Optimal pseudorandom sequence selection for online c-VEP based BCI control applications

Background: In a c-VEP BCI setting, test subjects can have highly varying performances when different pseudorandom sequences are applied as stimulus, and ideally, multiple codes should be supported. On the other hand, repeating the experiment with many different pseudorandom sequences is a laborious process. Aims: This study aimed to suggest an efficient method for choosing the optimal stimulus sequence based on a fast test and simple measures to increase the performance and minimize the time consumption for research trials. Methods: A total of 21 healthy subjects were included in an online wheelchair control task and completed the same task using stimuli based on the m-code, the gold-code, and the Barker-code. Correct/incorrect identification and time consumption were obtained for each identification. Subject-specific templates were characterized and used in a forward-step first-order model to predict the chance of completion and accuracy score. Results: No specific pseudorandom sequence showed superior accuracy on the group basis. When isolating the individual performances with the highest accuracy, time consumption per identification was not significantly increased. The Accuracy Score aids in predicting what pseudorandom sequence will lead to the best performance using only the templates. The Accuracy Score was higher when the template resembled a delta function the most and when repeated templates were consistent. For completion prediction, only the shape of the template was a significant predictor. Conclusions: The simple and fast method presented in this study as the Accuracy Score, allows c-VEP based BCI systems to support multiple pseudorandom sequences without increase in trial length. This allows for more personalized BCI systems with better performance to be tested without increased costs.
Automatic Atrial Fibrillation Detection: A Novel Approach Using Discrete Wavelet Transform and Heart Rate Variability

Early detection of Atrial Fibrillation (AF) is crucial in order to prevent acute and chronic cardiac rhythm disorders. In this study, a novel method for robust automatic AF detection (AAFD) is proposed by combining atrial activity (AA) and heart rate variability (HRV), which could potentially be used as a screening tool for patients suspected to have AF. The method includes an automatic peak detection prior to the feature extraction, as well as a noise cancellation technique followed by a bagged tree classification. Simulation studies on the MIT-BIH Atrial Fibrillation database was performed to evaluate the performance of the proposed method. Results from these extensive studies showed very promising results, with an average sensitivity of 96.51%, a specificity of 99.19%, and an overall accuracy of 98.22%.
Automatic minimization of ocular artifacts from electroencephalogram: A novel approach by combining Complete EEMD with Adaptive Noise and Renyi’s Entropy

Ocular artifacts (OAs) are one of the major interferences that obscure electroencephalogram (EEG) signals. In this paper, a novel, completely automatic, adaptive and fast method that combines the Complete Empirical Mode Decomposition with Adaptive Noise (CEEMDAN) and Renyi’s Entropy (RE) is proposed for minimizing the OAs from corrupted EEG signals. The RE criterion is suggested to automatically select the intrinsic Mode Functions (IMFs) to reconstruct the artifact minimized EEG signals. The scheme requires only a single channel OAs corrupted EEG recording and a reasonable computation time. The methodology was first evaluated on simulated OAs (one, two, and several blinks as well as saccadic eye movements) corrupted EEG signals and then extended to real EEG signals. The signal-to-noise ratio improvement (SNRimp) along with time and power spectral density (PSD) plots were used for evaluating the performance of the scheme. The method is compared to the one based on the CEEMDAN and manual choice of IMFs for OAs minimization from EEG. Results from extensive simulation studies clearly indicate the efficacy of the proposed scheme in automatically minimizing the OAs from the corrupted EEG signals.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Politecnico di Torino
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Pages: 63–75
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Biomedical Signal Processing and Control
Volume: 36
ISSN (Print): 1746-8094
Ratings:
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.82 SJR 0.659 SNIP 1.574
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.631 SNIP 1.559 CiteScore 2.55
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.43 SNIP 1.44 CiteScore 1.89
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.566 SNIP 1.8 CiteScore 2.28
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.378 SNIP 1.277 CiteScore 1.6
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.407 SNIP 1.087 CiteScore 1.75
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.37 SNIP 0.926
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.31 SNIP 1.083
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.251 SNIP 0.813
- Scopus rating (2007): SJR 0.141 SNIP 0.284
Original language: English

Electroencephalogram (EEG), Ocular artifacts (OAs), Artifact minimization, Complete Ensemble Empirical Mode Decomposition Adaptive Noise (CEEMDAN), Renyi’s Entropy (RE)
Detection of User Independent Single Trial ERPs in Brain Computer Interfaces: An Adaptive Spatial Filtering Approach

Brain Computer Interfaces (BCIs) use brain signals to communicate with the external world. The main challenges to address are speed, accuracy and adaptability. Here, a novel algorithm for P300 based BCI spelling system is presented, specifically suited for single-trial detection of EventRelated Potentials (ERPs) by combining spatial filtering and new feature extraction methods. The adaptive spatial filtering technique, axDAWN, removes the need for calibration of the system thereby improving the overall speed of the system. Besides, axDAWN enhances the P300 response to target stimuli. The wavelet decomposition and entropy of the recorded ERPs are shown to be correlated with the presence of the P300 responses. The proposed scheme is validated thoroughly in a P300 speller and provides a solution to achieve high accuracy results for single-trial detection of ERPs, being the system user independent.

Economy, Movement Dynamics, and Muscle Activity of Human Walking at Different Speeds

The complex behaviour of human walking with respect to movement variability, economy and muscle activity is speed dependent. It is well known that a U-shaped relationship between walking speed and economy exists. However, it is an open question if the movement dynamics of joint angles and centre of mass and muscle activation strategy also exhibit a U-shaped relationship with walking speed. We investigated the dynamics of joint angle trajectories and the centre of mass accelerations at five different speeds ranging from 20 to 180% of the predicted preferred speed (based on Froude speed) in twelve healthy males. The muscle activation strategy and walking economy were also assessed. The movement dynamics was investigated using a combination of the largest Lyapunov exponent and correlation dimension. We observed an intermediate stage of the movement dynamics of the knee joint angle and the anterior-posterior and mediolateral centre of mass accelerations which coincided with the most energy-efficient walking speed. Furthermore, the dynamics of the joint angle trajectories and the muscle activation strategy was closely linked to the functional role and biomechanical constraints of the joints.
Electrophysiological dynamics of covert and overt visual attention.

Attention is a key neural function for choosing certain information to receive more processing than others. Attention is allocated either by directly looking at the target (overt) or without eye movement towards the target (covert). The current study was designed to extract relevant features by using steady-state visual evoked potentials (SSVEP) task. SSVEP task was presented to subjects at the same time that the electroencephalography (EEG) signals were recorded by the scalp electrodes. Subjects were instructed to respond to a certain stimulus by pressing a button. This way attention was measure in continuous manner. Results showed that the amplitude of SSVEP frequencies is higher in overt than covert attention. This indicates that by overt attention events are registered with larger power. However, exploring the harmonics of frequencies showed that covert attention generates larger 2nd harmonic (e.g. 12Hz) than the 1st harmonic (e.g. 6Hz). This pattern was not observed in overt attention. We suggest that covert attention increases the non-linearity in the visual system. Results from the source analysis showed that SSVEP signals are extracted from the primary visual cortex in overt attention. However, when covert attention is allocated to SSVEPs, frequencies are extracted from parietal and frontal areas. This shows that covert attention recruits higher cognitive function. To test how SSVEPs are represented in higher brain areas, we conducted an invasive multi-unit recording from rhesus monkeys. Monkeys were trained to perform similar SSVEP task. Recording was done from somatosensory (S1) and motor (M1) cortices. Results showed that the neuronal ring rates in S1 and M1 not only increased selectively to attended icker stimulus, but also they were highly synchronized. Moreover, some SSVEP frequencies was enhanced in single neurons. These results showed, for the rst time, that visual attention to repetitive stimuli is able to regulate neuronal activities in S1 and M1 regions.
Electrophysiological dynamics of covert and overt visual attention.
Publication: Research › Ph.D. thesis – Annual report year: 2017

**Novel Approach for Automatic Detection of Atrial Fibrillation Based on Inter Beat Intervals and Support Vector Machine**

Atrial fibrillation (AF) is the most common cardiac arrhythmia associated with a major economic burden for the society. Automatic detection of AF in long term recordings can efficiently assist in early diagnosis and management of comorbidities associated with AF. This study presents a novel approach for AF detection based on Inter Beat Intervals (IBI) extracted from long term electrocardiogram (ECG) recordings. Five time-domain features are extracted from the IBIs and a Support Vector Machine (SVM) is used for classification. The results are compared to a state of the art algorithm based on raw ECG. Both algorithms are evaluated on the MIT-BIH Atrial Fibrillation database resulting in equally high classification performance (Sensitivity ≥ 95%). The proposed approach requires detection of R-peaks in the ECG signal but allows for significantly reduced computation time without loss of performance.

**General information**
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Pages: 2039-2042
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Publisher: IEEE
ISBN (Print): 978-1-5090-2809-2
Main Research Area: Technical/natural sciences
DOI: 10.1109/EMBC.2017.8037253

**Spatial Filter Feature Extraction Methods for P300 BCI Speller: A Comparison**

Brain Computer Interface (BCI) systems enable subjects affected by neuromuscular disorders to interact with the outside world. A P300 speller uses Event Related Potential (ERP) components, generated in the brain in the presence of a target stimulus, to extract information about the user’s intent. Several methods have been proposed for spatial filtering and classification of the P300 components. In this study, xDAWN algorithm, Independent Component Analysis (ICA) and Principal Component Analysis (PCA) methods are used and evaluated based on the classification performance of two different classifiers, namely the Support Vector Machine (SVM) and Fisher’s Linear Discriminant Analysis (FLDA). In addition, it is shown that the incorporation of some prior knowledge regarding the location of P300 elicitation on the scalp can reduce the computational load while maintaining or even improving the classification performance.

**General information**
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Electrical Engineering, Biomedical Engineering, Technical University of Denmark
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Number of pages: 5
Pages: 003859-003863
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of 2016 IEEE International Conference on Systems, Man, and Cybernetics
Publisher: IEEE
ISBN (Print): 978-1-5090-1897-0
Main Research Area: Technical/natural sciences
DOI: 10.1109/SMC.2016.7844836
A comparative study of pseudorandom sequences used in a c-VEP based BCI for online wheelchair control

In this study, a c-VEP based BCI system was developed to run on three distinctive pseudorandom sequences, namely the m-code, the Gold-code, and the Barker-code. The Visual Evoked Potentials (VEPs) were provoked using these codes. In the online session, subjects controlled a LEGO® Mindstorms® robot around a fixed track. Choosing the optimal code proved a significant increase in accuracy.

General information
State: Published
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Pages: 1512-15
Publication date: 2016

Host publication information
Title of host publication: 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Publisher: IEEE
ISBN (Print): 978-1-4577-0220-4
Main Research Area: Technical/natural sciences
Electroactivity in neurophysiological processes, Physiology of the eye: nerve structure and function, Aids for the handicapped, Biological and medical control systems, Robotics, Computer assistance for persons with handicaps, Human-robot interaction, brain-computer interfaces, Gold codes, handicapped aids, human-robot interaction, medical robotics, random sequences, visual evoked potentials, wheelchairs, pseudorandom sequences, m-code, Gold-code, Barker-code, optimal code, LEGO® Mindstorms® robot, brain computer interface, online wheelchair control, online c-VEP based BCI system
DOIs: 10.1109/EMBC.2016.7590997
Source: FindIt
Source-ID: 2347648512
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

A comprehensive performance analysis of EEMD-BLMS and DWT-NN hybrid algorithms for ECG denoising

Electrocardiogram (ECG) is a widely used non-invasive method to study the rhythmic activity of the heart. These signals, however, are often obscured by artifacts/noises from various sources and minimization of these artifacts is of paramount importance for detecting anomalies. This paper presents a thorough analysis of the performance of two hybrid signal processing schemes ((i) Ensemble Empirical Mode Decomposition (EEMD) based method in conjunction with the Block Least Mean Square (BLMS) adaptive algorithm (EEMD-BLMS), and (ii) Discrete Wavelet Transform (DWT) combined with the Neural Network (NN), named the Wavelet NN (WNN)) for denoising the ECG signals. These methods are compared to the conventional EMD (C-EMD), C-EEMD, EEMD-LMS as well as the DWT thresholding (DWT-Th) based methods through extensive simulation studies on real as well as noise corrupted ECG signals. Results clearly show the superiority of the proposed methods.

General information
State: Published
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Pages: 178-187
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: Biomedical Signal Processing and Control
Volume: 25
ISSN (Print): 1746-8094
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Neurofeedback Therapy for Enhancing Visual Attention: State-of-the-Art and Challenges

We have witnessed a rapid development of brain-computer interfaces (BCIs) linking the brain to external devices. BCIs can be utilized to treat neurological conditions and even to augment brain functions. BCIs offer a promising treatment for mental disorders, including disorders of attention. Here we review the current state of the art and challenges of attention-based BCIs, with a focus on visual attention. Attention-based BCIs utilize electroencephalograms (EEGs) or other recording techniques to generate neurofeedback, which patients use to improve their attention, a complex cognitive function. Although progress has been made in the studies of neural mechanisms of attention, extraction of attention-related neural signals needed for BCI operations is a difficult problem. To attain good BCI performance, it is important to select the features of neural activity that represent attentional signals. BCI decoding of attention-related activity may be hindered by the presence of different neural signals. Therefore, BCI accuracy can be improved by signal processing algorithms that dissociate signals of interest from irrelevant activities. Notwithstanding recent progress, optimal processing of attentional neural signals remains a fundamental challenge for the development of efficient therapies for disorders of attention.
Steady State Visual Evoked Potential Based Brain-Computer Interface for Cognitive Assessment

Cognitive assessment is of growing importance, with the general population getting older and a rapidly growing incidence of dementia, which is a major public health issue. Treatment of dementia must, to be most effective, start early in the disease process. Thus, early detection of cognitive decline is important. Cognitive decline may be detected using fully automated computerized assessment. Such systems will provide inexpensive and widely available screenings of cognitive ability. The aim of this pilot study is to develop a real time steady state visual evoked potential (SSVEP) based brain-computer interface (BCI) for neurological cognitive assessment. It is intended for use by patients who suffer from diseases impairing their motor skills, but are still able to control their gaze. Results are based on 11 healthy test subjects. The system performance have an average accuracy of 100% ± 0%. The test subjects achieved an information transfer rate (ITR) of 14.64 bits/min ± 7.63 bits=min and a subject test performance of 47.22% ± 34.10%. This study suggests that BCI may be applicable in practice as a computerized cognitive assessment tool. However, many improvements are required for the system to be fully valid and of clinical use.

General information
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Pages: 1508-1511
Publication date: 2016

Host publication information
Title of host publication: Proceedings of 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Publisher: IEEE
Article number: WeCT8.7
A 3D Learning Playground for Potential Attention Training in ADHD

This paper presents a novel brain-computer interface (BCI) system that could potentially be used for enhancing the attention ability of subjects with attention deficit hyperactivity disorder (ADHD). It employs the steady state visual evoked potential (SSVEP) paradigm. The developed system consists of a 3D classroom environment with active 3D distractions and 2D games executed on the blackboard. The system is concealed as a game (with stages of varying difficulty) with an underlying story to motivate the subjects. It was tested on eleven healthy subjects and the results undeniably establish that by moving to a higher stage in the game where the 2D environment is changed to 3D along with the added 3D distractions, the difficulty level in keeping attention on the main task increases for the subjects. Results also show a mean accuracy of 92.26 ± 7.97% and a mean average selection time of 3.07 ± 1.09 seconds.

General information
State: Published
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Pages: 67-70
Publication date: 2015


In this pilot study, a novel and minimalistic Brain Computer Interface (BCI) based wheelchair control application was developed. The system was based on pseudorandom code modulated Visual Evoked Potentials (c-VEPs). The visual stimuli in the scheme were generated based on the Gold code, and the VEPs were recognized and classified using subject-specific algorithms. The system provided the ability of controlling a wheelchair model (LEGO R MINDSTORM R EV3 robot) in 4 different directions based on the elicited c-VEPs. Ten healthy subjects were evaluated in testing the system where an average accuracy of 97% was achieved. The promising results illustrate the potential of this approach when considering a real wheelchair application.

General information
State: Published
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Pages: 602-605
Publication date: 2015
BCI inside a virtual reality classroom: a potential training tool for attention

Background: A growing population is diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and are currently being treated with psychostimulants. Brain Computer Interface (BCI) is a method of communicating with an external program or device based on measured electrical signals from the brain. A particular brain signal, the P300 potential, can be measured about 300 ms after a voluntary cognitive involvement to external stimuli. By utilizing the P300 potential, we have designed a BCI-assisted exercising tool targeting attention enhancement within an immersive 3D virtual reality (VR) classroom.

Methods: Combining a low-cost infrared camera with an "off-axis perspective projection" algorithm to achieve the illusion of 3D, an engaging training environment has been created. The setup also includes a single measurement electrode placed on the scalp above the parietal lobe (Pz). Two sets of experiments have been performed to elicit the P300 potential. One used a system which is a variant of Farwell and Donchin's famous P300 speller and the other used a system where the user is required to search for a specific letter in a series of changing images. A non-linear optimized support vector machine (SVM) classifier has been used to automatically detect the P300 potential.

Results: Six subjects have participated in the preliminary experiment to test the prototype system, and an average error rate below 0.30 have been achieved, which is noteworthy considering the simplicity of the scheme.

Conclusions: This work has successfully demonstrated a non-intrusive, low-cost, and portable system targeting attention in a motivating and engaging environment.


Electrocardiogram (ECG) is a widely used noninvasive method to study the rhythmic activity of the heart and thereby to detect the abnormalities. However, these signals are often obscured by artifacts from various sources and minimization of these artifacts are of paramount important. This paper proposes two adaptive techniques, namely the EEMD-BLMS (Ensemble Empirical Mode Decomposition in conjunction with the Block Least Mean Square algorithm) and DWT-NN (Discrete Wavelet Transform followed by Neural Network) methods in minimizing the artifacts from recorded ECG signals, and compares their performance. These methods were first compared on two types of simulated noise corrupted ECG signals: Type-I (desired ECG+noise frequencies outside the ECG frequency band) and Type-II (ECG+noise frequencies both inside and outside the ECG frequency band). Subsequently, they were tested on real ECG recordings. Results clearly show that both the methods works equally well when used on Type-I signals. However, on Type-II signals the DWT-NN performed better. In the case of real ECG data, though both methods performed similar, the DWT-NN method was a slightly better in terms of minimizing the high frequency artifacts.
Real-time brain computer interface using imaginary movements

Background: Brain Computer Interface (BCI) is the method of transforming mental thoughts and imagination into actions. A real-time BCI system can improve the quality of life of patients with severe neuromuscular disorders by enabling them to communicate with the outside world. In this paper, the implementation of a 2-class real-time BCI system based on the event related desynchronization (ERD) of the sensorimotor rhythms (SMR) is described. Methods: Off-line measurements were conducted on 12 healthy test subjects with 3 different feedback systems (cross, basket and bars). From the collected electroencephalogram (EEG) data, the optimum frequency bands for each of the subjects were determined first through an exhaustive search on 325 bandpass filters. The features were then extracted for the left and right hand imaginary movements using the Common Spatial Pattern (CSP) method. Subsequently, a Bayes linear classifier (BLC) was developed and used for signal classification. These three subject-specific settings were preserved for the on-line experiments with the same feedback systems. Results: Six of the 12 subjects were qualified for the on-line experiments based on their high off-line classification accuracies (CAs > 75 %). The overall mean on-line accuracy was found to be 80%. Conclusions: The subject-specific settings applied on the feedback systems have resulted in the development of a successful real-time BCI system with high accuracies.
Representation of steady-state visual evoked potentials in sensorimotor cortical areas of a nonhuman primate.

General information
State: Published
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Publication date: 2015
Event: Abstract from 45th annual meeting of the Society for Neuroscience 2015, Chicago, ILL, United States.
Main Research Area: Technical/natural sciences
Electronic versions: SFN2015_Abstract.pdf

Brain-computer interface
A computer-implemented method of providing an interface between a user and a processing unit, the method comprising: presenting one or more stimuli to a user, each stimulus varying at a respective stimulation frequency, each stimulation frequency being associated with a respective user-selectable input; receiving at least one signal indicative of brain activity of the user; and determining, from the received signal, which of the one or more stimuli the user attends to and selecting the user-selectable input associated with the stimulation frequency of the determined stimuli as being a user-selected input.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Copenhagen University Hospital
Authors: Sørensen, H. B. D. (Intern), Puthusserypady, S. (Intern), Vilic, A. (Intern), Kjaer, T. W. (Ekstern), Thomsen, C. E. (Intern)
Publication date: 2014

Publication information
IPC: G06F3/01
Patent number: WO2014207008
Date: 31/12/2014
Priority date: 28/06/2013
Priority number: EP20130174262
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Patent – Annual report year: 2015

Brain-computer interface using P300 and virtual reality: A gaming approach for treating ADHD
This paper presents a novel brain-computer interface (BCI) system aiming at the rehabilitation of attention-deficit/hyperactive disorder in children. It uses the P300 potential in a series of feedback games to improve the subjects' attention. We applied a support vector machine (SVM) using temporal and template-based features to detect these P300 responses. In an experimental setup using five subjects, an average error below 30% was achieved. To make it more challenging the BCI system has been embedded inside an immersive 3D virtual reality (VR) classroom with simulated distractions, which was created by combining a low-cost infrared camera and an "off-axis perspective projection" algorithm. This system is intended for kids by operating with four electrodes, as well as a non-intrusive VR setting. With the promising results, and considering the simplicity of the scheme, we hope to encourage future studies to adapt the techniques presented in this study.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering
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Pages: 3606-3609
Publication date: 2014
SSVEP-modulation by covert and overt attention: Novel features for BCI in attention neuro-rehabilitation

In this pilot study the effect of attention (covert and overt) on the signal detection and classification of steady-state visual-evoked potential (SSVEP) were investigated. Using the SSVEP-based paradigm, data were acquired from 4 subjects using 3 scalp electroencephalography (EEG) electrodes located on the visual area. Subjects were instructed to perform the attention task in which they attended covertly or overtly to either of the stimuli flickering with different frequencies (6, 7, 8 and 9Hz). We observed a decrease in signal power in covert compared to the overt attention. However, there was a consistent pattern in covert attention causing an increase in the power of the 2nd harmonic of the attended frequency. Encouraging results of this preliminary study indicates that it can be adapted and implemented in the brain-computer interface (BCI) system which could potentially be used as a neuro-rehabilitation tool for individuals with attention deficit.
Statistical Discriminability Estimation for Pattern Classification Based on Neural Incremental Attribute Learning

Feature ordering is a significant data preprocessing method in Incremental Attribute Learning (IAL), a novel machine learning approach which gradually trains features according to a given order. Previous research has shown that, similar to feature selection, feature ordering is also important based on each feature's discrimination ability, and should be sorted in a descending order of their discrimination ability. However, such an ordering is crucial for the performance of IAL. As the number of feature dimensions in IAL is increasing, feature discrimination ability also should be calculated in the corresponding incremental way. Based on Single Discriminability (SD), where only the feature discrimination ability is computed, a new filter statistical feature discrimination ability predictive metric, called the Accumulative Discriminability (AD), is designed for the dynamical feature discrimination ability estimation. Moreover, a criterion that summarizes all the produced values of AD is employed with a GA (Genetic Algorithm)-based approach to obtain the optimum feature ordering for classification problems based on neural networks by means of IAL. Compared with the feature ordering obtained by other approaches, the method proposed in this paper exhibits better performance in the final classification results. Such a phenomenon indicates that, (i) the feature discrimination ability should be incrementally estimated in IAL, and (ii) the feature ordering derived by AD and its corresponding approaches are applicable with IAL.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, University of Liverpool
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Pages: 37-57
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Applied Evolutionary Computation
Volume: 5
Issue number: 2
ISSN (Print): 1942-3594
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
DOI:
10.4018/ijaec.2014040103
Source: FindIt
Source-ID: 270714694
Publication: Research - peer-review › Journal article – Annual report year: 2014

BCI using imaginary movements: The simulator

Over the past two decades, much progress has been made in the rapidly evolving field of Brain Computer Interface (BCI). This paper presents a novel concept: a BCI-simulator, which has been developed for the Hex-O-Spell interface, using the sensory motor rhythms (SMR) paradigm. With the simulator, it is possible to evaluate how the model parameters such as error classifications, delay between classifications and success rate affect the communication rate. Another advantage of the simulator is that it allows us to study for more classes than most online BCI systems which are limited to only two classes. Results show that the BCI simulator is able to give a deeper understanding of the feedback systems. We also find that a 3-class system is more efficient than a 2-class system if it obtains a success rate of at least 55% of the 2-class system.

General information
State: Published
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Pages: 300-307
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Computer Methods and Programs in Biomedicine
Volume: 111
DTU BCI speller: An SSVEP-based spelling system with dictionary support

In this paper, a new brain computer interface (BCI) speller, named DTU BCI speller, is introduced. It is based on the steady-state visual evoked potential (SSVEP) and features dictionary support. The system focuses on simplicity and user friendliness by using a single electrode for the signal acquisition and displays stimuli on a liquid crystal display (LCD). Nine
healthy subjects participated in writing full sentences after a five minutes introduction to the system, and obtained an information transfer rate (ITR) of 21.94 ± 15.63 bits/min. The average amount of characters written per minute (CPM) is 4.90 ± 3.84 with a best case of 8.74 CPM. All subjects reported systematically on different user friendliness measures, and the overall results indicated the potentials of the DTU BCI Speller system. For subjects with high classification accuracies, the introduced dictionary approach greatly reduced the time it took to write full sentences.

**General information**
- **State:** Published
- **Organisations:** Department of Electrical Engineering, Biomedical Engineering, Copenhagen University Hospital
- **Authors:** Vilic, A. (Intern), Kjaer, T. W. (Ekstern), Thomsen, C. E. (Intern), Puthusserypady, S. (Intern), Sørensen, H. B. D. (Intern)
- **Pages:** 2212-2215
- **Publication date:** 2013

**Host publication information**
- **Title of host publication:** IEEE Engineering in medicine and biology society conference proceedings
- **Publisher:** IEEE
- **ISBN (Print):** 9781457702167
- **Main Research Area:** Technical/natural sciences
- **Conference:** 35th Annual International Conference of the IEEE EMBS, Osaka, Japan, 03/07/2013 - 03/07/2013
- **Engineered Materials, Dielectrics and Plasmas
- **DOIs:**
  - 10.1109/EMBC.2013.6609975
  - Source: dtu
  - Source-ID: n::oai:DTIC-ART:iel/409081098::33230
  - Publication: Research - peer-review » Article in proceedings – Annual report year: 2013

**Semi-supervised adaptation in ssvep-based brain-computer interface using tri-training**

This paper presents a novel and computationally simple tri-training based semi-supervised steady-state visual evoked potential (SSVEP)-based brain-computer interface (BCI). It is implemented with autocorrelation-based features and a Naïve-Bayes classifier (NBC). The system uses nine characters presented on a 100 Hz CRT-monitor, three scalp electrodes for signal acquisition, a gUSB-amp for preamplification and two PCs for data-processing and stimulus control respectively. Preliminary test results of the system on nine healthy subjects, with and without tri-training, indicates that the accuracy improves as a result of tri-training.

**General information**
- **State:** Published
- **Organisations:** Department of Electrical Engineering, Biomedical Engineering, Technical University of Denmark, Copenhagen University Hospital
- **Authors:** Bender, T. (Ekstern), Kjaer, T. W. (Ekstern), Thomsen, C. E. (Intern), Sørensen, H. B. D. (Intern), Puthusserypady, S. (Intern)
- **Number of pages:** 4
- **Pages:** 4279-4282
- **Publication date:** 2013

**Host publication information**
- **Title of host publication:** IEEE Engineering in medicine and biology society conference proceedings
- **Publisher:** IEEE
- **ISBN (Print):** 978-1-4577-0216-7
- **Main Research Area:** Technical/natural sciences
- **Conference:** 35th Annual International Conference of the IEEE EMBS, Osaka, Japan, 03/07/2013 - 03/07/2013
- **Engineered Materials, Dielectrics and Plasmas, Brain-Computer Interface, Steady-State Visual Evoked Potentials, Tri-training, Autocorrelation, Naive-Bayes Classifier
- **DOIs:**
  - 10.1109/EMBC.2013.6610491
  - Source: dtu
  - Source-ID: n::oai:DTIC-ART:iel/409080065::33231
  - Publication: Research - peer-review » Article in proceedings – Annual report year: 2013

**An Asynchronous P300 BCI With SSVEP-Based Control State Detection**

In this paper, an asynchronous brain–computer interface (BCI) system combining the P300 and steady-state visually evoked potentials (SSVEPs) paradigms is proposed. The information transfer is accomplished using P300 event-related potential paradigm and the control state (CS) detection is achieved using SSVEP, overlaid on the P300 base system. Offline and online experiments have been performed with ten subjects to validate the proposed system. It is shown to achieve fast and accurate CS detection without significantly compromising the performance. In online experiments, the
system is found to be capable of achieving an average data transfer rate of 19.05 bits/min, with CS detection accuracy of about 88%.

**General information**

State: Published
Organisations: Biomedical Engineering, Department of Electrical Engineering, National University of Singapore
Authors: Panicker, R. C. (Ekstern), Puthusserypady, S. (Intern), Sun, Y. (Ekstern)
Pages: 1781-1788
Publication date: 2011
Main Research Area: Technical/natural sciences

**Publication information**

Journal: IEEE Transactions on Biomedical Engineering
Volume: 58
Issue number: 6
ISSN (Print): 0018-9294
Ratings:
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.214 SNIP 1.995 CiteScore 4.2
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.132 SNIP 2.083 CiteScore 3.74
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.84 SNIP 1.973 CiteScore 3.34
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.081 SNIP 2.073 CiteScore 3.53
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.816 SNIP 1.706 CiteScore 3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.7 SNIP 1.715 CiteScore 3.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.686 SNIP 1.637
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.81 SNIP 1.94
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.826 SNIP 1.719
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.144 SNIP 2.187
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.317 SNIP 2.426
Scopus rating (2005): SJR 1.023 SNIP 2.252
Scopus rating (2004): SJR 0.73 SNIP 1.689
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.849 SNIP 1.367
Scopus rating (2002): SJR 0.888 SNIP 1.428
Scopus rating (2001): SJR 0.767 SNIP 1.578
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.942 SNIP 1.505
Scopus rating (1999): SJR 0.613 SNIP 2.187
Adaptation in P300 braincomputer interfaces: A two-classifier cotraining approach

A cotraining-based approach is introduced for constructing high-performance classifiers for P300-based braincomputer interfaces (BCIs), which were trained from very little data. It uses two classifiers: Fishers linear discriminant analysis and Bayesian linear discriminant analysis progressively teaching each other to build a final classifier, which is robust and able to learn effectively from unlabeled data. Detailed analysis of the performance is carried out through extensive cross-validations, and it is shown that the proposed approach is able to build high-performance classifiers from just a few minutes of labeled data and by making efficient use of unlabeled data. An average bit rate of more than 37 bits/min was achieved with just one and a half minutes of training, achieving an increase of about 17 bits/min compared to the fully supervised classification in one of the configurations. This performance improvement is shown to be even more significant in cases where the training data as well as the number of trials that are averaged for detection of a character is low, both of which are desired operational characteristics of a practical BCI system. Moreover, the proposed method outperforms the self-training-based approaches where the confident predictions of a classifier is used to retrain itself. © 2010 IEEE.
Asynchronous P300 BCI: SSVEP based control state detection

An asynchronous hybrid brain-computer interface (BCI) system combining the P300 and steady-state visually evoked potentials (SSVEP) paradigms is introduced. A P300 base system is used for information transfer, and is augmented to include SSVEP for control state detection. The proposed system has been validated through off-line and online experiments. It is shown to achieve fast and accurate control state detection without significantly compromising the performance. For the two subjects who participated in the online experiments, the system achieved an average data transfer rate of 20.13 bits/min, with control state classification accuracy of more than 97%.
Robust Estimation of HDR in fMRI using H-infinity Filters

Estimation and detection of the hemodynamic response (HDR) are of great importance in functional MRI (fMRI) data analysis. In this paper, we propose the use of three H-infinity adaptive filters (finite memory, exponentially weighted, and timevarying) for accurate estimation and detection of the HDR. The H8 approach is used because it safeguards against the worst case disturbances and makes no assumptions on the (statistical) nature of the signals [B. Hassibi and T. Kailath, in Proc. ICASSP, 1995, vol. 2, pp. 949-952; T. Ratnarajah and S. Puthusserypady, in Proc. 8th IEEEWorkshopDSP, 1998, pp. 1483-1487]. Performances of the proposed techniques are compared to the conventional t-test method as well as the well-known LMSs and recursive least squares algorithms. Extensive numerical simulations show that the proposed methods result in better HDR estimations and activation detections.
Variants of Kalman filter for the synchronization of chaotic systems

General information
State: Published
Organisations: National University of Singapore, University of Calgary
Authors: Puthusserypady, S. (Intern), Ajeesh, K. (Ekstern)
Pages: 209-224
Publication date: 2010

Host publication information
Title of host publication: Applications of Kalman Filter
Editor: Vedran, K.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262587
Publication: Research - peer-review › Book chapter – Annual report year: 2010

Rate prioritized power adaptation for IEEE 802.11 WLANS

General information
State: Published
Organisations: National University of Singapore
Authors: Krishnamurthy, R. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2009
Semi-blind channel estimation for space-time coded amplify-and-forward relay networks

General information
State: Published
Organisations: Jacobs University Bremen, King’s College London, National University of Singapore
Authors: Yang, L. (Ekstern), Feifei, G. (Ekstern), Puthusserypady, S. (Intern), Arumugam, N. (Ekstern)
Pages: 1684-1688
Publication date: 2009

Analysis of fMRI data with drift: Modified general linear model and Bayesian estimator

The slowly varying drift poses a major problem in the analysis of functional magnetic resonance imaging (fMRI) data. In this paper, based on the observation that noise in fMRI is long memory fractional noise and the slowly varying drift resides in a subspace spanned only by large scale wavelets, we examine a modified general linear model (GLM) in wavelet domain under Bayesian framework. This modified model estimates the activation parameters at each scale of wavelet decomposition. Then, a model selection criterion based on the results from the modified scheme is proposed to model the drift. Results obtained from simulated as well as real fMRI data show that the proposed Bayesian estimator can accurately capture the noise structure, and hence, result in robust estimation of the parameters in GLM. Besides, the proposed model selection criterion works well and could efficiently remove the drift.

General information
State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1504-1511
Publication date: 2008
Main Research Area: Technical/natural sciences
EOG artifact minimization using oblique projection corrected eigenvector decomposition

General information
State: Published
Organisations: National University of Singapore
Authors: Zhou, Z. (Ekstern), Puthusserypady, S. (Intern)
Pages: 4656-4659
Publication date: 2008

Host publication information
Title of host publication: Proceedings of the 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Main Research Area: Technical/natural sciences

Error correction with chaotic switching between convolutional codecs

General information
State: Published
Organisations: DSO National Laboratories, Nanyang Technological University, National University of Singapore
Performance Study of a Novel Selective Cooperative Spectrum Sensing Scheme for Secondary Radios

General information
State: Published
Organisations: National University of Singapore, Institute of Infocom Research
Authors: H, Y. (Ekstern), Y H, C. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2008

Host publication information
Title of host publication: IEEE MILCOM
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: Proceedings of the IEEE MILCOM 2008, 01/01/2008
Source: orbit
Source-ID: 262596
Publication: Research - peer-review › Article in proceedings – Annual report year: 2008

Self-synchronizing chaotic stream ciphers

General information
State: Published
Organisations: National University of Singapore
Authors: Ajeesh, K. (Ekstern), Puthusserypady, S. (Intern)
Pages: 2442-2452
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Signal Processing
Volume: 88
Issue number: 10
ISSN (Print): 0165-1684
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.048 SNIP 1.905 CiteScore 3.6
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.958 SNIP 2.001 CiteScore 3
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.059 SNIP 2.311 CiteScore 3.19
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.024 SNIP 2.34 CiteScore 3.13
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.122 SNIP 2.478 CiteScore 2.88
ISI indexed (2012): ISI indexed yes
A constrained genetic algorithm for efficient dimensionality reduction for pattern classification

In automated pattern recognition systems, the two main challenges are feature selection and extraction. The features selected directly affects the number of measurements required; and extracting low-dimensional features from the selected ones reduces the computational complexity of the classifier. In traditional approaches, human expertise is obligatory for feature selection and statistical techniques are employed for feature projection. In this paper, a constrained genetic algorithm for performing these two tasks simultaneously, in conjunction with the k-nearest neighbor classifier is proposed. This algorithm requires minimal human intervention as it realizes good tradeoff solutions between classification accuracy, feature measurement requirements, and computational complexity.

General information
State: Published
Organisations: National University of Singapore
Authors: Panicker, R. (Ekstern), Puthusserypady, S. (Intern)
Pages: 424-427
Publication date: 2007

Host publication information
Title of host publication: International Conference on Computational Intelligence and Security CIS'2007
ISBN (Print): 978-0-7695-3072-7
Main Research Area: Technical/natural sciences
Conference: International Conference on Computational Intelligence and Security CIS'2007, 01/01/2007
DOIs: 10.1109/CIS.2007.193
Source: orbit
Source-ID: 262597
Publication: Research - peer-review › Article in proceedings – Annual report year: 2007

Adaptive spatio-temporal modeling and estimation of the event-related fMRI responses

Functional magnetic resonance imaging (fMRI) data analysis is a challenging problem due to the underlying physiological complexity of the brain and the scanning process. From engineering perspective, the fMRI data analysis can be viewed as a system modelling problem. In this paper, assuming the fMRI signal as the output of an unknown linear time-invariant system, a spatiotemporal adaptive filter is proposed to model the spatial activation patterns as well as the haemodynamic...
response (HDR) to the event-related stimulus. The well-known least mean square adaptive algorithm is used for estimating the coefficients of the spatiotemporal filter. The proposed method is shown to be equivalent to the canonical correlation analysis method. It is then extended to multiple event type scenarios to estimate the HDRs of each event type. Results from simulated as well as real fMRI data show that these adaptive modelling schemes can capture the variations of the HDR at different regions of the brain and hence enhance the estimation accuracy of the activation patterns.

**General information**

State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 2810-2822
Publication date: 2007
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Signal Processing
Volume: 87
Issue number: 11
ISSN (Print): 0165-1684
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.048 SNIP 1.905 CiteScore 3.6
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.958 SNIP 2.001 CiteScore 3
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.059 SNIP 2.311 CiteScore 3.19
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.024 SNIP 2.34 CiteScore 3.13
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.122 SNIP 2.478 CiteScore 2.88
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.786 SNIP 1.937 CiteScore 2.19
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.741 SNIP 1.678
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.76 SNIP 1.551
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.66 SNIP 1.37
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.574 SNIP 1.331
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.539 SNIP 1.394
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.507 SNIP 1.29
Scopus rating (2004): SJR 0.558 SNIP 1.351
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.622 SNIP 0.97
Scopus rating (2002): SJR 0.689 SNIP 1.067
Scopus rating (2001): SJR 0.841 SNIP 1.234
Scopus rating (2000): SJR 0.859 SNIP 1.085
Scopus rating (1999): SJR 0.532 SNIP 0.971
Analysis of schizophrenic EEG synchrony using empirical mode decomposition

General information
State: Published
Organisations: National University of Singapore
Authors: Z. Z. (Ekstern), Puthusserypady, S. (Intern)
Pages: 131-134
Publication date: 2007

Host publication information
Title of host publication: 15th International Conference on Digital Signal Processing
Main Research Area: Technical/natural sciences
Conference: 15th International Conference on Digital Signal Processing, 01/01/2007
Source: orbit
Source-ID: 262601
Publication: Research - peer-review › Article in proceedings – Annual report year: 2007

A novel hybrid algorithm for function optimization: Particle Swarm assisted incremental evolution strategy

General information
State: Published
Organisations: IBM, Xian Jiaotong-Liverpool University, National University of Singapore
Authors: Wenting, M. (Ekstern), Sheng-Uei, G. (Ekstern), Puthusserypady, S. (Intern)
Pages: 101-125
Publication date: 2007

Host publication information
Title of host publication: Hybrid Evolutionary Systems
Publisher: Springer
Series: Studies in Computational Intelligence
Number: 75
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262579
Publication: Research - peer-review › Book chapter – Annual report year: 2007

Chaotic time series prediction and additive white Gaussian noise

General information
State: Published
Organisations: Imperial College London, National University of Singapore
Authors: Lim, T. P. (Ekstern), Puthusserypady, S. (Intern)
Pages: 309-314
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Volume: 365
Issue number: 4
ISSN (Print): 0375-9601
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Estimation of the hemodynamic response of the fMRI data using RBF neural networks

General information
State: Published
fMRI data analysis with nonstationary noise models: A Bayesian approach

General information
State: Published
Organisations: National University of Singapore
Authors: Hualen, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1621-1630
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Biomedical Engineering
Volume: 54
Issue number: 9
ISSN (Print): 0018-9294
Ratings:
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.214 SNIP 1.995 CiteScore 4.2
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.132 SNIP 2.083 CiteScore 3.74
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.84 SNIP 1.973 CiteScore 3.34
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.081 SNIP 2.073 CiteScore 3.53
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.816 SNIP 1.706 CiteScore 3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.7 SNIP 1.715 CiteScore 3.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.686 SNIP 1.637
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.81 SNIP 1.94
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.826 SNIP 1.719
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.144 SNIP 2.187
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.317 SNIP 2.426
Scopus rating (2005): SJR 1.023 SNIP 2.252
Scopus rating (2004): SJR 0.73 SNIP 1.689
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.849 SNIP 1.367
Scopus rating (2002): SJR 0.888 SNIP 1.428
Scopus rating (2001): SJR 0.767 SNIP 1.578
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.942 SNIP 1.505
Scopus rating (1999): SJR 0.613 SNIP 2.187
H∞ adaptive algorithms for noninvasive fetal electrocardiogram estimation

General information
State: Published
Organisations: National University of Singapore
Authors: Puthusserypady, S. (Intern)
Pages: 927-937
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Medical & Biological Engineering & Computing
Volume: 45
Issue number: 10
ISSN (Print): 0140-0118
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.699 SNIP 1.238 CiteScore 2.05
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.805 SNIP 1.177 CiteScore 2.14
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.634 SNIP 1.321 CiteScore 2.16
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.668 SNIP 1.266 CiteScore 2.19
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.732 SNIP 1.343 CiteScore 2.15
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.621 SNIP 1.221 CiteScore 2.15
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.683 SNIP 1.267
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.612 SNIP 1.381
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.535 SNIP 1.008
Scopus rating (2007): SJR 0.56 SNIP 1.138
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.589 SNIP 1.108
Scopus rating (2005): SJR 0.574 SNIP 1.228
Scopus rating (2004): SJR 0.446 SNIP 1.012
Scopus rating (2003): SJR 0.441 SNIP 1.005
Scopus rating (2002): SJR 0.475 SNIP 1.018
Scopus rating (2001): SJR 0.491 SNIP 0.867
Scopus rating (2000): SJR 0.418 SNIP 0.773
Scopus rating (1999): SJR 0.342 SNIP 0.706
Original language: English
Cardiac state diagnosis using adaptive neuro-fuzzy techniques

General information
State: Published
Organisations: Ngee Ann Polytechnic, National University of Singapore, University of Idaho
Authors: Natarajan, K. (Ekstern), C M, L. (Ekstern), Rajendra, A. (Ekstern), Puthusserypady, S. (Intern), laxminarayan, S. (Ekstern)
Pages: 809-815
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Medical Engineering & Physics
Volume: 28
Issue number: 8
ISSN (Print): 1350-4533
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.713 SNIP 1.199 CiteScore 2.1
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.791 SNIP 1.273 CiteScore 2.11
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.739 SNIP 1.638 CiteScore 2.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.834 SNIP 1.562 CiteScore 2.51
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.797 SNIP 1.599 CiteScore 2.34
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.753 SNIP 1.638 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.685 SNIP 1.299
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.614 SNIP 1.551
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.741 SNIP 1.478
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.683 SNIP 1.308
Scopus rating (2006): SJR 0.687 SNIP 1.09
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.452 SNIP 1.216
Scopus rating (2004): SJR 0.553 SNIP 1.177
Scopus rating (2003): SJR 0.499 SNIP 0.832
Scopus rating (2002): SJR 0.374 SNIP 0.718
Scopus rating (2001): SJR 0.426 SNIP 1.042
Scopus rating (2000): SJR 0.333 SNIP 0.651
Scopus rating (1999): SJR 0.341 SNIP 0.716
Chaotic synchronization: A nonlinear predictive filtering approach

General information
State: Published
Organisations: National University of Singapore
Authors: Ajeesh, K. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Chaos
Volume: 16
Issue number: 1
ISSN (Print): 0108-4453
Ratings:
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
ISI indexed (2007): ISI indexed no
Original language: English
Source: orbit
Source-ID: 262480
Publication: Research - peer-review › Journal article – Annual report year: 2006

Cross-validation error criteria for chaotic time series prediction

General information
State: Published
Organisations: National University of Singapore
Authors: Lim, T. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2006

Host publication information
Title of host publication: In Proceedings of the 6th Symposium on Understanding Complex Systems
Main Research Area: Technical/natural sciences
Conference: 6th Symposium on Understanding Complex Systems, 01/01/2006
Source: orbit
Source-ID: 262607
Publication: Research - peer-review › Article in proceedings – Annual report year: 2006

Elman neural networks for dynamic modeling of epileptic EEG

General information
State: Published
Organisations: National University of Singapore, Ngee Ann Polytechnic
Authors: Natarajan, K. (Ekstern), Puthusserypady, S. (Intern), Choo Min, L. (Ekstern)
Pages: 6145-6148
Erratum to "Entropies for detection of epilepsy in EEG"

General information
State: Published
Organisations: National University of Singapore, Ngee Ann Polytechnic
Authors: Natarajan, K. (Ekstern), C M, L. (Ekstern), Rajendra, A. (Ekstern), Puthusserypady, S. (Intern)
Pages: 193-193
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Computer Methods and Programs in Biomedicine
Volume: 81
Issue number: 2
ISSN (Print): 0169-2607
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.639 SNIP 1.492 CiteScore 2.67
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.867 SNIP 1.636 CiteScore 2.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.775 SNIP 1.604 CiteScore 2.65
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.642 SNIP 1.5 CiteScore 2.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.487 SNIP 1.574 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.564 SNIP 1.629 CiteScore 2.25
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.53 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.445 SNIP 1.299
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.484 SNIP 1.108
Scopus rating (2007): SJR 0.467 SNIP 0.892
Scopus rating (2006): SJR 0.371 SNIP 0.793
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.426 SNIP 1.224
Error criteria for cross-validation in the context of chaotic time series prediction

General information
State: Published
Organisations: National University of Singapore
Authors: Lim, T. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Chaos
Volume: 16
Issue number: 1
ISSN (Print): 0108-4453
Ratings:
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: English
Source: orbit
Source-ID: 262486
Publication: Research - peer-review > Journal article – Annual report year: 2006

Multiuser receiver for DS-CDMA signals in multipath channels: An enhanced multisurface method

General information
State: Published
Organisations: National University of Singapore
Authors: Chetan, M. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1592-1605
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Neural Networks
Volume: 17
Issue number: 6
NARX neural networks for dynamical modeling of fMRI data

General information
State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2006

Host publication information
Title of host publication: In Proceedings of the International Joint Conference on Neural Networks, IEEE World Congress on Computational Intelligence (WCCI-2006)
Main Research Area: Technical/natural sciences
Conference: International Joint Conference on Neural Networks, IEEE World Congress on Computational Intelligence (WCCI-2006), 01/01/2006
Performance analysis of nonlinear predictive filter based chaotic synchronization

Robust adaptive techniques for minimization of EOG artifacts from EEG Signals
Secure digital communication using chaotic symbols

General information
Spatio-temporal modeling and analysis of fMRI data using NARX neural network

General information
State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 139-149
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Neural Systems
Volume: 16
Issue number: 2
ISSN (Print): 0129-0657
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.121 SNIP 1.519 CiteScore 5.16
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.871 SNIP 1.732 CiteScore 4.85
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.947 SNIP 2.278 CiteScore 5.14
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.108 SNIP 1.922 CiteScore 5.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.91 SNIP 1.531 CiteScore 4.61
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.552 SNIP 1.194 CiteScore 3.51
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.478 SNIP 0.963
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.529 SNIP 0.865
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.31 SNIP 0.494
Unscented Kalman filter and particle filter for chaotic synchronization

General information
State: Published
Organisations: National University of Singapore
Authors: Ajeesh, K. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2006

Host publication information
Title of host publication: In Proceedings of the IEEE Asia Pacific Conference on Circuits and Systems (APCCAS-2006)
Main Research Area: Technical/natural sciences
Conference: IEEE Asia Pacific Conference on Circuits and Systems (APCCAS-2006), 01/01/2006
Source: orbit
Source-ID: 262604
Publication: Research - peer-review › Article in proceedings – Annual report year: 2006

A sparse Bayesian method for determination of flexible matrix for fMRI data analysis

General information
State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 2699-2707
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Circuits and Systems Part 1: Regular Papers
Volume: 52
Issue number: 12
ISSN (Print): 1549-8328
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.91 SJR 1.031 SNIP 1.916
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.269 SNIP 2.114 CiteScore 3.6
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.225 SNIP 2.334 CiteScore 3.59
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.315 SNIP 2.294 CiteScore 3.67
Characterization of EEG - A comparative study

General information
State: Published
Organisations: Ngee Ann Polytechnic, National University of Singapore
Authors: Natarajan, K. (Ekstern), Rajendra, A. (Ekstern), C M, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 17-23
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Computer Methods and Programs in Biomedicine
Volume: 80
Issue number: 1
ISSN (Print): 0169-2607
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.639 SNIP 1.492 CiteScore 2.67
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.867 SNIP 1.636 CiteScore 2.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.775 SNIP 1.604 CiteScore 2.65
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.642 SNIP 1.5 CiteScore 2.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.487 SNIP 1.574 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Entropies for detection of epilepsy in EEG

General information
State: Published
Organisations: National University of Singapore, Ngee Ann Polytechnic
Authors: Kannathal, N. (Ekstern), Choo, M. L. (Ekstern), Acharya, U. R. (Ekstern), Puthusserypady, S. (Intern)
Pages: 187-194
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Computer Methods and Programs in Biomedicine
Volume: 80
Issue number: 3
ISSN (Print): 0169-2607
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.639 SNIP 1.492 CiteScore 2.67
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.867 SNIP 1.636 CiteScore 2.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.775 SNIP 1.604 CiteScore 2.65
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.642 SNIP 1.5 CiteScore 2.28
ISI indexed (2013): ISI indexed yes
H∞ adaptive filters for eye-blink artifact minimization from electroencephalogram

General information
State: Published
Organisations: National University of Singapore, Queen's University Belfast
Authors: Puthusserypady, S. (Intern), Ratnarajah, T. (Ekstern)
Pages: 816-819
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Volume: 12
Issue number: 12
ISSN (Print): 1070-9908
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.54 SJR 0.942 SNIP 1.805
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Multilayer perceptions for the classification of brain computer interface data

General information
State: Published
Organisations: National University of Singapore
Authors: Divya, B. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2005

Host publication information
Title of host publication: In Proceedings of the IEEE 31st Annual Northeast Bioengineering Conference
Main Research Area: Technical/natural sciences
Conference: IEEE 31st Annual Northeast Bioengineering Conference, 01/01/2005
Source: orbit
Source-ID: 262515
Publication: Research - peer-review › Journal article – Annual report year: 2005

Performance enhancement of DS/CDMA system using chaotic complex spreading sequence

General information
State: Published
Organisations: National University of Singapore
Authors: Ajeeesh, K. (Ekstern), Puthusserypady, S. (Intern), Su Myat, H. (Ekstern)
Post processing methods for finding the embedding dimension of chaotic time series

General information
State: Published
Organisations: National University of Singapore
Authors: Lim, T. (Ekstern), Puthusserypady, S. (Intern)
Pages: 027204
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Volume: 72
Issue number: 2
ISSN (Print): 1539-3755
The eye-care PC

General information
State: Published
Organisations: National University of Singapore, ITE
Authors: C Y Y, P. (Ekstern), Puthusserypady, S. (Intern), T L, S. (Ekstern)
Pages: 159-162
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Innovative Techniques for Biology & Medicine
Volume: 26
Original language: English
Source: orbit
Source-ID: 262519
Publication: Research - peer-review » Journal article – Annual report year: 2005

Bayesian radial basis function network for modeling fMRI data

General information
State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2004

Host publication information
Title of host publication: Proceedings of the 26th Annual Conference of the IEEE EMBS
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262635
Publication: Research - peer-review » Article in proceedings – Annual report year: 2004

Cardiac health diagnosis using heart rate variability signals A comparative Study

General information
State: Published
Organisations: Ngee Ann Polytechnic, Louisiana State University, National University of Singapore
Authors: Natarajan, K. (Ekstern), Rajendra, A. (Ekstern), C M, L. (Ekstern), Puthusserypady, S. (Intern), S S, I. (Ekstern)
Pages: 23-36
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Intelligent Automation and Soft Computing
Volume: 10
Issue number: 1
ISSN (Print): 1079-8587
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.257 SNIP 0.625 CiteScore 0.77
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.261 SNIP 0.37 CiteScore 0.42
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.236 SNIP 0.36 CiteScore 0.36
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.166 SNIP 0.228 CiteScore 0.29
Complex dynamics of epileptic EEG

General information
State: Published
Organisations: National University of Singapore, Ngee Ann Polytechnic
Authors: Natarajan, K. (Ekstern), Puthusserypady, S. (Intern), Choo Min, L. (Ekstern)
Publication date: 2004

Host publication information
Title of host publication: Proceedings of the 26th Annual Conference of the IEEE EMBS
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262632
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

Complex valued chaotic spreading sequence for quadrature modulation based I-Q DS/SS system

General information
State: Published
Organisations: National University of Singapore
Authors: Puthusserypady, S. (Intern), Su Myat, H. (Ekstern)
Publication date: 2004

Host publication information
Title of host publication: Proceedings of the 10th International Conference on Information System Analysis and Synthesis (CITSAS 2004)
Main Research Area: Technical/natural sciences
Effect of reflexology on EEG: A nonlinear approach

General information
State: Published
Organisations: Ngee Ann Polytechnic, National University of Singapore
Authors: Natarajan, K. (Ekstern), Paul, J. (Ekstern), C M, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 641-650
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: American Journal of Chinese Medicine
Volume: 32
Issue number: 4
ISSN (Print): 0192-415X
Ratings:
Web of Science (2017): Indexed Yes
Scopus rating (2016): SJR 0.873 SNIP 0.868 CiteScore 2.83
Scopus rating (2015): SJR 0.819 SNIP 0.893 CiteScore 2.72
Scopus rating (2014): SJR 0.902 SNIP 1.141 CiteScore 2.71
Scopus rating (2013): SJR 0.866 SNIP 1.112 CiteScore 2.65
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.786 SNIP 1.082 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 0.769 SNIP 1.212 CiteScore 2.06
ISI indexed (2011): ISI indexed yes
Scopus rating (2010): SJR 0.58 SNIP 0.819
Scopus rating (2009): SJR 0.534 SNIP 0.812
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.472 SNIP 0.656
Scopus rating (2007): SJR 0.511 SNIP 0.784
Scopus rating (2006): SJR 0.383 SNIP 0.836
Scopus rating (2005): SJR 0.35 SNIP 0.644
Scopus rating (2004): SJR 0.27 SNIP 0.482
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.271 SNIP 0.605
Scopus rating (2002): SJR 0.326 SNIP 0.38
Scopus rating (2001): SJR 0.244 SNIP 0.509
Scopus rating (2000): SJR 0.315 SNIP 0.862
Scopus rating (1999): SJR 0.284 SNIP 0.845
Original language: English
Source: orbit
Source-ID: 262522
Publication: Research - peer-review › Journal article – Annual report year: 2004

Embedding EEG data on 3D read modeled using MRI data

General information
State: Published
Organisations: National University of Singapore
Authors: Arun, M. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2004

Host publication information
Title of host publication: Proceedings of the 26th Annual Conference of the IEEE EMBS
Mackey-Glass based communication scheme: System security analysis

General information
State: Published
Organisations: National University of Singapore
Authors: Chetan, M. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2004

Host publication information
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262614
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

Neural networks for fMRI spatio-temporal analysis
Most of the analysis techniques applied to functional magnetic resonance imaging (fMRI) consider only the temporal information of the data. In this paper, a new method combining temporal and spatial information is proposed for the fMRI data analysis. The nonlinear autoregressive with exogenous inputs (NARX) model realized by radial basis function (RBF) neural network is used to model the fMRI data. This new approach models the fMRI waveform in each voxel as a regression model that combines the time series of neighboring voxels together with its own. Both simulated as well as real fMRI data were tested using the proposed algorithm. Results show that this new approach can model the fMRI data very well and as a result, can detect the activated areas of human brain successfully and accurately.

General information
State: Published
Organisations: National University of Singapore
Authors: Huaien, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1292-1297
Publication date: 2004

Host publication information
Title of host publication: Neural Information Processing
ISBN (Print): 3-540-23931-6
Series: Lecture Notes in Computer Science
Volume: 3316
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 11th International Conference on Neural Information Processing (ICONIP), Calcutta, India, 22/01/2004 - 22/01/2004
DOIs: 10.1007/978-3-540-30499-9_201
Source: orbit
Source-ID: 262610
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

Nonlinear analysis of EEG signal at different mental states

General information
State: Published
Organisations: Ngee Ann Polytechnic, National University of Singapore
Authors: Natarajan, K. (Ekstern), Rajendra, A. (Ekstern), Fadilah, A. (Ekstern), Thelma, T. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1-11
Publication date: 2004
Main Research Area: Technical/natural sciences
Nonlinear analysis of EMG signals A chaotic approach

General information
State: Published
Organisations: National University of Singapore
Authors: Pavitra, P. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2004
Performance analysis of Volterra-based nonlinear adaptive blind multiuser detectors for DS-CDMA systems

General information
State: Published
Organisations: National University of Singapore
Authors: Guo, L. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1941-1956
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Signal Processing
Volume: 84
Issue number: 10
ISSN (Print): 0165-1684
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.048 SNIP 1.905 CiteScore 3.6
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.958 SNIP 2.001 CiteScore 3
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.059 SNIP 2.311 CiteScore 3.19
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.024 SNIP 2.34 CiteScore 3.13
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.122 SNIP 2.478 CiteScore 2.88
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.786 SNIP 1.937 CiteScore 2.19
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.741 SNIP 1.678
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.76 SNIP 1.551
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.66 SNIP 1.37
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.574 SNIP 1.331
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.539 SNIP 1.394
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.507 SNIP 1.29
Scopus rating (2004): SJR 0.558 SNIP 1.351
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.622 SNIP 0.97
Scopus rating (2002): SJR 0.689 SNIP 1.067
Scopus rating (2001): SJR 0.841 SNIP 1.234
Scopus rating (2000): SJR 0.859 SNIP 1.085
Scopus rating (1999): SJR 0.532 SNIP 0.971
Original language: English
Source: orbit
Synchronization of chaotic maps using predictive filtering techniques

General information
State: Published
Organisations: National University of Singapore, Unknown
Authors: T N, B. (Ekstern), Ajeeesh, K. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2004

Host publication information
Title of host publication: Proceedings of the 10th International Conference on Information System Analysis and Synthesis (CITSAS 2004)
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262636
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

The eye-care PC

General information
State: Published
Organisations: National University of Singapore, ITE
Authors: C Y Y, P. (Ekstern), Puthusserypady, S. (Intern), Lee Suang, T. (Ekstern)
Publication date: 2004

Host publication information
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262611
Publication: Research - peer-review › Article in proceedings – Annual report year: 2004

Admissibility of post nonlinear methods in ICA for fMRI data

General information
State: Published
Organisations: National University of Singapore
Authors: Puthusserypady, S. (Intern), Anand, S. (Ekstern), Eng Tian, T. (Ekstern)
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the World Congress on Medical Physics and Biomedical Engineering
Main Research Area: Technical/natural sciences
Conference: World Congress on Medical Physics and Biomedical Engineering, Sydney, Australia, 24/08/2003 - 24/08/2003
Source: orbit
Source-ID: 262648
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

An adaptive decision feedback PIC asynchronous DS-CDMA system

General information
State: Published
Organisations: National University of Singapore
Authors: Du, L. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
An iterative noise reduction method for electrocardiogram

General information
State: Published
Organisations: National University of Singapore
Authors: Y L, L. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the 2nd Joint Meeting of the IEEE EMBS-BMES Conference
Main Research Area: Technical/natural sciences
Conference: 2nd Joint Meeting of the IEEE EMBS-BMES Conference, Housten, TX, United States, 23/10/2002 - 23/10/2002
Source: orbit
Source-ID: 262639
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

A novel CDP DS/SS system with 2-dimensional Ikeda map chaotic sequence

General information
State: Published
Organisations: National University of Singapore
Authors: Htut, S. M. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the 14th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, PIMRC-2003
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262642
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

A novel DS/SS System with complex chaotic spreading sequence

General information
State: Published
Organisations: National University of Singapore
Authors: Htut, S. M. (Ekstern), Kurian, A. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
Main Research Area: Technical/natural sciences
Conference: 57th IEEE Semi Annual Vehicular Technology Conference (VTC-2003), 01/01/2003
Source: orbit
Source-ID: 262654
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

Classification of cardiac patient states using artificial neural networks - A new approach

General information
State: Published
Organisations: Ngee Ann Polytechnic, Nanyang Technological University, National University of Singapore
Dynamic reconstruction and analysis of EEG under the effect of reflexology

Modified post nonlinear ICA algorithm for large fMRI dataset

Nonlinear analysis of ECG under reflexology stimulation
Nonlinear independent component analysis for EEG source localization

General information
State: Published
Organisations: National University of Singapore
Authors: Rohit, M. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the World Congress on Medical Physics and Biomedical Engineering
Main Research Area: Technical/natural sciences
Conference: World Congress on Medical Physics and Biomedical Engineering, Sydney, Australia, 24/08/2003 - 24/08/2003
Source: orbit
Source-ID: 262653
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

Parallel interference cancellation scheme based on adaptive MMSE detector for DS-CDMA systems

General information
State: Published
Organisations: National University of Singapore
Authors: Du, L. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the 14th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, PIMRC-2003
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262641
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

Performance analysis of Volterra-based nonlinear blind multiuser detector for DS-CDMA systems

General information
State: Published
Organisations: National University of Singapore
Authors: Guo, L. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the IEEE Wireless Communications and Networking Conference
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262655
Publication: Research - peer-review › Article in proceedings – Annual report year: 2003

A novel multiuser detection scheme combining adaptive MMSE receiver and parallel interference canceller for near-far resistance

The adaptive minimum mean-squared error (MMSE) detector for direct-sequence code-division multiple access (DS-CDMA), is attractive because it has simple structure. Also the adaptive nature of the detector allows it to learn the required information and adjust it to the prevailing interference and noise environment. However, it shows performance degradation in severe near-far environment. On the other hand, parallel interference cancellation (PIC) detector has the potential to combat the near-far problem, since it is designed to subtract out interference. However, this performance depends on its data estimates. A novel multiuser detector is proposed in this paper to combat the near-far problem in DS-CDMA schemes. It utilizes the advantages of the two detectors by combining an adaptive MMSE multi-user detector and PIC detector. The focus of this paper is on the near-far resistance capability of the detector. Simulation studies performed on the proposed detector shows that it is immune to the near-far problem on top of its improved bit error rate.
Detection of humans buried in rubble: An electronic nose to detect human body odor

Nonlinear blind interference cancellation with an approximate Newton algorithm for DS-CDMA systems

Adaptive noise cancellation scheme for a chaotic communication system
A super resolution algorithm for the adaptive detection of signals in a CDMA scheme

General information
State: Published
Organisations: National University of Singapore
Authors: L H W, T. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 2001

Host publication information
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262660
Publication: Research - peer-review › Article in proceedings – Annual report year: 2001

Validity of dimensional complexity measures of EEG signals

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience
Authors: Pradhan, N. (Ekstern), Puthusserypady, S. (Intern)
Pages: 173-186
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Volume: 7
Issue number: 1
ISSN (Print): 0218-1274
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.589 SNIP 0.868 CiteScore 1.43
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.757 SNIP 0.923 CiteScore 1.34
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.571 SNIP 0.854 CiteScore 1.14
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.678 SNIP 0.943 CiteScore 1.26
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.568 SNIP 0.787 CiteScore 1.04
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.595 SNIP 0.717 CiteScore 1
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.679 SNIP 0.813
Chaotic Dynamics of Sea Clutter

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern)
Number of pages: 217
Publication date: 1999

Publication information
Publisher: Wiley
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262526
Publication: Research - peer-review › Journal article – Annual report year: 2000

An H∞ approach to adaptive minimization of EOG artifacts from EEG signals

General information
State: Published
Organisations: McMaster University, Queen's University Belfast
Authors: Ratnarajah, T. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 1998

Host publication information
Title of host publication: Proceedings of the 8th IEEE Workshop on DSP
Main Research Area: Technical/natural sciences
Conference: Proceedings of the 8th IEEE Workshop on DSP, Utah, USA, 01/01/1998
Source: orbit
Source-ID: 265943
Publication: Research - peer-review › Article in proceedings – Annual report year: 1998
Chaotic characterization of microwave HF radar returns from sea surface

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern), Brian, C. (Ekstern)
Publication date: 1998

Publication information
Place of publication: Communications Research Laboratory, Canada
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262592
Publication: Research › Report – Annual report year: 1998

Dynamic reconstruction of sea clutter using regularized RBF networks

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern), Paul, Y. (Ekstern)
Pages: 19-23
Publication date: 1998

Host publication information
Title of host publication: Proceedings of the 32nd Asilomar Conference on Signals, Systems and Computers
Main Research Area: Technical/natural sciences
Conference: 32nd Asilomar Conference on Signals, Systems and Computers, California, USA, 01/01/1998
Source: orbit
Source-ID: 265945
Publication: Research - peer-review › Article in proceedings – Annual report year: 1998

Sea clutter dynamics: A nonlinear analysis of observations

General information
State: Published
Organisations: McMaster University, Unknown
Authors: Puthusserypady, S. (Intern), Simon, H. (Ekstern)
Publication date: 1998

Host publication information
Title of host publication: Proceedings of the Conference on Advance in Computing
Main Research Area: Technical/natural sciences
Conference: Conference on Advance in Computing, 01/01/1998
Source: orbit
Source-ID: 265944
Publication: Research - peer-review › Article in proceedings – Annual report year: 1998

Chaotic Dynamics of Sea Clutter
The notion that a deterministic nonlinear dynamical system (with relatively few degrees of freedom) can display aperiodic behavior has a strong bearing on sea clutter characterization: random-looking sea clutter may be the outcome of a chaotic process. This new approach envisages deterministic rules for the underlying sea clutter dynamics, in contrast to the stochastic approach where sea clutter is viewed as a random process with a large number of degrees of freedom. In this paper, we demonstrate, convincingly for the first time, the chaotic dynamics of sea clutter. We say so on the basis of results obtained using radar data, collected from a series of extensive and thorough experiments, which have been carried out with ground-truthed sea clutter data sets at three different sites. The study includes correlation dimension analysis (based on the maximum likelihood principle) and Lyapunov spectrum analysis. The Lyapunov (Kaplan-Yorke) dimension, which is a byproduct of Lyapunov spectrum analysis, shows that it is indeed a good estimator of the correlation dimension. The Lyapunov spectrum also reveals that sea clutter is produced by a coupled system of nonlinear differential equations of order five or six. (C) 1997 American Institute of Physics.
Chaos, sea clutter, and neural networks

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern)
Pages: 1224-1227
Publication date: 1997

Publication information
Journal: Proceedings of the 31st Asilomar Conference on Signals, Systems and Computers
Volume: 31
Number: 1
Place of publication: Communications Research Laboratory, Canada
Original language: English

Chaotic characterization of simulated sea clutter

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 1997

Publication information
Place of publication: Communications Research Laboratory, Canada
Original language: English
Chaotic dynamics of sea clutter

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 1997

Publication information
Place of publication: Communications Research Laboratory, Canada
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262589
Publication: Research › Report – Annual report year: 1997

Chaotic dynamics of sea clutter: An experimental study

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern)
Pages: 75-78
Publication date: 1997

Host publication information
Title of host publication: Proceedings of the IEE International Symposium RADAR ‘97
Main Research Area: Technical/natural sciences
Conference: IEE International Symposium RADAR ‘97, 01/01/1997
Source: orbit
Source-ID: 265947
Publication: Research - peer-review › Article in proceedings – Annual report year: 1997

Development of Newton type adaptive algorithm for minimization of EOG artifacts from noisy EEG Signals

General information
State: Published
Organisations: Indian Institute of Science, McMaster University
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 173-186
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: Signal Processing
Volume: 62
Issue number: 2
ISSN (Print): 0165-1684
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.048 SNIP 1.905 CiteScore 3.6
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.958 SNIP 2.001 CiteScore 3
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.059 SNIP 2.311 CiteScore 3.19
Dynamic reconstruction of a chaotic process using regularized RBF networks

General information
State: Published
Organisations: McMaster University
Authors: Simon, H. (Ekstern), Puthusserypady, S. (Intern), Paul, Y. (Ekstern)
Publication date: 1997

Publication information
Place of publication: Communications Research Laboratory, Canada
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262591
Publication: Research › Report – Annual report year: 1997

EEG delta band spectral power: difference between unilateral and bilateral ECT seizures

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science
Authors: B N, G. (Ekstern), Narayana, D. (Ekstern), P K, M. (Ekstern), Puthusserypady, S. (Intern)
Pages: 61-63
Publication date: 1997
ANC schemes for the enhancement of EEG signals in the presence of EOG artifacts
One of the most important applications of adaptive systems is in noise cancellation using adaptive filters. In this paper, we propose adaptive noise cancellation schemes for the enhancement of EEG signals in the presence of EOG artifacts. The effect of two reference inputs is studied on simulated as well as recorded EEG signals and it is found that one reference input is enough to get sufficient minimization of EOG artifacts. This has been verified through correlation analysis also. We use signal to noise ratio and linear prediction spectra, along with time plots, for comparing the performance of the proposed schemes for minimizing EOG artifacts from contaminated EEG signals. Results show that the proposed schemes are very effective (especially the one which employs Newton's method) in minimizing the EOG artifacts from contaminated EEG signals. (C) 1996 Academic Press, Inc.

Detection of seizure activity in EEG by ANN: A preliminary study

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience
Authors: N. P. (Ekstern), G R. A. (Ekstern), Puthusserypady, S. (Intern)
Pages: 303-313
Estimation of attractor dimension of EEG using singular value decomposition

This paper describes a novel application of singular value decomposition (SVD) of subsets of the phase-space trajectory for calculation of the attractor dimension of a small data set. A certain number of local centres (M) are chosen randomly on the attractor and an adequate number of nearest neighbours (q = 50) are ordered around each centre. The local intrinsic dimension of a local centre is determined by the number of significant singular values and the attractor dimension (D-2) by the average of the local intrinsic dimensions of the local centres. The SVD method has been evaluated for model data and EEG. The results indicate that the SVD method is a reliable approach for estimation of attractor dimension at moderate signal to noise ratios. The paper emphasises the importance of SVD approach to EEG analysis.
Relevance of surrogate data testing in electroencephalogram analysis

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience
Authors: N. P. (Ekstern), Puthusserypady, S. (Intern)
Pages: 2684-2692
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Volume: 53
Issue number: 3
ISSN (Print): 1063-651X
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.95 SJR 0.993 SNIP 0.896
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.047 SNIP 0.978 CiteScore 1.89
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.22 SNIP 1.123 CiteScore 2.05
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.311 SNIP 1.239 CiteScore 2.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.42 SNIP 1.226 CiteScore 2.28
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.485 SNIP 1.225 CiteScore 2.28
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
SVD based technique for noise reduction in electroencephalogram

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 179-189
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: Signal Processing
Volume: 55
Issue number: 2
ISSN (Print): 0165-1684
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.048 SNIP 1.905 CiteScore 3.6
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.958 SNIP 2.001 CiteScore 3
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.059 SNIP 2.311 CiteScore 3.19
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.024 SNIP 2.34 CiteScore 3.13
The nature of dominant Lyapunov exponent and attractor dimension curves of EEG in sleep

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience
Authors: Pradhan, N. (Ekstern), Puthusserypady, S. (Intern)
Pages: 419-428
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication Information
Journal: Computers in Biology and Medicine
Volume: 26
Issue number: 5
ISSN (Print): 0010-4825
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.547 SNIP 1.031 CiteScore 2.13
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.564 SNIP 1.296 CiteScore 2.08
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.45 SNIP 1.148 CiteScore 1.72
Automation of seizure duration estimation during ECT: Use of fractal dimension

General information
State: Published
Organisations: Biomedical Engineering, Department of Electrical Engineering, National Institute of Mental Health and Neuroscience, Indian Institute of Science
Authors: B N, G. (Ekstern), N, J. (Ekstern), Narayana, D. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 1995

Host publication information
Title of host publication: Proceedings of the 14th Annual Conference of BME Society of India: an International Meeting
Main Research Area: Technical/natural sciences
Conference: 14th Annual Conference of the Biomedical Engineering Society of India. An International Meeting, 15/02/1995 - 15/02/1995
Source: orbit
Source-ID: 265969
Publication: Research - peer-review › Article in proceedings – Annual report year: 1995

Estimation of attractor dimension of EEG using singular value decomposition

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science
Authors: N, P. (Ekstern), Narayana, D. (Ekstern), Puthusserypady, S. (Intern), R G, R. (Ekstern)
Pages: 71-79
Publication date: 1995

Host publication information
Title of host publication: Proceedings of the SPCOM'95
Line interference cancellation from recorded EEG signals using linear phase FIR digital filters

**General information**
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1995

**Host publication information**
Title of host publication: Proceedings of the 14th Annual Conference of BME Society of India, an International Meet
Main Research Area: Technical/natural sciences
Conference: 14th Annual Conference of the Biomedical Engineering Society of India. An International Meeting, 15/02/1995 - 15/02/1995
Source: orbit
Source-ID: 265948
Publication: Research - peer-review › Article in proceedings – Annual report year: 1995

LMS based ANC schemes with sigmoid nonlinearity for minimization of EOG artifacts from EEG signals

**General information**
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1995

**Host publication information**
Title of host publication: Proceedings of the International Conference on Recent Advances in BME
Main Research Area: Technical/natural sciences
Conference: International Conference on Recent Advances in BME, 01/01/1995
Source: orbit
Source-ID: 265977
Publication: Research - peer-review › Article in proceedings – Annual report year: 1995

Patterns of attractor dimensions of sleep EEG

**General information**
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science
Authors: N, P. (Ekstern), Puthusserypady, S. (Intern), Somnath, C. (Ekstern), Narayana, D. (Ekstern)
Pages: 455-462
Publication date: 1995
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Computers in Biology and Medicine
Volume: 25
Issue number: 5
ISSN (Print): 0010-4825
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.547 SNIP 1.031 CiteScore 2.13
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.564 SNIP 1.296 CiteScore 2.08
Signal processing algorithms for minimization of artifacts in electroencephalogram

General information
State: Published
Organisations: Unknown
Authors: Puthusserypady, S. (Intern)
Number of pages: 114
Publication date: 1995

Publication information
Place of publication: Kgs. Lyngby, Denmark
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262537
Publication: Research - peer-review › Journal article – Annual report year: 1995

Use of finite word-length FIR digital filter structures with improved magnitude and phase characteristics for the reduction of muscle noise artifacts from EEG signals

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 306-312
Use of SVD in extracting features of attractor dimension of sleep EEG

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science, Unknown
Authors: N, P. (Ekstern), Puthusserypady, S. (Intern), M, S. (Ekstern), Narayana, D. (Ekstern)
Publication date: 1995

Host publication information
Title of host publication: Proceedings of the 14th Annual Conference of BME Society of India, an International Meet
Main Research Area: Technical/natural sciences
A nonlinear estimation model for the minimization of EOG artifacts from EEG signals

General information
State: Published
Organisations: Department of Electrical Engineering, Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Dutt, N. (Ekstern)
Pages: 199-207
Publication date: 1994
Main Research Area: Technical/natural sciences

Publication information
Volume: 36
ISSN (Print): 0020-7101
Original language: English
Source: orbit
Source-ID: 262538
Publication: Research - peer-review › Journal article – Annual report year: 1994

Chaotic dynamics of sleep EEG in drug naive schizophrenics

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science
Authors: N, P. (Ekstern), S, C. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 1994

Host publication information
Title of host publication: Proceedings of International Conference on Schizophrenia
Main Research Area: Technical/natural sciences
Conference: International Conference on Schizophrenia, 01/01/1994
Source: orbit
Source-ID: 265976
Publication: Research - peer-review › Article in proceedings – Annual report year: 1994

Computers in ECT II: Automated method of seizure duration estimators

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science
Publication date: 1994

Host publication information
Title of host publication: Proceedings of 46th Annual National Conference of Indian Psychiatric Society
Main Research Area: Technical/natural sciences
Conference: 46th Annual National Conference of Indian Psychiatric Society, Madras, India, 06/01/1994 - 06/01/1994
Source: orbit
Source-ID: 265970
Publication: Research - peer-review › Article in proceedings – Annual report year: 1994

EEG power spectral analysis of ECT induced seizures

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science
Authors: P K, M. (Ekstern), B N, G. (Ekstern), Puthusserypady, S. (Intern), Narayana, D. (Ekstern), N, J. (Ekstern)
Minimization of EOG artifacts from corrupted EEG signals using neural networks approach

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 441-449
Publication date: 1994
Main Research Area: Technical/natural sciences

Publication information
Journal: Computers in Biology and Medicine
Volume: 24
Issue number: 6
ISSN (Print): 0010-4825
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.547 SNIP 1.031 CiteScore 2.13
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.564 SNIP 1.296 CiteScore 2.08
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.45 SNIP 1.148 CiteScore 1.72
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.575 SNIP 1.5 CiteScore 2.22
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.428 SNIP 1.224 CiteScore 1.68
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.441 SNIP 1.308 CiteScore 1.86
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.434 SNIP 1.035
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.462 SNIP 1.448
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.449 SNIP 0.843
Scopus rating (2007): SJR 0.459 SNIP 1.408
Scopus rating (2006): SJR 0.442 SNIP 1.216
Scopus rating (2005): SJR 0.647 SNIP 1.234
Scopus rating (2004): SJR 0.394 SNIP 0.871
Scopus rating (2003): SJR 0.393 SNIP 0.937
Scopus rating (2002): SJR 0.297 SNIP 0.625
Scopus rating (2001): SJR 0.288 SNIP 0.978
Scopus rating (2000): SJR 0.19 SNIP 0.554
Use of attractor dimension estimates of EEG signals in evaluating the patterns of sleep

General information
State: Published
Organisations: National Institute of Mental Health and Neuroscience, Indian Institute of Science, Unknown
Authors: N, P. (Ekstern), Narayana, D. (Ekstern), Puthusserypady, S. (Intern)
Publication date: 1994

Host publication information
Title of host publication: Proceedings of the National Symposium on Modern trends in Electronics and Communication Systems
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 265975
Publication: Research - peer-review › Article in proceedings – Annual report year: 1994

Newton based ANC scheme for the enhancement of EEG signals in presence of EOG artifacts

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1993

Host publication information
Title of host publication: Proceedings of the Discussion Meeting on Signal Processing and Communication
Main Research Area: Technical/natural sciences
Conference: Discussion Meeting on Signal Processing and Communication, 01/01/1993
Source: orbit
Source-ID: 265979
Publication: Research - peer-review › Article in proceedings – Annual report year: 1993

Noise minimization of corrupted EEG signals using SVD based technique

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1993

Host publication information
Title of host publication: Proceedings of the National System Conference
Main Research Area: Technical/natural sciences
Conference: National System Conference, 01/01/1993
Source: orbit
Source-ID: 265978
Publication: Research - peer-review › Article in proceedings – Annual report year: 1993

Comparison of LMS and Gauss-Newton ANC scheme for enhancement of EEG signals in the presence of EOG artifacts

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1992
Minimization of EOG artifacts from EEG signals using adaptive noise cancellation techniques with a nonlinear estimation model

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 1-10
Publication date: 1992
Main Research Area: Technical/natural sciences

Performance comparison of ANC scheme with non-linear estimation model for the enhancement of EEG signals in presence of EOG signals

General information
State: Published
Organisations: Indian Institute of Science, Unknown
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1992

Adaptive technique for the minimization of EOG artifacts from EEG signals using TDL structure and nonlinear estimation model

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 251-255
Publication date: 1991
Improved adaptive cancellation of EOG artifact from EEG signals using linearly predictive reference input

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 53-64
Publication date: 1991
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Modeling, Simulation and Control C
Volume: 26
Issue number: 3
Original language: English
Source: orbit
Source-ID: 262541
Publication: Research - peer-review › Journal article – Annual report year: 1991

Muscle noise cancellation from corrupted EEG signals using finite word-length linear phase FIR digital filters

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1991

Host publication information
Title of host publication: Proceedings of the International Conference on Instrumentation, Measurements and Control, IMC’91
Main Research Area: Technical/natural sciences
Conference: International Conference on Instrumentation, Measurements and Control, IMC’91, 01/01/1991
Source: orbit
Source-ID: 265984
Publication: Research - peer-review › Article in proceedings – Annual report year: 1991

Neural network Approach to the enhancement of EEG signals in presence of EOG artifacts

General information
State: Published
Organisations: Indian Institute of Science
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Pages: 136-140
Publication date: 1991

Host publication information
Title of host publication: Proceedings of the IEEE TENCON’91
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 265987
Publication: Research - peer-review › Article in proceedings – Annual report year: 1991

Performance comparison of two feedback type NN models for the minimization of EOG artifacts from EEG signals

General information
State: Published
Organisations: Indian Institute of Science, Unknown
Authors: Puthusserypady, S. (Intern), Narayana, D. (Ekstern)
Publication date: 1991
Removal of eye movement artifact from EEG signals using pre-processed EOG reference and fast transversal filters

Improved adaptive cancellation of EOG artifacts from EEG signals using linearly predicted reference input

Minimization of EOG artifacts from EEG signals using adaptive noise cancellation technique with a non-linear estimation model

Processing of EEG signals for reducing the effects of adjacent activities
Eye movement artifact rejection in electroencephalographic signals by adaptive cancellation techniques

Projects:

Brain-Computer Interface Controlled Functional Electrical Stimulation as a Complete Neurorehabilitation Tool for Post-Stroke Patients

In-situ and Personalized Cognitive Behavioural Therapy for Mental Health
Main Supervisor:
Bardram, Jakob Eyvind (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Automatic ultrasound scanning**
Department of Electrical Engineering
Period: 15/12/2013 → 12/04/2017
Number of participants: 7
Phd Student:
Moshavegh, Ramin (Intern)
Supervisor:
Hemmsen, Martin Christian (Intern)
Martins, Bo (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
D’Hooge, Jan (Ekstern)
Ranefall, Petter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

**Relations**
Publications:
Automatic Ultrasound Scanning
Project: PhD

**A Brain Computer Interface (BCI) System for Neuro-rehabilitation**
Department of Electrical Engineering
Period: 01/09/2012 → 07/09/2016
Number of participants: 8
Phd Student:
Ordikhani-Seyedlar, Mehdi (Intern)
Supervisor:
Kjaer, Troels Wesenberg (Ekstern)
Sams, Thomas (Intern)
Serensen, Helge Bjarne Dissing (Ekstern)
Main Supervisor:
Puthusserypady, Sadasivan (Intern)
Examiner:
Sams, Thomas (Intern)
Karstoft, Henrik (Ekstern)
Klonowski, Wlodzimierz (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Electrophysiological dynamics of covert and overt visual attention.
Project: PhD
Optimal low power microelectronic implementation for single-use ECG arrhythmia detection device

Department of Electrical Engineering
Period: 01/05/2011 → 07/05/2015
Number of participants: 8
Phd Student:
Saadi, Dorthe Bodholt (Intern)
Supervisor:
Andersen, Gunnar B. (Ekstern)
Egstrup, Kenneth (Ekstern)
Hoppe, Karsten (Intern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
Karstoft, Henrik (Ekstern)
Van Huffel, Sabine (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
Design of Low Power Algorithms for Automatic Embedded Analysis of Patch ECG Signals
Project: PhD

Tidlig Diagnosticering af Neurodegenerative Sygdomme

Department of Electrical Engineering
Period: 01/02/2010 → 15/08/2013
Number of participants: 6
Phd Student:
Kempfner, Jacob (Intern)
Supervisor:
Jennum, Poul (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
Karstoft, Henrik (Ekstern)
Mayer, Geert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Tidlig Diagnosticering af Neurodegenerative Sygdomme
Project: PhD

Synthetic aperture flow imaging using a dual beamformer approach

Department of Electrical Engineering
Period: 01/09/2009 → 18/12/2012
Number of participants: 5
Phd Student:
Li, Ye (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
D’Hooge, Jan (Ekstern)
Sörnmo, Leif (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Synthetic Aperture Flow Imaging Using a Dual Beamformer Approach
Project: PhD

Design of digital audio Class-D output stage with feedback - emphasis on hearing aid application

Department of Electrical Engineering
Period: 01/07/2009 → 26/09/2013
Number of participants: 6
Phd Student:
Pracný, Peter (Intern)
Supervisor:
Andersen, Michael A. E. (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
Bogason, Gudmundur (Intern)
Wisland, Dag T. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD