (ICSE), pp.485-495, 2009.
[8] A. Lozano, M. Wermelinger and B. Nuseibeh, "Evaluating the Harmfulness of Cloning: A Change Based Experiment," Proc. Fourth Intl. Workshop Mining Software Repositories (MSR'07:ICSE Workshops 2007), pp.18-21 , 2007.
[9] R. Koschke, R. Falke and P. Frenzel, " Clone Detection Using Abstract Syntax Suffix Trees," Pro. 13th Working Conf. Reverse Engineering (WCRE 2006), pp. 253-262, 2006.
[10] C. K. Roy and James R. Cordy, " An Empirical Study of Function Clones in Open Source Software," Proc. 15th Working Conf. Reverse Engineering, pp.81-90, 2008.
[11] R. Tiarks, R. Koschke and R. Falke, " An Assessment of Type-3 Clones as Detected by State-of-the-Art Tools," Proc. Ninth IEEE Intl. Working Conf. Source Code Analysis and Manipulation (scam), pp.67-76, 2009.
[12] E. E. Mills, "Software Metrics ," SEI Curriculum Module SEI-CM-12-1.1, Seattle University, 1988.
[13] C. Kaner and W.P. Bond, "Software Engineering Metrics: What do they measure and how do we know?" 10th Intl. Software Metrics Symposium, Sept, 2004.
[14] J. Mayrand, C. Leblanc and E. Merlo, " Experiment on the Automatic Detection of Function Clones in A Software System Using Metrics," Proc. Intl. Conf. Software Maintenance,pp. 244–253, 1996.
[15] K. Kontogiannis, R. DeMori, M. Bernstein, , M. Galler, and E. Merlo, "Pattern Matching for Design Concept Localization,"Proc. Working Conf. Reverse Engineering, IEEE Computer Society Press, pp96–103, 1995.

[16] G. Di Lucca, M. Di Penta and A. Fasolino, " An Approach to Identify Duplicated Web Pages," Proc. Intl. Conf. Computer Software and Applications, pp. 481–486, 2002.
[17] F. Lanubile and T. Mallardo, " Finding Function Clones in Web Applications," Proc. Intl. European Conf. Conference on Software Maintenance and Reengineering. pp. 379–386, 2003.
[18] N. Davey, P. Barson, S. Field and R. Frank, " The Development of a Software Clone Detector," J. App. Soft. Tech., vol. 1, pp. 219-236, 1995.
[19] J. Mayrand, C. Leblanc, and E. Merlo, " Experiment on the Automatic Detection of Function Clones in a Software System Using Metrics," Proc. Intl. Conf. Software Maintenance, pp. 244–253, IEEE Computer Society Press, 1996.
[20] K. Kontogiannis, " Evaluation Experiments on the Detection of Programming Patterns Using Software Metrics," Proc. Working Conf. Reverse Engineering, pp. 44–55. IEEE Computer Society Press, 1997.
[21] Understand, A tool for reverse engineering, documentation and metrics for source code, http://www.scitools.com.
[22] The Abyss, http://abyss.sourceforge.net/.
[23] S. Bellon and R. Koschke, " Detection of Software Clone: Tool Comparison Experiment," http://www.bauhaus-stuttgart.de/clones/.
[24] S. L. Chiu, " Fuzzy Model Identification Based on Cluster Estimation," J. Intelligent and Fuzzy Systems, vol. 2, no. 3, pp. 267–278, 1994.
[25] C. V. Ronaldo, R.L. Silvio, L.I. Adriano and J.M. Bruno, " Comparative Study of Clustering Techniques for the Organization of Software Repositories," Proc. 19th IEEE Intl. Conf. Tools with Artificial Intelligence, pp.210-214, 2007.
[26] Y. Saeys, I. Inza and P. Larranaga, " A Review of Feature Selection Techniques in Bioinformatics," Bioinformatics, vol. 23, no. 19, pp. 2507-2517, 2007.
[27] P. R. Thangaiah, R. Shriram and K. Viv, " Adaptive Hybrid Methods for Feature Selection Based on Aggregation of Information Gain and Clustering Methods", Intl. J. Computer Science and Network (IJCSNS) , vol. 9, no.2,p164-170, 2009.
[28] H. Liu and L. Yu, " Toward Integrating Feature Selection Algorithms for Classification and Clustering," IEEE Trans. Knowl. Data Eng., vol. 17, pp. 494–502, 2005.
[29] I. Guyon, A. Elisseeff, " An Introduction to Variable and Feature Selection," J. Mach. Learn. Res., vol. 3, pp. 1157–1182, 2003.
[30] O. Boz, " Feature Subset Selection by Using Sorted Feature Relevance," Proc. Intl. Conf. Machine Learning and Application, pp. 147-153, 2002.
[31] B. Pang and L. Lee, " A Sentimental Education: Sentiment Analysis Using Subjectivity Summarization Based on Minimum Cuts," Proc. ACL, pp. 271–278, 2004.
[32] A. Abbasi, H. C. Chen and A. Salem, "Sentiment Analysis In Multiple Languages: Feature Selection For Opinion Classification In Web Forums," ACM Trans. Information Systems, vol. 26, no. 3, 2008.
[33] S. Schleimer, D.S. Wilkerson and A. Aiken, "Winnowing: Local Algorithms for Document Fingerprinting," Proc. SIGMOD,pp. 76–85, 2003.
[34] J. Patenaude, E.Merlo, M. Dagenais, and B. Lague, " Extending Software Quality Assessment Techniques to Java Systems," Proc. IWPC, pp. 49-56, 1999.
[35] A. Leitao, "Detection of Redundant Code Using R2D2 ," J. Soft. Qual., vol. 12, no. 4, pp. 361-382, 2004.

A Novel Approach for Protein Classification Using Fourier Transform

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***Abstract*—**Discovering new biological knowledge from the high throughput biological data is a major challenge to bioinformatics today. To address this challenge, we developed a new approach for protein classification. Proteins that are evolutionarily- and thereby functionally- related are said to belong to the same classification. Identifying protein classification is of fundamental importance to document the diversity of the known protein universe. It also provides a means to determine the functional roles of newly discovered protein sequences. Our goal is to predict the functional classification of novel protein sequences based on a set of features extracted from each protein sequence. The proposed technique used datasets extracted from the Structural Classification of Proteins (SCOP) database. A set of spectral domain features based on Fast Fourier Transform (FFT) is used. The proposed classifier uses multilayer back propagation (MLBP) neural network for protein classification. The maximum classification accuracy is about 91% when applying the classifier to the full four levels of the SCOP database. However, it reaches a maximum of 96% when limiting the classification to the family level. The classification results reveal that spectral domain contains information that can be used for classification with high accuracy. In addition, the results emphasize that sequence similarity measures are of great importance especially at the family level.

***Keywords*—**Bioinformatics, Artificial Neural Networks, Protein Sequence Analysis, Feature Extraction.

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References:

[1] J. Zhao, "Multivariate Statistical Analysis of Protein Variation", A Ph. D. dissertation, available at http://www.lib.ncsu.edu/theses/available/etd-12092005-003538/unrestricted/etd.pdf
[2] A. Murzin, S. Brenner, T. Hubbard, and C. Chothia, "SCOP: A Structural Classification of Proteins Database for the Investigation of Sequences and Structures," *Journal of Molecular Biology*, vol. 247, no. 4, pp. 536-540, 1995.
[3] C. Orengo, A. Michie, S. Jones, D. Jones, M. Swindells, and J. Thornton, "CATH- A Hierarchic Classification of Protein Domain Structures," s*tructure*, vol. 5, no. 4, pp. 1093-1108, 1997.
[4] A. Bateman, L. Coin, R. Durbin, R. Finn, V. Hollich, S. Griffiths-Jones, A. Khanna, M. Marshall, S. Moxon, E. Sonnhammer, D. Holme, C. Yeats, and S. Eddy, "The Pfam protein Families Database," *Nucleic Acids Res*., vol. 32, no. 36, pp. D138-D141, 2004.
[5] O. Camoglu, T. Can, A. Singh, and Y. Wang, "Decision Tree Based Information Integration for Automated Protein Classification," Journal of Bioinformatics and Computational Biology (JBCB), Vol. 3, No. 3, pp. 717- 742, 2005.
[6] O. André, F. Daniel, F. António, "Peptide programs: applying fragment programs to protein classification", *Proceeding of the 2nd International Workshop on Data and Text Mining in Bioinformatics*, pp. 37-44, 2008.
[7] S. F. Altschul, T. L. Madden, A. A. Schaffer, J. Zhang, Z. Zhang, W. Miller, and D. J. Lipman, "Gapped BLAST and PSI-BLAST: a new generation of protein database search programs", *Nucleic Acids Res*., vol. 25, no. 17, pp. 3389-3402, 1997.
[8] W. Tian, and J. Skolnick, "How well is enzyme function conserved as a function of pairwise sequence identity?", *Molecular Biological*, vol. 3, no.4, pp. 863-882, 2003.
[9] D. Devos, and A. Valencia, "Intrinsic errors in genome annotation", *Trends Genetics*, vol. 17, no.8, pp. 429-431, 2001.
[10] E. N. Baker, V. L. Arcus, and J. S. Lott, "Protein structure prediction and analysis as a tool for functional genomics", *Appl. Bioinformatics*, vol. 2, no. 3, pp. 3-10, 2003.
[11] M. Grotthuss, D. Plewczynski, K. Ginalski, L. Rychlewski, and E. I. Shakhnovich, "PDB-UF: database of predicted enzymatic functions for unannotated protein structures from structural genomics", *BMC Bioinform*atics, vol. 7, no. 1, pp. 53-56, 2006.
[12] J. C. Whisstock, and A. M. Lesk, "Prediction of protein function from protein sequence and structure", *Q Rev Biophys*., vol. 36, no. 3, pp. 307- 340, 2003.
[13] I. Friedberg, "Automated protein function prediction the genomic challenge", *Brief Bioinfo*rmatics, vol. 7, no. 3, pp. 225-242, 2006.

[14] I., Melvin, E. Ie, J. Wetson, W. S. Noble, and C. Leslie, "Multi-class protein classification using adaptive codes", *J Mach. Learn. Res.*, vol. 8, pp. 1557-1581, 2007.
[15] L. Y. Han , C. Z. Cai, Z. L. Ji, Z. W Cao., J. Cui, and Y. Z. Chen, " Predicting functional family of novel enzymes irrespective of sequence similarity: a statistical learning approach", *Nucleic Acids Res.*, vol. 32, no. 21, pp. 6437-6444, 2004.
[16] R. E. Langlois, M. B. Carson, N. Bhardwaj, and H. Lu "Learning to translate sequence and structure to function: Identifying DNA binding and membrane binding proteins" , *Annals of Biomedical Engineering*, vol. 35, no. 6, pp. 1043-1052, 2007.
[17] Z. R. Yang, and R. Hamer, "Bio-basis function neural networks in protein data mining", *Current Pharmaceutical Design*, vol. 13, no. 14, pp. 1403-1413, 2007.
[18] J. Busch, P. Ferrari, A. Flesia, S. P. Grynberg, and F. Leonardi," Testing statistical hypothesis on random trees and applications to the protein classification problem", Annals of Applied Statistics, Vol.3, No.2, pp.542- 563, 2009.
[19] M. Q. Yang, J. Y. Yang, and O. K. Ersoy, "Classification of proteins multiple-labelled and single-labelled with protein functional classes", *Int. J Gen. Syst*., vol. 36, no.1, pp. 91-109, 2007.
[20] C. Pasquier, V. Promponas, and S. J. Hamodrakas, "PRED-CLASS: Cascading Neural networks for generalized protein classification and genome wide applications", *Proteins, PROTEINS: Structure, Function, and Genetics*, vol. 44, no.1, pp. 361-369, 2001.
[21] B. J. Webb-Robertson, C. Oehmen, and M. Matzke, "SVM-BALSA: Remote homology detection based on Bayesian sequence alignment", *Computational Biological Chemistry*, vol. 29, no. 6, pp. 440-443, 2005.
[22] Z. D. Zhang, S. Kochhar, and M. G. Grigorov, " Descriptor-based protein remote homology identification", *Protein Science*, vol. 14, no.2, pp. 431-444, 2005.
[23] N. Bhardwaj, R. E. Langlois, G. J Zhao, and H. Lu " Kernel-based machine learning protocol for predicting DNA binding proteins", *Nucleic Acids Res*, vol. 33, no. 20, pp. 6486-6493, 2005.
[24] P. D. Dobson, and A. J. Doig, "Predicting enzyme class from protein structure without alignments", *Journal of Molecular Biology*, vol. 345, no. 1, pp. 187-199, 2005.
[25] Y. D. Cai, and A. J. Doig, "Prediction of Saccharomyces cerevisiae protein functional class from functional domain composition", *Bioinformatics*, vol. 20, no.8, pp. 1292-1300, 2004.
[26] Q. W. Dong, X. L. Wang, and L. Lin, "Application of latent semantic analysis to protein remote homology detection", *Bioinformatics*, vol. 22, no. 3, pp. 285-290, 2005.
[27] R. Kuang, E. Ie, K. Wang, K. Wang, M. Siddiqi, Y. Freund, and C. Leslie, "Profile-based string kernels for remote homology detection and motif extraction", *Journal of Bioinformatics and Computational Biology*, vol. 3, no.3, pp. 527-550, 2005.
[28] H. Rangwala, and G. Karypis, "Profile-based direct kernels for remote homology detection and fold recognition", *Bioinformatics*, vol. 2, no.23, pp. 4239-4247, 2005.
[29] L. Nanni, S. Mazzara, L. Pattini, and A. Lumini, "Protein classification combining surface analysis and primary structure", *Protein Engineering: Design and Selection*, vol. 22, no. 4, pp. 267-272, 2009.
[30] D. Eisenberg, R. Weiss, and T. Terwilliger, "The Helical Hydrophobic Moment: A Measure of the Amphiphilicity of a Helix", *Nature*, vol.4, pp. 299-371, 1982.
[31] D. Eisenberg, E. Schwarz, M., Komaromy and R. Wall, "Analysis of Membrane and Surface Protein Sequences with the Hydrophobic Moment Plot", *Journal of Molecular Biology*, vol.42, no.1, pp. 125-179, 1984.
[32] L. Pattini, L. Riva, and S. Cerutti, "A wavelet based method to predict the alpha helix content in the secondary structure of globular proteins", *Proceedings of the IEEE-EMBS*, pp.132-133 , 2002.
[33] A. Shepherd, G. Gorse, and J. Thornton, "A novel approach to the recognition of protein architecture from sequence using Fourier analysis and neural networks", *Proteins*, vol. 50, no.2, pp. 290-302, 2003.
[34] A. Antonina, H. Dave, C. John-Marc, and E. Steven, "Data growth and its impact on the SCOP database: new developments", *Nucleic Acids Res*., vol. 36, no. 1, pp. 1-7, 2008.
[35] H.M. Berman, J. Westbrook, Z. Feng, G. Gilliland, T.N. Bhat, H. Weissig, I.N. Shindyalov, and P.E. Bourne, "The Protein Data Bank", *Nucleic Acids Res*., vol. 28, no. 1, pp.235–242, 2000.
[36] L. Lo Conte, S.E. Brenner, T.J.P. Hubbard, C. Chothia, and A.G. Murzin, "SCOP database in 2002: refinements accommodate structural genomics", *Nucleic Acids Res*., vol. 30, no.1, pp. 264–267, 2002.
[37] J. M. Chandonia, G. Hon, N.S. Walker, L. Lo Conte, P. Koehl, M. Levitt, and S.E. Brenner, "The ASTRAL compendium in 2004", *Nucleic Acids Res*., vol. 32, no.1, pp. 189–192, 2004.
[38] D. Wilson, M. Madera, C. Vogel, C. Chothia, and J. Gough, "The SUPERFAMILY database in 2007: families and functions", *Nucleic Acids Res*., vol. 35, Database Issue, pp. 308–313, 2007.

CLASSIFICATION OF THE IMAGINATION OF THE LEFT AND RIGHT HAND MOVEMENTS USING EEG

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Abstract-**Brain-computer interface (BCI) is a new and promising area of research which is assumed to help in solving a lot of problems especially for handicapped people. Detection of the imagination of the left and right hand movements can be used to control a wheelchair accordingly. Fortunately, modification of the brain activity caused by the imagination of the left or right hand movements is similar to the modification observed from a real left or right hand movements. The electrical activity of these modifications can be picked up from scalp electroencephalogram electrodes. In this work, we introduce a new method to detect and classify the imagination of the left and/or right hand movements. This method is based on exploring the time domain information in both alpha and beta rhythms using complex Morlet wavelet transform. Then, the fast Fourier transform is applied to explore the frequency domain information. The extracted features using both time and frequency domain information are then reduced using a feature subset selection algorithm. Then, the reduced features were fed into a multilayer backpropagation neural network to classify left from right hand movement imagination. The experimental results showed that the algorithm has reveals classification accuracy rates ranges from 97.77% to 100%, which are superior to the classification accuracy rates compared to other techniques.**

Keywords - brain **computer interface, motor imagery, feature subset selection, EEG classification**

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References:

[1] G. M. Shephred, Neurobiology, oxford university Press, 1983.
[2] P. Jezzard, P.M. Matthews, S.M. Smith, Eds., Functional MRI: An Introduction to the Methods, Oxford University Press, 2002.
[3] M. Hamalainen, R. Hari, R. Ilmoniemi, J. Knuutila, and O. V. Lounasmaa, "Magnetoencephalography, theory, instrumentation, and applications to noninvasive studies of the working human brain," Reviews of Modern Physics, vol. 65, no. 2, pp. 413–497, 1993.
[4] D. J. Dowsett, P. A. Kenny, R. E. Johnston, The Physics of Diagnostic Imaging. Chapman & Hall Medical, 1998.
[5] E. NiederMeyer, and F. Lopes da Silva, Eds., Electroencephalography. Lippincott Williams & Wilkins, 1999.
[6] M. J. Jeannerod, "Mental imagery in the motor context," Neuropsychologia, vol. 33, no. 11, pp. 1419–1432, 1995.
[7] U. Hoffmann, J.-M. Vesin and T. Ebrahimi, "Recent Advances in Brain-Computer Interfaces," IEEE International Workshop on Multimedia Signal Processing (MMSP07), 2007.
[8] Neuper, C., Pfurtscheller, G., 1999. Motor imagery and ERD. In: Pfurtscheller, G., Lopes da Silva, F.H. (Eds.), Event Related Desynchronization. Handbook of Electroencephalography and clinical Neurophysiology (Revised Edition), Vol. 6. Elsevier, Amsterdam, pp. 303-325.
[9] G. Pfurtscheller, C. Neuper, A. Schlögl, and K. Lugger, "Separability of EEG signals recorded during right and left motor imagery using adaptive autoregressive parameters," IEEE Trans. Rehab. Eng., vol.6, no. 3, pp. 316–325, 1998.
[10] R. W. Homan, J. Herman, and P. Purdy, "Cerebral location of international 10-20 system electrode placement," Electroenceph. Clin. Neurophysiol., vol. 66, pp. 376–382, 1987.
[11] http://ida.first.fhg.de/projects/bci/competition/
[12] http://ida.first.fraunhofer.de/projects/bci/competition_iii/index.html
[13] http://www.dpmi.tu-graz.ac.at/schloegl/bci/bci7/ Description _bci7.pdf
[14] M. Zhong, F. Lotte, M. Girolami, A. Lécuyer, "Classifying EEG for Brain Computer Interfaces Using Gaussian Processes", Pattern Recognition Letters, vol. 29, no. 3, pp. 354-359, 2008
[15] Nicolas Brodu, "Multifractal Feature Vectors for Brain- Computer Interfaces", the 2008 IEEE World Congress on

Computational Intelligence, June 2008.
[16] http:// ida. first. fhg. de/ projects /bci/competition_iii/results/
[17] C. Guger, H. Ramoser, and G. Pfurtscheller, “Real-time EEG analysis for a brain–computer interface (BCI) with subjectspecific spatial patterns,” IEEE Trans. Rehab. Eng., vol. 8, no. 4, pp. 447–456, 2000.
[18] B. Obermaier, C. Guger, C. Neuper, and G. Pfurtscheller, “Hidden Markov models for online classification of single trial EEG data,” Pattern Recognit. Lett., 2001.
[19] S. Lemm, C. Schäfer, and G. Curio, “BCI Competition 2003—Data Set III: Probabilistic Modeling of Sensorimotor μ Rhythms for Classification of Imaginary Hand Movements,” IEEE Trans BME, vol. 51, no. 6, June 2004.
[20] C. Guger, A Schlögl, C. Neuper, D. Walterspacher, T, Strein, and G. Pfurtscheller, "Rapid prototyping of an EEG-based brain-computer interface (BCI)," IEEE Trans. Rehab. Eng., 2000.
[21] H. liu, X. Gao, F. Yang, and S. Gao, "Imagined hand movement identification based on spatio-temporal pattern recognition of EEG," First Int. IEEE EMBS Conference on Neural Engineering, 2003, pp. 599-602.
[22] S. Rezaei1, K. Tavakolian, A. M. Nasrabadi, and S. K. Setarehdan, "Different classification techniques considering brain computer interface applications," J. Neural Eng., 2006., pp. 139–144
[23] R. C. Gonzalez, R. E. Woods, Digital Image Processing, 2nd. ed., 2002, Pearson Education, India, pp 150.
[24] K. Yang, H. Yoon, and C. Shahabi, “CLeVer: a Feature Subset Selection Technique for Multivariate Time Series,” Pacific-Asia conference on advances in knowledge discovery and data mining (PAKDD), 2005, No9, Hanoi VIETNAM, vol. 3518, pp. 516-522.

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Dr. Ahmed Seddik has worked as a consultant since 1997. He is used to be responsible for delivering and supporting enterprise solutions, integrating systems and advising in technology direction. His current position requires him to analyze and determine business requirements as well as advise architectural direction for the organization. He has strong organizational, analytical and communication skills which is found to be crucial to the success of any project. His expertise in multi-system environments, medical systems, development and networking will greatly benefit any organization. This experience includes participating in project teams, leading committee's made up of third party vendors as well as leading projects as small as medical units customization to large multi-million dollar compliance large hospital systems implementations. He was the project initiator of the most successful national Egyptian projects in the field of health, and education. He worked as a consultant for many national and international organizations such as European Union, African Union, United Nations Development Program.

Main Research Technology Topics:

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Tissue Engineering.
Bioinformatics.
Biosensors.
Biotechnology.
Image Processing and Pattern Recognition.
Medical Imaging.
Biometric Identification Systems.
Medical Analysis Equipments.
Encription.

Honors and Awards:

- Certificate of Honor and appreciation from the Egyptian Presidency Feb. 2013.
- Certificate of Honor from the Minister of Health and from Minister of communications & Information Technology for the great effort in the field of early detection of diseases.
- Certificate of Honor from the Minister of Higher Education for supervising a student's team that Won the First Position in ROBOCON competition.
- B.Sc. Electronics and Communication Dept, Cairo University, Faculty of Engineering, Distinction with honor degree.

• PUBLICATIONS

1. Safaa M. Naeem, Ahmed F. Ali, Mohamed A. Eldosoky, “Comparison between Using Linear and Non-linear Features to Classify Uterine Electromyography Signals of Term and Preterm Deliveries”, 30th NATIONAL RADIO SCIENCE CONFERENCE (NRSC 2013) April 16-18, 2013.

2. Ahmed Seddik, Mohamed El Adawy, Ahmed Ismail, “A robust speech disorders correction system for Arabic language using visual speech recognition", Biomedical Research, Volume (24), Issue (2), 2013.
3. Ahmed Farag Aly, Amal S. Eldesouky and Kamel A.M.Eid, "Evaluation, Characterization and Cell Viability of Ceramic Scaffold and Nano-gold loaded Ceramic Scaffold for Bone Tissue Engineering", American Journal of Biomedical Sciences, September , 2012.
4. Doaa. M. Shawky and Ahmed F. Ali, “Defining a Measure of Cloud Computing Elasticity”, 1st IEEE International Conference on Systems and Computer Science, Villeneuve d'Ascq, France, August 29-31, 2012.
5. MMA Hadhoud, MI Eladawy, A Farag, "Region of Interest Localization of Cardiac Structure from Cine MRI Images", Proceedings of the 2012 Ninth International Conference on Information Technology - New Generations(ITNG '12), Pages 14-17, IEEE Computer Society Washington, DC, USA 2012.
6. Marwa MA Hadhoud, Mohamed I Eladawy, Ahmed Farag, Franco M Montevecchi, Umberto Morbiducci, "Left Ventricle Segmentation in Cardiac MRI Images", American Journal of Biomedical Engineering,Volume(2), Issue(3), Pages 131-135, Scientific & Academic Publishing, 2012.

7. MMA Hadhoud, MI Eladawy, A Farag, "Left Ventricle Cavity Segmentation from Cardiac Cine MRI", International Journal of Computer Science Issues (IJCSI), Vol. 9, Issue 2, No 2, March 2012.
8. Ahmed Farag and Mahmoud Fakhreldin,"Heart Localization from Magnetic Resonance Images Sequence", Journal of Computer Science , Volume 8, Issue 4, Pages 499-505, Jan 2012.
9. Marwa M. A. Hadhoud, Mohamed I. Eladawy, Ahmed Farag,"Automatic Global Localization of The Heart From Cine MRI Images", IEEE International Symposium on IT in Medicine & Education (ITME 2011), Guangzhou, China, 9-11 December, 2011.
10. Ahmed Farag Aly , Ahmed Agameia, Amal Samir Eldesouky, and Mohamed A. Sharaf, ” Scaffold Development and Characterization Using CAD System”, American Journal of Biomedical Sciences, ISSN: 1937-9080,2011.
11. Doaa. M. Shawky and Ahmed F. Ali, “ A Feature Selection Method Using Misclassified Patterns”, International Journal of Computer Theory and Engineering, Vol. 3, No. 5,pp. 643-651, October 2011.
12. Doaa. M. Shawky and Ahmed F. Ali, “ A Practical measure for the agility of software development processes”, Second IEEE International conference on Computer technology and development (ICCTD2010) , Cairo, Egypt, 2-4 November, 2010.
13. Ahmed Farag Aly, Ahmed Agameia, Amal Samir Eldesouky, and Mohamed A. Sharaf, “Bioceramic Bone Scaffolds for Tissue Engineering”, Journal of Applied Sciences Research(JASR), American-Eurasian Network for Scientific Information (AENSI), Vol. 6,No. 11, pp. 1712-1721, November 2010.
14. Ahmed Farag Aly , Ahmed Agameia, Amal Samir Eldesouky, and Mohamed A. Sharaf, “CAD System for Bio-material Characterization”, 20th International

Conference on Computer theory and applications(ICCTA2010), Alexandria, Egypt , 23-25 October, 2010.

15. Doaa. M. Shawky and Ahmed F. Ali, " Modeling clones evolution in open source systems through chaos theory", Second IEEE International conference on software technology and engineering (ICSTE2010) , Puerto Rico, USA, 3-5 October, 2010.
16. Doaa. M. Shawky and Ahmed F. Ali, " An approach for assessing similarity metrics used in metric-based clone detection techniques", Third IEEE International conference on computer science and information technology,Chengdu, China, 9-11 July, 2010.
17. Ahmed Farag, D. M. Shawky, " A Novel Approach for protein classification using Fourier Transform", Journal of World Academy of Science, Engineering and Technology, Issue 68, 2010.
18. M. A. Hassan, Ahmed Farag, M. I. Eladawy, "Classification of the Imagination of the Left and Right Hand Movements Using EEG", The 4th Cairo International Biomedical Engineering Conference, Cairo, Egypt, 18th - 20th December, 2008.
19. E. Monir, E. Sarhan, A. Farag, "Recognition of Human Iris Patterns for Biometric Identification" , The Journal of Engineering and Applied Science, Faculty of Engineering, Cairo University, Vol. 54, No. 6, pp. 635-651, December 2007.
20. M. El Adawy, Aan Ali, Ahmed Farag, and AlShimaa Abd-Elaal, "Different Signal Representations For Detection Of Epileptic Seizures In Electroencephalogram", The 2nd IEEE International Computer Engineering Conference, Faculty of Engineering, Cairo University Cairo, Egypt, December 26-28, 2006.
21. M. El Adawy, Aan Ali, Ahmed Farag, and Alshimaa Abd-Elaal, "Multivariate features extraction for detection of epileptic seizures in electroencephalogram", The

4th IEEE International Conference on Information and Communications Technology (ICICT 2006), ITI , Cairo, Egypt, December 2006.

22. Abou zaid Sayed Abou zaid, Waleed Fakhr, Ahmed Farag, “Automatic Diagnosis Of Liver Diseases From Ultrasound Images", The 2006 IEEE International Conference on Computer Engineering & Systems (ICCES'06), Ain Shams University, Cairo, Egypt, November 5-7, 2006.
23. Marwa Hadhoud, Mohamed El Adawy, Ahmed Farag, “Computer Aided Diagnosis of Cardiac Arrhythmias", The 2006 IEEE International Conference on Computer Engineering & Systems (ICCES'06), Ain Shams University, Cairo, Egypt, November 5-7, 2006.
24. Ghada Abdel Razek, Waleed Fakhr, Ahmed Farag, “Content-Based Image retrieval using Color, Texture, Edge Detection, and Shape: A Comparative Study", The IEEE Fourth International Conference on Informatics and Systems, Cairo University (INFOS2006), Cairo, Egypt, March 2006.
25. F. H. Alhadi , W. Fakhr and A. Farag, “Hidden Markov Models for Face Recognition”, the IASTED International Conference on Computational Intelligence (CI 2005), Calgary, Canada , July 2005.
26. Farag A., “Spatial and spectral features for early detection of microcalcifications in mammograms”, The Journal of Engineering and Applied Science, Faculty of Engineering, Cairo University, April 2005.
27. Farag A. , Mashali S., “DCT Based features for the detection of microcalcification in digital mammograms”, Proceedings of the 46th Symposium on Circuits and Systems. Cairo, Egypt, 28-30 December 2003.
28. Farag A., “Computer Based Acute Leukemia Classification”, Proceedings of the 46th Symposium on Circuits and Systems. Cairo, Egypt, 28-30 December 2003.

29. Farag A., Samir I. Shaheen, "E-Health: Challenges and Opportunities", Proceedings of the Third IEEE International Conference on biomedical engineering, Cairo, Egypt,28-29 December 2004.
30. Farag A., Shaheen S.I., Mashali S., “New Technique for Motion Estimation to be used in MPEG Systems”, The XXIV SPIE Conference, Proceedings of the International Conference on Applications of Digital Image Processing, Vol. 4472, pp.368-376, 2001.
31. Farag A., Shaheen S.I., Mashali S., “ Predictive DCT Based Motion Estimation Technique to be used in MPEG Systems”, The Proceedings of the First IEEE International Symposium on Signal Processing and Information Technology, Cairo, Egypt,28-30 December 2001.
32. Shaheen S., Mashali S., Farag A., "Using Intel MMX technology to Accelerate the DCT Based Motion Estimation Algorithm ", Internal Report, Cairo University, Computer Engineering Dept., 2000.
33. Farag A., Shaheen S.I., Mashali S., “A New Technique for Motion Estimation to be used in MPEG Systems”, The Journal of Engineering and Applied Science, Faculty of Engineering, Cairo University, pp. 695-708, August 2001.