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ARPN Journal of Engineering and Applied Sciences 🔓

|	
Country	Pakistan
Subject Area and Category	Engineering Engineering (miscellaneous)
Publisher	Asian Research Publishing Network (ARPN)
Publication type	Journals
ISSN	18196608
Coverage	2011-ongoing

12

H Index

Quartiles

The set of journals have been ranked according to their SJR and divided into four equal groups, four quartiles. Q1 (green) comprises the quarter of the journals with the highest values, Q2 (yellow) the second highest values, Q3 (orange) the third highest values and Q4 (red) the lowest values.

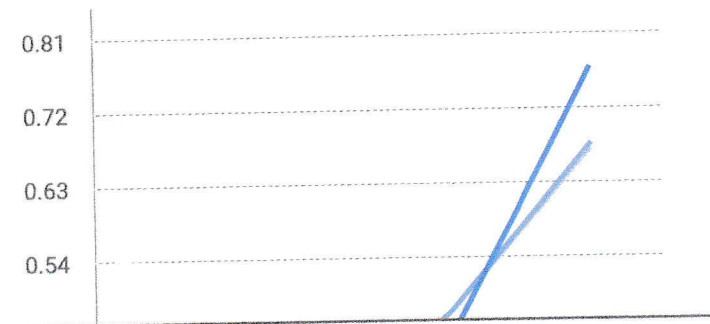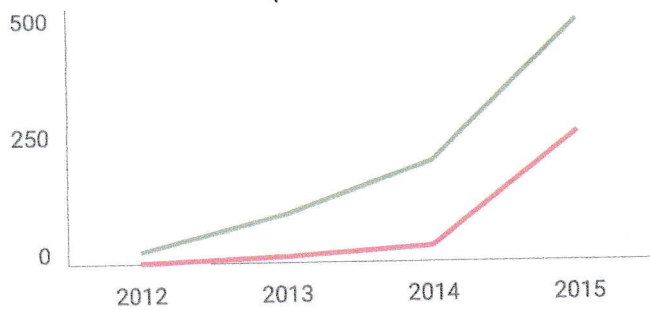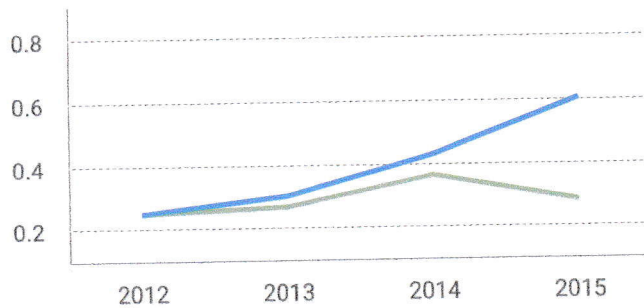| Category	Year	Quartile
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Engineering (miscellaneous)	2013	Q3
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SJR

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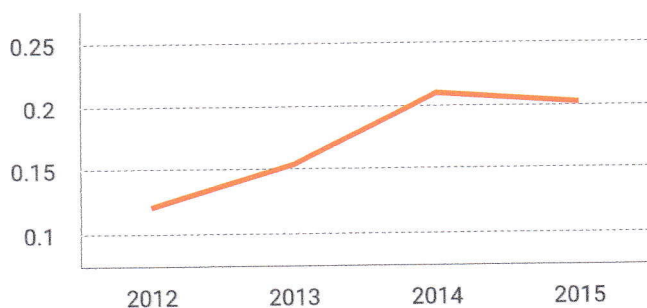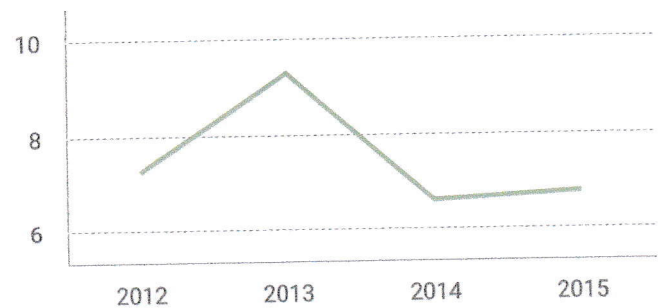
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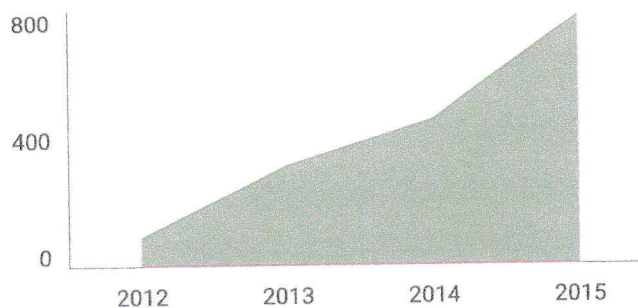
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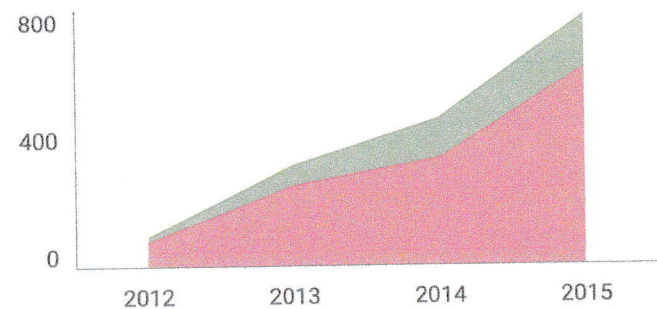
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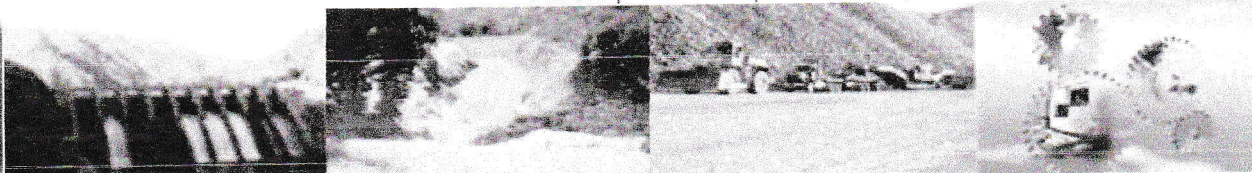
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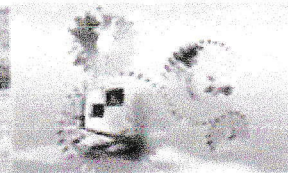
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Publication Fee

Title: Evaluation of feature extraction algorithm for multi-ethnic facial sketch recognition

Author (s): Andrew Japar, Anto Satriyo Nugroho, James Purnama and Maulahikmah Galinium

Abstract: There are many cases of criminal where some biometrics factors difficult to be identified and the photo image of a suspect is not available. Therefore, facial sketch recognition system to identify suspects face from sketches is very important to assist the process of investigation. Main purpose of this research is to get the best facial sketch recognition system by comparing the ROC (Receiver Operating Characteristics) curve using local-feature based approach and appearance-based approach. Based on the experiments, the ROC curve proves that local-feature based approach using LFDA framework [1] show better recognition result with less error rate than appearance-based approach. Local-feature based implemented inside facial sketch recognition system return between 85% to 90% accuracy rates against good quality viewed sketches.

Full Text

Title: Automated classification of malaria plasmodia from thin blood smears microphotograph

Author (s): Maulahikmah Galinium, Raymond Septevan Chandra, Anto Satriyo Nugroho, Made Gunawan, Vitria Pragesjvara, Ismail Ekoprayitno Rozi and Puji Budi Setia Asih

Abstract: Malaria is one of the malignant diseases which can be found in a tropical climate country like Indonesia. Automated malaria detection using host blood samples is an important approach to improve time efficiency for diagnosing the disease and giving the treatment as soon as possible. This automated detection uses a thin blood smears microphotograph which is stained using a Giemsa stain as input material. Furthermore the microphotograph is proceed using image processing algorithm which consists of image pre-processing, image thresholding using Otsu method, blood cell segmentation, suspected erythrocyte classification, and plasmodium classification. Two stages of classification are used in plasmodium classification by observing the size of object and the intensity supported by the Bayes classifier. The output from this program is expected to determine the plasmodium species of human plasmodium i.e. Plasmodium falciparum, Plasmodium malaria, Plasmodium viva, and Plasmodium ovale.

Full Text

Title: Fuzzy concepts compression using Principal Component Analysis with Singular Value Decomposition

Author (s): Noor Hafhizah Abd Rahim

Abstract: Recent years, the volume of data is increasing rapidly. There is a huge of information available that lead to extremely large datasets. Most of data comes in unstructured forms such as Twitter, Face book, Blogs, and others. Formal Concept Analysis (FCA) is a way to organize data. However, large dataset leads to the complex formal lattice and becomes unreadable. Principal Component Analysis (PCA) using Singular Value Decomposition (SVD) are used to reduce the high dimension of data. This method is able to be used with both fuzzy and crisp formal contexts. In order to select principal components, we combine two rules; first rule is we use Cumulative Explained Variance Fraction and second rule is we examine Cattell's Scree Graph. This method is compared with other methods using Edit Distance measurement that quantify the distance between original lattice and reduced lattices.

Full Text

Title: Ensemble based majority voting for point-to-point measurements of Gyrodactylus species identification

Author (s): Rozniza Ali, Amir Hussain and Andrew Abel

Abstract: In the 21st Century, a key challenge in both wild and cultured fish populations for control and management of disease is to securely and consistently perform pathogen identification. To provide automated accurate classification for the challenging Gyrodactylus species, we introduce an ensemble based majority voting approach for their classification. In this system, an ensemble classification approach is created that utilizes a combination of multiple feature sets and classifiers for Gyrodactylus species identification. The classifier base makes use of K-Nearest Neighbor (K-NN) and Linear Discriminant Analysis (LDA) approaches; with three different feature sets used for successful multi species

Linear Discriminant Analysis (LDA) approaches, with three different feature sets used for successful multi-species classification, considering 25 point-to-point data measurements, as well as smaller feature sets chosen using different feature selection techniques. The results show that our proposed ensemble based approach is accurate and robust, with ensemble based majority voting of classifiers and feature sets together found to be more effective than only combining feature sets.

Full Text

Title: TransATH: Transporter prediction via annotation transfer by homology

Author (s): Faizah Aplop and Greg Butler

Abstract: A significant deficiency in the existing state-of-the-art for the reconstruction of metabolic pathways is the ability to associate genes and proteins to the transport reactions that move specific compounds across the membranes of the cell. This paper presents TransATH, which stands for Transporters via ATH (Annotation Transfer by Homology), a system which automates Saiers protocol and includes the computation of subcellular localization and improves the computation of transmembrane segments. The choice of thresholds for the parameters of TransATH is investigated to determine optimal performance as defined by a gold standard set of transporters and non-transporters from S. cerevisiae. We demonstrate TransATH on the fungal genome of A. niger CBS 513.88 and evaluates the correctness of TransATH using the curated information in AspGD (the Aspergillus Database). A website for TransATH is available for use.

Full Text

Title: Adaptive scientific visualization of color information in HDR image

Author (s): June-Hwan Lee and Yong-Hwan Lee

Abstract: While tone mapping operation of high dynamic range (HDR) images for realistic display is commonly researched, scientific visualization for analyzing scene luminance within HDR image has much less attention from researches. This paper has presented and implemented an approach for the reproduction and visualization of the colour information in HDR images. We attempt several simple color visualizing functions, and estimate their effectiveness through the evaluation factors with common HDR images. The experimental result shows that sigmoidal mapping function is better performance in the visualization, compared to other approaches.

Full Text

Title: Evaluation of articles published in Mendeley and CrossRef in relation to the Google Scholar pages

Author (s): Adian Fatchur Rochim and Riri Fitri Sari

Abstract: This paper aims to show the performance of a researcher from their published articles. Our software crawled 10 (ten) most cited articles on the Google Scholar (GS), Mendeley and CrossRef with several of crawling methods. The method used in data retrieval is scrapping due to the limitations on the Application Programming Interface (API) provided by the Google search engine. To retrieve the Digital Object Identifier (DOI) data from Crossref, the API method has been used. In order to count the number of reader of paper on the Mendeley we used the API method. We used the R programming language, Python and Bash scripting shell. The operating system was based on Ubuntu 8.04 Linux and Mac OS. The Apache webserver were used to serve the website and we used the MySQL database to store the data. The database of MySQL is used for interfacing between R with the PHP language purposes. The Hypertext Preprocessor (PHP) is used for server-side scripting. Data was obtained by scrapping the best 10 articles from 100 Indonesia's scientists indexed on the GS. Firstly, the data samples (S') were obtained from the list of Indonesian scientists in Webometrics as the input of the GS scrapping. Secondly, the data resulted (S'') were used as the input of the Crossref's API query to obtain the DOI of each article. Finally, the DOIs were used as the input for the API query to get the number of the result to show the number of readers of each to article on Mendeley. The software produced can crawl the data from Google Scholar, Crossref and Mendeley reader count.

Full Text

Title: Implementation of information display device for estimation of bus arrival time

Author (s): Fauzi Maulana, Misbahuddin, Riri Fitri Sari, Ruki Harwahyu, Anak Agung Putri Ratna, and Ellen S. W. Tangkudung

Abstract: The purpose of the research is to implement a device that functions as a real-time display of the estimated arrival time of the yellow bus in University of Indonesia. The device uses an 8-bit Atmel AVR microcontroller based on Arduino platform as its main controller, and utilizes GPRS-based connection to transmit the data to the server. The system fetches the data of the calculated estimation arrival time of the Yellow Bus for each bus stop. The information will be updated periodically by the server. The testing results show that the success rate of the data-fetching was 99.6% for the duration of 23:53 until 02:46, and 99.7% for the duration of 07:24 until 09:43. The average usage of GPRS quota was 10.3 MB for a period of 10 days. Finally, the device's additional function for maintenance and debugging by utilizing SMS service has been proved to work properly.

Full Text

Title: Inferring an optimal algorithm for detecting brain neuron network connectivity in response to external stimuli

Author (s): Rahul Mani and Vinod Dubey

Abstract: The focus of neuroscience research over the years has been to understand how neurons respond to a variety of stimuli and communicate with each other and to construct models that attempt to predict responses to similar stimuli. Findings have been used for establishing better treatments for human diseases like, epilepsy, stroke and Alzheimer's. This in turn has also been helpful in designing appropriate prosthetic devices. The recent advances in multiple-electrode recording and computational capacity have made it possible to study the simultaneous spiking activity of multiple neurons. A systematic analysis and understanding of simultaneous spike recording of multiple neurons using computational algorithms offers new promise for investigating some of the fundamental questions concerning how the brain works. This research contributes to this growing literature through using new datasets and computational techniques. In this paper, we develop a computational algorithm to estimate the neural connections of a simulated

neuronal network data of 10 cultured neurons obtained from the MLBIO+ Lab at George Mason University. The inferred brain network derived from the algorithm was then compared using statistical techniques such as RMSE and MAE with observed truth data which mimic actual functioning of the brain. The results suggest that average error between truth and simulated network decreases as the number of time steps increases. This means, longer it takes between the stimuli and firing of neuronal responses, the closer we get to the optimal network. This type of research is very relevant as it can help neuroscientists design complex experiments and as a consequence, answer some of the key on the functioning of the brain.

<div align="right">Full Text</div>

Title: An integrated semi-supervised clustering model for time course gene expression data

Author (s):   Peter Juma Ochieng and Taufik Djatna

Abstract: Clustering the time course data using basic conventional clustering methods often, present computational challenges and most algorithms are porn error when dealing with such data structures. Thus, the aim of this study is to introduce an integrated semi-supervised model for clustering time course gene expression data. The proposed model implement four series approximation to account for the periodic gene expression; AR(1) mixed random effect to account for the auto correlated data structure for time course gene expression and rejection controlled EM algorithm to minimize the computational cost during m-step. The interest of the proposed method is illustrated by its application to yeast cell life cycle dataset. Simulation results indicate the proposed method to cluster the various genes expression to their correct profiles. Further empirical comparison indicates the proposed method to outperform the HMRF-Kmean with 0.154 error rate; 0.785 rand index and 0.592 adjusted rand index. Therefore, integrating the Fourier series approximation, AR (1) random effect model and rejection controlled EM algorithm the proposed model provides a more reliable and robust method for clustering time-course data since the model allows for the correlation among observations at different time points.

<div align="right">Full Text</div>

Title: High-performance computing and communication models for solving the complex interdisciplinary problems on DPCS

Author (s):   Norma Alias, Riadh Sahnoun and Victor Malyshkin

Abstract: The paper presents some advanced high performance (HPC) and parallel computing (PC) methodologies for solving a large space complex problem involving the integrated difference research areas. About eight interdisciplinary problems will be accurately solved on multiple computers communicating over the local area network. The mathematical modeling and a large sparse simulation of the interdisciplinary effort involve the area of science, engineering, biomedical, nanotechnology, software engineering, agriculture, image processing and urban planning. The specific methodologies of PC software under consideration include PVM, MPI, LUNA, MDC, OpenMP, CUDA and LINDA integrated with COMSOL and C++/C. There are different communication models of parallel programming, thus some definitions of parallel processing, distributed processing and memory types are explained for understanding the main contribution of this paper. The matching between the methodology of PC and the large sparse application depends on the domain of solution, the dimension of the targeted area, computational and communication pattern, the architecture of distributed parallel computing systems (DPCS), the structure of computational complexity and communication cost. The originality of this paper lies in obtaining the complex numerical model dealing with a large scale partial differential equation (PDE), discretization of finite difference (FDM) or finite element (FEM) methods, numerical simulation, high-performance simulation and performance measurement. The simulation of PDE will perform by sequential and parallel algorithms to visualize the complex model in high-resolution quality. In the context of a mathematical model, various independent and dependent parameters present the complex and real phenomena of the interdisciplinary application. As a model executes, these parameters can be manipulated and changed. As an impact, some chemical or mechanical properties can be predicted based on the observation of parameter changes. The methodologies of parallel programs build on the client-server model, slave-master model and fragmented model. HPC of the communication model for solving the interdisciplinary problems above will be analyzed using a flow of the algorithm, numerical analysis and the comparison of parallel performance evaluations. In conclusion, the integration of HPC, communication model, PC software, performance and numerical analysis happens to be an important approach to fulfill the matching requirement and optimize the solution of complex interdisciplinary problems.

<div align="right">Full Text</div>

Title: Spectrum-less communication by virtualizing the core network of 4G wireless network

Author (s):   Ardian Ulvan, Melvi Ulvan, Robert Bestak and Hery Dian Septama

Abstract: The efficiency of spectrum in mobile and wireless network might be achieved by exploiting the technical specification within the spectrum itself, and by introducing the new technical mechanism called network virtualization. The latter emphasis's the enhancement of control and user planes of the network rather than utilize the spectrum. This research work focuses on the network virtualization, particularly on virtualizing the network elements in LTE-based core network (Evolved Packet Core EPC). A design of network virtualization is built from the end-user to the core network, which includes all the functionality of the network elements. The EPC is assumed as the main core network system, while the 2G/3G/4G systems are as client stations. Testing, measurement and performance analysis are done by developing a testbed of cloud network in the Local Area Network where the access rate is up to 100 Mbps. Subsequently, the traffic loads of 0 Mbps, 10 Mbps, 50 Mbps, 75 Mbps, and 100 Mbps, based on TCP and UDP transport protocols, are generated into the testbed. All elements of the EPC-LTE on this testbed (i.e., HSS, MME, S-GW, P-GW and PCRF) are logically separated from one another in a cloud network. Two parameters of Quality of Service (QoS), i.e., jitter and delay, are used as performance parameters. Based on the test and measurement it is found that the highest value of jitter and delay are 26.87 ms and 6.53 ms respectively, when network is loaded with traffic at 100Mbps. From the results, it can be concluded that the network virtualization can be implemented.

<div align="right">Full Text</div>

Title: Three-dimensional advance dynamic culture system promotes microvessel development from cultured endothelial cells in vitro

Author (s):   Mohd. Ramdan, Irza Sukmana, Nur Syazana, Noor Jasmawati, Mohammed Rafiq and Ardiyansyah Syahrom

Abstract: The present study describes a dynamic system that can be used in a three- dimensional (3D) in vitro cell culture environment which promotes new microvessel formation. Human umbilical vein endothelial cells (HUVECs) were used in this study to form the inner lining of the microvessel, guided by the dynamic flow produced by our system within a

3D matrix made from fibrin. A 2D environment was used as a comparison. The dynamic flow was set to produce 5, 10, 15 or 20 dynes/cm2 shear stress to the cells in culture. Cultured HUVECs were observed for the increase in cell numbers and formation of microvessels. Cells cultured after 2 days demonstrated an increase in cell numbers when subjected to 10dynes/cm2 or more. By day 4, cells appeared to have altered morphologies and were oriented towards the direction of fluid flow. From the fluorescence images observed, it became apparent that there were microvascular channels forming in the 3D cultures. Our dynamic flow system appears to influence endothelial cells to promote microvascular formations in a 3D environment.

Full Text

Title: Airplane design: The superiority of FSW aluminum-alloy pure monocoque over CFRP black constructions

Author (s): Stefano Cassani

Abstract: CFRP composite structures offer a noteworthy weight lessening over traditional aluminum-alloy semi-monocoque airplanes. This weight lessening enhances the fuel effectiveness of the aerial vehicle by around 20%, which results in a cost sparing in fuel. In this paper introduced a contrasting option to CFRP. Aluminum lithium alloy 2195 with FSW (Friction Stir Welding) is acquainted as a successful option to CFRP structures. The "tough skin" monocoque plan is examined. An old WWII Reggiane 2005 has been upgraded both to CFRP and 2195-FSW. The outcome is a further reduction in weight much more important for different perspectives, as large scale manufacturing cost, reparability and environmental impact. The choice of the Reggiane 2005 is because of the complete knowledge on the original flying machine geometry and burdens. This outcome can be straightforwardly exchanged to larger aerial structures. On a pure mass premise, the advantage of the CFRP Reggiane 2005 is extremely light over the monocoque 2195-FWS. However, the monocoque structure is advantaged in the mounting of accessories. In fact, aluminum alloy structures can be easily machined with extreme precision and modifications can be introduced with extreme flexibility both in the design and the prototyping phase. On the contrary, way CFRP structures are extremely difficult to work and to modify. The though skin and the protected structure approach give approximately the same results. However, the though skin approach has the advantage of easier production technique. On the maintenance and disposal point of view the 2195-FSW structure has larger advantages [1-5].

Full Text

Title: Optimization of kerf width obtained in WEDM of Aluminum hybrid composite using Taguchi method

Author (s): A. Muniappan, C. Thiagarajan and S. Somasundaram

Abstract: In this paper, an experiment is conducted to optimize the kerf width of wire electrical discharge machining (WEDM) on Aluminum hybrid composite with Zinc coated brass wire using Taguchi method. Aluminum metal matrix composites (MMCs) reinforced with silicon carbide particulate (SiCp) find several applications due to their improved mechanical properties for a wide variety of aerospace and automotive applications. The hybrid composite (Al6061/Sic/Graphite) is prepared by stir casting route. Parameters considered for this study is pulse on time, pulse off time ,peak current, gap set voltage, wire feed and wire tension. Taguchi orthogonal method is used to design the experiment (L27). In this analysis of results shows that kerf width is mostly influenced by the peak current.

Full Text

Title: The cost of traffic accident and equivalent accident number in developing countries (Case study in Indonesia)

Author (s): Gito Sugiyanto

Abstract: Many developing countries like Indonesia have a serious road accident problem. Traffic accidents data in 2014 was recorded 95,906 cases that resulted in 28,297 people died, 26,840 people serious injuries, and 109,741 people slightly injuries. There are 108,883 accidents involving motorcyclists. Various attempts have been made to reduce the number of traffic accidents. One of the parameters to perform cost-benefit analysis of the program conducted the necessary value of the accidents cost. The aims of this study is to analysis traffic accidents cost using Gross Output Method and determining the value of an equivalent accident number based on accident cost. The research location is in Purbalingga, Indonesia using accident data from 2010-2012. The accident cost analysis based on the casualty severity of accidents is fatality, serious injury, slight injury, and Property Damage Only (PDO). Components of accident costs include costs to repair vehicle, loss of productivity, medical expenses, administrative expenses, and cost of pain, grief and suffering as well as the costs incurred by family. Casualty accident costs by severity type fatality is IDR263,025,680.96; serious injury is IDR12,066,000; slightly injury is IDR1, 904, 312.87, and PDO is IDR1, 562, 909.09. Total accident cost in Purbalingga was estimated IDR27, 582, 518,750 or 0.38% of the gross domestic product. Equivalent accident number using conversion accident cost Fatality: Serious-injury: Slight-injury: PDO = 168:8:2:1.

Full Text

Title: Modified critical path method to solve networking problems under an intuitionistic fuzzy environment

Author (s): T. Yogashanthi and K. Ganesan

Abstract: In this paper, we propose a new method to solve networking problems under an intuitionistic fuzzy environment. We use triangular Intuitionistic fuzzy numbers to represent activity duration in the project network. We obtain the intuitionistic fuzzy critical path for the project network using a new type of arithmetic operations and a ranking function on triangular intuitionistic fuzzy numbers. Numerical example is provided to show the efficiency of the proposed algorithm.

Full Text

Title: Project of multi-purpose research nuclear installation on fast neutrons is to ensure the national economy safety

Author (s): V. A. Rudenko, M. V. Golovko, S. A. Tomilin and A. A. Marchenko

Abstract: The article considers some opportunities of perspective nuclear power development which being guarantee of branch competitiveness in the internal and external markets, make essential impact on formation of national economy safety potential. In the conditions of an unstable environment of the raw markets the nuclear power strengthens the priority in system of instruments of increase of an economical and political statehood in the world community. Accumulation of

Title: A new proposed adaptive Cognitive Radio detection system based on MLP neural network for different modulation schemes

Author (s):   Hadi T. Ziboon and Ahmed A. Thabit

Abstract: The frequency spectrum of the electromagnetic radio is crowded day by day due to the expansion in wireless devices and applications. It has been additionally found that the allocated spectrum is underutilized as a result of the static portion of the spectrum. Cognitive radio (CR) allows for usage of licensed frequency bands by unlicensed users. These unlicensed users need to monitor the spectrum continuously to avoid possible interference with the licensed users. Spectrum usage regulations not permitting unlicensed users to authorized in a licensed spectrum. It has been seen that the whole licensed spectrum is not used at all places constantly. An unlicensed user can exploit advantage of such a situation to communicate thereby increasing spectrum efficiency. This is the fundamental thought behind Cognitive Radio. Demand for spectrum is expected to increasing rapidly and it would get in future. As more and more technologies are moving towards fully wireless, demand for spectrum is enhancing. In this paper, a proposed adaptive CR detection system is designed based on statistical features using neural network (multi layer perceptron) for intermediate frequency stage. Matlab simulation program is used to obtain the results. In order to evaluate the performance of the proposed CR detection systems, different modulated digital signals (2FSK, 4FSK, BPSK, QPSK, 8PSK, 4QAM, 16QAM, 64QAM and 256QAM) are generated at low SNR values. Multilayer perceptron is better than single layer due to their speed and nonlinearity solving problem. This is clearly seen in the obtained results such as Pd =100% for Pf=0.1 at SNR= -16dB, also Pd=90% at SNR= -40 dB and 95% at SNR= - 24dB with sensing time ?10? ^(-4) sec at AWGN noisy channel.

Full Text

Title: Identification of black spot and equivalent accident number using Upper Control Limit method

Author (s):   Gito Sugiyanto, Ari Fadli and Mina Yumei Santi

Abstract: Traffic accident is one of the serious problems faced by the Indonesian Government. The traffic accident rate in Indonesia is still considerably high. In 2014, 28,297 people died in traffic accidents, 26,840 people serious-injury and 109,741 people slight-injury. The aim of this research is to identify black spot location and equivalent accident number using Upper Control Limit (UCL) method. The study location is in Purbalingga, Central Java, Indonesia. Database of traffic accidents from January 2010 to December 2013 were obtained from Purbalingga Police. The results showed that the equivalent accident number for death victims or fatality is 10, a serious injury is 4.25, a slight injury is 2.33, and property damaged only is 1. Seven roads have weighted accident number value greater than the upper control limit value and identified as a black spot location. Black spot location in Purbalingga district are Jln. Raya turut Desa Bojongsari, Jln. Raya turut Desa Jetis, Jln. Raya Bayeman, Desa Tlahab Lor; Jln. Raya Mayjend. Sungkono, Blater; Jln. Raya turut Desa Penaruban; Jln. Raya turut Desa Kembangan and Jln. Raya turut Desa Gembong.

Full Text

Title: Routing discovery scheme for high mobility in MANET

Author (s):   Haider Alani and Raed Alsaqour

Abstract: Mobile Ad-hoc Network (MANET) is an important technology that is widely used in many applications. Routing discovery and route maintenance are important issues in MANET. Broadcasting is used in a MANET to discover a route in on-demand routing protocols. Establishment and regular maintenance of a route represent the challenges issue. Therefore, nodes require to broadcast control packets among themselves. This situation leads to broadcast storm problem, which increases overhead of control packets and decreases the performance of the network. In this paper, the Ad-hoc On-demand Distance Victor (AODV) routing protocol is used for implementing the propose scheme, namely AODV-Packet Timing Information (PTI), to reduce the unnecessary control packets for discovery routing. In addition, the proposed AODV-PTI scheme reduced the network overhead. Network Simulation version 2.35 (NS2.35) was used to compare the proposed scheme with AODV routing protocol in terms end-to-end delay, average throughput, packet delivery ratio, and packet overhead ratio.

Full Text

Title: Power speed reduction units for general aviation part 2: General design, optimum bearing selection for propeller driven aircrafts with piston engines

Author (s):   Luca Piancastelli and Stefano Cassani

Abstract: The power speed reduction unit (PSRU) is the device that is loaded by the generating unit and the thrusters. Propeller induced, gyroscopic and inertia loads are extremely important for PRSU bearing selection and life evaluation. Engine powers become easily a secondary factor for bearings and housing design. For this reason, it is important to select the best bearing assembly for the specific application with the required propeller. After a general discussion about PRSU and housing design, a very simplified method for bearing life calculation is introduced in this paper. It is based on similar, proven and extremely successful design of existing PRSUs. This method compares the life of this design with the new one. Aerobatics and general aviation loads are also compared. This paper demonstrates that the selection of a CFRP fixed pitch propeller for aerobatics keeps the load approximately to the same level of a general aviation aircraft. This is true in the case of plywood-reinforced off-the-shelf propeller for the general aviation load history. Aluminum alloy propellers are to be discarded for aerobatic use [1-2].

Full Text

Title: Semantic search using Latent Semantic Indexing and Word Net

Author (s):   Anita R., Subalalitha C. N., Abhilash Dorle and Karthick Venkatesh

Abstract: Semantic Search and Information Retrieval forms an integral part of various Search Engines in use. Famous search engines such as, Yahoo, Google, Lycos etc. use the concept of semantic search, where the only comparator for the objects under study is semantic similarity between the objects. The general method involves document-to-document similarity search. This sort of search involves the sequential search of documents one after the other, which involves

numerous noise effects. An efficient way of improving this technique is the Latent Semantic Indexing (LSI). LSI maps the words under study on a conceptual space. The conceptual space depends on the queries and the document collection. It uses a mathematical function to figure out the similarity between the words, something called as Singular Value Decomposition. It utilizes the words under study and the ones that are being compared and produces appropriate results. The results obtained are free of semantics like synonymy, polysemy etc. Integrating Word Net, a large lexical database of English language is an efficient way to increase the search result. The word under consideration is linked to the application and the semantic similarities of the word are found out. Documents similar to these similarities are then indexed and listed. The proposed model is tested with standard set of Forum for Information Retrieval (FIRE) documents and a comparison with the term based search has been done.

Full Text

Title: An efficient revocation scheme for stateless receiver with less encryption and less key storage

Author (s): Abdullah Rashed and Samir Hammami

Abstract: In the revocation scheme for stateless receivers, the center delivers information securely to the authorized users over a public channel, where the receivers do not update their state from session to session. This paper presents a view of multimedia Conditional Access Systems (CAS) one-way broadcasting and suggests a new approach. The proposed approach is an efficient revocation scheme for stateless receivers. It reduces the number of private keys used in traditional CAS and number of encryptions as it does not need to encrypt the ciphering keys. Furthermore, the presented approach eliminates the proposed key refreshment presented in (Zhang, Yang, Liu, Tian, 2009) and (Koo, Kwon, & Kim, 2005). The researchers applied the proposed system using AES algorithm. A numerical example is used to demonstrate the effectiveness of the presented approach.

Full Text

Title: Numerical analysis on the performance of a compact scroll compressor with vapor injection

Author (s): S. W. Jang and Y. L. Lee

Abstract: Applying vapor injection to refrigeration compressors may improve the heating capacity and COP. However, a small scroll compressor may not be commercialized due to the increase of the internal leakage and the production costs. In this study, a compact scroll compressor was considered to apply vapor injection for the improvement of the cycle efficiency. To this end, the performance of the compressor was numerically analyzed with vapor injection. The results show that vapor injection is still applicable to relatively small refrigerant compressors resulting in increased cooling capacity and COP.

Full Text

Title: A 0.5V low power single stage folded cascode amplifier for bio-signals

Author (s): D. Hari Priya, A. S. C. S. Sastry and K. S. Rao

Abstract: Long term monitoring and measurement of bio signals requires new techniques that promise light weight devices consuming low power and are maintenance free. The basic block in processing analog signal happens to be operational trans-conductance amplifier (OTA) and the design of sub-threshold OTA for low voltage low frequency applications consuming less power is proposed. With an operating voltage of 0.5V the gain achieved is 58dB and CMRR of 88.5dB. The input referred noise is measured as 1.159μV and the power consumption has 620nW. The circuit was implemented in 0.18μm technology using Cadence tool.

Full Text

Title: Analyze of pilot reuse with achievable sum rate for massive MIMO cellular uplink

Author (s): A. Salh, L. Audah, N. S. M. Shah and S. A. Hamzah

Abstract: The last ten years have seen important developments of massive multi-input multi-output (MIMO) in wireless communication. Massive MIMO has currently been presented in the 5G wireless standards. The number of terminals is increasing with additional appliances. At the same time, high transmission sum rates and communication reliability are required. Moreover, the multi-cell MMSE scheme, which includes an uplink MMSE and MRT precoder. Furthermore, this paper focuses how the MMSE activities all obtainable pilots for interference suppression. Specifically, this paper investigates the spectral efficiency of the massive MIMO, pilot contamination, which MMSE exploits all available pilots for interference suppression, and estimated locally at every BS, to actively suppress both intra-cell and inter-cell interference. Consequently, the average sum rate is proportional with SINR, using the linear scheme all of MMSE, ZF and optimal MMSE, while the sum rate is reverse proportional with linear precoding MRT. Then, when the number of base stations increases, the linear schemes MMSE, ZF and optimal MMSE have more convergence, while when the number of BS decreases the linear precoding schemes only have convergence except for MRT. However, at high SNR a higher number of antennas achieve better than a low number of antennas.

Full Text

Title: Airport classification based on freight ratio and Federal Aviation Administration (Case study in Indonesia)

Author (s): Gito Sugiyanto, Purwanto Bekti Santosa, Aris Wibowo and Mina Yumei Santi

Abstract: There are seven airports in Indonesia with production of cargo very high i.e.: Soekarno-Hatta Airport, Sentani Airport, Sultan Hasanuddin Airport, Kuala Namu Airport, Hang Nadim Airport, Juanda Airport, and Sultan Aji Muhammad Sulaiman Sepinggan Airport. The airfreight distribution in Indonesia spread unevenly. The solutions for freight shipments problem is evaluate the hub and spoke airport networks. The flight route in Indonesia has not been fully developed in accordance with the concept of hubs and spokes. The aim of this paper is to analysis the hub and spoke airport in Indonesia based on freight ratio and percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration. The freight ratio value for domestic flight from thirty-four airports 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of freight ratio value and the category as a freight interest airport or cargo interest. The freight ratio value for international flight from nineteen airports 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the

passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value and the category as a freight interest airport or cargo interest. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% to 38.229%. Total of cargo production for international flight is 370,240,491 kg. The percentage of cargo production for international flight is 0.002% to 88.162%. Soekarno-Hatta International Airport has the highest of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight.

Full Text

Title: Content based image classification and retrieval using Visual bag of Features and adaboost algorithm

Author (s): Parthiban S. and Srinivasa Raghavan S.

Abstract: This paper proposes the content based classification and retrieval of images using Visual bag of Features and adaboost classifier. The Visual bag of Features has been extracted from the input images and then the visual bag of features is classified using the adaboost classifier algorithm. The proposed algorithm greatly reduces the Storage cost and efficient search using the inverted data structure. The efficiency of the proposed algorithm is tested with Mean Opinion Score (MOS).

Full Text

Title: Image retrieval based on hybrid features

Author (s): Talluri Sunil Kumar, V. Vijaya Kumar and B. Eswara Reddy

Abstract: The present paper put forward efficient content-based image retrieval (CBIR) system by extracting structural, texture and local features from images. The local features are extracted from local directional pattern (LDP). The LDP produces a steady local edge response in the presence of noise, illumination changes. The LDP coded image is converted in to a ternary pattern image based on a threshold. The structural features are derived by extracting textons on the "local directional ternary pattern (LDTP") image. The texture features are derived by constructing grey level co-occurrence matrix (GLCM) on the derived texton image. Image retrieval results on various data base images based on various classifiers have proved the discrimination power of the proposed method over existing methods.

Full Text

Title: Automatic data processing system of renewable electric power prices in end-use residential sector of USA

Author (s): Maleeva E. A., Moshenets M. K. and Kritski O. L.

Abstract: We propose a computer-based automatic system of electric power prices processing and finding an optimal price level for renewable electric energy produced in USA. We implement classical Markowitz portfolio theory to electric energy prices in all regions of USA. For given margin volatility we find shares of electric power that should be bought in different US regions for making K.W.H. as cheap as possible for US residents.

Full Text

Title: Power Speed Reduction units for general aviation part 5: Housing/casing optimized design for propeller-driven aircrafts and helicopters

Author (s): Luca Piancastelli and Stefano Cassani

Abstract: The purpose of this paper is to focus on the design of casings for aircrafts and helicopters PSRU (Power Speed Reduction Unit). This paper introduces a rigorous and practical design procedure for gearboxes. The work starts from the experience of the Authors in Formula 1 and Aircraft gearboxes. For certification, safety and durability reasons, aircraft and helicopter gearboxes did not have the same development rate of the Formula 1 counterparts. A brief history of Formula 1 PRSU/gearboxes forms the first part of this paper. This part includes also an introduction to material and manufacturing technologies. Then the modal analysis of the gearbox is discussed, along with the influence of tolerances and operating temperatures. Then cooling is briefly introduced. The gear train is focus of the PSRU. Proper gear meshing in any load and environmental condition is the main requirement of the PSRU. Unfortunately gears and transmissions are the source of many forcing time-varying forces that act on the housing. This forces not only vary with tolerances, temperatures and loads, but also with wear. Therefore, a comparison of the natural frequency of the housing, the torsional critical speed of rotor system and the flexural critical speeds of each of the shafts with the exciting frequency clearly may be used to qualify the gearbox housing. A finite element modelling of the gearbox housing can be carried out to obtain its natural frequency, stress distribution and forced response. Unfortunately, the excitation frequencies vary with tolerances and operating conditions. Furthermore, in aircraft PRSUs, it is common practice to vary the transmission ratio (and the gears) in the same housing. Therefore, the housing should dampen a fairly large number of exciting frequencies. This result is obtained by curved surfaces, ribbing and double walling. This approach also reduces the noise produced by the transmission. In fact, noise radiated by a gearbox is directly related to the vibratory level of its housing. Therefore, an additional aim of this study is to analyze the transfer mechanisms between the static transmission error of a gear pair and the dynamic responses of gear and housing of a gearbox. Aerospace and Formula 1 transmissions have many similarities, with Aerospace engineers working on both sides and importing solution. The great advantage of Formula 1 gearboxes was (until the unlucky Regulations of 2010) that it was extremely easy to make experiments. This is due to the fact that all Formula 1 cars are prototypes with test pilots on board. Therefore, this paper will take advantage of the knowledge achieved in Formula 1 to transfer these data to aerospace PSRU and transmissions [1-2].

Full Text

Title: Rheological model parameters for bentonite drilling mud treated with local cassava starch

Author (s): Harry T. F., Joel O. F., Ademiluyi F. T. and Oduola K.

Abstract: Rheological model parameters were determined for bentonite muds treated with two local cassava starches (TMS 98/0581 and M98/0068) and an imported starch. The parameters were that of Power Law, Casson and Herschel-Bulkley models which predict the shear stress - shear strain rate relationships. Physicochemical properties were determined for

the starches. Herschel-Bulkley model provided the best correlation with experimental data, while Casson model was next. Correlation between Casson and Herschel models yield stresses was good. The yield stress was found to increase with increase in temperature and behaved differently with the starches. It was found to be highest at 1.0 percent M98/0068 starch concentration in the bentonite mud system. However, the yield stress did not differ significantly for the mud system with TMS 98/0581 starch concentrations. For the imported starch, the yield stress was highest at 2.0 percent concentration at 80oF and 120oF, while it was highest at 0.5 percent at 150oF and 190oF. The yield stresses ranged between 3 and 30 Pa for the bentonite starch mud systems investigated. The model parameters predicted the shear stress - shear rate relationships for bentonite-local polymer drilling mud system and supported the utilization of the local cassava starches as drilling fluid additives.

Full Text

Title: A SWOT analysis tool for Indonesian small and medium enterprise

Author (s):   Husni Thamrin, Rahmandani Herlambang, Bella Brylian, Aldino K. A. Gumawang and Agus Makmum

Abstract: Small and medium enterprises (SMEs) play important role in the growth and stabilization of Indonesian economy. SMEs face many challenges that affect their growth and existence. However, they rarely adopt strategic management planning such as SWOT analysis that considers the external environment for opportunities and threats and internal conditions for strengths and weaknesses. SME operators are somewhat aware of the factors but many have limited understanding of how to employ the analysis. In this work, we develop "Sparta", a SWOT analysis tool that is easy to operate by novice users. The tool has many features. A user needs only to input profile data and answer a set of questionnaire. From the answers, Sparta calculates strength and competitive posture, maps many aspects of SMEs condition into S, W, O and T categories and provides general strategies. Sparta helps doing the 8 steps of a normal

SWOT analysis session so that they can be executed in approximately 15 minutes, compared to hours when doing them manually.

Full Text

Title: Identification and quantification of anthocyanins in muscadine grapes by HPLC and HPLC-MS

Author (s):   Eduardo Pastrana-Bonilla and Casimir C. Akoh

Abstract: Total anthocyanin content and individual anthocyanin profile of ten cultivars of muscadine grapes were assessed. Total anthocyanin content was determined by a pH differential method. Individual anthocyanins were analyzed by HPLC and their identity confirmed by HPLC-MS. The total anthocyanin content and the sum of the individual anthocyanins had a high correlation ($R = 0.98$). The average anthocyanin content of muscadine grapes was lower than published values for red European and other American red grapes. However, the purple muscadine grapes have anthocyanins levels that may be considered important from the nutraceutical point of view.

Full Text

Title: SINR performance by combining Fractional Frequency Reuse and Dynamic Power Control methods based on simulation model

Author (s):   Mastura Rosdi, Azita Laily Yusof, Norsuzila Ya'acob and Darmawaty Mohd. Ali

Abstract: In order to cope with the increase in demand for stable and high data rates among mobile users, femtocell or called as Home Evolve Node B (HeNB) has been developed to improve indoor capacity and coverage. Femtocell is a small base station aims for indoor usage such as at home or enterprise. The femtocell transmits a cellular signal that is received by mobile users then backhauled through the user's wired broadband connection. It is very user deployed so it reduces operations cost for mobile operators, and at the same time provide a high user experiences to users. However, femtocell deployments caused interference between femtocells itself and also to the existing macrocells. This paper analyzed the interference management which are combining Fractional Frequency Reuse (FFR) and Dynamic Power Control (DPC) methods by looking on the Signal to Interference plus Noise Ratio (SINR) performance based on the proposed fraction of cell radius (r_{th}), fraction of system bandwidth (β) and path loss compensation factor (α) value in our previous papers. The proposed r_{th}, β and α are then used in the simulation model in order to analyzed the SINR performance between the proposed method and the conventional method. The simulation results showed that the proposed method gives the higher values of SINR and show that there is a significant reducing of interference occurrence compared to the conventional method.

Full Text

AIRPORT CLASSIFICATION BASED ON FREIGHT RATIO AND FEDERAL AVIATION ADMINISTRATION (CASE STUDY IN INDONESIA)

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ABSTRACT

There are seven airports in Indonesia with production of cargo very high i.e., Soekarno-Hatta International Airport, Sentani Airport, Sultan Hasanuddin International Airport, Kuala Namu International Airport, Hang Nadim International Airport, Juanda International Airport, and Sultan Aji Muhammad Sulaiman Sepinggan International Airport. The airfreight distribution in Indonesia spread unevenly. The solutions for freight shipments problem is evaluate the hub and spoke airport networks. The flight route in Indonesia has not been fully developed in accordance with the concept of hubs and spokes. The aim of this paper is to analysis the hub and spoke airport in Indonesia based on freight ratio and percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration. The freight ratio value for domestic flight from thirty-four airports is 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of freight ratio value and the category as a freight interest airport or cargo interest. The freight ratio value for international flight from nineteen airports is 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value and the category as a freight interest airport or cargo interest. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% to 38.229%. Total of cargo production for international flight is 370,240,491 kg. The percentage of cargo production for international flight is 0.002% to 88.162%. Soekarno-Hatta International Airport has the highest of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight.

Keywords: freight ratio, hub airport, federal aviation administration, cargo volume.

INTRODUCTION

There are seven airports in Indonesia with production of cargo very high i.e.: Soekarno-Hatta Airport, Sentani Airport, Sultan Hasanuddin Airport, Kuala Namu Airport, Hang Nadim Airport, Juanda Airport, and Sultan Aji Muhammad Sulaiman Sepinggan Airport. Soekarno-Hatta International Airport (SHIA) is the busiest airport in Indonesia and the 18th rank of the busiest airport in the world in 2015 [1]. In 2015, Soekarno-Hatta International Airport serving 41,773,510 passengers and 288,410,185 kg of goods for domestic flights and 12,221,498 passengers and 326,411,673 kg of goods for international flights. In Sumatra island, Kuala Namu International Airport is the busiest airport that serving 6,374,897 passengers and 37,413,257 kg of goods for domestic flights and 1,629,894 passengers and 4,215,927 kg of goods for international flights. Sultan Hasanuddin International Airport is the busiest airport in Sulawesi island that serving 8,538,901 passengers and 53,473,971 kg of goods. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan is the busiest airport in Kalimantan island that serving 4,004,026 passengers and 27,753,782kg of goods. Sentani Airport in Jayapura is the busiest airport in Papua island that serving 1,728,549 passengers and 130,616,171 kg of goods [2].

The Master plan for Acceleration and Expansion of Indonesia's Economic Development or Master plan Percepatandan Perluasan Pembangunan Ekonomi Indonesia (MP3EI) year 2011-2025 targets are support the acceleration economic corridor of Java as the center of industry and national services, strengthen national connectivity for local and global, and increased efficiency in transportation cost and logistics distribution effectiveness of air transport [3]. The airfreight distribution in Indonesia spread unevenly. The flight route in Indonesia has not been fully developed in accordance with the concept of hub and spokes [4]. Insufficient number of infrastructures, transportation costs that lead to high economic costs, and limited network and capacity are the problems in logistics service [5]. One of the efforts that can be done to perform air transportation network is determine the hub and spoke airports.

The aim of this paper is to analysis of hub and spoke airport networks in Indonesia based on cargo volume and percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration (FAA). Based on freight ratio value, airport can be classified in four types: full passenger airport, freight interest airport, freight specialist airport, and mixed passenger and freight airport. Fives airport classifications based on percentage of annual passenger boarding and cargo volume according to Federal Aviation Administration are large hub, medium hub, small hub, non-hub primary and non-primary commercial service [6].

LITERATURE

A) Hub and spoke network systems

A multi-objective model for the selection of a newly constructed hub and spoke system is proposed by Çiftçi and Sevkli [7] to maximize aircraft utilization and revenue whilst reducing the commercially infeasible network detour factor. The data includes unit passenger revenues and operating costs for the segments, distances between cities and hubs, expected load factors and flying times of segments.

Factors that affect the network structure of an airline are as follows: number of hubs, potential traffic at the hub cities, and location of the hub in order to minimize flying costs, good airport facilities, good weather facilities and strategy of competitors [8]. Discussions of airline competition analysis and network strategies in a hub and spoke system can be found in [9, 10, 11]. A location must have the four following features in order to be a hub i.e. traffic rights, short Minimum Connection Times (MCT), bi-directional connection and sufficient detour [12]. Traffic to regional air express and airfreight hubs is likely to respond in complex ways to fuel costs [13]. Air traffic punctuality is one of the most important criteria for choosing an air service [14].

Hub and spoke network systems have significant advantages for network carriers [15, Caves *et al*., 1984 in [7]. These include:

a) Consolidating passenger numbers and creating economies of density.
b) Decreasing the number of routes required to connect each pair of cities in a network.
c) Increasing the demand for frequent flights.
d) Consolidating the activities of personnel, maintenance, and operations.
e) Decreasing costs and increasing customer loyalty through airport domination.

B) Freight ratio

The number of hub flight is based on the number of spoke and inter-connected city [16]. Classification of airport as a hub or spoke can be classified based on Freight Ratio (FR). Freight ratioin kg per passenger is ratio between the number of cargo (kg) and the number of passenger boarding in the airport. The classification of airport based on freight ratio is follows:

a) Full passenger airport is airport with freight ratio (FR) value is very low.
b) Freight interest airport is airport with freight ratio (FR) value between 30-100 kg per passenger.
c) Freight specialist airport is airport with freight ratio (FR) value is more than 100 kg per passenger.
d) Mixed passenger and freight airport is airport with freight ratio (FR) value is 30 kg per passenger and the number of passenger boarding in the airport is high.

C) Federal aviation administration (FAA) classification of airport

The Federal Aviation Administration (FAA) has its own method for classifying whether an airport as a hub or non-hub. In Table-1 given the category of airports if used methods of grouping the FAA. In this method there are two criteria, the first criteria is airport classifications (commercial service and non-primary or except commercial service) and the second criteria is percentage of annual passenger boarding. Commercial service is publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service There are five categories of airport i.e. large hub airport, medium hub airport, small hub airport, non-hub primary airport, and non-primary commercial service airport [6].

Table-1. Classification of airport according to FAA[6].

Airport classifications		Hub type: Percentage of annual passenger boarding	Common name
Commercial service: Publicly owned airportsthat have at least 2,500passenger boardingseach calendar year andreceive scheduled passenger service	Primary: Have more than 10,000 passenger boardings each year	Large:1% or more	Large Hub
		Medium: at least 0.25%,but less than 1%	Medium Hub
		Small: at least 0.05%,but less than 0.25%	Small Hub
		Non-hub:More than 10,000,but less than 0.05%	Non-hub Primary
	Non-primary	Non-hub: at least 2,500and no more than 10,000	Non-primary Commercial Service
Non-primary (Except Commercial Service)		Not Applicable	

RESULT AND DISCUSSIONS

a. Hierarchy of airport

Hierarchy of airports in Indonesia as referred to Ministerial Decree of Transportation KM No. 11 (2010) in Article 9 (1) consists of hub airport and spoke airport. Hub airport is classified into three levels i.e.: primary hub, secondary hub and tertiary hub [17]. The hierarchy of thirty-four airports in Indonesia is shown in Table-2.

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Table-2. Hierarchy of thirty-four airports in Indonesia.

No.	Airports, City	Hierarchy of airport
1.	Sultan IskandarMuda, Banda Aceh	Tertiary hub
2.	Kuala Namu, Medan	Primary hub
3.	Minangkabau, Padang	Secondary hub
4.	Sultan SyarifKasim II, Pekanbaru	Secondary hub
5.	Hang Nadim, Batam	Primary hub
6.	Depati Amir, Pangkal Pinang	Tertiary hub
7.	Sultan Thaha, Jambi	Tertiary hub
8.	FatmawatiSoekarno, Bengkulu	Tertiary hub
9.	Sultan Mahmud Badaruddin II, Palembang	Secondary hub
10.	RadinInten II (Branti), Lampung	Tertiary hub
11.	HuseinSastranegara, Bandung	Tertiary hub
12.	Soekarno-Hatta, Jakarta	Primary hub
13.	Ahmad Yani, Semarang	Secondary hub
14.	AdiSumarmo, Solo	Secondary hub
15.	AdiSutjipto, Yogyakarta	Secondary hub
16.	Juanda, Surabaya	Primary hub
17.	NgurahRai, Denpasar	Primary hub
18.	Selaparang, Mataram	Secondary hub
19.	Eltari, Kupang	Secondary hub
20.	Supadio, Pontianak	Secondary hub
21.	TjilikRiwut, Palangkaraya	Tertiary hub
22.	Syamsuddin Noor, Banjarmasin	Secondary hub
23.	Sultan Aji Muhammad Sulaiman (Sepinggan), Balikpapan	Primary hub
24.	Juwata, Tarakan	Tertiary hub
25.	Sam Ratulangi, Manado	Primary hub
26.	Djalaluddin, Gorontalo	Secondary hub
27.	Mutiara, Palu	Secondary hub
28.	Tampa Padang, Mamuju	Tertiary hub
29.	Sultan Hasanuddin, Makassar	Primary hub
30.	WolterMonginsidi, Kendari	Secondary hub
31.	Pattimura, Ambon	Tertiary hub
32.	Sultan Babullah, Ternate	Tertiary hub
33.	Sentani, Jayapura	Secondary hub

No.	Airports, City	Hierarchy of airport
34.	Rendani, Manokwari	Tertiary hub

From Table-2, eight airports include primary hub i.e. Soekarno-Hatta International Airport Jakarta, Juanda International Airport Surabaya, Kuala Namu International Airport Medan, Hang Nadim International Airport Batam, NgurahRai International Airport Denpasar, Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport Balikpapan, Sultan Hasanuddin International Airport Makassar, and Sam Ratulangi International Airport Manado. There are 14 airports that include as secondary hub and 12 airports that include as tertiary hub [18]. Three secondary hub airports in Sumatra Islandare Minangkabau Airport in Padang, Sultan Syarif Kasim II Airport in Pekanbaru, and Sultan Mahmud Badaruddin II Airport in Palembang. Three secondary hub Airports in Java Island are Ahmad Yani Airport in Semarang, AdiSumarmo Airport in Solo, and AdiSutjipto Airport in Yogyakarta. Two secondary hub airports in Kalimantan Island are Supadio Airport in Pontianak and Syamsuddin Noor Airport in Banjarmasin. Three secondary hub airports in Sulawesi Island are Djalaluddin Airport in Gorontalo, Mutiara Airport in Palu, and Wolter Monginsidi Airport in Kendari. Sentani Airport is a secondary airport in Papua Island.

Flight route map of airport in Indonesia is shown in Figure-1. There are thirty-three provinces in this map and thirty-four airports. In Central Java Province, there are two airports, the first is Ahmad Yani in Semarang and the second is AdiSumarmo in Surakarta (Solo). The hierarchy of Ahmad Yani airport and AdiSumarmo airport are classified as a secondary hub airport. From Figure-1, Soekarno-Hatta International Airport is a central hub because all of the spoke cities in Indonesia fly into SHIA. There are route flights from SHIA to all cities in Indonesia. This result is in line with the findings of Sugiyanto *et al.*[18], based on Herfindahl-Hirschmann Index (HHI), the amount of domestic cargo hub is required for distribution logistics/cargo in Indonesia are two airports. Two airports with the largest cargo production, the first is Soekarno-Hatta International Airport in Jakarta and the second is Juanda International Airport in Surabaya [18].

Data required includes the production data of each airport, the number of passengers boarding (people), number of cargo production (kg) for domestic flights and international flights, these couple's flights from 34 airports for domestic flights and 19 airports for international routes pair. Data production of each of the airports is obtained from the Directorate General of Air Transportation, Ministry of Transportation Republic of Indonesia in 2016 [2]. This data was used to analyse the freight ratio value for domestic flight and international flight and airport classifications according to Federal Aviation Administration (FAA) method.
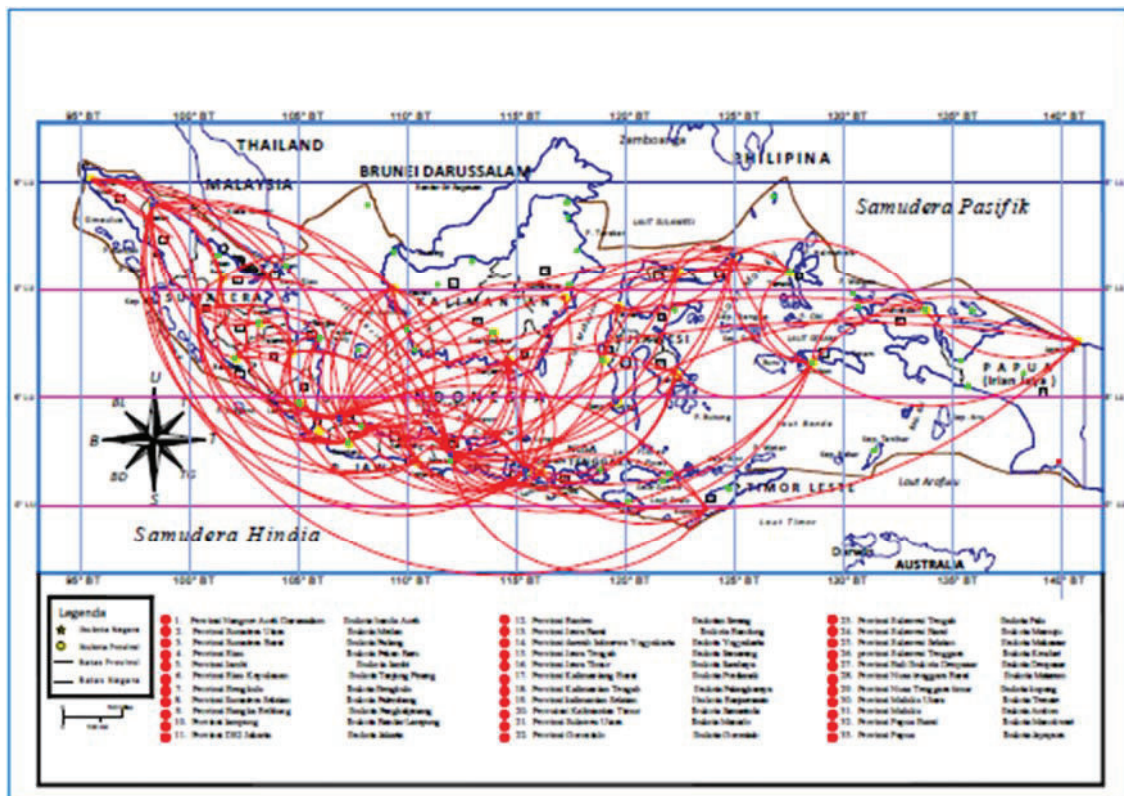
Figure-1. Flight route map of airport in Indonesia [5].

b. Freight ratio value for domestic flight

Freight ratio is ratio between the number of cargo (kg) and the number of passenger boarding in the airport.Freight ratio value for domestic flight from thirty-four airports in Indonesia is shown in Table-3. The highest value of cargo for domestic flight in Soekarno-Hatta International Airport is 288,410,185 kg. Number of passengers boarding from Soekarno-Hatta International Airport for domestic flight is 41,773,510 peoples. The freight ratio value for domestic flight in Soekarno-HattaInternational Airport is 6.904 kg/passenger. The freight ratio value for domestic flight from thirty-four airports in Indonesia is between 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of

freight ratio value (75.564 kg per passenger) for domestic flight and the category as a freight interest airport or cargo interest. Based on the freight ratio value for domestic flight, Supadio Airport in Pontianak, West Kalimantan and Tampa Padang Airport in Mamuju, West Sulawesi as a full passenger airport because the freight ratio (FR) value is very low.The freight ratio value in Tampa Padang Airport is 0.443 kg/passenger. There are thirty-one airport in Indonesia include in mixed passenger and freight airport category with the lowest freight ratio value is 1.959 kg per passenger in NgurahRai International Airport, Denpasarand the highest is 7.196 kg per passenger in Hang Nadim International Airport, Batam.

Table-3. Freight ratio value for domestic flight from thirty-four airports in Indonesia.

No.	Airport	Number of passengers boarding (people)	Number of cargo (kg)	Freight ratio (kg/passenger)	Category
1.	Sultan IskandarMuda	611,881	3,572,254	5.838	Mixed Passenger and Freight Airport
2.	Kuala Namu	6,374,897	37,413,257	5.869	Mixed Passenger and Freight Airport
3.	Minangkabau	2,937,780	9,372,979	3.190	Mixed Passenger and Freight Airport
4.	Sultan SyarifKasim II	2,504,666	9,308,292	3.716	Mixed Passenger and Freight Airport
5.	Hang Nadim	4,590,854	33,035,468	7.196	Mixed Passenger and Freight Airport
6.	Depati Amir	1,636,319	6,671,234	4.077	Mixed Passenger and Freight Airport

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7.	Sultan Thaha	1,168,219	6,088,310	5.212	Mixed Passenger and Freight Airport
8.	FatmawatiSoekarno	590,982	2,034,146	3.442	Mixed Passenger and Freight Airport
9.	S.M. Badaruddin II	3,038,130	11,854,587	3.902	Mixed Passenger and Freight Airport
10.	RadinInten II (Branti)	1,419,342	4,437,830	3.127	Mixed Passenger and Freight Airport
11.	Husein Sastranegara	2,493,761	6,401,393	2.567	Mixed Passenger and Freight Airport
12.	Soekarno-Hatta	41,773,510	288,410,185	6.904	Mixed Passenger and Freight Airport
13.	Ahmad Yani	2,558,957	11,008,548	4.302	Mixed Passenger and Freight Airport
14.	Adi Sumarmo	610,039	2,841,117	4.657	Mixed Passenger and Freight Airport
15.	Adi Sutjipto	3,507,317	10,477,826	2.987	Mixed Passenger and Freight Airport
16.	Juanda	7,094,450	31,763,155	4.477	Mixed Passenger and Freight Airport
17.	NgurahRai	9,024,656	17,680,795	1.959	Mixed Passenger and Freight Airport
18.	Selaparang	1,632,235	6,536,373	4.005	Mixed Passenger and Freight Airport
19.	Eltari	624,416	2,241,050	3.589	Mixed Passenger and Freight Airport
20.	Supadio	2,639,562	2,495,401	0.945	Full Passenger Airport
21.	TjilikRiwut	642,330	3,587,391	5.585	Mixed Passenger and Freight Airport
22.	Syamsuddin Noor	1,647,229	11,533,966	7.002	Mixed Passenger and Freight Airport
23.	Sultan Aji Muhammad Sulaiman(Sepinggan)	3,966,206	25,926,867	6.537	Mixed Passenger and Freight Airport
24.	Juwata, Tarakan	983,893	6,888,095	7.001	Mixed Passenger and Freight Airport
25.	Sam Ratulangi	930,517	5,378,145	5.780	Mixed Passenger and Freight Airport
26.	Djalaluddin	381,082	2,295,757	6.024	Mixed Passenger and Freight Airport
27.	Mutiara	672,698	3,075,858	4.572	Mixed Passenger and Freight Airport
28.	Tampa Padang	48,494	21,488	0.443	Full Passenger Airport
29.	Sultan Hasanuddin	8,436,271	52,491,364	6.222	Mixed Passenger and Freight Airport
30.	WolterMonginsidi	662,468	3,123,571	4.715	Mixed Passenger and Freight Airport
31.	Pattimura	588,517	3,168,744	5.384	Mixed Passenger and Freight Airport
32.	Sultan Babullah	274,488	1,692,400	6.166	Mixed Passenger and Freight Airport
33.	Sentani	1,728,549	130,616,171	75.564	Freight Interest Airport or Cargo Interest
34.	Rendani	497,736	978,148	1.965	Mixed Passenger and Freight Airport

c. Freight ratio value for international flight

Freight ratio value for international flight from nineteenairports in Indonesia is shown in Table-4. The highest value of cargo for international flight in Soekarno-Hatta International Airport is 326,411,673 kg. Number of passengers boarding from Soekarno-Hatta International Airport for international flight is 12,221,498 peoples. The freight ratio value for international flight in Soekarno-HattaInternational Airport is 26.708 kg/passenger.The freight ratio value for international flight from nineteen airports in Indonesia is 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value (48.306 kg per passenger) for international flight and the category as a freight interest airport or cargo interest. Based on freight ratio value for international flight, Sultan IskandarMuda Airport in Banda Aceh and Supadio Airport in Pontianak, West Kalimantan as a full passenger airport because the freight ratio (FR) value is very low.The freight ratio value in Supadio Airport is 0.182 kg/passenger. There are six-teen airports in Indonesia include in mixed passenger and freight airport category with the freight ratio value 1.330 kg per passenger in Hussein Sastranegara International Airport, Bandung, West Java to 29.086 kg per passenger in Hang Nadim International Airport, Batam.

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Table-4. Freight ratio value for international flight from nine-teen airports in Indonesia.

No.	Airport	Number of passengersboarding (people)	Number of cargo (kg)	Freight ratio (kg per passenger)	Category
1.	Sultan IskandarMuda	109,846	80,241	0.730	Full Passenger Airport
2.	Kuala Namu	1,629,894	4,215,927	2.587	Mixed Passenger and Freight Airport
3.	Minangkabau	89,455	784,875	8.774	Mixed Passenger and Freight Airport
4.	Sultan SyarifKasim II	447,858	1,179,191	2.633	Mixed Passenger and Freight Airport
5.	Hang Nadim	60,589	1,762,264	29.086	Mixed Passenger and Freight Airport
6.	S.M. Badaruddin II	108,872	236,881	2.176	Mixed Passenger and Freight Airport
7.	HuseinSastranegara	653,046	868,709	1.330	Mixed Passenger and Freight Airport
8.	Soekarno-Hatta	12,221,498	326,411,673	26.708	Mixed Passenger and Freight Airport
9.	Ahmad Yani	99,301	244,555	2.463	Mixed Passenger and Freight Airport
10.	AdiSumarmo	100,808	146,218	1.450	Mixed Passenger and Freight Airport
11.	AdiSutjipto	140,232	605,414	4.317	Mixed Passenger and Freight Airport
12.	Juanda	1,741,297	21,864,736	12.557	Mixed Passenger and Freight Airport
13.	NgurahRai	4,040,994	8,759,059	2.168	Mixed Passenger and Freight Airport
14.	Selaparang	5,992	93,489	15.602	Mixed Passenger and Freight Airport
15.	Supadio	48,332	8,774	0.182	Full Passenger Airport
16.	Sultan Aji Muhammad Sulaiman(Sepinggan)	37,820	1,826,915	48.306	Freight interest airport or Cargo Interest
17.	Juwata, Tarakan	4,601	12,801	2.782	Mixed Passenger and Freight Airport
18.	Sam Ratulangi	27,532	164,111	5.961	Mixed Passenger and Freight Airport
19.	Sultan Hasanuddin	102,630	982,607	9.574	Mixed Passenger and Freight Airport

d. FAA classification

Airport classifications according to FAA method based on percentage of annual passenger boarding and cargo volume [6]. The percentage value of cargo production in Indonesia for domestic flight from thirty-four airports and international flight from nineteen airports is shown in Table-5. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% in Tampa Padang Airport, Mamuju to 38.229% in Soekarno-Hatta International Airport (SHIA). Soekarno-Hatta International Airport has the category as a large hub because SHIA have the commercial service (publicly owned airports that have at least 2,500 passenger boarding each calendar year and receive scheduled passenger service and have more than 10,000 passenger boarding each year. There are 41,773,510 passengers boarding from SHIA for domestic flight and 12,221,498 passengers for international flight. Based on the percentage of cargo production for domestic flight, 14 airports in large hub category (Kuala Namu Airport, Minangkabau Airport, Sultan SyarifKasim II Airport, Hang Nadim Airport, Sultan Mahmud Badaruddin II Airport, Soekarno-Hatta Airport, Ahmad Yani Airport,

AdiSutjipto Airport, Juanda Airport, NgurahRai Airport, Syamsuddin Noor Airport, Sultan Aji Muhammad Sulaiman(Sepinggan) Airport, Sultan Hasanuddin Airport, and SentaniAirport). Seven-teen airports in medium hub category with the percentage of annual passenger boarding0.27% in FatmawatiSoekarno Airport to 0.913% in Juwata Airport. Two airports in small hub category (Sultan Babullah Airport and Rendani Airport) and one airport in non-hub primary category (Tampa Padang Airport).

Total of cargo production for international flight is 370,240,491 kg. The highest value of total of cargo production is in Soekarno-Hatta International Airport with the amount of 326,411,673 kg. The percentage of cargo production for international flight is 0.002% in Supadio Airport, Pontianak to 88.162% in Soekarno-Hatta Airport. Soekarno-Hatta International Airport has the highest of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight. For international flight, there are four airports with category in large hub (Kuala Namu International Airport, Soekarno-Hatta International Airport, Juanda International Airport, and NgurahRai International Airport). Four

airports in medium hub category with the percentage value of cargo production 0.265% to 0.493% (Sultan SyarifKasim II International Airport, Hang Nadim International Airport, Sultan Aji Muhammad Sulaiman(Sepinggan) International Airport and Sultan Hasanuddin International Airport). There are five airports in small hub category (Minangkabau International Airport, Sultan Mahmud Badaruddin II International Airport, HuseinSastranegara International Airport, Ahmad Yani International Airport, and AdiSutjipto International Airport). There are four airports with category in non-hub primary (Sultan Iskandar Muda International Airport, AdiSumarmo International Airport, Supadio International Airport and Sam Ratulangi International Airport) and two airports in non-primary commercial service category (Selaparang International Airport and Juwata International Airport).

Table-5. Category of thirty-four airports for domestic flight and nineteen airports for international flight according to FAA.

No.	Airport	Domestic flight			International flight		
		Cargo production (kg)	Percentage	Classification according to FAA	Cargo production (kg)	Percentage	Classification according to FAA
1.	Sultan IskandarMuda	3,572,254	0.474%	Medium Hub	80,241	0.022%	Non-hub primary
2.	Kuala Namu	37,413,257	4.959%	Large Hub	4,215,927	1.139%	Large Hub
3.	Minangkabau	9,372,979	1.242%	Large Hub	784,875	0.212%	Small Hub
4.	Sultan SyarifKasim II	9,308,292	1.234%	Large Hub	1,179,191	0.318%	Medium Hub
5.	Hang Nadim	33,035,468	4.379%	Large Hub	1,762,264	0.476%	Medium Hub
6.	Depati Amir	6,671,234	0.884%	Medium Hub	-	-	-
7.	Sultan Thaha	6,088,310	0.807%	Medium Hub	-	-	
8.	FatmawatiSoekarno	2,034,146	0.270%	Medium Hub	-	-	-
9.	S.M. Badaruddin II	11,854,587	1.571%	Large Hub	236,881	0.064%	Small Hub
10.	RadinInten II (Branti)	4,437,830	0.588%	Medium Hub	-	-	-
11.	Husein Sastranegara	6,401,393	0.849%	Medium Hub	868,709	0.235%	Small Hub
12.	Soekarno-Hatta	288,410,185	38.229%	Large Hub	326,411,673	88.162%	Large Hub
13.	Ahmad Yani	11,008,548	1.459%	Large Hub	244,555	0.066%	Small Hub
14.	Adi Sumarmo	2,841,117	0.377%	Medium Hub	138,269	0.037%	Non-hub primary
15.	Adi Sutjipto	10,477,826	1.389%	Large Hub	605,414	0.164%	Small Hub
16.	Juanda	31,763,155	4.210%	Large Hub	21,864,736	5.906%	Large Hub
17.	NgurahRai	17,680,795	2.344%	Large Hub	8,759,059	2.366%	Large Hub
18.	Selaparang	6,536,373	0.866%	Medium Hub	93,489	0.025%	Non-primary Commercial Service
19.	Eltari	2,241,050	0.297%	Medium Hub	-	-	-
20.	Supadio	2,495,401	0.331%	Medium Hub	8,774	0.002%	Non-hub primary
21.	TjilikRiwut	3,587,391	0.476%	Medium Hub	-	-	-
22.	Syamsuddin Noor	11,533,966	1.529%	Large Hub	-	-	-
23.	Sultan Aji Muhammad Sulaiman(Sepinggan)	25,926,867	3.437%	Large Hub	1,826,915	0.493%	Medium Hub
24.	Juwata	6,888,095	0.913%	Medium Hub	12,801	0.003%	Non-primary Commercial Service
25.	Sam Ratulangi	5,378,145	0.713%	Medium Hub	164,111	0.044%	Non-hub

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No.	Airport	Domestic flight			International flight		
		Cargo production (kg)	Percentage	Classification according to FAA	Cargo production (kg)	Percentage	Classification according to FAA
							primary
26.	Djalaluddin	2,295,757	0.304%	Medium Hub	-	-	-
27.	Mutiara	3,075,858	0.408%	Medium Hub	-	-	-
28.	Tampa Padang	21,488	0.003%	Non-hub Primary	-	-	-
29.	Sultan Hasanuddin	52,491,364	6.958%	Large Hub	982,607	0.265%	Medium Hub
30.	WolterMonginsidi	3,123,571	0.414%	Medium Hub	-	-	-
31.	Pattimura	3,168,744	0.420%	Medium Hub	-	-	-
32.	Sultan Babullah	1,692,400	0.224%	Small Hub	-	-	-
33.	Sentani	130,616,171	17.313%	Large Hub	-	-	-
34.	Rendani	978,148	0.130%	Small Hub	-	-	-
	Total of cargo production (kg)	754,422,165		Total of cargo production (kg)	370,240,491		

CONCLUSIONS

The airfreight distribution in Indonesia spread unevenly. The solutions for freight shipments problem is evaluate the hub and spoke airport networks. The freight ratio value for domestic flight from thirty-four airports is 0.443 to 75.564 kg per passenger. Sentani Airport in Jayapura has the highest of freight ratio value and the category as a freight interest airport or cargo interest. The freight ratio value for international flight from nineteen airports is 0.182 to 48.306 kg per passenger. Sultan Aji Muhammad Sulaiman (Sepinggan) International Airport in Balikpapan, East Kalimantan has the highest of freight ratio value and the category as a freight interest airport or cargo interest. Total of cargo production for domestic flight is 754,422,165 kg. The percentage of cargo production for domestic flight from thirty-four airports in Indonesia is 0.003% to 38.229%. Total of cargo production for international flight is 370,240,491 kg. The percentage of cargo production for international flight is 0.002% to 88.162%. Soekarno-Hatta International Airport has the highest value of percentage of cargo production. The percentage of cargo volume in Soekarno-Hatta International Airport is 38.229% for domestic flight and 88.162% for international flight.

REFERENCES

[1] Airports Council International (ACI). 2016. Releases preliminary world airport traffic rankings. Retrieved on 2016-06-16http://www.aci.aero/News/Releases/Most-Recent/2016/04/04/ACI-releases-preliminary-world-airport-traffic-rankings.

[2] Ministry of Transportation Republic of Indonesia. Lalu Lintas Angkutan Udara. Jakarta: Directorate General of Air Transport Republic of Indonesia, Retrieved on 2016-03-15 http://hubud.dephub.go.id/?id/produksi/index.

[3] Indonesia Coordinator Ministry of Economy, Republic of Indonesia. 2011. Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia Tahun 2011-2025 (The Master plan for Acceleration and Expansion of Indonesia's Economic Development year 2011-2025), Jakarta, Indonesia.

[4] Sugiyanto,G., Santosa, P.B., Wibowo,A. and Santi,M.Y. 2015. Analysis of Hub-and-Spoke Airport Networks in Java Island, Indonesia based on Cargo Volume and Freight Ratio. Procedia Engineering. 125: 556-563. doi:10.1016/j.proeng.2015.11.061.

[5] Ministry of Transportation Republic of Indonesia. 2012. Studi Kelayakan Hub dan Spoke Distribusi Logistik Angkutan Udara. Jakarta: Directorate General of Air Transport Republic of Indonesia.

[6] Federal Aviation Administration (FAA), Airport Categories, Retrieved on 2015-03-04 http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/.

[7] Çiftçi M.E. and Sevkli M. 2015. A new hub and spoke system proposal: A case study for Turkey's aviation industry. Journal of Air Transport Management. 47(2015): 190-198.

[8] Martın J.C. and Roman C. 2004. Analysing competition for hub location in intercontinental aviation markets. Transportation Research Part E: Logist. Transp. Rev. 40(2): 135e150. http://dx.doi.org/10.1016/s1366-5545(03)00037-1.

[9] Hansen M. 1990. Airline competition in a hub-dominated environment: an application of noncooperative game theory. Transportation Research Part B: Methodol. 24(1): 27e43. http://dx.doi.org/10.1016/0191-2615(90)90030-3.

[10] Hong S. and Harker P.T. 1992. Air traffic network equilibrium: toward frequency, price and slot priority analysis. Transportation Research Part B: Methodol. 26(4): 307e323. http://dx.doi.org/10.1016/0191-2615(92)90040-4.

[11] Adler N. 2001. Competition in a deregulated air transportation market. Eur. J. Oper. Res. 129(2): 337e345.http://dx.doi.org/10.1016/S0377-2217(00)00231-9.

[12] Goedeking P. 2010. Networks in Aviation: Strategies and Structures. Springer-Verlag Berlin Heidelberg. Retrieved on 2016-07-16http://refhub.elsevier.com/S0969-6997(15)00069-15/sref16.

[13] O'Kelly M.E. 2014. Air freight hubs in the FedEx system: Analysis of fuel use. Journal of Air Transport Management. 36: 1-12.

[14] Ha Man-Seok, Namgung Jung-II, and Park Soo-Hyun. 2015. Analysis of Air-Moving on Schedule Big Data based on Crisp-Dm Methodology. ARPN Journal of Engineering and Applied Sciences. 10(5): 2088-2091.

[15] Brueckner J.K., Spiller P.T. 1994. Economies of traffic density in the deregulated airline industry. J. Law Econ. 37(2): 379e415. http://dx.doi.org/10.2307/725737.

[16] Graham, B. 1998. International Air Transport in Hoyle. Modern Transport Geography 2nd edition, 374 p. Wiley, Chi Chester.

[17] Peraturan Menteri Perhubungan Republik Indonesia Nomor: KM 11 Tahun 2010 tentang Tatanan Kebandarudaraan Nasional. Ministry of Transportation Republic of Indonesia.

[18] Sugiyanto, G., Santosa, P.B., Wibowo, A. and Santi, M.Y.2016. Hub and Spoke Airport Networks in Indonesia Based on Herfindahl-Hirschmann Index (HHI). Journal of Engineering and Applied Sciences. 11(8): 1804-1810.