Mahidol University
IT Management, Faculty of Engineering
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IEEE
THAILAND SECTION

MITiCON

The 2nd Management Innovation Technology International Conference

"Technology and Innovation Management for Societal and Global Challenges"

November 16-18, 2015

Bangkok, Thailand

Proceedings

Editor: Sotarat Thammaboosadee

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Welcome Message from the General Chair and Secretary

On behalf of the Organizing Committee, it is our greatest honor to welcome you to the 2nd Management and Innovation Technology International Conference (MITiCON2015), hosted at the Grand Mercure Fortune Bangkok Hotel, Thailand, 16–18th November 2015. MITiCON2015 is supported and sponsored by the Information Technology Management Program, Faculty of Engineering, Mahidol University, co-sponsored by the Graduated Studies of Commerce, Burapha University and supported by several industrial firms. The MITiCON2015 features a world-class conference that brings together researchers and practitioners in the field of management, innovation technology and information technology for the society and global challenges according to the conference theme: "Technology and Innovation Management for Societal and Global Challenges". MITiCON2015 provides an opportunity for academic and industry professionals to present and discuss the latest issues and research progress in the area of technology and innovation management such as IT and innovation management, knowledge management, technology assessment, strategic management, data management, IT corporate management, IT governance, Enterprise Architecture, business management, financial management, economics, policies management, educational management, and their social impacts. Additionally, other related engineering and science topics are also welcome.

This year we received 125 high-quality papers from more than 10 countries. Many papers demonstrated notable systems with empirical analyses. Many of them proposed interesting and outstanding researches in the related fields of innovation management. Each paper was reviewed by two reviewers. Based on these rigorous reviews, MITiCON2015 consequently accepted 73 papers in 7 research tracks for inclusion in the conference program. Therefore MITiCON2015 represents an acceptance rate around to 58%. All accepted

papers will be included in the Proceeding of Management and Innovation Technology International Conference.

The highlights of the conference include:

• Three Keynote speeches by researchers and executive from academic and industry:

- Dr. Smitti Darakorn Na Ayutthaya (Mahidol University), who gives a talk in "Innovation in the Digital Economy for National Policy of Thailand".

- Asst. Prof. Dr. Banpot Wiroonratch (Graduated Studies of Commerce, Burapha University), he provides an academic tutorial in Ph.D. research conduction.

- Ben Gerber (DBS Bank, Singapore), who gives a talk in "Understanding Privacy"

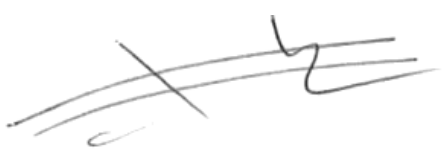
• 10 parallel sessions of international paper oral presentations throughout a two-day period

• 2 parallel sessions of local paper oral presentations on the last day of the conference; and

A series of social functions have been planned, which include a welcome reception, lunches, conference banquet at Grand Mercure Fortune Bangkok Hotel.

Apart from attending the technical program, you are encouraged to experience the magic of the Nightlife City, Bangkok, especially to the Ratchada area which the conference venue is located.

Last but not least, we would like to express our sincere gratitude to everyone involved in making the conference a success. Many thanks go to advisory board members, the organizing committees, the keynote speakers, the program committee and reviewers, the session chairs, the conference participants, and of course, to all the contributing authors who will be sharing the innovation and novelty of their high quality research. We wish our best wishes for an awesome staying in Thailand!



Asst. Prof. Dr. Supaporn Kiattisin
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Keynote Speech

Innovation in the Digital Economy for National Policy of Thailand

Dr. Smitti Darakorn Na Ayutthaya

On behalf of the Royal Thailand Government has pledged to promote the digital economy for transformation. The Ministry of Information and Communication Technology is joining hands with the Federation of Thai Industries in translating the Government's policy on the digital economy into action. Thai economy in 2015 would grow by about 4 percent. The digital economy in the industrial sector, SME operators would be urged to adopt e-business as a new channel for their business operations. "Digital economy" refers to an economy that is based on digital technologies, which are rapidly transforming both business practices and societies. The Thai government is giving a boost to the digital economy in order to enhance the competitiveness of the Thai industrial sector and prepare Thailand for the ASEAN Economic Community. In response to this policy, entrepreneurs and operators of the digital business will be created and developed, so that they will become a driving force for the country's productivity.

Keynote Speech

The Conduct of Dissertation:

The questions must be answered is

how the discovered models can be really used

Asst. Prof. Dr. Banpot Wiroonratch

Mostly research methodology for social sciences are carried out in three steps. 1. What is the original idea? 2. What is the problem found? 3. What the new idea is. Whenever you can answer these questions you can complete you research. Addition, the used sample size and statistic should be suitable as well.

Keynote Speech

Understanding Privacy

Ben Gerber

Data is driving opportunity and increasing quality of life across the world. To realize these opportunities, organizations must demonstrate they are trustworthy and value privacy as a social good by handling data responsibly.

What is privacy? Where do privacy expectations originate from? What does your organization need to do to respect privacy, and meet or exceed the expectations of customers, constituents and regulators? This session will provide the audience with an understanding of international privacy concepts, legal and regulatory requirements and best practices.

Conference Agenda

The 2nd Management and Innovation Technology International Conference (MITiCON2015)

16 - 18 November 2015, Bangkok, Thailand

Grand Mercure Bangkok Fortune Hotel

November 16, 2015		
4:30 pm to 6:30 pm	**Registration and Reception Lobby, Fl.1**	
November 17, 2015		
8:30 am to 10:00 am	**Registration and Reception Room: Grand Mercure 4, Fl.3**	
9:30 am to 10:00 am	**Opening Ceremonies Room:Grand Mercure 4, Fl.3**	
10:00 am to 10:45 am	**Keynote Speech-I Presenter:Dr. Smitti Darakorn Na Ayutthaya Topic:Digital Economy Room:Grand Mercure 4, Fl.3**	
10:45 am to 11:00 am	*Coffee Break*	
11:00 am to 11:30 am	**Keynote Speech-II Presenter:Asst. Prof. Dr. Banpot Wiroonratch Topic:The Conduct of Dissertation (presented in Thai) Room:Grand Mercure 4, Fl.3**	
11:30 am to 1:00 pm	**Lunch Location: One Rachada, Fl. G**	
1:00 pm to 5:30 pm	**PRESENTATION**	
1:00 pm to 2:15 pm	**Track-IM1 Information Technology and Innovation Management Session Chair: *Asst. Prof. Dr. Adisorn Leelasantitham* Room: Grand Mercure 3, Fl.3**	**Track-EM&PS Educational Management & Policies Management and Social Aspects Session Chair: *Dr. Sarunya Lertputtarak* Room: Grand Mercure 4, Fl.3**
1:00 pm to 1:15 pm	**IM-044** IT Management for SCM and Logistics in Agricultural Product Industry *Thongchai Surinwarangkoon*	**PS-026** Personal Factors Affecting Visionary Leadership for Supply Chain Management in the Manufacture Industrial of Thailand: An Empirical Study *Kasem Bunnoiko, Walailak Atthirawong*
1:15 pm to 1:30 pm	**IM-066** Requirement Prioritization for Software Release Planning Based on Customer Value with Analytic Hierachy Process *Alissara Chindapornsopit, Taweesak Samanchuen*	**PS-025** "Facebook" a Dreamlike Stage: Big Data Features, Performance, and Neoliberal Economic Approaches *Sustarum Thammaboosadee, Rubkwan Thammaboosadee, Sotarat Thammaboosadee*
1:30 pm to 1:45 pm	**IM-056** A Truck Tires Usage Worthiness Prediction Model *Nakarin Prateeppattanatumrong, Sotarat Thammaboosadee*	**EM-054** Constructing a Risk Behavior Guideline for Adolescent Students using Decision Tree *Surin Aunsan, Sotarat Thammaboosadee*
1:45 pm to 2:00 pm	**IM-075** The Hierarchical Technology Valuation Model for Big Data Technology Applied in Recruitment *Thiti Noydee, Sotarat Thammaboosadee*	**EM-057** Analyzing the Characteristics of Maths and English Tablet-based Games for Primary School Children *Hsu Nang, Antony Harfield, Ratchada Viriyapong*
2:00 pm to 2:15 pm	**IM-086** Of Online Community: Clustering Group of Compatible Mentor and Mentee *Pratya Nuankaew, Punnarumol Temdee*	**EM-027** A Study of Relationships of Attitudes and Behaviors towards to Usage of Google Translate of IT Students *Onwara Thanongsaksakul, Sotarat Thammaboosadee, Rubkwan Thammaboosadee*
2:15 pm to 2:30 pm	*Coffee Break*	
2:30 pm to 4:00 pm	**Track-IM2 Information Technology and Innovation Management Session Chair: *Emeritus Prof. Lance Fung* Room: Grand Mercure 3, Fl.3**	**Track-EM Educational Management Session Chair: *Dr. Jean Paolo G. Lacap* Room: Grand Mercure 4, Fl.3**

2:30 pm to 2:45 pm	**IM-062** Analysis of Global Mobile Device in Thailand *Panyaphat Aekitsawatwikul, Adisorn Leelasantitham, Supaporn Kiattisin, Smitti Darakorn Na Ayuthaya*	**EM-049** Application of BIM into Civil Engineering Management Class *Thoedtida Thipparat, Narong Chaisongkroh, Nonthachart Kulprapa, Thongpoon Thaseepetch*
2:45 pm to 3:00 pm	**IM-055** CRM Strategies discovered by Clustering Technique and Business Intelligence; case study in Chemical Industry *Thanakal Yotsomsak, Sotarat Thammaboosadee*	**EM-050** Application of QFD to Design a Course in Building Information Modeling (BIM) *Thoedtida Thipparat, Narong Chaisongkroh, Nonthachart Kulprapa, Sunantha Srisopha*
3:00 pm to 3:15 pm	**IM-005** Information Format-Shopping Orientation Fit in Mobile Commerce App: A Contradiction between Functional and Psychological Consequences *Chiang-Yu, Cheng, Yu-Tsu Lin, Chih-Wei, Cheng*	**EM-016** The Preparation of Vietnamese Students at Burapha University for Asean Economic Community (AEC) Skilled Labour Market *Chinh Bui Xuan, Saranya Lertbuddharak, Sirinya Chokchaiworarat*
3:15 pm to 3:30 pm	**IM-009** A Web-and-Android-Based Crime Data Retrieval System: A Case Study: Investigation Sub-Division Chiangrai Police Station *Thammavich Wongsamerchue, Wimol San-Um*	**EM-002** A Framework for Empowering Teachers to Author Interactive Content for Tablet Classroom Activities *Siwawes Wongcharoen, Jaratsri Rungrattanaubol, Antony Harfield*
3:30 pm to 3:45 pm	**IM-053** Semantic Ontology for Fine Arts Knowledge Management *Wassana Ouppala, Sotarat Thammaboosadee*	**EM-087** Classification of Basic Computer Skills for Skill Based Online Learning *Sataworn Chaichumpa, Santichai Wicha, Punnarumol Temdee*
3:45 pm to 4:00 pm	**IM-046** The Model Development of Incremental Innovation Affecting Organization Performance of Thailand Furniture Industry *Kitipong Tangkit, Vinai Panjakajornsak*	**EM-052** Univeristy Students' Year Level, Gender, and Entrepreneurial Attitude Orientation: The Case of Management and Entrepreneurship Students of a Philippine Higher Education Institution *Jean Paolo G. Lacap*
4:00 pm to 5:30 pm	**Track-EG** **Engineering, Science, and Technology Management** **Session Chair: *Prof. Dr. B. K. Pal*** **Room: Grand Mercure 3, Fl.3**	**Track-IT1** **Computer Engineering, Computer Science, Information Technology,and Software Engineering** **Session Chair: *Dr. Taweesak Samanchuen*** **Room: Grand Mercure 4, Fl.3**
4:00 pm to 4:15 pm	**EG-068** Occupational Health Hazards Vis-à-vis Industrial Safetyand Environmental Degradation – Case Studies *Dr. B. K. Pal, Sunil Kumar Bisoyi, Deepak Majhi, Susil Kumar Bisoyi*	**IT-061** Efficient Compact Join Algorithm for Acyclic Conjunctive SPARQL *Jaesung Lee, Dongguk Kim, Kyungsun Kim, Hanmin Jung*
4:15 pm to 4:30 pm	**EG-071** Optimal routing model for multi modal transportation *Thanawat Bamrungthai, Supaporn Kiattisin, Smitti Darakorn Na Ayuthaya*	**IT-070** A Development of Efficient Routing Algorithm Applied in Transportation Networks *Tun Tun Naing, Sunantha Sodsee*
4:30 pm to 4:45 pm	**EG-063** The Development of Distributed Sensors Network for Measurement of Thermal Comfort in Academic Classroom *Wipawadee Wongsuwan, Wimol San-Um*	**IT-065** A Verification of Instantaneous Acoustic Emission Signals Based on ASTM E976-94 Standard through Short-Time Fourier Transform Method *Jirayu Samkunta, Wimol San-Um*
4:45 pm to 5:00 pm	**EG-001** A Structural Equation Model Development of Environmental Performance and Economic Performance of The Electrical and Electronics Industry in Thailand *Surin Wichchuwong, Vinai Panjakajornsak, Amnuay Saengnoree*	**IT-064** An Image Encryption Scheme and Its Android Application using Robust Chaotic Map with Absolute Value Nonlinearity *Sivapong Nilwong, Wimol San-Um*
5:00 pm to 5:15 pm	**EG-038** Application of AHP and VIKOR for Chemical Product Selection *Thoedtida Thipparat, Narong Chaisongkroh*	**IT-039** Emotion Recognition using EEG data with a Multiple Classification Framework *Anuchin Chatchinarat, Chun Che Fung, Kok Wai Wong*
5:15 pm to 5:30 pm	**EG-051** 4D Application for Energy Building Project *Thoedtida Thipparat, Narong Chaisongkroh*	**IT-032** Improving Classification Performance with Complementary Fuzzy-Based Neural Networks *Ratchakoon Pruengkarn, Chun Che Fung, Kok Wai Wong, Worapat Paireekreng*
5:30 pm to 5:45 pm	**EG-090** Design of Thermoelectric-Based Cooling System used for Portable Application *Teerapon Thongpasri, Surapong Pongyupinpanich*	
6:30 pm to 8:30 pm	**Evening Reception** **Location: Rim Suan, Fl.12**	

November 18, 2015	
8:30 am to 9:00 am	**Registration and Reception** **Room: Grand Mercure 4, Fl.3**
9:15 am to 11:45 am	**MORNING PRESENTATION**

9:15 am to 10:30 am	**Track-EA&IT** **Enterprise Architecture, IT Corporate Management, and IT Governance** **Session Chair: *Prush Sa-Nga-Ngam*** **Room: Grand Mercure 3, Fl.3**	**Track-BM1** **Business, Marketing, Strategic, and Financial Management** **Session Chair: *Asst. Prof. Dr.Yordying Thanatawee*** **Room: Grand Mercure 4, Fl.3**
9:15 am to 9:30 am	**EA-030** The Factors Affecting to Acceptable Behaviors of Enterprise Resource Planning *Mathuros Panmuang, Chonnikarn Rormorn, Khuanwara Potiwara*	**BM-010** The Use of Social Media for Corporate Disclosure by Companies Listed in the GCC *Ehab K. A. Mohamed, Mohamed A. K. Basuony*
9:30 am to 9:45 am	**EA-074** Economic Analysis of the Information System Investment Using Cost and Benefit Analysis (CBA) Method *Leo Willyanto Santoso, Yulia, Imelia Widjanadi*	**BM-014** A Study of the Core Competencies Affecting the Performance of Security Investment Consultant at Security Companies in the Stock Exchange of Thailand *Phatre Friestad*
9:45 am to 10:00 am	**EA-076** IT Investment Evaluation Using Multi Objective Multi Criteria: Case Study on an Expedition Company *Yulia, Leo Willyanto Santoso, Danny Tantra*	**BM-034** Employee or Employer? Entrepreneurial Perspectives of Tourism Management Students of a Higher Education Institution in Angeles City, Philippines *Darriel B. Mendoza, Jean Paolo G. Lacap*
10:00 am to 10:15 am	**IT-077** Towards an Internet-of-Things aware Process Modeling Method - An Example for a House Suveillance System Process Model *Roland Petrasch, Roman Hentschke*	**BM-060** A Structural Equation Model Development of Service Quality, Brand Image, and Switching Deterrents Affecting Customer Loyalty for Mobile Service Providers in Thailand *Patcharanan Klankaew, Amnuay Saengnoree, Vinai Panjakajornsak*
10:15 am to 10:30 am	**IT-033** Management of Internet Bandwidth Using Machine Learning Technique *Hari Suparwito, Hong Xie, Chun Che Fung, Shri Rai*	**BM-045** The Role of Regulatory Focus on Promotional Mental Accounts *Pei-Ru, Li, Po-Shun, Chen, Chia-Jung Chang*
10:30 am to 10:45 am	*Coffee Break*	
10:45 am to 12:00 am	**Track-IT2** **Computer Engineering, Computer Science, Information Technology,and Software Engineering** **Session Chair: *Dr. Sotarat Thammaboosadee*** **Room: Grand Mercure 3, Fl.3**	**Track-BM2** **Business, Marketing, Strategic, and Financial Management** **Session Chair: *Dr. Supasit Lertbuasin*** **Room: Grand Mercure 4, Fl.3**
10:45 am to 11:00 am	**IT-073** Implementing Historical Aspects of Majapahit Empire in A Turn Based Strategy Game *Liliana, Gregorius Satia Budhi, Silvia Rostianingsih, Erandaru*	**BM-007** A Structural Equation Model Development of Service Quality Customer Satisfaction and Relationship Quality That Affect Customer Loyalty of Sea Freight Forwarders in Thailand *Teewin Narunart, Vinai Panjakajornsak*
11:00 am to 11:15 am	**IT-079** Comparison Between Shape-based And Area-based Features Extraction for Java Character Recognition *Rudy Adipranata, Gregorius Satia Budhi, Liliana, Bondan Sebastian*	**BM-040** A Causal Model of Innovation Capability, Market Orientation and Absorptive Capacity Affecting Competitive Advantage of Thailand Rubber Industry *Prapapan Mantam, Vinai Panjakajornsak*
11:15 am to 11:30 am	**IT-078** The Use of Probabilistic Neural Network and ID3 Algorithm for Java Character Recognition *Gregorius Satia Budhi, Rudy Adipranata, Bondan Sebastian, Liliana*	**BM-015** The Preparedness to Apply Total Quality Mangement in Production: a Case Study of a Company Making Metallic Coated Steel in Rayong Province *Jarun Suantai, Surat Supitchayangkul, Sarayuth Chokchaiworarat*
11:30 am to 11:45 am	**IT-083** Nudity Detection Using Combination of Color-Based and Morphological Methods *Sangjun Rattanee, Werapon Chiracharit*	**BM-017** Activity Types and Agro-tourism Route at Khun Dan Prakarn Chon Dam, Nakorn Nayok Province *Nitt Visesphan, Sarunya Lertputtarak, Wilailuk Khamloy*
11:45 am to 12:00 pm	**IT-069** Applying Item Category Rating in Recommendation Systems *Thanaphon Phukseng, Nawaporn Wisitpongphan, Sunantha Sodsee*	**BM-035** Value Analysis of Cyber Security Based on Attack Types *Mehrnaz Akbari Roumani, Chun Che Fung, Shri Rai, Hong Xie*
12:00 pm to 1:00 pm	**Lunch** **Location: One Rachada, Fl. G**	
1:00 pm to 1:30 pm	**Keynote Speech-III** **Presenter: Ben Gerber** **Topic: Understanding Privacy** **Room:Grand Mercure 4, Fl.3**	
1:45 pm to 4:15 pm	**LOCAL PRESENTATION (Thai Tracks)**	
1:45 pm to 4:15 pm	**Track-TT1** **Thai Track I** **Session Chair: *Manutsiri Chansutthirangkool*** **Room: Grand Mercure 3, Fl.3**	**Track-TT2** **Thai Track II** **Session Chair: *Dr. Taweesak Samanchuen*** **Room: Grand Mercure 4, Fl.3**
1:45 pm to 2:00 pm	**TT-012** การสรรหาเงินฝากเชิงกลยุทธ์ธนาคารออมสินในเขตอำเภอวิหารแดงจังหวัดสระบุรี *พรพรรณ รักษาค, ภูวรินทร์ นิลรังษี, ธีทัต ตรีศิริโชติ*	**TT-028** ผลกระทบจากอิทธิพลส่งผ่านของนวัตกรรมผลิตภัณฑ์ระหว่างสารสนเทศในการจัดการความรู้และการบรรลุเป้าหมายองค์กร *นจรี ภาคาสัตย์, ศักดิ์ชาย จันทร์เรือง*

2:00 pm to 2:15 pm	**TT-047** การพัฒนาชุดจำลองเครือข่ายคอมพิวเตอร์บนพื้นฐานของ Dummynet: การกำเนิด Jitter *จรัสพงศ์ กาญจนลักษณ์, เทอดพงษ์ แดงสี, ดุลย์ ไตรยสรรค์, พงษ์พิสิฐ วุฒิดิษฐโชติ*	**TT-080** การประเมินประสิทธิภาพการดำเนินงานด่านชายแดนไทยด้วยวิธีการวิเคราะห์การวางกรอบข้อมูล *ดำรงพล ชนะวรรณ, จิรพรรณ เลี่ยงโรคาพาธ, อดิศร ลีลาสันติธรรม, สุภาภรณ์ เกียรติสิน, สมิทธิ ดาราภร ณ อยุธยา*
2:15 pm to 2:30 pm	**TT-019** การพัฒนาสื่อประชาสัมพันธ์หลักเกณฑ์การจัดเก็บภาษีห้างหุ้นส่วนสามัญและคณะบุคคลที่มิใช่นิติบุคคล *เยาวลักษณ์ วรกานต์ทวีกิจ, นพดล เดชประเสริฐ*	**TT-085** การตรวจหาภาพปีนโดยการแปลงลักษณะเด่นแบบไม่แปรผันตามขนาด *สุเมธ คำง่าเมือง,วีรพล จิรจริต*
2:30 pm to 2:45 pm	**TT-020** การพัฒนาคุณสมบัติของข้อมูลสถิติเศรษฐกิจภาคต่างประเทศของธนาคารแห่งประเทศไทย *รวี อาณาบาล, สุชนนี เมธิโยธิน*	**TT-021** แนวทางการพัฒนาการจัดเก็บภาษีอากรและลดจำนวนผู้เสียภาษีที่เป็นกลุ่มเสี่ยงของสำนักงานสรรพากรพื้นที่นนทบุรี 2 *เรียม เขียนทอง, นพดล เดชประเสริฐ*
2:45 pm to 3:00 pm	*Coffee Break*	
3:00 pm to 3:15 pm	**TT-081** การเปรียบเทียบคุณลักษณะและประสิทธิภาพเครื่องแม่ข่ายเสมือนแบบก้อนเมฆของศูนย์ข้อมูลกลาง Uninet ระหว่าง ยูคาลิปตัสคราวด์และไมโครซอฟท์ซิสเต็มเซ็นเตอร์ 2012 *ศรัด จันทร์ไกร, สุภาภรณ์ เกียรติสิน, อดิศร ลีลาสันติธรรม, สมิทธิ ดาราภร ณ*	**TT-089** การวิเคราะห์สมรรถนะการทำงานของโรงไฟฟ้าพลังงานร่วม: กรณีศึกษา *อัญชิตา จิตตามัย, สุเมธ เนติสัตตานนท์*
3:15 pm to 3:30 pm	**TT-004** การเปรียบเทียบประสิทธิภาพการทำงานของ Extract, Transform and Loading (ETL) โดยใช้ต้นไม้การตัดสินใจและตรรกศาสตร์คลุมเครือ *ณัฐพล นาคบัวแก้ว, สุภาภรณ์ เกียรติสิน, อดิศร ลีลาสันติธรรม, โชษาศรัดต ธรรมบุษดี สมิทธิ ดาราภร ณ อยุธยา*	**TT-018** มาตรฐานการบริการคนไร้ที่พึ่งนนทบุรี ในสถานแรกรับคนไร้ที่พึ่งนนทบุรี *ณัฐสิมี วรัตน์กลบันทร์, นพดล เดชประเสริฐ*
3:30 pm to 3:45 pm	**TT-023** การบริหารจัดการที่ส่งผลต่อการมีส่วนร่วมในการพัฒนาสถานทำงานน่าอยู่ น่าทำงานของพนักงานและข้าราชการ สำนักนโยบายและยุทธศาสตร์ สำนักงานปลัดกระทรวงสาธารณสุข *สโรชิน สหสาคร, สุชนนี เมธิโยธิน*	**TT-022** แนวทางการปฏิบัติงานในการเข้าถึงมวลชนของหน่วยทหารระดับกองร้อยในพื้นที่หน่วยเฉพาะกิจยะลา ระหว่างปี 2552 - 2557 *วาทินี สุวรรณรักษ์, สุชนนี เมธิโยธิน*
3:45 pm to 4:00 pm	**TT-091** การลดสัญญาณรบกวนข้ามช่องใน VLSI Design โดยใช้ทฤษฎีกบกระโดด *อดิศักดิ์ จีบคำพล, นุสรา ฮวดโพธิ์พันธ์, อภิชาต ดีรประเสริฐสิน*	**TT-092** การจัดวางโครงสร้าง VLSI Chip เพื่อลดเส้นทางการเชื่อมต่อโดยใช้ทฤษฎีกบกระโดด *วิไลพร แหว่กระโทก, สิทธิพงศ์ ชวนโพธิ์, พรภัสสร อ่อนเกิด, อภิชาต ดีรประเสริฐสิน*
4:00 pm to 4:15 pm	**TT-094** Designing the Governance and Measurement Model for Thailand Mobile Connect Service by Utilising the TM Forum eTOM and ISO 38500 Framework *Mahasak Pijittum , Supaporn Kiattisin, Smitti Darakorn Na Ayuthaya*	**TT-093** การออกแบบจัดวางผังโรงงานเพื่อลดขั้นตอนการเดินทางโดยใช้เทคนิคซัฟเฟิลฟรอกลิปปิง *อนัญญา ศรีวงษ์, สิรินทิพย์ วันจันทึก, ประกาย นาคี, อภิชาต ดีรประเสริฐสิน*

The Use of Probabilistic Neural Network and ID3 Algorithm for Java Character Recognition

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***Abstract*— Java character is the character that is used especially in Java island, Indonesia. Java character has a special form of writing consist of basis characters, vowels, complementary, etc. In this research, the authors conducted Java character recognition using 2 methods, namely probabilistic neural network (PNN) and ID3 algorithm. PNN is a method of artificial neural network that can be trained supervised and unsupervised. PNN is built based on the theory of probability which is realized as an artificial neural network. This method is used because PNN has a high accuracy in the classification of data, also has high speed when performing the process. ID3 (Iterative Dichotomiser) is a decision tree algorithm. Basic ID3 algorithm using tree induction that gives attribute to the node in the tree based on how much information increases from the node. From experimental results, PNN method can achieve an accuracy up to 92.35% for data that has been trained previously, and up to 61.08 % for data hasn't been trained before. While ID3 can achieve recognition rate of 100% for data has been trained before but only 15.57% for data hasn't been trained before.**

***Keywords*— Java character recognition, probabilistic neural network, ID3.**

I. INTRODUCTION

Java character is the character that is used especially in Java island, Indonesia. Java character has a special form of writing consist of basis characters, vowels, complementary, etc. In this research, the authors conducted Java character recognition using 2 methods, namely probabilistic neural network (PNN) [1] and ID3 algorithm [2].

The process of Java character recognition can be divided into three stages: segmenting the image of the Java character document, extracting features of each Java character, and doing recognition of Java character from the features that have been extracted [3]. The image segmentation is the process of cutting Java character document image into pieces, each of which contains only one Java character.

Features extraction is the process of identifying the features of each Java character, where the features can be the outline or shape of the character. Features of Java character can be curve, straight lines, or loop [4]. Features extraction process will identify the edge of curvature, a straight line, a loop, or a number of pixels in small area which is owned by a character. After the features of Java character obtained, then the features will be processed, so that the computer can recognize the character. For recognition process, we use and compare between PNN and ID3 algorithm.

II. JAVA CHARACTER

Java character consist of basis character called *Carakan*, vowel and complimentary called *Sandhangan*, number called *Wilangan*, consonant called *Pasangan*, etc. Basis character of Java character consist of 20 characters, can be seen in Fig. 1 [5].

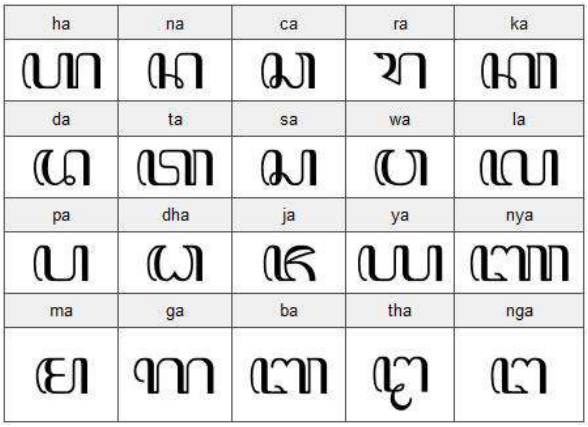

Fig. 1. Basis character.

III. PROBABILISTIC NEURAL NETWORK

PNN is a method of artificial neural network that can be trained supervised and unsupervised. PNN is built based on the theory of probability which is realized as an artificial neural network [1, 6]. This method is used because PNN has a high accuracy in the classification of data, also has high speed when performing the process. PNN Architecture can be seen in Fig. 2 [1].

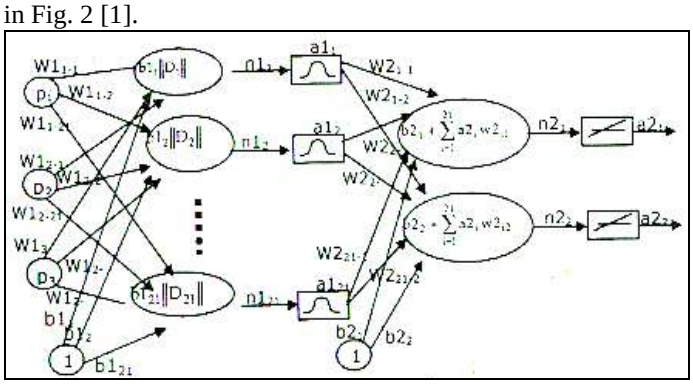

Fig. 2. PNN architecture.

Here is the training algorithm (points 1-3) and classification algorithm (points 4-7) of PNN [1, 6]:

1. Perform initialization of the initial weight *W* of the matrix *Q x R* where *R* is the dimension of input and *Q* is the amount of training data.
2. Perform initialization of bias value (*b*) of the spread value entered using (1).
   b= √(-ln0.5) /s (1)
3. Perform initialization of final weight matrix *M* which is a *K x Q* where *K* is the number of groups of the classification result and *Q* is the amount of training data. *i-th* row of the matrix *M* representing the the *i-th* training data and *j-th* column matrix values will be valued 1 if the training data entry into the group, otherwise it will be valued 0.
4. Calculate the distance between the input data vector *P* by vectors in each row on the initial weight *W* (euclidean distance between the vector *P* with the vector W_i) resulting in vector distance || *W* - *P* || in *R* dimension.
5. Calculate the activation value of the distance between the initial weight and the input data (vector *a*), using *radbas* function () in (2), (3), (4).

   radbas(n) = e^{-n^2} (2)

   $n = \|W - P\| .* b$ (3)

   $b = \frac{\sqrt{-\ln 0.5}}{s}$ (4)

6. Multiplying vector *a* by matrix *M* so as to produce the output vector *d*.
7. Looking output of PNN with competitive function *C* where this competitive function will seek the greatest value in the vector *d*. The index of the largest value will indicates the classification result of input data *P*.

IV. Decision Tree

Decision tree induction is a decision tree learning from class-labelled training tuples. Decision tree shaped like a flowchart in which each internal node represents a test on an attribute, each branch illustrates the results of the tests, and each leaf node indicates the class label. Top node is the root node [2]. Example of a decision tree can be seen in Fig. 3 [2].

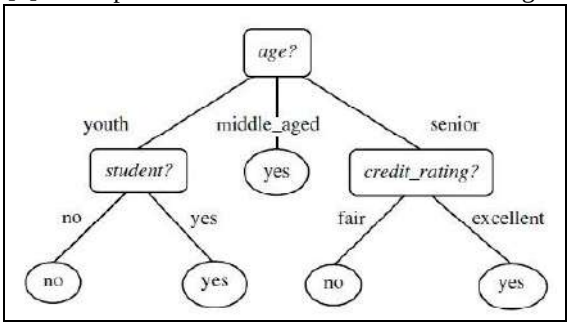

Fig. 3. Decision tree.

Fig. 3 shows the prediction of whether a customer in All Electronics will buy a computer or not. Internal node described by the box, and the leaf node depicted with oval.

During the making tree, should choose the most excellent attributes in differentiating classes. The algorithms used for decision tree is ID3.

V. ID3

ID3 (Iterative Dichotomiser) is a decision tree algorithm created by J. Ross Quinlan [2]. Basic ID3 algorithm using tree induction that gives attribute to the node in the tree based on how much information increases from the node. ID3 method allows an attribute to have two or more values in a node or split point [7]. Selected attributes for each node is an attribute that maximize information gain. ID3 can classify large amounts of data in a relatively fast, depending on how large the data set used [2].

ID3 use the Information gain for the selection of attributes. Information attribute that has the highest gain was elected splitting attribute for a node. Information that is expected to be required to classify a tuple in D is given by (5) [2]:

$$\text{Info(D)} = -\sum_{i=1}^{m} p_1 \log 2 (p_1) \quad (5)$$

where p_i is the possibility of an arbitrary tuple in *D* belongs to the class C_i and is estimated by $|Ci_{,D}|/|D|$. Log function with base 2 is used as information calculated in bits. *Info(D)* is the average amount of information used to identify the class label of a tuple in *D*. *Info(D)* is known as entropy of *D*. The amount of information is still needed to achieve the desired partition measured by (6) [2]:

$$info_A(D) = a_0 + \sum_{j-l}^{v} \frac{|D_j|}{|D|} Info(D_j) \quad (6)$$

Term $\frac{|Dj|}{|D|}$ functions as the weight of the *j* partition. *InfoA(D)* is estimate of the information needed to classify a tuple of *D* based partitioning by A. The smaller expected information need, the greater degree of partition purity. Information gain is defined as the difference between the information needs with the needs of the new origin, as calculated using (7) [2].

Gain(A) = Info(D)-InfoA(D) (7)

In other words, *Gain(A)* tell how much will grow by branching in A. Attribute A with the greatest information gain (*Gain (A)*) will be selected as the splitting attribute at the node.

VI. System Design

Java character recognition system can be divided into two main processes, namely training and classification. Process flow is described using flowchart which can be seen in Fig. 4.

Training of PNN method is just the weight 0 initialization process, last weight, and the bias value. Flowchart of PNN training can be seen in Fig. 5.

In Fig. 5, it can be seen that before initialization of variables in PNN done, first read the data features and the value of the spread. Both feature data and the spread value obtained from user input. After the input is read, the data features incorporated into the initial weight (weight 0). Then the value of bias will be calculated based on spread value. The last

weight is initialized and then the resulting data sets are ready to be saved to an external file. The data set consists of the initial weight (weight 0), last weight, spread values and bias that have been initialized earlier.

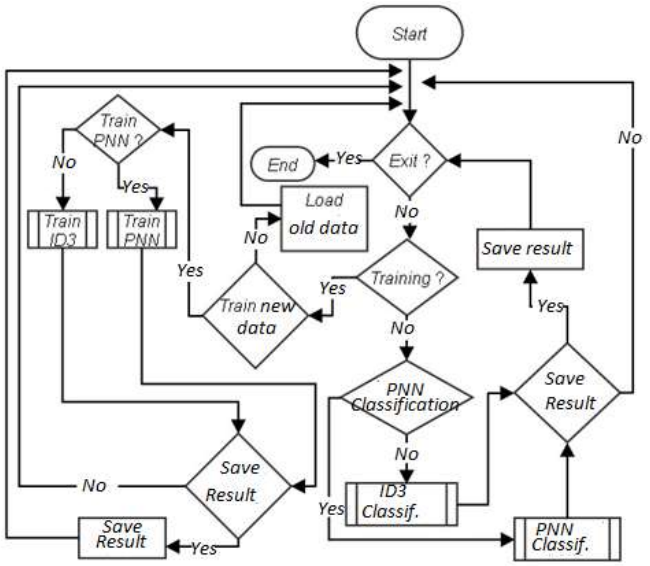

Fig. 4. System flowchart..

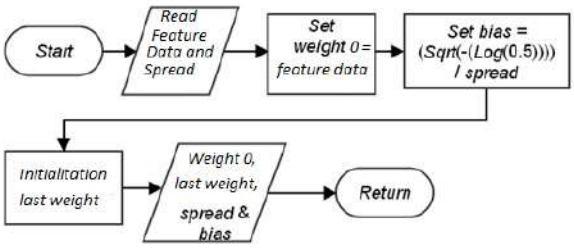

Fig. 5. PNN training flowchart..

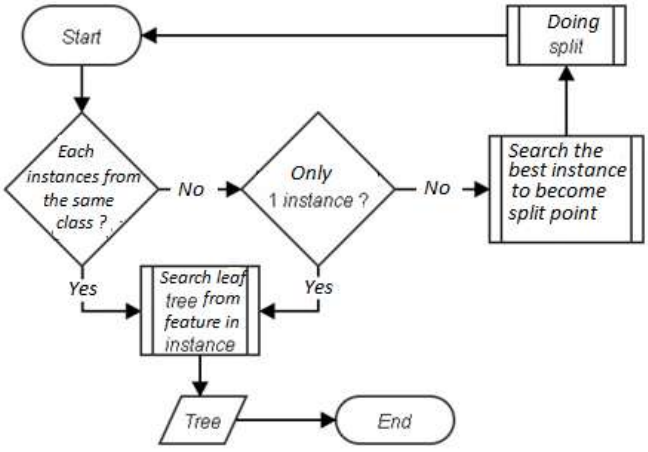

Fig. 6. ID3 training..

The process of training the decision tree is basically a rule-making tree with specific algorithms to obtain an effective rule for classifying data. In this system, the algorithm used is Iterative Dichotomiser 3 (ID3). In ID3, rule-making is based on information gain contained in an instance/node tree, which in Javanese character recognition system, each node is the type/class of a Java character. Flowchart of the rule-making process tree using ID3 algorithm can be seen in Fig. 6.

The process of establishing rule tree or decision tree occur recursively. This function will stop when the leaf of a tree has only one instance alone, or when the leaf of the tree has multiple instances of the same class. If the condition for stopping has not been met, then the best instance of the search function will be executed. Best instance found will be used as the split point or a branching point in the tree.

The overview process of PNN classification method can be described as follows: PNN that have been trained before will receive input in the form of matrix *X*. Matrix *X* is a collection of input vector *x*, where *x* is the set of features of a unknown Java character. Furthermore, every vector *x* will be calculated the distance with each vector in the matrix *W* (initial weight). This process will produce a distance vector, which then will go through the activation process (radial basis function). The activation process will produce activated distance vector, where the vector is to be incorporated into the competitive function to generate a vector representation index Java character. This vector will be used to search for Java character that matches the index of the pattern unit. After all vectors *x* in the matrix *X* are processed, the results matrix will be prepared to be sent to the next process.

ID3 classification overview are the nodes searching in the tree which class is in accordance with the input. Input is in the form of matrix *M* that every line is a vector *m* that stores the features of a unknown types/class Java character. Each vector in the matrix *M* will be read, and then each feature information in it will be matched with each node in the tree until a leaf of the tree is found. Leaf is what would be considered a class of a set of features in the vector *m.*

VII. EXPERIMENTAL RESULT

In experiment, we used 10 images of Java character documents. Each image has from 25 until 283 Java characters. Experiment is done by using the data that has been previously trained and with the data has never been trained before. The results of recognition will be compared between the use of the PNN method and ID3 method.

TABLE I RECOGNITION RESULT OF PNN USING DATA TRAINED BEFORE

No.	Document	Number of Java Character	Accuracy (%)
1	Document 1	136	99.26
2	Document 2	55	92.73
3	Document 3	177	89.27
4	Document 4	212	94.81
5	Document 5	283	89.75
6	Document 6	198	93.94
7	Document 7	196	94.90
8	Document 8	25	100
9	Document 9	130	86.15
10	Document 10	156	89.74
Average			**92.35**

Experiment result of PNN method using data that has been trained before can be seen in Table I. Spread value used in this experiment is 1.

Based on experimental results in Table 1, it can be seen that the PNN can achieve an average accuracy rate of 92.35% in classifying the data that has been trained before. In next experiment, PNN will be used to classify the data that has never been trained before. Documents used in the experiment remains the same with the previous experiment, but not all of the data in an image is used for training. Only a portion of the data will be used for training, and the rest tried to be classified. Of each characters contained in the image, limited to a maximum two types of the same typeface that may be used as training data, the rest will be used as a data classification. The experimental results are shown in Table II.

TABLE II RECOGNITION RESULT OF PNN USING DATA NEVER BEEN TRAINED BEFORE

No.	Document	Number of Java Character for Training	Number of Java Character for Classification	Accuracy (%)
1	Document 1	57	79	54.43
2	Document 2	28	27	55.56
3	Document 3	51	126	64.29
4	Document 4	59	153	66.01
5	Document 5	61	222	56.76
6	Document 6	56	142	62.68
7	Document 7	60	136	63.24
8	Document 8	15	10	60.00
9	Document 9	43	87	75.86
10	Document 10	46	110	49.09
Average				**61.08**

From the experiment result in Table II, the average accuracy rate is 61.08% for data has never been trained before.

The next experiment is done using ID3 method with data that has been trained before. Recognition accuracy results can be seen in Table III.

TABLE III. EXPERIMENTAL RESULT OF ID3 USING DATA TRAINED BEFORE

No.	Document	Number of Java Character	Accuracy (%)
1	Document 1	136	100
2	Document 2	55	100
3	Document 3	177	100
4	Document 4	212	100
5	Document 5	283	100
6	Document 6	198	100
7	Document 7	196	100
8	Document 8	25	100
9	Document 9	130	100
10	Document 10	156	100
Average			**100**

For the results of the experiment using data that has never been trained before can be seen in Table IV

TABLE IV EXPERIMENTAL RESULT OF ID3 USING DATA NEVER BEEN TRAINED BEFORE

No.	Document	Number of Java Character for Training	Number of Java Character for Classification	Accuracy (%)
1	Document 1	57	79	8.86
2	Document 2	28	27	29.63
3	Document 3	51	126	19.84
4	Document 4	59	153	20.26
5	Document 5	61	222	16.67
6	Document 6	56	142	8.45
7	Document 7	60	136	12.50
8	Document 8	15	10	20.00
9	Document 9	43	87	27.59
10	Document 10	46	110	6.36
Average				**15.57**

The recognition results of ID3 by using the data that has been trained before reached 100% as shown in Table 3. It is better than PNN accuracy rate, but for data that has not been trained, the results of the recognition only 15.57% as shown in Table IV.

VIII. CONCLUSIONS

From experimental results, PNN method can achieve an accuracy rate up to 92.35% for data that has been trained previously, and up to 61.08 % for data hasn't been trained before. While ID3 can achieve recognition rate of 100% for data has been trained before but only 15.57% for data hasn't been trained before. So we can conclude that PNN method is more suitable for use in Java character recognition than ID3 algorithm.

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