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Title:	FCM-BPSO: ENERGY EFFICIENT TASK BASED LOAD BALANCING IN CLOUD COMPUTING
Author:	GEETHA MEGHARAJ, DR. K. G. MOHAN
Abstract:	Virtual machine (VM) migration is a methodology used for attaining the system load balancing in a cloud environment by transferring the one VM from one physical host to another host. In this paper, we plan to migrate the extra tasks from overloaded VM to suitable VM instead of migrating the entire overloaded VM. In order to select the host VMs, a FCM clustering algorithm has been used to group the similar kind of host VMs. Once the VMs identified as overloaded, then the corresponding candidate VMs are found using the FCM clustering algorithm. Binary Particle Swarm Optimization (BPSO) methodology has been used for selecting the host VMs from the set of candidate VMs based on multi-objective fitness function, which includes task transferring time, task execution time and energy consumption. By allocating the extra task from the overloaded VMs to the proper VMs, we achieved the load balancing in the cloud environment. The implementation of proposed methodology FCM-BPSO has been done using CloudSim tool and comparative analysis done to evaluate the FCM-BPSO method with a traditional load balancing algorithm in terms of energy consumption and time.
Keywords:	Load Balancing Algorithm, Task Scheduling, Particle Swarm Optimization, Fuzzy C Means, Clustering
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	COMPARISON OF THINNING ALGORITHMS FOR VECTORIZATION OF ENGINEERING DRAWINGS
Author:	MATUS GRAMBLICKA , JOZEF VASKY
Abstract:	The thinning algorithms are used for creation the skeleton of an object. The thinned image consists of the lines one pixel wide. The thinning or skeletonization reduces the image complexity. The thinning process is widely used in vectorization based on the thinning methods. In this contribution is presented the comparison of nine known iterative parallel thinning algorithms with one proposed and their performance evaluation on sets of the engineering drawings. The results are evaluated and compared in regard to suitability to vectorization of the engineering drawings.
Keywords:	Thinning Algorithm, Skeleton, Vectorization, Engineering Drawing
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	IMPLEMENTATION OF MC ELIECE ENCRYPTION SCHEME BASED ON QUASI-CYCLICS GOPPA CODES (QC-GOPPA)
Author:	IDY DIOP, IBRA DIOUM, SAMBA DIAW , MADIOP DIOUF, SIDI MOHAMED FARSSI, YACOUB MAHAMAT ADOUM
Abstract:	The McEliece cryptosystem is one of the oldest public key cryptosystems. It is also the first public key cryptosystem based on error correcting codes. Its main advantages are its speed of encryption and decryption, and high security (promised to resist the quantum computer). But it suffers from a major drawback. Indeed, it requires a very large size of the public key, which makes it very difficult to use in practice. The use of codes having compact generator matrices can significantly reduce the size of the public key. However with such matrices, security must be strengthened by making a good choice of parameters of the code, if not an opponent will use this change to attack the system. The objective of this paper is to see and propose solutions on hardware difficulty encryption algorithms and deciphering based on Key size and transmission rate. This work is an electronic contribution on the using of Goppa codes in McEliece cryptosystems. We propose in this paper implementation on FPGA cart of the schema of encryption based on these codes inspired by the mathematical approach. We evaluated the performance by of our method by study Key

submitting it for review, we will edit the necessary information at our side. Submissions to JATIT should be full research / review papers (properly indicated below main title).

	size and transmission rate .
Keywords:	Linear codes, quasi-cyclic codes, Goppa codes, McEliece cryptosystem.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	A NOVEL SOFTWARE QUALITY PREDICTION SYSTEM BASED ON INCORPORATING ISO 9126 WITH MACHINE LEARNING
Author:	OSAMA ALSHAREET , AWNI ITRADAT, IYAD ABU DOUSH, AHMAD QUTTOUM
Abstract:	To begin with, this research defines Software Quality Prediction System (SQPS) as a system composed of a Classification Algorithm (CA) and a Software Quality Measurement Model (SQMM). Machine Learning applications in software quality measurement are expanding as research intensifies in two directions, the first direction focuses on improving the performance of CAs while the other direction concentrates on improving SQMMs. Despite of the increasing attention in this area, some well-designed SQPSs showed considerable false predictions, which could be explained by faults in the design of the CA, the SQMM, or the SQPS as a whole. In this context, there is a debate on which CA is better for measuring software quality, as well as there is a debate on which SQMM to follow. To start with, the research studied an original dataset of 7311 software projects. Then, the research derived quality measurements from the ISO 9126 Quality Model and developed the SQMM accordingly. Next, the research compared statistical measures of performance of four CAs, using WEKA and SPSS. Our experimental results showed that ISO 9126 is general, but flexible enough to act as a SQMM. Despite of their convergent performance, our experiments showed that Multilayer Perceptron Network (MLPN) have more balanced predictions than Naive Bayes does. Following a rarely researched approach, the SQPS predicted five levels of software quality instead of making a binary prediction, limited with defect or non-defect software.
Keywords:	Software Quality Prediction System (SQPS), ISO 9126 Software Quality Model, Multilayer Perceptron Network (MLPN), Classification Algorithm (CA), Software Quality Measurement Model (SQMM), Machine Learning.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	ENHANCE NON-IDEAL IRIS RECOGNITION SYSTEM FROM NIR IRIS VIDEO
Author:	NUR KHDR NSEAF, AZRULHIZAM SHAPII, ASAMA KUDER NSEAF, AZIZAH JAAFAR, KHIDER NASSIF JASSIM, AHMED KHUDHUR NSAIIF
Abstract:	Iris pattern is one of the most consistent biometric methods used for recognizing and identifying persons. Employing videos as a capturing instrument is a pretty modern style in the area of iris biometric. The use of frame by frame method provides more information and offers more suppleness compared to old-fashioned still images. Nevertheless, the size, quality and shape of the iris might differ between a frame and another. Additionally, to getting best performance it need a rapid and precise method to segment iris to amelioration rate of recognition. This work presents a method for choosing the best frames found in an iris video. This method is based on detecting motion blur and occlusion in iris videos and investigating their influence on the process of recognition. This proposed is followed by a rapid and precise method to detect pupil area, this method on the grounds of dynamic threshold with Circular Hough Transform then apply Geodesic Active Contour for detect outer boundary of iris. Experimental results are carried out on the MBGC NIR Iris Video datasets from the National Institute for Standards and Technology (NIST). Results show that the suggested selection method in NIR Iris Videos results in substantial enhancement in recognition efficiency. Results also indicated that the experimental evaluation of Iris segmented technique proposed in this work indicates that the precision and speed of the iris recognition via video is improved.
Keywords:	Iris Biometrics, Video Iris Recognition, Pupil Segmentation, Non-Ideal Iris Recognition, GAC Iris Segmentation
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	PERFORMANCE ANALYSIS OF SLEACH, LEACH AND DSDV PROTOCOLS FOR WIRELESS SENSOR NETWORKS (WSN)
Author:	IBRIHICH OUAFAA, ESGHIR MUSTAPHA, KRIT SALAH-DDINE, EL HAJJI SAID

Abstract:	Wireless Sensor Networks (WSN) is an emerging technology for attraction of researchers with its research challenges and various application domains. It consists of small nodes with sensing, computation, and wireless communications capabilities. The limited energy resource is one of the main challenges facing the security in such networks. An attempt has been made to compare the performance of three protocols DSDV, LEACH and SLEACH. The purpose of this paper is to create a simulation of these protocols using NS2. Comparison is made based on packet delivery fraction, average end-to-end delay, throughput, average jitter and packet loss. This paper presents all scenarios for simulation and then we analyzed the results.
Keywords:	Wireless Sensor Network, Hierarchical Routing, DSDV, LEACH, SLEACH
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	AN OPTIMAL TUNING OF PSS USING AIS ALGORITHM FOR DAMPING OSCILLATION OF MULTI-MACHINE POWER SYSTEM
Author:	RAMADONI SYAHPUTRA, INDAH SOESANTI
Abstract:	This paper proposes an optimal tuning of Power System Stabilizer (PSS) using Artificial Immune System (AIS) algorithm for damping oscillation of multi-machine power system. PSS is the efficient devices to damp the power system oscillations which are caused by interruptions. This study presents a robust algorithm to determine the PSS parameters using AIS algorithm. The PSS parameters tuning is usually formulated as the objective function with constraints, including the damping ratio and damping factor. Optimization with maximum value of the damping factor and the damping ratio of power system modes are taken as the goals functions, when designing the PSS parameters. This optimization procedure could enhance the cloning process and lead to a better outcome. In this work, the two-area multi-machine power system of IEEE model, under a wide range of system configurations and operation conditions is investigated. The system has been used to illustrate the performance of the proposed algorithm. The performance of the AIS-based PSS is compared to the Delta w PSS and Delta Pa PSS. The results verify that, AIS-based PSS, Delta w PSS and Delta Pa PSS gives relatively good in reducing oscillation system variables of which transfer electrical power, changes in angular velocity generator, and the generator terminal voltage. All PSS can work well in order to stabilize the system under interruption. However, AIS-based PSS have relatively better than Delta w PSS and Delta Pa PSS in terms of ability to reduce oscillation and speed of reaching a state of instability.
Keywords:	Power System Stabilizer (PSS), Artificial Immune System (AIS) Algorithm, Optimal Tuning, Transient Stability, Damping Oscillation, Multi-Machine Power System.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

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Title:	GOAL-BASED MODELING FOR REQUIREMENT TRACEABILITY OF SOFTWARE PRODUCT LINE
Author:	ASAD ABBAS, ISMA FARAH SIDDIQUI, SCOTT UK-JIN LEE
Abstract:	Software Product Line (SPL) is extensively used in industry for quick development with reusability of resources from domain engineering to application engineering. For testing the products from domain engineering to application engineering traceability of requirements are important. In sequential product development, it is easy to create the links between software artifacts. However, in SPL traceability links are difficult to create where multiple products from same domain with some variation point according to stakeholder. This paper proposes framework for traceability links in SPL processes i.e. domain engineering to application engineering artifacts by using goal base modeling. First step is to identify the variation points from domain feature model and trace the link at implementation level of SPL platform. Second step is to trace the links from each artifact of domain to application engineering for the development of final products. We have applied our approach on general SPL feature model and get the results of final products with zero constraint violation.
Keywords:	Software Product Line, Feature Model, Requirement Traceability
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Title:	A NOVEL PROBABILISTIC BASED FEATURE SELECTION MODEL FOR CREDIT CARD ANOMALY DETECTION
Author:	Y.A.SIVA PRASAD, DR.G.RAMAKRISHNA

Abstract:	Due to the increase in online financial applications, the fraudulent operations through online transactions have increased rapidly. Also, the anomaly detection in credit card transactions has become equally important in many fields in which the data have high dimensional attributes. Finding noisy anomaly attributes using the conventional models are inefficient and infeasible, as the size and number of instances are large. In this paper, an optimized probabilistic based feature selection model was implemented on credit card fraud detection. An efficient ranked attributes are extracted using the hybrid feature selection algorithm. Experimental results show that proposed system efficiently detects the relevant attributes compared to traditional models in terms of time and dimensions are concerned
Keywords:	Feature selection algorithm, Fraud detection, Markov model, density distribution.
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Title:	INTEGRATION BALANCED SCORECARD AND FUZZY ANALYTIC NETWORK PROCESS (FANP) FOR MEASURING PERFORMANCE OF SMALL MEDIUM ENTERPRISE (SME)
Author:	YENI KUSTIYAHNINGSIH, EZA RAHMANITA, JAKA PURNAMA
Abstract:	The purpose of this research is to determine the standards or uniformity performance measurement indicators SMEs in accordance with needs and conditions in Bangkalan Indonesia, Constructing and building decision models with multi-criteria decision making (MCDM) by a hybrid between the method of the balanced scorecard (BSC), fuzzy analytic network process (FANP), and technique for order preferences of similarity ideal solution (TOPSIS), Implementation of multi-criteria decision making (MCDM) to Determine the performance measurement SMEs in Bangkalan Indonesian. The research is based on three main ideas; the first is a fuzzy logic approach due to the complexity and lack of clarity in the assessment criteria for performance measure indicators. The second is to measure the overall performance according to the balanced scorecard perspectives, namely customer, financial, internal business, learning, and growth. The third is to rank all criteria weighted using Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. Based on the integration of three methods: fuzzy ANP, Balanced scorecard, and TOPSIS, this way it makes better decisions in this process.
Keywords:	Integration, Fuzzy ANP, Balanced Scorecard, Perspectives, Assessment
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Title:	SOLVING A PROBLEM OF RESOURCE-INTENSIVE MODELING OF DECODERS ON MASSIVELY PARALLEL COMPUTING DEVICES BASED ON VITERBI ALGORITHM
Author:	ALEXEY VIKTOROVICH BASHKIROV, ALEXANDER VASILIEVICH MURATOV, OLEG YURIEVICH MAKAROV, VASILY IVANOVICH BORISOV, KSENIA NIKOLAEVNA LAPSHINA
Abstract:	In this paper, we consider the problem of resource-intensive simulation of coding/decoding which corrects errors made at the preliminary stages of modern telecommunication system development. We propose to use the technology of parallel computing on GPU (GPGPU) to solve the problem of the process acceleration. We discuss the aspects of encoding/decoding simulation, which corrects errors in heterogeneous systems. The results of this technology applying in the convolutional codec parameters simulation, decoded by Viterbi algorithm, are given as well. Another problem concerned with limitation of the interaction speed with the computing device tail part and a random access to memory is also considered. We propose a solution by communication minimization at host-computing device level, as well as the use of caching. The simulation tools are described in the paper, including the use of computing technique of general purpose on GPU allowing to reduce the time required to optimize the noiseless coding system and thus for the development and implementation of telecommunication devices. We describe the solutions of tasks on codecs characteristics research using massively parallel computing, differing by simplified initialization of flow pseudorandom-number generator (PRNG) ensuring high performance with sufficient accuracy of calculations by reducing the number of calls to an external status register.
Keywords:	Parallel Computing, Viterbi Algorithm, Noiseless Coding, GPU Of The Opencl Standard, Communication Channels, Heterogeneous System.
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Title:	A SECURED AND EFFICIENT MULTI-FACTOR BIOMETRIC AUTHENTICATION SCHEME USING PLAN RECOGNITION TECHNIQUE
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Author:	NOOR AFIZA MOHD ARIFFIN, NOR FAZLIDA MOHD SANI, ZURINA HANAPI, RAMLAN MAHMUD
Abstract:	One of the most important parts in security is an authentication. It has become an essential security features for network communication. Nowadays, there is a need for strong level of authentication to ensure high level of security is being delivered to the application. All of this being done while still maintaining the desired level of performance that is expected of it. However, this approach brings challenging issues on efficiency and security. There have been several schemes and proposals related to multi-factor authentication previously but all of these schemes are still vulnerable to certain types of attacks. Furthermore, a more pressing issue for multi-factor authentication is on the high execution time which leads to a downfall in overall performance. The objective of this research is to propose an authentication method scheme and measure the effectiveness based on the authentication time. This scheme uses plan recognition technique, which is able to detect and identify the user effectively, defend from well-known attacks such as brute force or dictionary attack. The proposed scheme should able to run with a very low execution time. An experiment has been conducted to evaluate the scheme. Result from the experiment shows that the proposed scheme processing time is lower than the other previous schemes. This is even after additional security features has been added to the scheme.
Keywords:	Multi-Factor Authentication, Biometric, Plan Recognition, Effectiveness, Execution Time
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Title:	MODERN STATISTICAL AND LINGUISTIC APPROACHES TO PROCESSING TEXTS IN NATURAL LANGUAGES
Author:	ALEKSANDR EVGENJEVICH PETROV, DMITRII ALEKSANDROVICH SYTNIK
Abstract:	Natural language processing (NLP) is a research area that focuses on studying the methods of computer analysis and synthesis of natural languages. The sources of information can include not only texts, but also audio and video data. In this article, we will focus on text mining. The analysis is divided into the following subtasks: information extraction, tonality analysis, question-answer systems, etc. In turn, information extraction also includes subtasks: named entity recognition (NER), relation extraction, extraction of keywords and word combinations (collocations). The methods of NLP are divided into linguistic (based on rules and grammars) and probabilistic; there are also hybrid methods that combine both approaches. The aim of this paper is to provide an overview of modern approaches to text processing using the example of the tasks of named entities recognition and identifying the relationships between them.
Keywords:	NLP, Information Extraction, Named Entity Recognition, NER, Relation Extraction, Text Mining, Statistical Method, Linguistic Method, Machine Learning, Supervised Learning, Semi-Supervised Learning.
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Title:	E-GOVERNMENT SERVICES IN DEVELOPING COUNTRIES: A SUCCESS ADOPTION MODEL FROM EMPLOYEES PERSPECTIVE
Author:	OMAR AHMED IBRAHIM, NOR HIDAYATI ZAKARIA
Abstract:	In government organizations, e-government services have become invaluable tools through the information they offer in a timely and effective manner. More specifically, ICTs have become invaluable in enhancing staff abilities to achieve effective and efficient tasks. In contrast to developed countries that encounter only limited issues in adopting e-government services, developing nations face numerous adoption issues from the viewpoint of stakeholder groups. One aspect of e-government relating to government units and their workers is government-to-employee (G2E). In the present work, the researcher determined the factors enhancing e-government adoption in a developing nation. These factors include website quality, awareness, computer self-efficacy, capability of IT workforce, and training incorporated in UTAUT - a model that has been expansively employed by studies in literature. A survey for this study was conducted and analysis was performed on the responses received from 42 Iraqi employees. The obtained data was analyzed with the help of Smart PLS 2.0 software. This study's proposed model was confirmed and validated by using data gathered from respondents who are experienced in the use of e-government services. The analysis findings showed that the proposed relationships were all significant and supported. The study provided limitations and recommendations for future studies.
Keywords:	E-government Services, G2E, Adoption, UTAUT, Developing Countries

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Title:	THE MODERATING EFFECT OF ISLAMIC WORK ETHICS ON THE RELATIONSHIP BETWEEN KNOWLEDGE MANAGEMENT CAPABILITIES AND ORGANIZATIONAL PERFORMANCE AT THE PRIVATE HIGHER EDUCATION INSTITUTIONS IN OMAN
Author:	AIDA A.AZIZ AHMED AL-ARIMI, MASLIN MASROM, NIK HASNAA NIK MAHMOOD
Abstract:	Knowledge management capabilities are recognized as an important means for sustaining and improving organizational performance of the private higher education institutions. The evaluation of knowledge management infrastructure capabilities and knowledge management process capabilities has become important since it provides a reference for directing the private higher education institutions to enhance their organizational performance. The Islamic work ethics may have a moderating effect on the relationship between knowledge management infrastructure capabilities, knowledge management process capabilities and organizational performance. This paper provides an understanding of relationship between knowledge management infrastructure capabilities, knowledge management process capabilities, organizational performance and the Islamic work ethics. Additionally, it provides a new framework that helps the private higher education institutions to assess their knowledge management infrastructure capabilities, knowledge management process capabilities, organizational performance and the Islamic work ethics. The research findings showed that the level of knowledge management infrastructure and process capabilities at the private higher education institutions was high, and indicated that the knowledge management process capabilities had a positive significant causal effect relationship with organizational performance, however the research findings showed that the relationship between knowledge management infrastructure capabilities with organizational performance had a non-significant causal effect. Finally, the Islamic work ethics had a significant moderating effect on the relationship between knowledge management infrastructure and process capabilities and organizational performance.
Keywords:	Knowledge Management, Knowledge Management Infrastructure Capabilities, Knowledge Management Process Capabilities, Organizational Performance, Islamic Work Ethics, Private Higher Education Institutions.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016
	Full Text
Title:	A HIDDEN MARKOV MODEL TO PREDICT HOT SOCKET ISSUE IN SMART GRID
Author:	ISMA FARAH SIDDIQUI, ASAD ABBAS, SCOTT UK-JIN LEE
Abstract:	Smart meters collect sensor data at distribution ends of smart grid. The collection process performs non-stop data bundling and results in hot socket issue due to high resistance. This results an abnormal generation of dataset and overall severely affect the operational aspects of smart grid. In this paper, we present a model for Smart Meter Abnormal Data Identification (SMADI) over the communication bridge of Smart grid repository and distribution end units, to redirect abnormal samples to HBase error repository using Message propagation strategy. SMADI predicts possible hot socket smart meter node through HMM and generates a sequence of possible hot socket smart meters over time interval. The simulation results show that SMADI precisely collect error samples and reduce complexity of performing data analytics over giant data repository of a smart grid. Our model predicts hot socket smart meter nodes efficiently and prevent computation cost of performing error analytics over smart grid repository.
Keywords:	IoT, Smart meter, Smart grid, HBase, Hot Socket.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016
	Full Text
Title:	APPLICATION OF CONFIDENCE RANGE ALGORITHM IN RECOGNIZING USER BEHAVIOR THROUGH EPSB IN CLOUD COMPUTING
Author:	MOHANAAD SHAKIR, ASMIDAR BIT ABUBAKAR, YOUNUS YOUSOFF, MOSTAFA AL-EMRAN , MAYTHAM HAMMOOD
Abstract:	Within the security scope, Authentication is considered as a core model to control accessing any system. Password is one of the most significant mechanisms which diagnose the authorized user from others. However, it is facing many problems such as spoofing and man in the middle attack(MitMA). When unauthorized user has got the correct password. Then, this user would be able to access into the data and

	change previous password which causes significant loss in efforts and cost. Similarly, the hacker "who dont have a password" is also trying to penetrate the system through predicted a set of words. In fact, both of authorized and hacker users work to input a wrong password, but authorized user may have only one or two wrong characters while the hacker inputs a whole wrong password. The aim of this paper, established an algorithm under the name of "Confidence Range ". The main tasks of this algorithm are monitoring all the activities which associated with the password on time, error, and style to the authorized user to recognize any suspicious activity. For that reason, a unique EPSB, Electronic Personal Synthesis Behavior, has been generated to the authorized user by the application of confidence range algorithm.
Keywords:	Information system security, Data Security, Hybrid Cloud computing, Confidence Range(CR), Data classification. Electronic Personal Synthesis Behavior(EPSB)
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

[Full Text](#)

Title:	CURRENT CHALLENGES AND CONCEPTUAL MODEL OF GREEN AND SUSTAINABLE SOFTWARE ENGINEERING
Author:	KOMEIL RAISIAN , JAMAIAH YAHAYA , AZIZ DERAMAN
Abstract:	Software is a fundamental component in a rapidly advancing technological society. The science of software engineering is the utilization of a systematic, disciplined, quantifiable methodologies to deal with the development, operation, and maintenance of software and also the investigation of these methodologies which practically means how to apply engineering science to the application of software. Sustainability is turning into an essential point in information technology as commitment of information technology to uphold our Future, and as advancing business sector fragment. The issue of sustainability was not duly accounted for in the conventional and older software engineering field. Software engineers deal with particular themes that need to take into account sustainability, for instance, green IT, efficient algorithms, smart grids, agile practices and knowledge management, yet there does not exist a thorough comprehension of the idea of sustainability and if it can be incorporated to software engineering. Information communication technology hugely affects sustainable improvements because of its rising popularity for vitality and resource management required when producing hardware and software units. The ranking technique made 374 papers out of 11 different databases. In the wake of performing the exclusion measures, the set was diminished to 97 papers that were clearly identified with the models characterized for performing a composed survey. The purpose of current study is to recognize recent issues in green software engineering and examine the aspect of sustainable and create green software product to render a conceptual model of sustainable software engineering product to wind up even greener. Consequently, we recommend a technique to incorporate sustainability in product life cycle. Then, a conceptual model is rendered demonstrating the consolidated life cycles of sustainable product and principle sustainable measurement dimensions, such as energy or information efficiency, low cost and human health.
Keywords:	Green Software Engineering; Sustainability And Sustainability Dimensions Software Product Life Cycle, Hardware, Conceptual Model
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

[Full Text](#)

Title:	SCALE-SPACE APPROACH FOR CHARACTER SEGMENTATION IN SCANNED IMAGES OF ARABIC DOCUMENTS
Author:	NOUREDDINE EL MAKHFI, OMAR EL BANNAY
Abstract:	The characters segmentation is an important stage for the optical character recognition in documents. In this article, we present a new method for segmenting the Arabic documents into text characters. Our method based on the scale space to retrieve the blobs forming each character in the word image. These blobs detected in appropriate scales to recover the characters and cut the junctions between the text characters. The experimental results reveal that the proposed method is encouraging despite some subdivision of characters, which mainly produced by the reconciliations exaggerated between the characters in words. This subdivision can be corrected by adding new steps to merge the character fractions in the recognition phase.
Keywords:	Digital Image/Text; Scale Space; Cursive Writing; Character Segmentation; Arabic OCR.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

[Full Text](#)

Title:	TIME SERIES FORECASTING FOR OUTDOOR TEMPERATURE USING NONLINEAR AUTOREGRESSIVE NEURAL NETWORK MODELS
Author:	SANAM NAREJO, EROS PASERO
Abstract:	Weather forecasting is a challenging time series forecasting problem because of its dynamic, continuous, data-intensive, chaotic and irregular behavior. At present, enormous time series forecasting techniques exist and are widely adapted. However, competitive research is still going on to improve the methods and techniques for accurate forecasting. This research article presents the time series forecasting of the metrological parameter, i.e., temperature with NARX (Nonlinear Autoregressive with eXogenous input) based ANN (Artificial Neural Network). In this research work, several time series dependent Recurrent NARX-ANN models are developed and trained with dynamic parameter settings to find the optimum network model according to its desired forecasting task. Network performance is analyzed on the basis of its Mean Square Error (MSE) value over training, validation and test data sets. In order to perform the forecasting for next 4,8 and 12 steps horizon, the model with less MSE is chosen to be the most accurate temperature forecaster. Unlike one step ahead prediction, multi-step ahead forecasting is more difficult and challenging problem to solve due to its underlying additional complexity. Thus, the empirical findings in this work provide valuable suggestions for the parameter settings of NARX model specifically the selection of hidden layer size and autoregressive lag terms in accordance with an appropriate multi-step ahead time series forecasting.
Keywords:	Artificial Neural network (ANN), multi-step ahead forecasting, Nonlinear Autoregressive (NARX) model, Outlier Detection, Time Series Prediction, Temperature forecasting.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

[Full Text](#)

Title:	IDENTIFY AND CLASSIFY VIBRATION FAULT BASED ON ARTIFICIAL INTELLIGENCE TECHNIQUES
Author:	MONEER ALI LILO , L.A.LATIFF, AMINUDIN BIN HAJI ABU
Abstract:	Steam turbines (ST) need to be protected from damaging faults in the event it ends up in a danger zone. Some examples of faults include vibration, thrust, and eccentricity. Vibration fault represents one of the challenges to designers, as it could cause massive damages and its fault signal is rather complex. Researches in the field intend to prevent or diagnose vibration faults early in order to reduce the cost of maintenance and improve the reliability of machine production. This work aims to diagnose and classify vibration faults by utilized many schemes of Artificial Intelligence (AI) technique and signal processing, such as Fuzzy logic-Sugeno FIS (FLS), Back Propagation Neural Network (BPNN) hybrid with FL-Sugeno (NFS), and BPNN hybrid with FL-Mamdani FIS (NFM). The signal of the fault and the design of the FL and NN were done using MATLAB. The results will be compared based on its ability to feed the output signal to the control system without disturbing system behavior. The results showed that the NFS scheme is able to generate linear and stable signals that could be fed to modify the main demand of the ST protection system. This work concluded that the hybrid of more than one AI technique will improve the reliability of protection system and generate smooth signals that are proportional to the fault level, which can then be used to control the speed and generated power in order to prevent the increase of vibration faults.
Keywords:	Artificial Intelligent Technique, Signals Processing, Fuzzy Logic, Neural Network, Fault Identification.
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016

[Full Text](#)

Title:	AN EFFICIENT METHOD TO CONSTRUCT DIAGONAL PERMUTATION SHIFT (DPS) CODES FOR SAC OCDMA SYSTEMS
Author:	HASSAN YOUSIF AHMED, Z. M. GHARSSELDIEN, S. A. ALJUNID
Abstract:	This work introduces a proficient method to build a newly proposed code, named diagonal permutation shifting (DPS) code for the spectral-amplitude-coding (SAC) optical code-division multiple-access (OCDMA) system. The DPS code is derived and constructed from well-known prime codes and certain matrix operations. This proposed code possesses numerous properties such as the cross-correlation (CC) between any two sequences is always equal to 1, short code length and proper design of the transmitter - receiver structure. In particular, the DPS is capable of removing the impact of multiple access interference (MAI) and further alleviate phase-induced intensity noise (PIIN). Numerical results demonstrate noticeable improvement for the DPS compared to the reported codes and can improve system performance considerably.
Keywords:	DPS, SAC, OCDMA, MAI, In-phase CC)

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	Full Text
Title:	COMPARING THE SIMILARITIES MEASUREMENT OF FACE EXPRESSION-RECOGNITION BASED ON 2DLDA MODIFICATION METHOD
Author:	FITRI DAMAYANT, WAHYUDI SETIAWAN, SRIHERAWATI, AERI RACHMAD
Abstract:	Facial expression recognition is the development of face recognition in an environment of pattern recognition (feature recognition). Research on facial expression recognition is very useful in many fields, for example in the field of human computer interaction, in this case the computer recognizes facial expressions of the user, then the computer programmatically perform the appropriate instructions to the facial expression of the user. Facial expressions can also be used as a measure of customer satisfaction with public services. In this study, the facial expression recognition applications were built to measure customer satisfaction with the process of feature extraction using the Modified Two Dimensional Linear Discriminant Analysis (Modified 2DLDA) to obtain input characteristics on each face. 2DLDA modification method is the development of methods 2DLDA; which may have the similarity measurement using Euclidean Distance, Manhattan Distance, and Two Dimensional Correlation Coefficient. The combination of these test methods uses Jaffe database which is a database that contains Japanese female facial expression. The highest test results using the Euclidean Distance is 88.57%, the Manhattan Distance method is 89.92%, and the method Two Dimensional Correlation Coefficient of 90.48%.
Keywords:	Facial Expressions, Euclidean, Manhattan, Two Dimensional Correlation- Coefficient, Modified 2DLDA
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016
	Full Text
Title:	A SOFTWARE-HARDWARE OPTIMIZER MODEL FOR OPTIMIZED DESIGN OF THINGS IN AGENTS OF THINGS
Author:	ANAS M MZAHM, MOHD SHARIFUDDIN AHMAD, ALICIA Y. C. TANG, AZHANA AHMAD
Abstract:	The machines, or things in the Internet of Things (IoT) lack self-reasoning capability, which limits their potential to provide value-added services for humans. Consequently, we introduce the concept of Agents of Things (AoT) as an extension to the IoT, in which the things are embedded with self-reasoning intelligent software agents to provide value-added services for humans. Two crucial issues in designing intelligent things are to determine what value-added services they should offer and the subsequent level of reasoning abilities that are required for these services. Consequently, we need to find an optimum match between the hardware capabilities of the things and their corresponding software agents reasoning abilities to deliver value-added services on top of performing their basic IoT functions. In this paper, we present the results of a software analysis represented by a software spectrum and a hardware analysis represented by a hardware spectrum. We then link these two spectra to form a structured hardware-software optimizer for a things design model, which we called the Structured Hardware-Software Optimizer or SHOM. We demonstrate the use of SHOM in designing optimized things in a simulated traffic scenario in manifesting the AoT concept.
Keywords:	Internet of Things; Agents of Things; Hardware Analysis; Software Analysis; Structured Hardware-Software Optimizer; Software Hardware Optimizer Model; Value-added Services; Optimum Things;
Source:	Journal of Theoretical and Applied Information Technology 31 st December 2016 -- Vol. 94. No. 2 -- 2016
	Full Text
Title:	APPLICATION OF THE BAYES RULE FOR ENHANCING THE PERFORMANCE OF THE BAGGING ENSEMBLE TO DETECT ABNORMAL MOVEMENTS ONBOARD AN AIRCRAFT
Author:	ALI H. ALI
Abstract:	This paper presents a novel approach to the detection of abnormal passengers movements onboard an aircraft. Firstly, it uses the simple indicators of the total passengers movements along the aisle and in their seats as classification features. Secondly, five machine learning classifiers are studied, namely: decision trees, SVM with Gaussian kernel, bagging ensemble, boosting ensemble and RUSBoost ensemble classifiers. The ROC curve, the confusion matrices and the McNemar tests are shown and conducted. Finally, we propose a method of enhancing the performance of the bagging ensemble using Bayes rule. The bagging ensemble are found to have a classification accuracy of about 65% which was increased by the application of the Bayes rule method to about 89.2%. The performance results of each method is reported and discussed.

Keywords:	Machine Learning; Ensemble Classifiers; Aviation Safety; Bayes Rule; Decision Support System
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COMPARING THE SIMILARITIES MEASUREMENT OF FACE EXPRESSION-RECOGNITION BASED ON 2DLDA MODIFICATION METHOD

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ABSTRACT

Facial expression recognition is the development of face recognition in an environment of pattern recognition (feature recognition). Research on facial expression recognition is very useful in many fields, for example in the field of human computer interaction, in this case the computer recognizes facial expressions of the user, then the computer programmatically perform the appropriate instructions to the facial expression of the user. Facial expressions can also be used as a measure of customer satisfaction with public services. In this study, the facial expression recognition applications were built to measure customer satisfaction with the process of feature extraction using the Modified Two Dimensional Linear Discriminant Analysis (Modified 2DLDA) to obtain input characteristics on each face. 2DLDA modification method is the development of methods 2DLDA; which may have the similarity measurement using Euclidean Distance, Manhattan Distance, and Two Dimensional Correlation Coefficient. The combination of these test methods uses Jaffe database which is a database that contains Japanese female facial expression. The highest test results using the Euclidean Distance is 88.57%, the Manhattan Distance method is 89.92%, and the method Two Dimensional Correlation Coefficient of 90.48%.

Keywords: *Facial Expressions, Euclidean, Manhattan, Two Dimensional Correlation- Coefficient, Modified 2DLDA*

1. INTRODUCTION

Intelligent system is a system that allows the computer to have a system of reasoning and intelligence thinking like human. The development of intelligent systems have several research fields such as pattern recognition, geographic information systems, decision-making systems, and others.

Recognition system facial expression is the development of face recognition system which in an environment of pattern recognition now is more and more being studied. This is because the demand to develop something is more advanced in the field of intelligent systems. So that the computer does not only recognize a person's face, but also to recognize facial expressions of someone including anger, disgust, fear, happiness, neutral, sad or surprised.

There are several studies of such facial expression recognition research which is done by Neeta Sarode, Shalini Bhatia in 2010, entitled "Facial Expression Recognition" [1]. Their study was about crating software for facial expression recognition using local 2D appearance-base approach and data test using Jaffe database. These

studies showed recognition with an accuracy of 81%.

Yong Xu, Zhu Qi, Yan Chen in 2013 also have similar research which is entitled "An Improvement to the Nearest Neighbor Classifier's Face Recognition Experiment" [2]. The study discusses the use of a modified method of nearest neighbor for facial expression recognition. The data test are AR database. These studies showed recognition with an accuracy of 89%.

Mandeep Kaur, Rajeev Vashisht, Nirvair Neerv in 2010, was doing a research in the same area which is entitled "Recognition of Facial Expressions with Prinsipcal Component Analysis (PCA) and Singular Value Decomposition (SVD)" [3]. This study uses Prinsipcal Component Analysis (PCA) and Singular Value Decomposition (SVD) for the introduction of facial expressions which the database also used Jaffe database. The level of accuracy of the study reached 80%.

Broadly speaking, research on facial expression recognition system has two stages. The first stage is the feature extraction, which is taking the features in the image, so that the feature is different between an image with another image.



The second step is the measurement of similarity, which is the measurement between the image of testing with the image of training is to get the value that is used as a benchmark to find the most similar image.

Methods Linear Discriminant Analysis (LDA) is a method of extracting feature that is aimed to find the projection linear (commonly called the 'fisherimage'), to maximize matrix covariance between objects (between-class covariance matrix), and also to minimize matrix covariance within the object itself (within-class covariance matrix) [4]. LDA also imposes a separate statistical properties of each object [5].

The LDA method uses models based on vector data representation. Generate vectors typically have a higher dimension. This is a drawback of the method of LDA [6]. Method Two Dimensional Linear Discriminant Analysis (2DLDA) directly assess within-class scatter matrix of images without image transformation matrix into a vector, and it solves singular problems in within-class scatter matrix [7]. 2DLDA uses fisher criterion to find the optimal projection discriminatory.

Methods 2DLDA search the value of R and L values which are used to calculate the within-class and *between-class scatter*. So there are two values within-class scatter i.e. S_w^R dan S_w^L , as well as the value of two S_b^R and S_b^L *between-class scatter*. The calculation of two values *within-class scatter* and the *two values between-class scatter* causes computation which is required even greater. Modification Method Two Dimensional Linear Discriminant Analysis (Modified 2DLDA) directly assess without transformation matrix image into vector image. 2DLDA modification method calculates the value of *within-class scatter* and the *between-class scatter values*. This can reduce the computation time required.

In this study, we modified the method of Two Dimensional Linear Discriminant Analysis (Modified 2DLDA). This 2DLDA modification method can directly assess without transformation matrix image into vector image. Moreover, this method calculates the value of within-class scatter and the between-class scatter values. The advantage of using this modification of 2DLDA method in comparison with 2DLDA is, 2DLDA modification can reduce the needed-computation time, while 2DLDA method may take a longer period to compute. 2DLDA modification method is used as a feature extraction and an introduction of process using several methods of measurement of distance, namely: Euclidean Distance, Manhattan Distance,

and Two Dimensional Correlation Coefficient. The results from the combination of these methods were compared to obtain optimal accuracy results.

2. SYSTEM DESIGN

2.1. Feature Extraction

Feature extraction in the training process is conducted by using Modified Two Dimensional Linear Discriminant Analysis (Modified 2DLDA). This stage aims to get the features that are selected from the data enter training. These features are selected obtained from all the facial features, look for eigenvalues and eigenvectors greatest. Features that are selected will be used for the classification process is used for training and testing data feature extraction.

Feature extraction in the testing process is done by taking the feature extraction results on the training process applied to the test data. Feature extraction results on this test data will be used as input to the classification process testing.

2.2. Two Dimensional Linear Discriminant Analysis (2DLDA)

2DLDA is the development of methods of LDA. In LDA on face recognition with 2D matrix, it must first be transformed into a one-dimensional shape vector image. While on 2DLDA or image projection technique which is called as direct matrix 2D facial image does not need to be transformed into the form of a vector image, but scatter image matrix can be formed directly by using the original image matrix.

$\{A_1, \dots, A_n\}$ is n matrix image, where A_i ($i=1, \dots, k$) is $r \times c$ matrix. M_i ($i=1, \dots, k$) is the average of the classroom to the training image i and M is the average image of all training data. Assuming $\ell_1 \times \ell_2$ dimension (dimensional space) $L \otimes R$ shows the tensor product, L span $\{u_1, \dots, u_{\ell_1}\}$ and R span $\{v_1, \dots, v_{\ell_2}\}$. Thus, it defined two matrix $L = [u_1, \dots, u_{\ell_1}]$ and $R = [v_1, \dots, v_{\ell_2}]$ [8].

Feature extraction method is to find the L and R so that the space of the original image (original image space) A_i is converted into low-dimensional image space which becomes $B_i = B_i = L^T A_i R$. Low dimensional space is obtained by a linear transformation L and R, the distance D_b between-class and within-class distance D_w defined in equation (1) and (2).

$$D_b = \sum_{i=1}^k n_i \|L^T (M_i - M) R\|_F^2, \quad (1)$$



$$D_w = \sum_{i=1}^k \sum_{x \in \Pi_i} \|L^T(X - M_i)R\|_F^2, \quad (2)$$

where $\| \cdot \|_F$ is Frobenius norm.

The review is $\|A\|_F^2 = \text{Ptrace}(A^T A) = \text{trace}(AA^T)$ to A. So that the equation (7) and (8) can be further represented as the equation (3) and (4).

$$D_b = \text{trace}\left(\sum_{i=1}^k n_i L^T (M_i - M) R R^T (M_i - M)^T L\right), \quad (3)$$

$$D_w = \text{trace}\left(\sum_{i=1}^k \sum_{x \in \Pi_i} L^T (X - M_i) R R^T (X - M_i)^T L\right). \quad (4)$$

Similarly, LDA, 2DLDA method is to find the matrix L and R, so that the class structure of the original space remains in the projection room. So, the benchmark (criterion) can be defined as an equation (5).

$$J_1(L, R) = \max \frac{D_b}{D_w}. \quad (5)$$

It is clear that the equation (5) consists of the transformation matrix L and R. The optimal transformation matrix L and R can be obtained by maximizing D_b and minimizing D_w . However, it is very difficult to calculate the optimal L and R simultaneously. Two optimization functions can be defined to obtain L and R. For a definite R, L can be obtained by completing an optimization function according to the equation (6).

$$J_2(L) = \max \text{trace}((L^T S_w^R L)^{-1} (L^T S_b^R L)), \quad (6)$$

which

$$S_b^R = \sum_{i=1}^k n_i (M_i - M) R R^T (M_i - M)^T, \quad (7)$$

$$S_w^R = \sum_{i=1}^k \sum_{x \in \Pi_i} (X - M_i) R R^T (X - M_i)^T. \quad (8)$$

Note that the size of the matrix and S_w^R dan S_b^R is $r \times r$ smaller than the size of the matrix S_w and S_b in classical LDA.

For a definite L, R can be obtained by solving the optimization function in equation (9).

$$J_3(R) = \max \text{trace}((R^T S_w^L R)^{-1} (R^T S_b^L R)), \quad (9)$$

which

$$S_b^L = \sum_{i=1}^k n_i (M_i - M)^T L L^T (M_i - M), \quad (10)$$

$$S_w^L = \sum_{i=1}^k \sum_{x \in \Pi_i} (X - M_i)^T L L^T (X - M_i), \quad (11)$$

S_w^L and S_b^L matrix size is $c \times c$ is smaller than the size of the matrix S_w and S_b in classical LDA.

2.3 Modification of Two Dimensional Linear Discriminant Analysis (Modification of 2DLDA)

This method is the development of 2DLDA methods which can calculate class-scatter and within-class scatter only once. So that, the computing time is less than the 2DLDA method. In this method, the calculation of 2DLDA between class scatter and within class scatter is done twice, they are calculating S_w^L dan S_b^L , S_w^R dan S_b^R . The method of computing time 2DLDA is used to perform feature extraction of $O(n^3)$, whereas the method of modification 2DLDA only takes amounted $O(n^2)$.

Here is the algorithm method 2DLDA Modification:

1. Input is a matrix x
2. Calculating $m_i = \frac{1}{n_i} \sum_{x \in \Pi_i} x$ is the average class i, and $m = \frac{1}{n} \sum_{i=1}^k \sum_{x \in \Pi_i} x$ is the global average.
3. Calculating the between class scatter matrix. Between class scatter matrix (S_b) is the distance matrix between classes. In accordance with the equation $S_b = \sum_{i=1}^k n_i (m_i - m)(m_i - m)^T$
4. Calculating the within class scatter matrix. Within class scatter matrix (S_w) is the distance matrices in the same class. In accordance with the equation $S_w = \sum_{i=1}^k \sum_{x \in \Pi_i} (x - m_i)(x - m_i)^T$
5. Calculating the generalized eigenvalue (λ_i) and eigenvector (V) of S_b dan S_w in accordance with equation (12) using SVD.

$$Z = \begin{bmatrix} S_w^{-1/2} (S_w)^T \\ S_b^{-1/2} (S_b)^T \end{bmatrix}. \quad (12)$$



2.4 Distance Measure

Facial expression recognition is essentially matching two facial expressions by constituting one facial expression facial expressions which have been trained and placed in a database; and then compared with images or image expression test of new facial expression. The match is using the distance measurement method. Basically, the distance measurement is used to calculate the difference between the two vectors images in eigenspace. After the image is projected into space facial expression of the face, the next task is to determine where the image of a facial expression is most similar to the image in the database. There are many ways to measure the degree of similarity and distance among the Euclidean distance, Manhattan, and 2D Correlation Coefficient. Moreover, it will ultimately be compared to the distance which has the highest level of compatibility.

2.5 Euclidean Distance

Euclidean space is finite-dimensional space with valuable real. Euclidean distance between two points is the length of the hypotenuse of a right triangle. Where x is the image of training and y is the input image test. If $x = (x_1, x_2, x_3, \dots, x_n)$ and $y = (y_1, y_2, y_3, \dots, y_n)$ are two points in space Eulidean n, the Euclidean distance x to y is according to the equation (13) :

$$d(x, y) = \sqrt{\sum_{i=1}^n (x_i - y_i)^2} \tag{13}$$

If the vector in Euclidean Distance value is close to 0, then the image of testing and training image is stated to resemble.

2.6 Manhattan Distance

Manhattan Distance is one of the most widely used measurement which involves replacing the squared difference by summing the absolute differences of the variables. This procedure is called absolute block or better known as the city block distance. Equation (14) is a measurement using the Manhattan Distance.

$$d(x, y) = \sum_{i=1}^n |x_i - y_i| \tag{14}$$

If the vector in Manhattan Distance value is close to 0, then the image of testing and training image stated to resemble.

2.7 2D Correlation Coefficient

In this study, the third method is used to measure the similarity is 2D Correlation Coefficient

This method aims to measure the distance between the image similarity testing with imagery training. Weight matrix testing the data will be processed by the 2D Correlation Coefficient which works by comparing the entire result of reduction in the value matrix of the i-th weight training data and value-i weight matrix to the data of testing with its square root. Data are considered most similar is the maximum value of each data comparison results of testing and training [9].

$$r = \frac{\sum_m \sum_n (A_{mn} - \bar{A})(B_{mn} - \bar{B})}{\sqrt{(\sum_m \sum_n (A_{mn} - \bar{A})^2)(\sum_m \sum_n (B_{mn} - \bar{B})^2)}} \tag{15}$$

Where:

- A = weight training image
- B = weight testing image
- \bar{A} = weighted average of the training image
- \bar{B} = weighted average of the testing image

3. EXPERIMENTS AND RESULTS

3.1 Data Training

The trial of facial expression recognition system developed in this study is conducted at the Jaffe Database which was taken from 10 samples of Japanese women. Each women has three poses and 7 expression of happiness, sadness, surprised, anger, disgusted, fear, and neutral. Thus, each sample of 21 poses represents the total data of 210 images. All the images have the intensity of gray (greyscale) with a size of 256 x 256.

The parameters which were used in this test were:

1. Variation of the sequence of training samples per class is used. In Jaffe Database sequence data taken as training data varies, not sequential as preliminary data in the database.
2. The amount of training samples per class is used. The amount of data used in the training process is divided into several scenarios.
3. The number of features taken in the process of training and testing. Feature fetch as much as 5, 10 and 15.

3.2 Testing Method

Tests on facial expression recognition system developed in this research is done by separating the facial image data in a database into two sets of mutually exclusive (disjoint) i.e. the set of training images and test images. The calculation of the percentage of successful introduction of testing is done on a set image.

Scenario testing is done by varying the sequence of face images in a database, varying the amount of training data, and varying the features is taken. The test was carried out using five variations in the amount of training data, shown in Table 1.

Table 1. Test Scenario

Class	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
	Training Data	Testing Data	Training Data	Testing Data	Training Data	Testing Data	Training Data	Testing Data	Training Data	Testing Data
1	10	20	20	10	23	7	7	23	15	15
2	10	20	20	10	23	7	7	23	15	15
3	10	20	20	10	23	7	7	23	15	15
4	10	20	20	10	23	7	7	23	15	15
5	10	20	20	10	23	7	7	23	15	15
6	10	20	20	10	23	7	7	23	15	15
7	10	20	20	10	23	7	7	23	15	15

3.3 Testing Result

These test method are in three groups. The first group uses 2DLDA Modified method for feature extraction and Euclidean method is for classification. The second group uses modification methods 2DLDA for feature extraction and classification methods to Manhattan. The third group uses methods Modification 2DLDA for feature extraction and 2D Correlation Coefficient method for classification. The test results for each group of methods can be seen in the following sections of this section:

3.4 The Result of Recognition by Using 2DLDA Modification Method and Euclidean Method.

Figure 1 shows the recognition accuracy by using Modified 2DLDA and Euclidean method for retrieval features 5, 10 and 15.

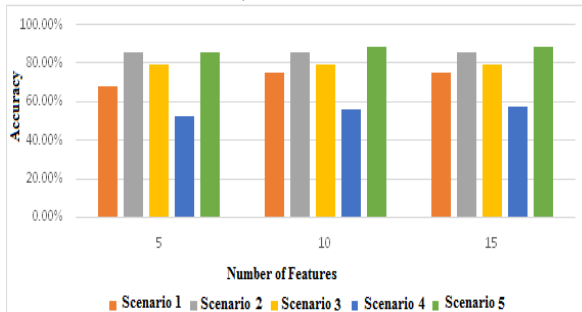


Figure 1. Graph Of The Recognition Accuracy Using Facial Expression Recognition 2DLDA Modification Methods And The Methods Of Euclidean

3.5 Results of Treatment using the Modified 2DLDA and methods Manhattan

Figure 2 shows the recognition accuracy by using Modified 2DLDA and methods for retrieval features Manhattan 5, 10 and 15.

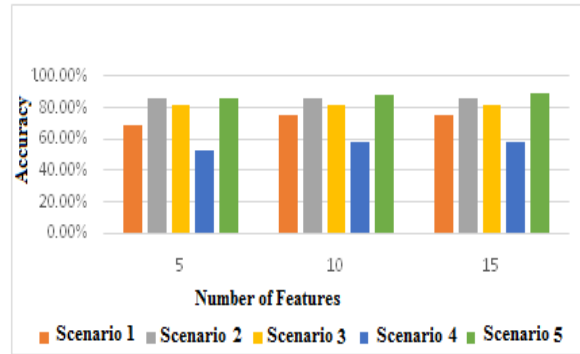


Figure 2. Graph Accuracy Of Facial Expression Recognition Method 2DLDA Modification And Methods Manhattan

3.6 Results of Treatment using the Modified 2DLDA and methods of 2D Correlation Coefficient

Figure 3 shows the recognition accuracy by using Modified 2DLDA and 2D Correlation Coefficient method for making feature 5, 10 and 15.

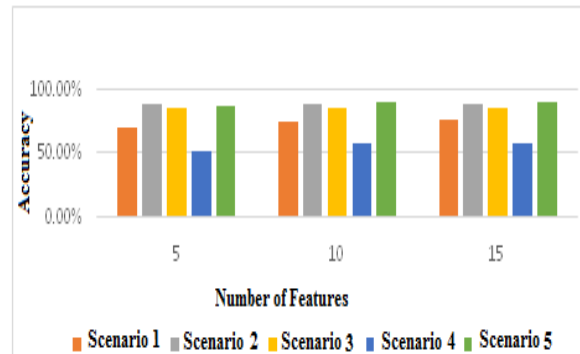


Figure 3. The Resulting Graph The Accuracy Of Facial Expression Recognition Method 2DLDA Modification And Methods Of 2D Correlation Coefficient

3.7 Analysis and Results of Testing System

Figure 1, Figure 2 and Figure 3 show that the number of features has 15 levels higher accuracy than the number of features of 10 and 5. Table 1 shows a comparison among the recognition accuracy and Euclidean method 2DLDA Modified, Modified method 2DLDA and Manhattan, methods modifications 2DLDA and 2D Correlation Coefficient, which use a variety of testing. The conducted fifth scenario test can be seen that scenario No. 5 has the amount of training data of 105. This recognition accuracy rate is higher than the other scenarios. Classification using 2D Correlation Coefficient generate higher recognition accuracy than the method of Manhattan Distance Euclidean Distance.



Table 1 Results Of Comparative Recognition Accuracy

Method	Scenario				
	1	2	3	4	5
Modifikasi 2DLDA - Euclidean	75%	85,71%	79,59%	57,14%	88,57%
Modifikasi 2DLDA - Manhattan	75,71%	85,71%	81,63%	58,39%	89,52%
Modifikasi 2DLDA - 2D Correlation Coefficient	76,43%	88,57%	85,71%	59,01%	90,48%

4. CONCLUSION

The highest percentage of accuracy of facial expression recognition using the Modified-2D Correlation 2DLDA Coefficient is equal to 90.48%. There are three important variables that affect the success rate of introduction, ie sequence variations of training samples per class, the number of training samples per class, and the number of features. The factors which affect the failure of an image can be recognized correctly due to the similarity of facial expression or pose different between one person and another person.

5. SUGGESTION

This research will continue to develop using classification method other than the method of measuring distance. The test can be developed by using a database of other facial expressions.

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