"Strengthening Nation Competitiveness through Intelligent Computing in the Current Digital Disruption Era"
2018 Third international Conference on Informatics and Computing (ICIC)

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Message from the General Chair

Our understanding of the shifts that disrupt businesses, industries, and sectors has profoundly improved over the past 30 years. We know far more about how to identify the shifts and what dangers their pose in the Disruption technology, although, there is still a need to better understand the nature of disruptions and their relationship to emerging technology. A disruptive technology displaces an established technology and shakes up the ground-breaking product and innovation that creates a completely new industry. “Emerging technology”, “disruptive innovation”, and “disruptive technology” have evolved as frequently used concepts in scientific literature on Science, Technology and Innovation. In many contexts, including academic and professional literature, the usage of these concepts may obfuscate their meaning to researchers and practitioners.

Considering these intelligent computing innovation and disruptive innovation, The 3rd International Conference on Informatics and Computing (ICIC 2018) has its theme as “Strengthening Nation Competitiveness through Intelligent Computing in the Current Digital Disruption Era. Our goal is to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results on all aspects of Informatics Engineering, Computing Science, Information Science, and Software Engineering, in relation to disruptive technology. The hot topics such as Artificial Intelligence, Internet of Thing, Blockchain, 5G using Massive MIMO, Wireless Sensor Network, e-Commerce, etc. will be discussed in 5 sessions and 6 parallel tracks of ICIC 2018.

The ICIC 2018 received a total of 312 submitted papers and each paper went through a thorough reviewing process to get at least three independent reviews. After a careful and rigorous selected process, we decided to accept 157 papers for the presentation in the main technical program. The acceptance rate of the paper for the conference was thus 50%. The paper presentations are organized into 30 sessions in total on the 17-18 October 2018. On top of the regular paper presentations, ICIC 2018 also features three keynote speeches delivered by internationally-renowned researchers; Dr. Gerard Borg from the Australian National University, Canberra, Australia, Dr. Thomas from Germany, and Prof. Dr. Zainal A. Hasbi from University of Indonesia, who is also the Chair of APJKOM.

ICIC 2018 attract researchers from 15 countries as authors and reviewers, i.e. Australia, France, Germany, Greece, India, Indonesia, Japan, Malaysia, Morocco, Oman, Nige, Netherlands, Philippines, Saudi Arabia, Sweden, ICIC 2018 has received submission from 919 authors, and we also supported by 91 reviewers.

As a general chair, I cordially welcome all participants to ICIC 2018. We are blessed to have competent and dedicated organizers, so I would like to thanks to APJKOM and University of Bina Darma as the host of ICIC 2018 and also to 12 co-hosts and co-sponsors from higher education institutions, i.e. Samporna University, STIKI Bandung Mandiri, Universitas Budi Luhur, STIKI Bina Insani, Universitas Dian Nusantara, STIKOM Bol, STIKOM Slipi, Universitas Parahyangan, STIKI Tasikmalaya, Universitas Pasundan.

In ICIC 2018, the participants can find new colleagues and new opportunity to make this conference as a fruitful conference. We trust that all participants will enjoy an intellectual and stimulating discussion during the conference that allow them to move forward in contributing their research work to the body of knowledge in Computer Engineering, Computing Science, Information Science, and Software Engineering.

Thank you.

Prof. Dr. Teddy Mantoro, SMIEEE
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General Chair
Teddy Mantoro, APTIKOM, Indonesia

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• Michel Paindavoine, Burgundy University, France
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• Murni Mahmud, International Islamic University Malaysia, Malaysia
• Naufal M. Saad, Universiti Teknologi Petronas, Malaysia
• Normaziah Azis, International Islamic University Malaysia, Malaysia
• Norshida Mohammad, Prince University, Saudi Arabia
• Paulus Insap Santosa, Gajah Mada University, Indonesia
• Prihandoko, Gunadarma University, Indonesia
• Rila Mandala, Bandung Institute of Technology, Indonesia
• Sabir Jacquir, Universite de Bourgogne, France
• Salwani BTE Mohd Daud, Universiti Teknologi Malaysia, Malaysia
• Shelvie Neyman, Institut Pertanian Bogor, Indonesia
• Supriyanto, Universitas Gunadarma, Indonesia
• Toei Sutikno, Ahmad Dahlan University, Indonesia
• Tubagus Maulana Kusuma, Gunadarma University, Indonesia
• Untung Rahardja, STIMIK Rahardja Banten, Indonesia
• Vincent Vajnowzki, Universite de Bourgogne, France
• Waralak Siricharoen, University of the Thai Chamber of Commerce, Thailand
• Wendi Usino, Budi Luhur University, Indonesia
• Wisnu Jatmiko, University of Indonesia, Indonesia
• Youssef Zaz, Abdelmalek Essaadi University, Morocco
• Yusuf Yudi Prayudi, Universitas Islam Indonesia, Yogjakarta, Indonesia
• Yugo Isal, University of Indonesia, Indonesia
Keynotes

Strengthening Nation Competitiveness through Intelligent Computing in the Current Digital Disruption Era

Prof. Dr. Zamal A. Hasbuan
Professor of Computer Science, University of Indonesia
Chairman of Indonesian Association of Computing and Informatics Higher Education (APTIKOM)

Abstract
Life-time of technology become shorter and get outdated easily. What we learn and the way we learn change faster than ever. Despite internal and external barriers, such as poor management, logistics digital payment infrastructure and so forth, Indonesian e-business economy seems to be thriving. Current studies show that there are still a lot of opportunities for Indonesia to shift to digital economy without jeopardizing the existing ones. Stand-alone research is a past. Now research is moving towards research collaborations in multi-disciplinary. The use of intelligent computing in multi-disciplinary research produces industry 4.0 technologies that create disruption in our daily life. These disruptive knowledge and technology are driven by a big volume of data, variety of data, velocity of data, and veracity of data. The constraint on memory size, computing power, sampled data are no longer exist. The data volume collected based on continuous spatial and temporal is growing with an unthinkable speed and with a very high variety, although the validity is questionable. However with a sophisticated algorithm in data analytic, deep learning, and intelligent system, the research results show promising solutions to many problems and creates opportunities to improve nation competitiveness.
Globalization, Artificial Intelligence and Education

Dr. Thomas Götz
Germany

Abstract
As a country and nation that is multi-ethnic, multi-religious, and multi-cultural, Indonesia continues to carry out dynamics in political, religious, social and cultural life. This dynamics is influenced by the process of globalization, religious change, cultural diversity and the implementation of political democracy. This talk will discuss the how the globalization is affected and supported by AI and education, and how it is going to influence a multi-cultural country like Indonesia.
Introduction to ANU-MIMO: a Wireless Network Infrastructure for Remote Populations

Dr. Gerard Borg - Australian National University College of Science

Abstract
ANU-MIMO is a scalable, distributed wireless MIMO network designed for decentralised deployment by a community. By leveraging existing back-haul, users can use ANU-MIMO to build a large-scale broadband wireless network. In this talk, we present the case for ANU-MIMO as a key enabler for the democratisation of the Internet infrastructure. We introduce its key technical ideas and present some case studies for Indonesia.

Dr. Gerard Borg is a research scientist and senior lecturer in wireless and radiofrequency engineering at the Australian National University. He received a PhD in Physics from the University of Sydney. Over his career, he has worked in various fields including fusion plasma research, fundamental physics of plasma, rf-based diagnostics, Internet-of-Things and wireless. He is the inventor of the plasma antenna and various radiofrequency circuit components. His current areas of focus include fixed wireless access, radiofrequency tracking and distributed systems. Gerard is a strong advocate for the democratisation of the Internet infrastructure and has invented ANU-MIMO, a technology to deliver low cost license-free broadband to everyone.
# PROGRAM SCHEDULE

| 16 October 2018                                      |
|------------------------------------------------------|
| 13:00-18:00  | Transfer from airport to main hotel and registration |

| 17 October 2018                                      |
|------------------------------------------------------|
| 07:30-08:15  | Registration                                          |
| 08:15-09:15  | Opening session of the ICIC 2018*                   |
| 08:15-08:22  | Welcoming Remark by General Chair Prof. Dr. Teddy Mantoro |
| 08:22-08:30  | Remark from Aplikom Prof Dr. Zainal Hasibuan         |
| 08:30-08:40  | Welcoming Remark from the Host-Rector UBD            |
| 08:40-08:55  | Traditional Dance                                    |
| 08:55-09:05  | Opening Remark by the Governor of South Sumatera or Mayor of Palombang |
| 09:05-09:15  | Official opening of the ICIC 2018 and Photo Session  |
| 09:15-09:30  | Coffee Break                                         |
| 09:30-10:25  | Keynote Speech 1**                                   |
| 10:30-12:00  | Technical Session 1 – TS1 (Parallel: 6 tracks)       |
| 12:00-13:05  | Lunch Break                                          |
| 13:10-14:10  | Keynote Speech 2**                                   |
| 14:15-15:55  | Technical Session 2 – TS2 (Parallel: 6 tracks)       |
| 15:55-16:15  | Coffee Break                                         |
| 14:15-15:55  | Technical Session 3 – TS3 (Parallel: 6 tracks)       |
| 18:10-19:00  | Break                                                |
| 19:00-21:30  | Gala Dinner                                          |
| Time          | Event                                              |
|--------------|----------------------------------------------------|
| 07.15-08.55  | Technical Session 4 – TS4 (Parallel: 6 tracks)     |
| 08.55-09.55  | Keynote Speech 3**                                 |
| 09.55-10.10  | Coffee Break                                       |
| 10.10-11.30  | Technical Session 5 – TS5 (Parallel: 6 tracks)     |
| 11.30-12.00  | Closing and Best papers announcement*              |
| 12.00-13.00  | Lunch and Disperse (Go to Munas Aptikom Opening)   |
### Technical Session Schedule

#### Technical Session-1

| Track 1 |
|---------|
| PaperID114 | Texture Feature Extraction Based On GLCM and DWT for Beef Tenderness Classification  
Sigit Widyanto, Santuwin Madenda, Eri Prasetyo Wibowo, Yuhara Sukra and Dini Ti Wardani  
| PaperID119 | Data Mining Classification of Intelligence Quotient in High School Students  
Des Suryani, Ause Labellepanas, Setia Wulandari and Ahmad Hidayat  
| PaperID114 | Feature Extraction Using Histogram of Oriented Gradient and Hu Invariant Moment for Face Recognition  
Eri Prasetyo Wibowo, Sandi Agung Harsono and Robby Kurniawan Harahap  
| PaperID148 | Deep Learning Long-Short Term Memory for Indonesian Speech Digit Recognition using LPC and MFCC Feature  
Erics Rachmat Swedia, Achmad Benny Mutara, Muhammad Subari, Ernasulti |

| Track 2 |
|---------|
| PaperID290 | Educational Data Mining (EDM) as a Model For Students's Evaluation in Learning Environment  
Nurul Hidayat, Retantiyo Wardoyo and Adean SIN  
| PaperID269 | Critical Success Factors for Project Management Office: an Insight from Indonesia  
Teguh Rahago, Betty Parwansari, Rif Satra and Its Solichah  
| PaperID293 | Webuse Usability Testing for Farmer and Farmer Group Data Collection System  
Halmi Budi Santoso, Rosa Delima and Wahyuini  
| PaperID296 | Comparison of Two Methods Between TOPSIS and MAUT in Determining BIDIKMISI Scholarship  
Ramadani, Heliza Rahmania Haifa, Nurta Norsia and Azaini  
| PaperID301 | Evaluation of User Engagement in E-learning Standardization and Conformity Assessment Using Subjective and Objective Measurement  
Lintang Yuniar Benrowati and Komang Anom Budi Utama |
| Track 3 |
|---------|
| PaperID236 | Integration of Region-based Open Data Using Semantic Web |
| A.A. Gede Yuwidi Paramantra, Kadek Yota Emanda Aryanto and Gede Rasben Darmerta |
| PaperID173 | Cloud-based e-Business Framework for Small and Medium Enterprises: Literature Review |
| H. Made Satria Irawan, Harry B. Santoso and Zainal A. Hasibuan |
| PaperID180 | Usability Evaluation and Development of a University Staff Website |
| Andre Valerian, Harry Budi Santoso, Gladhi Guardin and Martin Schrepp |
| PaperID183 | The Ontology of SME's Form Application for Interoperability Systems |
| Masodah Wirisono, Aris Budi Sellyawan, Dini Tri Wardani and Sigit Widiyanto |

| Track 4 |
|---------|
| PaperID213 | Comparative Evaluation of Object Tracking with Background Subtraction Methods |
| Dennis Aprilia Christie and Topan Sukma |
| PaperID225 | Peripapillary Atrophy Detection in Fundus Images Based on Sector With Scan Lines Approach |
| Anindita Septianini, Agus Harjoko, Reza Putungan and Retno Ekantini |
| PaperID227 | Drivers' visual search behaviour: Eye tracking analysis approach (Case study: on Ir. H. Juanda Street Depok) |
| Dian Kemala Purli, Mohammad Iqbal, Karmitasari and Kemal Ade Sekanarti |
| PaperID246 | The Generalized Learning Vector Quantization Model to Recognize Indonesian Sign Language (BIS/INDO) |
| Tri Handikha, Immyati Sari, Revaldo Ilfesta Metz Zen, Dewi Putine Lestari and Marni |
| PaperID250 | Algorithm for Simple Sentence Identification in Bahasa Indonesia |
| Dina Anggraini, Ahmad Benny Mutara, To. Maulana Kusuma and Lily Wulandari |
| Track 4                                      |
|---------------------------------------------|
| PaperID213                                  |
| Comparative Evaluation of Object Tracking  |
| with Background Subtraction Methods         |
| Dennis Agnill Christie and Topan Sukma     |
| PaperID225                                  |
| Peripapillary Atrophy Detection in Fundus   |
| Images Based on Sector With Scan Lines      |
| Approach                                     |
| Anindita Septiani, Agus Harjoko, Reza       |
| Pulungan and Retno Ekarintri                |
| PaperID227                                  |
| Drivers’ visual search behaviour: Eye       |
| tracking analysis approach (Case study: on  |
| Ir. H. Juanda Street Depok)                 |
| Dian Kemas Pri, Mohammad Iqbal, Karmillasari|
| and Kemal Ade Sekanwati                      |
| PaperID246                                  |
| The Generalized Learning Vector Quantization|
| Model to Recognize Indonesian Sign Language |
| (BIISINGO)                                   |
| Tri Handhika, Imamiat Sari, Revaldo Ilfesta  |
| Metri Zen, Dewi Putrie Lestari and Murr      |
| PaperID250                                  |
| Algorithm for Simple Sentence Identification |
| in Bahasa Indonesia                          |
| Dina Anggraini, Achmad Benny Mustara, Tb.   |
| Maulana Kusuma and Lily Wulandari           |

| Track 5                                      |
|---------------------------------------------|
| PaperID133                                  |
| Template Matching Algorithm For Noise       |
| Detection in Cargo Container                |
| Doni Salto Rambudti, Budiin Handayani and   |
| Lailatul Hidayah                            |
| PaperID222                                  |
| Genetic Algorithm Modification Of Mutation  |
| Operators In Max One Problem                |
| Ummul Khair, Aditya Ferdana, Arief          |
| Budiman, Yuyun Dwi Lestari and Dody         |
| Hidayat                                      |
| PaperID244                                  |
| Meme Opinion Categorization by Using Optical|
| Character Recognition (OCR) and Naive Bayes  |
| Algorithm                                     |
| Amalia Amalia, Aner Shariif, Fikri          |
| Haear, Dani Gunawan and Denny B Nusution     |
| PaperID379                                  |
| Improving Naive Bayes in Sentiment Analysis  |
| For Hotel Industry in Indonesia              |
| Fika Setiadi, Agung Suryanoto, Dedi           |
| Setiadi and Eka Durya Heragia               |
| PaperID109                                  |
| Early Identification of Leaf Stain Disease   |
| In Sugar Cane Plants Using Speeded-Up       |
| Method Robust Features                      |
| Romi Fadhilah Rahmat, Dani Gunawan, Shartina|
| Faiza, Karina Ginting and Erna Buchtarti    |
| Nababan                                    |
| Track 6                                      |
|---------------------------------------------|
| **PaperID188**                              |
| Design of Orchid Monitoring System Based on IoT |
| Farid Al Rafl, N. S. Salahudin, Anecostia Kowanda and Triki Septiani |
| **PaperID190**                              |
| Remote Sensing System of Odometry and Telemetry data in Real-Time |
| Dnul Fathurrochman, Purnawarman Musa, Dinda Desita Wimananda, Octarina Budi Lestari |
| **PaperID199**                              |
| Framework for Identifying Agent's Role in Multi-agent Based Self-healing System |
| Falahah, Ilping S. Suwardi and Kridanto Surendro |
| **PaperID207**                              |
| Fuzzy Rule-Based System for Monitoring Traffic Congestion using Technology Radio Frequency Identification |
| Afril Wicaksono Septianto, Suryono Suryono and Isnaeni Rosyida |
| **PaperID209**                              |
| Prediction of Smartphone Charging using K-Nearest Neighbor Machine Learning |
| Faza Ghassani, Mamon Abdurrohman and Aj Geutama Putrada |
## Technical Session Schedule

### Technical Session 2

| Track 1 | PaperID | Title | Authors |
|---------|---------|-------|---------|
| P1001179 | Comparison of Color Constancy Approaches on Images with Unbalanced Color Distribution | Mona Sastro Sillagin, Vega Valentine and Purnawarman Musa |
| P1002033 | Real-time Recognition and Information Extraction on C++ Syntax with Augmented Reality | Jacqueline montav S. Waworundeng, Andria Kusuma Wiyudi and Danielo Henembang Mudjono |
| P1003243 | Performance Analysis of Big Data Frameworks on Virtualized Clusters | Anil Ahmad Ishara, Muhammad Hikwar and Anfi Muhammad Kyanto |
| P1004244 | Fuzzy Kernel Robust Clustering for Anomaly based Intrusion Detection | Zeinab Kusuma and Aini Suri Tadila |
| P1005247 | Segmentation of Overlapping Areas on Pap Smear Images with Color Features Using K-Means and Otsu Methods | Delia Hanra, Henrian Tohir and Achmad Nazar Hidayanto |

| Track 2 | PaperID | Title | Authors |
|---------|---------|-------|---------|
| P1002233 | Hybrid CPU and GPU Computation to Detect Lung Nodule in Computed Tomography Images | I Wayan Bud. Sentana, Naser Jawas and Anqun Esti Wardani |
| P1003239 | Clustering Grey-Scale Face-Images Using Modified Adaptive Affinity Propagation with a New Modeled Preference | Rina Rezfianti, Achmad Benny Mulia, Asep Jierna and Adang Subekti |
| P1004245 | Optimizing Marshall Test Parameters on Asphalt Concrete Using Hybrid Neural Network - Genetic Algorithm Approach | Achmad Baroqah Pohan, Tali Mardiana, Ninung Suryani, Hilida Amalia, Yunita, Umi Fadillah, Rachmat Adi Purnama and Frengki Fernando |
| P1005252 | An Initial Study to Solve Imbalance Sundanese Handwritten Dataset in Character Recognition | E. Paulus, M. Suryani, S. Hadi and Fadhiliyah Natsir |
| P1005254 | Classification of Personality Type By Typology Hippocrates - Galenus Using NaiveBayes Algorithm and NaiveBayes Decision Tree Algorithm | Roky Firmanda and Desti Fitrianti |
| Track 3 | Track 4 |
|--------|--------|
| **PaperID210**  | **PaperID45** |
| An Adaptive e-Learning Model Based on Myers-Briggs Type Indicator (MBTI) | Filtering Impolite Words in Social Network Using Naive Bayes Classifier |
| Mestra Betty Yel, Sfenrianto Sfenrianto and Elisa Tri Meilawani | Lusrana, Hidayah Gemini and Yoyon Efendi |
| **PaperID241**  | **PaperID49** |
| Determinant factors of new investor intention for using online trading system | Comparing CART and C5.0 Algorithm Performance of Human Development Index |
| Fikri Pratama Afif, Putu Wuri Handayani and Ave Adriana Pinem | Priadi Assiroj, Harco Leslie Hendric Spits Warnars and Ahmad Faizi |
| **PaperID283**  | **PaperID51** |
| Comparative Analysis of Multi-Criteria Decision Making for Student Degree Completion Time based on Entropy Weighted Masna Wati, Niken Novirana, Edy Budiman and Hasrudi |
| Masa Masna, Niken Novirana, Edy Budiman and Hasrudi |
| **PaperID300**  | **PaperID107** |
| Global Software Development and Capability Maturity Model Integration: a Systematic Literature Review | Measuring Coefficient-Vector Quantization Implementation for Voice Detection of Rice-Eating Birds in The Rice Fields |
| Arika Hidayati, Bety Purwaningsih, Eko K. Budiarjo and Ilo Solichani | Romi Fadilah Raminat, Tri Rameshanti, Dani Gunawan, Sharfina Faza and Rammat Budiarjo |
| **PaperID305**  | **PaperID162** |
| Influence Blended Learning on Learning Result of Algorithm and Programming | Students’ Academic Performance Prediction using Data Mining |
| Anthony Anggrawan, Proff. Dr. Nurdi Anshari, M. Pd. Proff. Dr. Syukriho M. M. Pd and Christofer Satna, M. Sn. ACA | Fergie Joanda Kaunang and Reymon Rotikan |
### Track 5

| PaperID | Title                                                                                     | Authors/Details                                                                 |
|---------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| D171    | Comparison of Job Position Based Promotion Using VIKOR, ELECTRE And Promethee Method      | Akmaludin, Sulistianto SW, Adjat Sudrajat, Santoso Setiawan, Hendra Supendar,   |
|         |                                                                                            | Yogi Handranto, Rusdiansyah and Tusiatiya                                          |
| D236    | Symmetric Key Distribution Model Using RSA-CRT Method                                      | Redyanto Werdoyo, Emy Setyawangi and Aney Kartika Sarli                          |
| D271    | Identifying and Validating Components for National Cyber Security Framework               | Fariisa Setiadin Albaar Rubhasy and Zainal A Hasibuan                            |
| D272    | Hybrid RC4 and Affine Ciphers to Secure Short Message Service on Android                  | Opin Salim Sitompul, Nauru Hlava Pasaribu, Handriyant and Erna Suharti Nabaian    |
| D300    | Verification Authenticity Digital Documents of Certificate and Transcript Using Background Subtraction Method | opin salim sitompul, nauru hlava pasaribu, handriyant and erna suharti nabaian |

### Track 6

| PaperID | Title                                                                                     | Authors/Details                                                                 |
|---------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| D266    | Analysis Similarity of Taekwondo Movement Using Data Motion                               | Dharmayanti, Mohammad Iqbal, Adang Suhendra and Achmad Benny Mullara             |
| D270    | 6-box Construction of Highly Strict Avalanche Criterion Using Algebraic Technique         | Alkmaryn, Agus Ipepo and Tegutti Bharata Adji                                  |
| D286    | Experiments on Character and Word Level Features for Text Classification Using Deep Neural Network | Muhammad Garmiliq and Ayu Purwarianti                                          |
| D300    | Utilization of Semantic Web Rule Language for Tourism Ontology                            | Hernawan Warihama, Khatib Mustofa and Anny Kartika Sarl                         |
| D304    | Neural Network with Support Vector Regression for Land-Use Growth Prediction              | Hertawati, Rahmadaya Thais Handayanto and Solikan                                 |
## Technical Session Schedule

### Technical Session-3

#### Track 1

| Paper ID | Title                                                                                           | Authors                                                                                   |
|----------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Paper ID 65 | Quran Tajweed Extraction and Segmentation Based on HSV Color Space Models                        | Tji Awaliyah Zuraiyah, Sarutin Madenda, Rina Noviana and Ravi A. Salim                   |
| Paper ID 73 | Digital Image Analysis of Beef Color Using Euclidean Distance Method                           | Henry Hariayani Handayani and Deden Wahidin                                               |
| Paper ID 108 | Android-Based Text Recognition on Receipt Bill for Tax Sampling System                        | Rimi Fadillah Rahmat, Dani Gunawan, Shartina Faza, Novia Hadiro and Erna Budhianti Nababan |
| Paper ID 147 | Hardware Based Artificial Neural Networks for Basic Pattern Recognition Application            | Sunny Arih Sudiro, Aoi Putra Atlantik, Lindia Yafriy Widarti, Sriesti Agus Wardono and Iris Hapsia Wardhani |
| Paper ID 256 | SPOT A Low Cost Intelligent Parking System for Urban Malls                                      | Akem Olowatoyemo, Ala Abdulaziz Alarood, See Hwee Yap and Teddy Mantoro                   |

#### Track 2

| Paper ID 36 | Prediction the Crime Motorcycles of Theft using ARIMAX-TFM with Single Input                  | Ashari and Pradito Eko Prasetya Utomo                                                    |
| Paper ID 112 | Steganography with Highly Random Linear Congruential Generator for Security Enhancement       | Opin Salim Sitompul, Fransisiko Rio Naitaho, Zakariae Situmorang and Erna Budhianti Nababan |
| Paper ID 135 | Expert Mapping Development System with Disease Searching Symptom Based on ICD 10             | Aries Muslim, Adang Suhendra, A. Benny Mutara and Teddy Osawa                              |
| Paper ID 151 | Comparing SAW and AHP Decision Support Methods for Disease Analysis in Indonesia             | Prithandoko, Ardiono Roma Nugraha, Mufni Alida, Muhammad Nizar Yoga Pratama and Deasi Agushinta R. |
| Track 5                          |                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Paper ID 2                     | Redesigning CHIML: Orchestration Language for Chimera-Framework                                                    |
| Paper ID 130                   | Performance Analysis of Information Quality Indexing in Government Agency's Social Media: a case of Customs in Indonesia |
| Paper ID 141                   | Development of Banten E-Heritage using Virtual Reality Technology on Mobile Device                                  |
| Paper ID 178                   | Preprocessing For Crawler Of Short Message Social Media                                                             |
| Paper ID 237                   | Toward Immersive Mobile Multimedia: From Mobile Video to Mobile Extended Reality                                    |

| Track 6                          |                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Paper ID 273                    | Classification Default of Credit Card Clients Using LS-SVM Ensemble                                                |
| Paper ID 274                    | Classification for Multiformat Object of Cultural Heritage using Deep Learning                                     |
| Paper ID 291                    | Spellchecker Improvement on Stemmer Algorithm for Indonesian Language                                            |
| Paper ID 303                    | Cluster Analysis of Indonesian Province Based on Prices of Several Basic Food Commodities                         |

- Track 6:
  - Paper ID 273: Classification Default of Credit Card Clients Using LS-SVM Ensemble
  - Paper ID 274: Classification for Multiformat Object of Cultural Heritage using Deep Learning
  - Paper ID 291: Spellchecker Improvement on Stemmer Algorithm for Indonesian Language
  - Paper ID 303: Cluster Analysis of Indonesian Province Based on Prices of Several Basic Food Commodities
## Technical Session Schedule

### Technical Session-4

| Track 1                  | PaperID210 | Primary Care Functional Requirements of a Health Information System in Indonesia |
|--------------------------|------------|---------------------------------------------------------------------------------|
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Comparison of Job Position Based Promotion Using: VIKOR, ELECTRE And Promethee Method

Abstract - The long-term prospect of the company's progress is determined by the quality of human resources (HR). The urgency to maintain the company's survival it takes a reliable and futuristic leader. Measuring tool that can be used is none other than the performance of human resources. Of course with potential leaders will provide the vision of the company's mission to grow and expand. Leadership selection process can be done with promotion positions based on performance preference. The purpose of this research is to conduct selection of performance promotion based on performance using Multi-Criteria Decision Making (MCDM) selection methods such as Analytic Hierarchych Process (AHP), VIKOR, ELECTRE, and Promethee, in addition to proving the result of a number of methods based on MCDM such as AHP for the determination of preferences data design, while for data analysis using three methods that will be compared the results of VIKOR, ELECTREE and Promethee. The measurable performance bases for promotional positions are viewed from Intelegency (IG), Panning (PL), Depandebility (DP), Reaction Behavior (RB), Failed Jobs (FJ), Quantity of Work (QW), and Knowledge of Job (KJ). The results obtained provide an interpretation that the promethee method is closer to the actual results, while the vikor method is almost close to the results of truth and far away when compared with the electre method. Thus, it can be concluded that the best method for placing employee positions is promethee method.

Keyword - Multi-criteria, Preferences of Job Performance, Elimination Method, ELECTRE, VIKOR, Promethee.

I. INTRODUCTION

The quality of human resources is paramount to the progress of the company, because individualized expertise can be measured from individual performance [1], this is a very important thing as a benchmark in selecting a potential leader through the promotion process. Promotion of positions is an effort that must be done by the company to provide an opportunity for employees who have job performance to occupy a position higher than the occupation previously occupied and have greater authority and responsibility [1].

The purpose of this study is to compare the results of several methods to provide the best solution for achieving the objectives of the company and to compare the results of the promotion by using three methods, namely VIKOR, ELECTRE, and Promethee, how decisions are generated using the three methods. The three methods used to achieve performance appraisal goals, of course, require employees who have good performance appraisals that can work effectively and efficiently [2]. Good performance is just as an employee is able to demonstrate work behavior that leads to the achievement of company intent and purpose [2]. For that the company did many ways to improve employee performance including promotion of position for improvement of employee position, one of them using method Analytic Hierarchy Process (AHP) [3]. This research tries to perform a combination of methods to perform new solutions to the promotion process. The combination is a crystallization of Multi-Criteria Decision Making (MCDM) ie AHP and VIKOR, ELECTRE, and Promethee. Each method has its own function that can be collaborated to determine the final snap with the indexed result method with VIKOR. VIKOR can also be used for selecting personnel training [4] in addition to MCDM.

MCDM is one way used to analyze the criteria and tools alternative comparison depicted in the hierarchy of analysis on AHP. The MCDM method applied by means of iteration to obtain the eigenvector value and the result will be used to determine the preference of the criteria used in this discussion. MCDM is also included in the decision-making category by ranking [5]. Analytic Hierarchy Process (AHP) is a method for evaluating and selecting that simplifies complex problems.
simple by composing each level, the level being the goal, criteria, and alternative [6], [7], [8]. VIKOR became a widely-used collaboration with MCDM [9]. Vikor is a ranking method that uses the index system to determine the best alternative [10], and other multi-criteria of ELECTRE and Promethee.

The performance appraisal used for promotion consists of seven criteria, each criterion has a special understanding in giving an assessment, there are variables that have the greatest value with the best value meaning (High is the Best) and there is a small value variable that implies the best value (Low is the Best), [10]. The Compromise Ranking method, also known as the VIKOR, ELECTRE, and Promethee methods gives an alternative ranking and determines the solution called the most ideal compromise. In fact, this index considers few alternatives for simplicity, but this model can be used to evaluate more alternatives. Its main task is to compare a number of alternatives and choose the best [11].

## II. METHOD

Employee job preferences in companies that are not mentioned determine the progress of the company, so that it requires a number of appropriate criteria to choose the best leader, this assessment is determined by company policy which is determined to be seven assessment criteria, by seeing competition outside these criteria to be a company decision to remain a company who is able to lead the market.

The collecting data, a leader has done a number of samples from employees with seven criteria that have been set and have been done by experts to give value to a number of employees. This has been done for several periods, then the average value of each employee is taken.

In this section describes the concept of Position Promotion, Analytic Hierarchy Process (AHP), Multi-Criteria Decision Making (MCDM) analysis, and the elimination process using VIKOR, ELECTRE, and Promethee methods.

### 2.1. Promotion of Position.

Promotion of position should be done with a number of assessment criteria, each criterion can be seen from some skills interests, which is the total of the results that can be accountable. While performance in work performance is the result of work in quality and quantity achieved by an employee in performing its duties according to the responsibility given to him [3], [12], [13].

The criteria used for promotion include seven criteria: (1) intelligence (IG); (2) Planning (PL); (3) Dependability (DP); (4) Reaction Behavior (RB); (5) Failed Jobs (FJ); (6) Quantity of Work (QW); (7) Knowledge of Job (KJ). Each criterion has two special rating categories, rating with High Is The Best (HB) meaning that the highest score is the best value or Low is The Best (LB) the lowest value is the best. For category of HB criteria are PL, QW, and KJ, while those belonging to LB criteria category are IG, DP, RB, and FJ. Each preference gives unequal meanings in its usage, the amount of preference can be interpreted as the best MAX value or it can be interpreted that the MIN value is the best.

### 2.2. Analytic Hierarchy Process (AHP).

The current multi-criteria decision-making method (MCDM) presents a valid alternative to weighting multiple criteria while enabling the participation of multiple stakeholders. Among them, the Analytical Hierarchy Process (AHP) makes decisions in a way that is easily understood by stakeholders and allows them to analyze independent sub-problems by constructing problems in hierarchy and using pairwise comparisons [14]. The specificity of the AHP has an appropriate allocation in pairwise comparisons across the entire range of human activities, AHP [15], capable of handling both qualitative and quantitative problems [16] that apply to decomposed hierarchical modeling to facilitate solving complex problems [17] or variables in a hierarchical order, assigns numerical values to subjective considerations of the importance of each variable and synthesizes these considerations to determine which variables have the highest priority [2], [18].

![Fig. 1. Hierarchy for all level](image-url)

In this process AHP has a very important role to determine the value of the importance of each criterion as a preference measured based on the value of its importance in the form of a hierarchical model. Then arranged in pairwise matrix form.

### 2.3. Multi-Criteria Decision Making (MCDM).

Metode MCDM merupakan metode yang yang berbeda dan telah dibandingkan sebagian besar berdasarkan metode penyelesaian, algoritma, dan metode tertimbang [20].

The MCDM method is a different method and has been compared largely based on settlement methods, algorithms, and weighted methods [20]. Techniques such as MCDM that are multi-criteria are considered as one of the best ways and means to think and equate the level of some criteria for decision-making and deal with imprecision [21].

The MCDM method has proven to be widely used and has its own advantages in decision making which are the development of AHP [5], [10], [22], [23], [24]. MCDM is able to provide comparisons that generate rankings from each level of both criteria and alternatives. In this study the priority values generated from MCDM are used for preferences with multi-criteria VIKOR, ELECTREE, and Promethee. Some of the criteria of the VIKOR decision-making method are based as a combined function that represents the proximity to the ideal, derived from the compromise programming method. The linear normalization used by VIKOR to eliminate the unit
of criterion function [5], thus the baseline data as the reference for determining the largest value and the smallest value as the range for determining the magnitude of normalization which is continuously operated with preferences obtained by AHP and MCDM methods, through the optimal eigenvector value of each criterion, note (Table 1 and Table 2).

| TABLE I CRITERIA PAIRWISE MATRIX [25] |
|-----------------------------------|
| 1      |  a_{12} | a_{13} | ... |
| a_{12} | 1      | a_{23} | ... |
| ...    | ...    | ...   | ... |
| a_{n1} | a_{n2} | 1      | ... |

Where ai,j is the comparison between element i and j of the lower triangular matrix containing reciprocal mean [17], [25]. The role of MCDM in this case is to determine the value of each preferences that can be compared with AHP, while observation data is processed by VIKOR, ELECTRE, and Promethee method. The end result of the criteria was obtained from instrumentation in the form of questionnaires by using MCDM with a number of iterations to obtain the optimal value of eigenvector, which then made the standard as the weight preference of the seven criteria used in this study.

2.4. VIKOR.

The VIKOR Method (Vise Kriterijumska Optimizacija I Kompromisno Resenje) is a method used for multi-criteria decision making [26].

The VIKOR method is performed to calculate the positive and negative ideal solution ratios [27] which provides a list of alternative ratings with the highest rating of VIKOR which is the result closest to the ideal solution. A number of equation have been simplified as VIKOR calculations such as determining the Normalization of a matrix listed in (equation-1), which is used to determine the exact location of the sample R (i, j) of the specified range.

\[ R_{ij} = \frac{X^{*} - X_{ij}}{X^{*} - X^{'}j} \]  

Rij: Normalization Matrix VIKOR, Xij: The value of the sample data i criteria j, X^*j: The Largest Value in one criteria, X^': The Smallest Value in one criterion, i: The assessed employee (K1 ... K5), j: Criteria used (seven criteria).

After the sample R (i, j) is normalized, then the weight of the Wj criterion is multiplied by R (i, j) summed into Si shown in (equation-2) and Ri represents the largest value of each row i seen in (equation-3).

\[ S_i = \sum_{j=1}^{n} w_j x (R_{ij}) \]  
\[ R_i = \max_j [w_j x R_{ij}] \]

After knowing the weight of each row, the dimensions of Si, and S^* the largest value of S, S' the smallest value of S, R^* the largest variable R value and R' the smallest variable R value, of all, can be done determination of the VIKOR Qi index, with the equation seen in (equation-4).

\[ Q_i = \left( \frac{S_i - S^{'}}{S^* - S^{'}} \right) x V + \left[ \frac{R_i - R^{'}}{R^* - R^{'}} \right] x (1 - V) \]

2.5. ELECTRE

The ELECTRE method is a concept of elimination from a normalized result through a function which is further downgraded to concordance and discordance to rank. The ELECTRE method has a basic understanding of the same data as a VICOR that has been normalized before with the rules The largest value is the best value or the smallest value is the best value.

Some steps must be taken to use the ELECTRE method seen in (Fig.3), MCDM combination poured into AHP and is a simplified way to be understood. Some of the equation used...
in the ELECTRE method come from to search for data normalization using (equation-5).

\[ R_{ij} = \frac{(X_{ij} - X')}{(X' - X')} \]  

(5)

Where, \( R_{ij} \): Matrix Normalization,

\( X_{ij} \): The Searching Number,

\( X' \): Biggest Number,

\( X' \): Lowest Number,

\( i \): Assessed Employee (K1…K5),

\( j \): Seven Criteria’s.

While to find the value of concordance can use (equation-6), whereas to find the amount of discordance can use (equation -7). The equation used should still pay attention to the value of MAX and MIN values of each preference set.

\[ C(i, i') = \sum_j w_j \times \text{where } R_{ij} > R_{ij} \]  

(6)

\[ D(i, i') = \sum_j w_j \times \text{where } R_{ij} < R_{ij} \]  

(7)

So the end result can be searched by mathematical deduction of concordance and discordance resulting in a ranking of alternatives that can be decided.

2.6. Promethee.

Steps that must be known in Promethee there are some steps [28] namely:

Steph 1: Determination of deviations base on pairwise comparison.

Steph 2: Application of the preference function.

Steph 3: Calculation of an overall or global preference index.

Steph 4: Calculation of outranking flows the promethee-1 partial ranking (leaving flow dan entering flow).

Steph 5: Calculation of outranking flows the promethee-2 as complete ranking.

Promethee has a similar calculation process with ELECTRE, in terms of determining the magnitude of the matrix normalization, see (equation-8) to determine the normalization of the matrix. Other equation that can be used to analyze with the Promethee method in terms of aggregate determination of preference functions see (equation-9), leaving flow see (equation-10), entering flow see (equation-11) which is a partially separate outcome. To combine it using the net flow view see (equation-12).

\[ R_{ij} = \frac{(X_{ij} - X')}{(X' - X')} \]  

(8)

\[ \pi (i, i') = \left[ \sum_j w_j \times P_j (i, i') \right] / \sum_j w_j \]  

(9)

\[ \Phi^+(i) = \frac{1}{(n-1)} \sum_{i'=1}^{n} \pi (i, i') \]  

(10)

III. IMPLEMENTATION AND RESULTS

The making of hierarchy is a total picture of the research that creates the concept of modeling solutions. The hierarchy is used as a basic understanding model consisting of three levels: (1) the level of goal, which is the main target of employee performance performances for promotion of positions in an agency; (2) criterion level, is a barometer to measure the number of criteria determined by the value as a preference of each criterion. The preference quantity is obtained based on the hierarchical model which is processed iteratively until there is no difference to the eigenvector value, the use of this eigenvector value is the optimum value and will be used as the reference for the multiplication of the criteria with the result of normalization in multi-criteria calculation using VIKOR, ELECTRE, and Promethee.

![Fig. 3. Hierarchy of Position Based Promotion Model.](image)

Multi-Criteria with AHP, used to determine the preference for the magnitude of each criterion, known under the optimal eigenvector and obtained through the iteration stage in the absence of the difference with the previous eigenvector, is the importance of the eigenvector value [29]. For the value of criterion preferences, note (TABLE II).

**TABLE II. VALUE OF CRITERIA PREFERENCE**

| Criteria | KJ | PL | DP | RB | FJ | QW | KJ |
|----------|----|----|----|----|----|----|----|
| Value    | 0.23 | 0.16 | 0.19 | 0.15 | 0.07 | 0.11 | 0.09 |

In the (TABLE II) illustrates the preferences of the seven criteria that serve as the basis for the interest of observations through the MCDM-AHP method and serve as a benchmark for the calculation process with the three methods VIKOR, ELECTRE, and Promethee.

**TABLE III. OBSERVATION DATA VIKOR, ELECTRE, and Promethee**

| Criteria | IT | PL | DP | RB | FJ | QW | KJ |
|----------|----|----|----|----|----|----|----|
| K1        | 74.05 | 64.07 | 73.94 | 84.33 | 24.02 | 18.59 | 9.63 |
| K2        | 86.03 | 94.23 | 84.23 | 73.25 | 13.45 | 97.81 | 15.04 |
| K3        | 66.73 | 83.18 | 94.67 | 48.85 | 27.84 | 50.59 | 27.66 |
| K4        | 99.50 | 60.75 | 25.22 | 64.84 | 15.92 | 22.48 | 99.52 |
| K5        | 43.18 | 76.35 | 62.45 | 56.52 | 16.58 | 61.77 | 42.27 |
The data shown in (TABLE III) is the data that becomes the basis of promotion research positions that will be compared with three methods namely VIKOR, ELECTRE, and Promethee, from five employees (K1-K5) for job position base promotion. The data must be specified first MAX value and MIN value, (note the number that is thickened) that made the process of normalization parameters.

3.1. VIKOR Method.

The first stage of the VIKOR method is to determine the normalization matrix, see (TABLE IV).

| TABLE IV. NORMALIZATION WITH VIKOR. |
|--------------------------------------|
| LB | K1 | K2 | K3 | K4 | K5 |
|----|----|----|----|----|----|
| L1 | 0.55 | 0.88 | 0.36 | 1.00 | 0.22 |
| L2 | 0.76 | 0.00 | 0.68 | 0.69 | 0.00 |
| L3 | 0.42 | 0.33 | 2.00 | 0.00 | 1.00 |
| L4 | 1.00 | 0.00 | 0.40 | 0.45 | 0.17 |
| L5 | 0.00 | 0.58 | 0.00 | 0.22 | 0.45 |

With the result data normalized through VIKOR, then determine the value of Si that can be done with the equation that existed in (equation -2) with the calculation results can be seen in (TABLE V).

| TABLE V. MULTIPLICATION QUALITY AND NORMALIZATION. |
|------------------------------------------|
| K1 | 0.24 | 0.15 | 0.18 | 0.15 | 0.05 | 0.10 | 0.11 |
| K2 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 |
| K3 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| K4 | 0.24 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| K5 | 0.00 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

The next step determines the magnitude of each of the Si and Ri values. To obtain the value of Si can use (equation-2), whereas to determine the value of Ri can use the equation in (equation -3). The result of the value of Si and Ri values can be seen in (TABLE VI).

| TABLE VI. VALUE OF Si and Ri |
|-----------------------------|
| Alternative | Si | Ri |
| K1 | 0.70 | 0.16 |
| K2 | 0.52 | 0.18 |
| K3 | 0.56 | 0.18 |
| K4 | 0.64 | 0.24 |
| K5 | 0.24 | 0.07 |

At (TABLE VI) is the accompaniment of each of the Si and Ri values which in turn determine the VIKOR index to determine the ranking of selected alternatives. The results of the VIKOR index can determine the synthesize of the ranking of some alternatives, see (TABLE VII).

| TABLE VII. QUANTITY OF Q VALUE AND RANG VIKOR |
|-----------------------------------------------|
| Alternatives | S | R | Q | Ranking |
| K1 | 0.70 | 0.16 | 0.77 | 4 |
| K2 | 0.12 | 0.13 | 0.64 | 2 |
| K3 | 0.56 | 0.18 | 0.68 | 5 |
| K4 | 0.64 | 0.24 | 0.93 | 5 |
| K5 | 0.24 | 0.07 | 0.00 | 1 |

3.2. ELECTRE Method.

With reference to (TABLE III), the ELECTRE method can calculate Concordance and Discordance by using a comparison of criteria functions, note (TABLE VIII). Thus, the value of Concordance and Discordance can be simplified, see (TABLE IX).

| TABLE VIII. CONCORDANCE AND DISCORDANCE CRITERION FUNCTION. |
|-------------------------------------------------------------|
| Weight | K1 | K2 | K3 | K4 | K5 |
| Function | 0.24 | 0.15 | 0.18 | 0.16 | 0.06 | 0.1 | 0.11 |
| G(12) | 0.31 | 0.00 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 |
| G(13) | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 | 0.00 |
| G(14) | 0.45 | 0.12 | 0.04 | 0.00 | 0.11 | 0.00 | 0.00 |
| G(15) | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 |
| G(23) | 0.00 | 0.23 | 0.22 | 0.00 | 1.00 | 0.00 | 0.00 |
| G(24) | 0.24 | 1.00 | -0.23 | 0.00 | 0.17 | 0.95 | 0.00 |
| G(25) | 0.00 | 0.53 | 0.00 | 0.00 | 0.22 | 0.45 | 0.00 |
| G(31) | 0.13 | 0.25 | 0.00 | 1.00 | 0.00 | 0.13 | 0.20 |
| G(32) | 0.34 | 0.00 | 0.69 | 0.00 | 0.00 | 0.14 |
| G(33) | 0.58 | 0.67 | 0.00 | 0.45 | 0.00 | 0.10 | 0.00 |
| G(35) | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 |
| G(42) | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 |
| G(43) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| G(45) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| G(52) | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.25 | 0.40 |
| G(53) | 0.74 | 0.00 | 0.68 | 0.47 | 0.00 | 0.34 |
| G(55) | 0.42 | 0.20 | 1.00 | 0.00 | 0.00 | 0.17 | 0.20 |
| G(55) | 1.00 | 0.47 | 0.40 | 0.23 | 0.00 | 0.20 | 0.00 |

Note (TABLE IX), the value of the concordance is the value of the upper triangle, while the discordance value in the lower triangle will be obtained by determining the ranking of the ELECTRE method, see (TABLE X).

| TABLE IX. CONCORDANCE AND DISCORDANCE |
|---------------------------------------|
| K1 | 0.42 | 0.24 | 0.63 | 0.06 |
| K2 | 0.53 | 0.49 | 0.73 | 0.31 |
| K3 | 0.76 | 0.54 | 0.65 | 0.16 |
| K4 | 0.37 | 0.27 | 0.25 | 0.17 |
| K5 | 0.94 | 0.69 | 0.84 | 0.83 |

| TABLE X. ALTERNATIVE RANKING ELECTRE |
|--------------------------------------|
| Employee | Concordance | Discordance | C/D Ranking |
| K1 | 1.35 | 2.00 | -1.25 | 4 |
| K2 | 2.06 | 1.92 | 0.14 | 3 |
| K3 | 2.11 | 1.92 | 0.19 | 2 |
| K4 | 1.16 | 2.84 | -1.68 | 5 |
| K5 | 3.30 | 0.70 | 2.60 | 1 |

3.3. Promethee Method.

With reference to (TABLE III) which is an observation table, the processed data using the promethee method will assign aggregate preference functions first, note (TABLE XI).

| TABLE XI. AGGREGATE PROMETHEE PREFERENCES FUNCTION |
|-----------------------------------------------------|
| Alternatives | K1 | K2 | K3 | K4 | K5 |
| K1 | 0.110 | 0.189 | 0.139 | 0.012 |
| K2 | 0.305 | 0.278 | 0.332 | 0.153 |
| K3 | 0.303 | 0.195 | 0.320 | 0.032 |
| K4 | 0.178 | 0.120 | 0.245 | 0.058 |
| K5 | 0.463 | 0.404 | 0.042 | 0.470 |
The end result of the promethee, determined from the Leaning Flow and the Entering Flow that is still partial, so combined with the mathematical process to rank, take note (TABLE XII).

**TABLE XII. PROMETHEE RANKING**

| Alternatives | K1 | K2 | K3 | K4 | K5 |
|--------------|----|----|----|----|----|
| Leaning Flow | 0.113 | 0.267 | 0.213 | 0.156 | 0.435 |
| Entering Flow | 0.312 | 0.207 | 0.278 | 0.315 | 0.083 |
| C-D Ranking | -0.290 | 0.099 | -0.059 | -0.165 | 0.371 |

Comparison Results Promotion based performance performance using three methods of VIKOR, ELECTRE, and Promethee, can be seen in (TABLE XIII).

**TABLE XIII. RANKING OF VIKOR, ELECTRE, and PROMETHEE.**

| Alternatives | K1 | K2 | K3 | K4 | K5 |
|--------------|----|----|----|----|----|
| VIKOR | 0.770 | 0.636 | 0.678 | 0.933 | 0.050 |
| ELECTRE | -1.250 | 0.140 | 0.190 | -1.680 | 2.600 |
| Promethee | -0.200 | 0.059 | -0.066 | -0.165 | 0.371 |

The results obtained provide an interpretation that the promethee method is closer to the actual results, while the vikor method is almost close to the results of truth and far away when compared with the electre method. Thus, it can be concluded that the best method for placing employee positions is the promethee method.

**IV. CONCLUSION**

The conclusions that can be drawn from Job Promotion for performance-based employees appear to be varied, with the VIKOR method in sequential first rank K5-K2-K3-K1-K4, with the weight in sequence is 0.0: 0.636; 0.678; 0.77, and 0.93. While the results of ranking with the method of ELECTRE in sequence is K5-K3-K2-K1-K4, with consecutive weights 2.6: 0.19: 0.14: -1.25; and -1.68. And the result of ranking with Promethee method in sequence is K5-K2-K3-K4-K1, with consecutive weights 0.371; 0.059: -0.066: -0.165, and -0.2. The results obtained provide an interpretation that the promethee method is closer to the actual results, while the promethee method is almost close to the results of truth and far away when compared with the electre method. Thus, it can be concluded that the best method for placing employee positions is the promethee method.

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Yang bertanda tangan di bawah ini, Ketua Sekolah Tinggi Manajemen Informatika dan Komputer Nusa Mandiri (STMIK Nusa Mandiri) Jakarta menugaskan kepada:

Nama : Akmaludin, S.Kom, MMSI
NIP : 201203103

Untuk menghadiri The Third International Conference on Informatics and Computing (ICIC 2018), yang akan dilaksanakan pada:

Hari/Tanggal : Selasa s/d Rabu, 16 s/d 17 Oktober 2018
Waktu : 07.00 WIB s/d selesai
Tempat : Aryaduta Hotel Palembang

Demikianlah penugasan ini agar dapat dilaksanakan sebagaimana mestinya. Atas perhatian dan kerjasamanya kami mengucapkan terima kasih.

Yang menerima tugas,

Jakarta, 4 Oktober 2018
Yang memberi tugas,
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Akmaludin, S.Kom, MMSI

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on 17-18 October 2018

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