3rd Cyprus Workshop on Signal Processing and Informatics

University of Cyprus, *Nicosia, Cyprus*
New Campus, THEE001 ROOM 148

July 15, 2010

FINAL PROGRAM
AND
BOOK OF ABSTRACTS

Organized and Sponsored by:

Technically Co-Sponsored by:

IEEE EMBS Cyprus Section

Supported by:
***Java Digital Signal Processing (J-DSP),* Arizona State University (NSF Award 0817596)**
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Preface:

Following the successful one-day workshop we had in the last two years, we would like to cordially invite you to participate in the upcoming 3rd Cyprus Workshop on Signal Processing and Informatics (CWSPI 2010).

The overall objective of CWSPI 20010 is to disseminate new research results in several areas and help establish industry, university, and multi-university collaborations. The workshop is mainly targeted to our graduate students to present their most recent findings.

This one-day workshop hosts presentations by faculty, students, and industry researchers in the areas of signal processing image processing and analysis and informatics. A total of 13 abstracts are presented into 3 different sessions. These sessions are the following: *Wireless Communications, Sensor Networks and Signal Processing, Cognitive Systems, and Biomedical Signal, Image and Video Processing*. Moreover, we would like to express our sincere thanks to IEEE Cyprus Section, the IEEE EMBS Cyprus Chapter and the Cyprus Local Network for the sponsorship. The purpose of the workshop is to disseminate new research results in several areas and help establish industry, university, government and multi-university collaborations.

Last but not least we would like to express our sincere thanks to the two keynote lecturers: Prof. Andreas Ioannides, Director of Human Brain Dynamics and AAI Scientific Cultural Services Ltd, Nicosia, Cyprus, *Neural coding clues from early activity in well-circumscribed areas related to Attention, gender and Emotion recognition,* and Prof. Nikos Papanikolopoulos, Department of Computer Science and Engineering, University of Minnesota, USA, *Camera Networks for Surveillance Systems*.

Looking forward in making this workshop a yearly event. Wishing you a fruitful and joyful event.

C. Pattichis, A. Spanias, T. Kasperis, M. Pattichis, E. Kyriakou
July 2010

Topics:

- Digital signal and image processing
- Sensor networks and signal analysis
- Biomedical signal, image, and video analysis
- Wireless communications and signal processing
- Multimedia systems
- Speech, and audio, processing
- Cognitive systems
- FPGAS in signal, image and video processing.

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Technical Program

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16:15	**Efficient Node Placement in Densely Deployed Wireless Sensor Networks** *Charalambos Sergiou and Vasos Vassiliou* Department of Computer Science, University of Cyprus, Nicosia, Cyprus
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18:00	**Evolving internal rewards for effective multiagent learning in game theoretical situations** *Vassilis Vassiliades and Chris Christodoulou* Department of Computer Science, University of Cyprus
18:15	**Per-residue weight updating procedure for Protein Secondary Structure Prediction with Bidirectional Recurrent Neural Networks** *Michalis Agathocleous[1], Georgia Christodoulou[1],* *Vasilis Promponas[2], Chris Christodoulou[1],* *Vassilis Vassiliades[1], and Antonis Antoniou[1]* [1]Dept. of Computer Science, [2]Dept. of Biological Sciences, University of Cyprus,
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19:00	**An Integrated CAD System for the Assessment of Endometrial Cancer** *I. P. Constantinou[1&3], C. A. Koumourou[1], M. S. Neofytou[1&3],* *V. Tanos[2], C. S. Pattichis[3], M. S. Pattichis[4], E.C. Kyriakou[5]* [1]MedTechSol (Medical Technology Solutions) Ltd, Nicosia, Cyprus [2]Aretaeio Hospital, Nicosia, Cyprus [3]Department of Computer Science, University of Cyprus, Nicosia, Cyprus [4]Dept. of Elect. and Comp. Eng., Un. of New Mexico, Albuquerque, USA [5]Dept. of Computer Science and Eng., Frederick University Cyprus, Cyprus
19:15	**AM-FM Based Evaluation of Despeckled Filtering in Ultrasound Imaging of the Carotid Artery** *C.P. Loizou[1], M.S. Pattichis[2], T. Kasparis[3], A. Zavou[3], C.S. Pattichis[4]* [1]Intercollege, Dep. of Computer Science, School of Sciences, Limassol, Cyprus [2]University of New Mexico, Dept. of Electrical and Computer Engineering, Texas, USA [3]Cyprus University of Technology, Limassol, Cyprus [4]University of Cyprus, Department of Computer Science, Nicosia, Cyprus
19:30	**Diagnostically Driven Encoding, Transmission and Validation of Ultrasound Video** *A.Panayides[1], M.S. Pattichis[2], C. S. Pattichis[1], A. Spanias[3], C. Loizou[4], E. Kyriacou[5]* [1]Dept. of Computer Science, University of Cyprus, Nicosia, Cyprus [2]Dept. of Elect. and Comp. Eng., University of New Mexico, Albuquerque,

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19:45	**CLOSING REMARKS** **Chair: Andreas Spanias**

Abstracts

Session 1: Keynote Lectures

Neural coding clues from early activity in well-circumscribed areas related to Attention, gender and Emotion recognition

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Life has evolved to deal with instantaneous changes in the environment. These changes in the environment are often unpredictable and only a tiny fraction of the neural responses elicited by stimuli in our sensory organs every instant of time convey important information. Yet, these small fraction of neural responses are the only clues available for fleeting opportunities or deadly threads. It is therefore expected that evolution would have endowed the brain with mechanism for fast and accurate recognition, paying particular attention to the correct and fast recognition of biologically salient stimuli. Since it is inefficient to wire in advance the different stimuli and that the objects in the external world are unlabeled the brain has to invent its own categories and learn their significance through trial and error. It is believed that the main, possibly only way that the brain codes information is through the spikes that relay activity from one neuron to the next. Yet, not everything has to be learnt from scratch. Some stimuli, notably faces and the expressions of emotion they convey have a universal character and precise allocation of cortical real-estate for their preferential procssing [3]. Furthermore the processing of these stimuli appear to be hard-wired from birth, or at at least to be ready for maturation with only limited experience soon after birth [4].

The understanding of the principles that govern the information transmission through spikes, the deciphering of the neural code has been one of the key objectives of neuroscience in the last few decades. It is thought that an important part of decipering the neural code(s) entails understanding how the early responses in primary and nearby sensory areas that are organized according to basic stimulus properties, e.g. retinotopically for the visual system, are transformed into more abstract representations in “higher” areas. It is believed that this miraculous capability of the brain emerges from the use of

The neural code in the brain must not however be equated with a dry information transfer in a static communication network. It has been proposed instead to view the various manifestations of neural spike signaling as adaptations that optimize ecological expected utility [1]. This leads to competing constraints for the way neural coding should be studied. Scientific rigor on the one hand demands precisely control stimuli of one sensory modality which however are very different from stimuli encountered in the environment. Ecological considerations on the other hand demand natural stimuli often engaging more than one sensory modality that vary in in non-systematic way in different physical properties.

In our studies we have used magnetoencephalography (MEG) [xx] because it provides excellent temporal resolution and precise localization [yy]. We have resolved the

competing requirements od rigorous stilulus control and ecological relevance by focusing on the visual modality and using stimuli that have well-defined physical properties and proven biological significance. We chose the visual modality because primates, the most adaptable of species, rely extensively on visual cues and because the visual system is the only system we have a reasonably good understanding of how function is seggregated in different cortical areas. We have also contrasted the activity evoked by these stimuli when they presented in the centre of the visual field or one of the quadrants for two reasons. First the design allows our precise tomographic analysis to capture the first arrival of the stimulus-evoked response in the primary visual cortex V1, and each extrastriate area. Second we suspected partly because of ecological considerations [2] and partly because of some of our own results that different neural circuits may be activated, at least in the early stages of processing by stimuli in different parts of the visual field.

In different experiments we used simple checkerboard patterns to quantify the precision of our localization accuracy [3] and reproducibility of the results [4], faces with diffeent emotional expression in a face affect recognition task [5,6], faces, hands and shoes in a gender recognition task [7,8] and moving and stationary stimuli of different contrast to study the interplay of activity between V1 and the motion sensitive area, V5 [9,10]. In all our studies we used magnetic field tomography (MFT) [11,12] to extract tomographic estimates of activity throughout the brain from each timeslice of data, i.e. with millisecond temporal resolution.

In all our studies we identified the expected activations in early retinotopic areas and in "specialized" areas like V5 and the Fusiform face area (FFA) [13]. The combination of precise localization of our MFT results and exquisite time resolution of MEG allowed us to study in detail the timing in each area and the interaction between areas.

Our recent results have demonstrated ultra-fast mechanisms for spatial attention [1] and for differentiation of facial expressions [2], both well within 100 milliseconds from the onset of a visual stimulus.

The puzzle: single-neuron recording reveals that neural responses are enormously irregular under constant stimulus!

To process the vast amount of information efficiently, the neural code must adapt to cues outside the classical temporal and spatial extent, and top-down influence provides another ability to better encode what is most important to the animal.

the tradeoff between increasing statistical power with more specific stimulus assumptions (using structured artificial stimuli such as dots, bars, gratings) and losing statistical power with increased stimulus generality (noise stimuli in reverse correlation) occurs in every sensory modality and method.

Characterizations using natural scenes as stimuli appear to strike an appropriate balance by providing a wide array of ecologically relevant data that efficiently probes the space of neural responses relevant to the animal. Even simple cells in V1 are quite complex and require mathematical descriptions that are more involved than traditional models, and better characterizations are necessary for a more thorough understanding.

Ostwald D, Lam JM, Li S, Kourtzi Z. Neural coding of global form in the human visual cortex. *J Neurophysiol* 99: 456–2469, 2008.
The **deadline for the submission of abstracts is 15 July 2010**.

Ostwald D, Lam JM, Li S, Kourtzi Z. Neural coding of global form in the human visual cortex. *J Neurophysiol* 99: 456–2469, 2008. First published March 5, 2008; doi:10.1152/jn.01307.2007. Extensive psychophysical and computational work proposes that the perception of coherent and meaningful structures in natural images relies on neural processes that convert information about local edges in primary visual cortex to complex object features represented in the temporal cortex. However, the neural basis of these mid-level vision mechanisms in the human brain remains largely unknown. Here, we examine functional MRI (fMRI) selectivity for global forms in the human visual pathways using sensitive multivariate analysis methods that take advantage of information across brain activation patterns. We use Glass patterns, parametrically varying the perceived global form (concentric, radial, translational) while ensuring that the local statistics remain similar. Our findings show a continuum of integration processes that convert selectivity for local signals (orientation, position) in early visual areas to selectivity for global form structure in higher occipitotemporal areas. Interestingly, higher occipitotemporal areas discern differences in global form structure rather than low-level stimulus properties with higher accuracy than early visual areas while relying on information from smaller but more selective neural populations (smaller voxel pattern size), consistent with global pooling mechanisms of local orientation signals. These findings suggest that the human visual system uses a code of increasing efficiency across stages of analysis that is critical for the successful detection and recognition of objects in complex environments.

1.1.1 HFSP J. Volume 3, Issue 1, pp. 36-46 (February 2009) by **Tim Gollisch**

Our visual system can operate at fascinating speeds. Psychophysical experiments teach us that the processing of complex natural images and visual object recognition require a mere split second. Even in everyday life, our gaze seldom rests for long on any particular spot of the visual scene before a sudden movement of the eyes or the head shifts it to a newlocation. These observations challenge our understanding of how neurons in the visual system of the brain represent, process, and transmit the relevant visual information quickly enough. This article argues that the speed of visual processing provides an adjuvant framework for studying the neural code in the visual system. In the retina, which constitutes the first stage of visual processing, recent experiments have highlighted response features that allow for particularly rapid information transmission. This sets the stage for discussing some of the fundamental questions in the research of neural coding. How do downstream brain regions read out signals from the retina and combine them with intrinsic signals that accompany eye movements? And, how do the neural response features ultimately affect perception and behavior?

Keywords: Keyword number 1, Keyword number 2, Keyword number 3.

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Camera Networks for Surveillance Systems

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Algorithmical and hardware advances create many opportunities for image- and vision-based intelligent systems that are human-centric. Computing is ubiquitous in every household. Computers are becoming smaller, more portable, and embedded in many common appliances and devices. In addition, digital cameras are becoming pervasive in society. They are appearing in many varieties, and are embedded in many devices from cars to telephones. This work focuses on the problem of camera networks for security applications.

We will present the Hyperion framework (deployed to several Mass Transit sites around the U.S) which involves the computation of an extensive set of video-analytics based on human and crowd activity monitoring, automatic camera placement, camera-to-camera tracking, semi-autonomous calibration, and video forensics analysis. An innovative user interface allows a single user to monitor thousands of cameras. We augment the system capabilities by pairing cameras with robots in order to provide swift mobility in case that the data requires so. Finally, we try to create an engineering/scientific solution which is respectful of design, privacy, and societal issues.

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SESSION 2: Wireless Communications, Sensor Networks and Signal Processing

Indoor Positioning in WLAN using Radial Basis Function Networks with Received Signal Strength Fingerprints

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Positioning techniques enable the provision of location information regarding people, mobile devices and equipment. Estimating location accurately is a challenge especially inside buildings, where satellite-based positioning is not applicable due to the severe attenuation or blockage of satellite signals. Positioning accuracy is the key issue to effectively support advanced indoor location aware services. Indicative applications include in-building guidance, asset tracking in hospitals or warehouses and autonomous robot navigation.

Different positioning technologies have been discussed in the literature including infrared, Bluetooth, RFID, UWB, ultrasound and WLAN. Several positioning methods rely on WLANs, mainly due to the wide availability of relevant infrastructure in indoor environments. These methods exploit Angle of Arrival (AOA), Time of Arrival (TOA), Time Difference of Arrival (TDOA) and Received Signal Strength (RSS) measurements from Access Points (AP) to infer the unknown user location. In the context of WLAN positioning, RSS measurements are usually preferred, because they can be easily collected without the need for specialized and expensive equipment. Indoor radio propagation models have been used to transform RSS values into distances from at least three relevant APs in order to determine user location through multilateration. However, this approach has some limitations, mainly due to the multipath effect that renders the use of standard log-distance propagation models inadequate. Another problem is that the exact locations of the APs are required, and such information may not be available or is hard to obtain. Fingerprinting methods address both issues by utilizing RSS fingerprints collected a priori at some predefined reference points in the area of interest. Location can then be estimated using the currently measured fingerprint to find the best match among the reference fingerprints. Matching is based on a distance measure between the current and reference fingerprints or on probability distributions.

In our approach, we employ Radial Basis Function (RBF) networks and use the collected reference data to build a mapping between the RSS fingerprints and location coordinates. We present an efficient RBF-based positioning method and provide well defined ways for setting the RBF parameters. We investigate the performance of the RBF-based method as a function of the number of available APs, reference points or fingerprints and compare it to some well known approaches.

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Efficient Node Placement in Densely Deployed Wireless Sensor Networks

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The emergence of mission-critical and information demanding applications in Wireles Sensor Networks (WSNs) renders performance control essential for mission accomplishment. Heavy traffic is a major factor that affects significantly the performance of any type of network. The situation worsens in low-powered, unreliable WSNs. A prominent factor that under specific circumstances can improve or deteriorate the performance of WSNs under heavy load can be the way nodes are placed on the monitored field. Proper node placement is essential to ensure good sensing coverage and communication connectivity. In this paper we present and analyze several ways that nodes can be placed on a plane and we compare the performance of specific routing and congestion control algorithms under these placements.

Specifically we employ four different placements. A deterministic placement called Grid Placement, a semi deterministic placement called Biased Random placement as well as two non- deterministic placements called, Simple Diffusion, and Random placement.

In Grid placement nodes are placed strictly on the crossed lines of a grid. In Biased random placement nodes are placed randomly but in pre-specified sections of the grid (near the source and the sink), while in Simple Diffusion nodes are placed as if scattered from the air, centering on the sink. Finally in Random placement nodes are scattered completely randomly on the plane.

Each algorithm that we employ in our research represents a special category of congestion control or routing algorithm in Wireless Sensor Networks. These are ESRT which is a rate limiting algorithm focusing on reliability, SenTCP which is a rate-limiting algorithm focusing on congestion, HTAP, an algorithm based on the utilization of unused resources to mitigate congestion and Directed Diffusion algorithm, an algorithm not explicitly designed for congestion control but it can be considered as so, since it employs a combination of resource increment and data rate reduction, by reinforcing “good” paths and pruning off “bad quality” paths

Simulation results of these algorithms under the considered placements prove that algorithms which employ multiple or alternative paths for forwarding the excess of traffic from source to sink, can significantly improve their performance under specific node placements.

Acknowledgement:
This work has been conducted under the European Union Project GINSENG funded under the FP7 Program (FP7/2007- 2013) grant agreement no 224282.

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Radar Tracking Performance When Sensing and Processing Compressive Measurements

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Radar tracking performance is improved when using waveforms at high delay-Doppler resolution with concentrated ambiguity functions. High resolution measurement acquisition and processing, however, requires high rate sampling and intensive processing. Alternatively, compressive sensing and processing can be used to significantly reduce data rates with no loss in resolution. The drawback is, however, that using compressive measurements increases ambiguity function sidelobes and, thus, the tracking error.

In this paper, compressive sensing and processing is applied to the problem of single target tracking. The effect of compressive sensing and processing on the ambiguity function sidelobes is examined. Moreover, estimation using compressively sampled and processed Björck constant amplitude zero autocorrelation (CAZAC) sequences is shown to be improved over estimation using linear frequency modulated waveforms sampled at the Nyquist rate. This shows that low-rate acquisition and processing maintains reliable tracking performance at high resolution, while simplifying the receiver and reducing computational expense.

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Water Contamination Fault Diagnosis and Security Monitoring in Water Distribution Systems

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Water resources management is a key challenge that will become even more crucial in the years ahead. Water distribution systems are responsible for delivering clean water to consumers, and have an important role in sustaining certain vital societal functions. When a system fault occurs, such as water contamination or a pipe break, these societal functions may be affected negatively. In the previous years, various aspects of the security monitoring problem in water distribution systems have been examined; in addition, robust fault diagnosis algorithms have been developed within a system-theoretic framework. An open research area is the formulation of a system-theoretic framework suitable for fault diagnosis and security monitoring in water distribution systems.

In this study, we present an overview of the problem formulation and a method to find locations in a water distribution network, where on-line quality sensors should be installed, in order to minimize the risk of a severe damage on the population. In addition, we present an impact evaluation and source-area isolation algorithm to assist decision makers during the “confirmation stage” of a “credible” contamination fault.

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Signal and Information Processing for Solar Panel Array Management

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We will present a new project that we proposed recently to a company and a federal agency. The project addresses signal processing methods for controlling photovoltaic arrays and inverters through smart monitoring devices. The tasks of the project include studying how the available information will improve inverter efficiency, examining communication and networking methodologies for data flow through the system, and investigation of signal processing and optimization methodologies and data visualization to improve overall array performance and health.

SESSION 3: Cognitive Systems

Measuring single neuron operational modes using a metric based on the membrane potential slope

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We present a metric for measuring the response triggered synchrony of the input spike trains of a simple model neuron. In their simplest form, neurons sum incoming action potentials (spikes) and subsequently fire response spikes, when the potential of the cell's membrane reaches a fixed threshold. Upon firing a spike, the neuron's membrane potential is reset to a predefined value and the summation of incoming spikes continues. Our proposed metric is able to distinguish between the two operational modes that neurons are thought to be employing: temporal integration and coincidence detection. The importance of this distinction lies in the fact that each mode implies a corresponding encoding mechanism; temporal integration suggests that information is encoded on the average firing rate, while coincidence detection indicates the importance of timing of individual spikes [1]. Our metric is based on previous work that shows how higher levels of input synchrony result in higher pre-spike membrane potential slopes [2]. Based on this, we use the normalized mean slope of the membrane potential prior to the response spikes that are fired during a trial, to measure varying levels of each operational mode (i.e., measure the relative contribution of each mode to the firing of the neuron). More specifically, this metric is able to identify different levels of synchrony between input spike trains, with high synchrony denoting coincidence detection and low synchrony denoting temporal integration. The metric differs from other work on measuring spike train correlations and synchrony [3, 4] in that it only responds to such correlations between input spike trains when they are responsible for the triggering of response spikes. In this way, the metric is only concerned with the input statistics that affect its own spiking, in other words, it is sensitive to the response-relevant statistics of the input. We will present how the metric reliably responds to control experiments of a simulated neuron, as well as what it tells us about models and simulations that reproduce biophysical phenomena.

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Evolving internal rewards for effective multiagent learning in game theoretical situations

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In this study, we investigate the importance of rewards in Multiagent Reinforcement Learning in the context of the Iterated Prisoner's Dilemma. We use an evolutionary algorithm to evolve valid payoff structures with the aim of encouraging mutual cooperation. An exhaustive analysis is performed by investigating the effect of: i) the lower and upper bounds of the search space of the payoff values, ii) the reward sign, iii) the population size, and iv) the mutation operators used. Our results indicate that valid structures that encourage cooperation can quickly be obtained, while their analysis shows that: i) they should contain a mixture of positive and negative values and ii) the magnitude of the positive values should be much smaller than the magnitude of the negative values.

Acknowledgement: Funded by the University of Cyprus under an internal research project grant.

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Per-residue weight updating procedure for Protein Secondary Structure Prediction with Bidirectional Recurrent Neural Networks

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Successful protein secondary structure prediction is an important step towards modeling protein 3D structure, with several practical applications. Even though in the last four decades several PSSP algorithms have been proposed, we are far from being accurate. The Bidirectional Recurrent Neural Network (BRNN) architecture of Baldi et al. [1] is currently considered as one of the optimal computational neural network type architectures for addressing the problem.

Even though we implement the same BRNN architecture, we use a modified training procedure. More specifically, our aim is to identify the effect of the contribution of local versus global information, by varying the length of the segment on which the Recurrent Neural Networks operate for each residue position considered. In addition, the network is trained with an on-line training procedure by using the backpropagation learning algorithm, where the weight updates occur for every amino acid, as opposed to Baldi et al. [1], where the weight updates are applied after the presentation of the entire protein.

Our results with a single BRNN are better than Baldi et al. [1] by three percentage points (Q3) and comparable to results of [1] when they use an ensemble of 6 BRNNs. In addition, our results improve even further when sequence-to-structure output is filtered in a postprocessing step, with a novel Hidden Markov Model-based approach.

References

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Isolated Word Speech Recognition using Rank Order Coding

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Rank-order coding has been recognized as a viable alternative to rate-order coding for modeling the human visual system. Recently, speech recognition systems using rank-order coding networks have been evaluated and found to outperform Hidden Markov Models (HMM) in certain isolated word recognition experiments, particularly in the presence of background noise. Such systems also exhibit additional advantages in terms of training. We present a simple word recognition system using a rank order coding network which uses the spectrogram representation of spoken words as input.

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SESSION 4: Biomedical Signal, Image and Video Processing

The use of Granger causality for the characterization of bidirectional interactions of human brain activity during induction of general anaesthesia

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General anaesthesia (GA) is a reversible state of unconsciousness and depression of reflexes to afferent stimuli, induced by the administration of chemical agents [1]. Since the mechanism by which consciousness emerges is still not fully understood, the mechanism by which general anaesthetics prevent consciousness is also largely unexplained. One approach to understanding this critical mechanism is to look for invariant changes that manifest themselves in observables of the human brain (EEG).

Granger causality (GC), which has yet to be applied in the study of GA, can provide an insight into interactions of different brain areas. GC is a linear measure quantifying the bidirectional interaction between two time series, *X* and *Y*, by looking at whether the prediction of *X* (*Y*) is improved by incorporating information from *Y* (*X*) [2]. Large values of GC imply strong interaction. The direction of interaction can be deduced from the difference: $D = GC_{Y \to X} - GC_{X \to Y}$. A change in the sign of *D* implies a change in the direction of interaction.

We investigated the interactions between different brain areas during induction of anaesthesia, using GC. EEG data from 10 male patients, who gave written informed consent for their participation, was analysed. The data was collected at the Nicosia General Hospital while patients underwent general or urological surgery under GA. 8-minute segments corresponding to induction of anaesthesia with a propofol bolus were extracted from the continuous EEG records (3mins prior to and 5mins after induction). For each subject, 5 brain areas were defined as the average EEG activity from the 19 available electrodes: left and right frontal, left and right posterior, and midline areas. GC and *D* were estimated for each subject and pair of brain areas, and values were then averaged over all subjects. Prior to induction weak unidirectional interactions were found between posterior and midline areas to frontal areas. Administration of the anaesthetic bolus reversed the direction and increased the strength of the interactions. The lack of strong unidirectional interactions while the patient is awake is a reflection of the lack of generalised synchrony, as each brain area is involved in more localised tasks. Induction of anaesthesia induced strong unidirectional interactions. This indicates that the brain entered a synchronised state, with frontal areas acting as synchronisation pacemakers. Our findings suggest that GC can capture the physiological changes in the EEG activity, which are associated with administration of anaesthetic agents.

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An Integrated CAD System for the Assessment of Endometrial Cancer

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In this study we present an integrated computer aided diagnosis (CAD) system supporting the assessment of endometrial tissue in hysteroscopy imaging. The system consists of two components, the electronic patient record and the hysteroscopy imaging (CAD system). The electronic patient record is based on information collected from: appointments, patient info, hysteroscopy reporting and pharmacy. The CAD system is based on ROI manual or semi-automated extraction, color texture feature analysis, and SVM and C4.5 classification for differentiating between normal vs abnormal ROIs. The highest percentage of correct classifications score (%CC) was 79%, and it was obtained for the SVM classifier for the Y and the RGB color channels using the SF+SGLDS texture feature sets. The C4.5 algorithm gave slightly lower classification scores, but also classification rules. The proposed system offers an integrated platform to the physician for assessing suspicious areas of endometrial cancer.

Acknowledgement:

This study was partially funded by the Ministry of Commerce and Industry, Cyprus, Call for High Technology and Innovative Incubator Companies, project entitled: "A Computer Aided Diagnostic tool in Gynaecological Endoscopy (CAD_Gen)", May 2008 –April 2010.

AM-FM Based Evaluation of Despeckled Filtering in Ultrasound Imaging of the Carotid Artery

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The objective of this work was to carry out a comparative evaluation of despeckle filtering based on Amplitude Modulation-Frequency Modulation (AM-FM) analysis, image quality evaluation metrics, and visual evaluation by medical experts in the assessment of ultrasound images of the intima media thickness (IMT) of the common carotid artery (CCA). Furthermore, to investigate how AM-FM characteristics are affected by age. A total of fourteen despeckle filters were evaluated based on local statistics, median filtering, pixel homogeneity, geometric filtering, homomorphic filtering, anisotropic diffusion, nonlinear coherence diffusion, and wavelet filtering. The study was performed on 100 longitudinal-section ultrasound images acquired from asymptomatic subjects at risk of atherosclerosis. The images were automatically segmented where the intima-media complex was identified, and separated into three different age groups, namely below 50, 50-60, and above 60 years old.

The results of this study suggest that the homogeneous mask area filter, *lsminsc*, gave the best performance, followed by the non linear diffusion filter, *nld*, for the age groups below 50 and 50 to 60 years old. The filters Kuhawara followed by the hybermedian, gave the best performance for the age groups <50 and > 60. Finally the filters coherence enhancing diffusion, and hybermedian, gave the best performance for the age groups 50 to 60 and > 60. These filters improved the class separation between the three different age groups based on the statistics of the extracted AM-FM features, gave a better mahalanobis distance, and improved the visual assessment carried out by the an expert.

In conclusion, this study showed that a different pre-processing of the image may be required based on the age groups defined above. Further work is needed to evaluate at a larger scale and in clinical practice the performance of the proposed despeckle filters in the automated segmentation, texture analysis and classification of carotid ultrasound images.

Diagnostically Driven Encoding, Transmission and Validation of Ultrasound Video

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Advances in video compression, network technologies, and computer technologies have contributed to the rapid growth of mobile health (m-health) systems and services. Wide deployment of such systems and services is expected in the near future, and it's foreseen that they will soon be incorporated in daily clinical practice. This study focuses in describing the basic components of an end-to-end wireless medical video telemedicine system, providing a brief overview of the recent advances in the field, while it also highlights future trends in the design of telemedicine systems that are diagnostically driven.