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Handwritten word segmentation using Kaiser window (Conference Paper)

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Faculty of Science and Technology, Sanata Dharma University, Yoevakarta, Indonesia

Abstract

In the field of handwritten word recognition field, word segmentation into letters is an approach that could be used. Using this approach, word segmentation would be a complicated task, especially when dealing with a cursive handwritten word. A simple method in word segmentation called oversegmentation could be used. This paper discusses a simple method using Kaiser window. In general, the word segmentation process in this paper can be described as follow: Input - Preprocessing - Segmentation - Output. The input is an image of isolated handwritten word in binary format, while the output is images of letter segment. The main purpose of preprocessing is to correct slant and slope. This preprocessing is necessary since the segmentation method used is sensitive with slant and slope. The main purpose of segmentation is to divide a word into some letter segments. Based on a subjective test result, it was shown that the minimum parameters for the Kaiser window that can be used effectively for oversegmentation are 8 points in window's length and 10 in beta value. As its window's length is getting longer and its beta value is getting bigger, it can also be used effectively for oversegmentation. However, it must be noted that if the letter size is getting bigger, there will be more letter segments resulted. © 2013 IEEE.

Author keywords

Handwritten word Kaiser window segmentation

Indexed keywords

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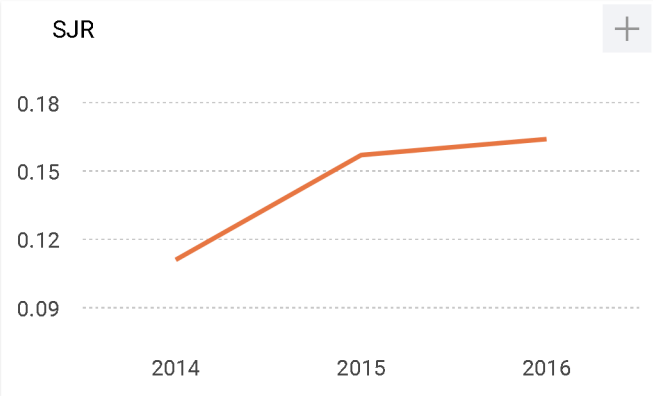

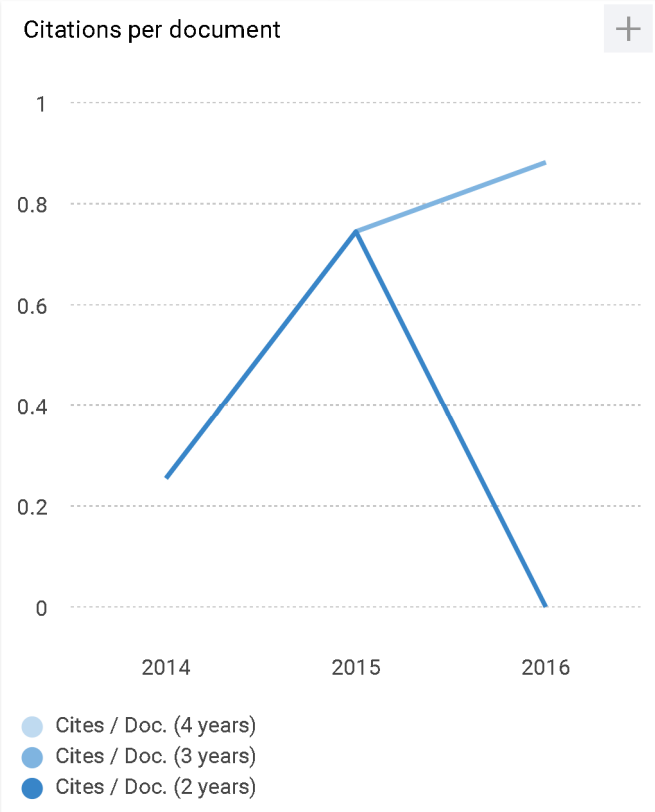

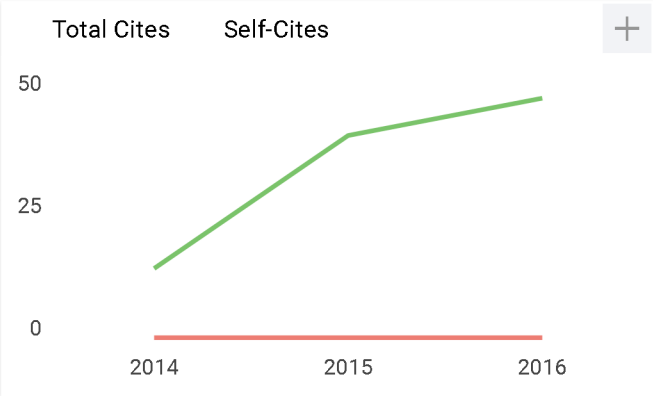

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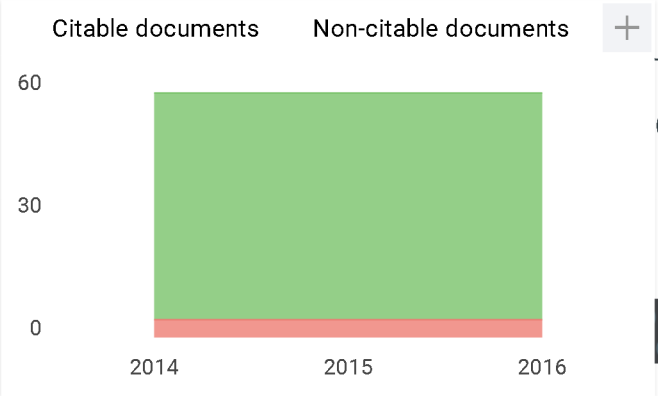

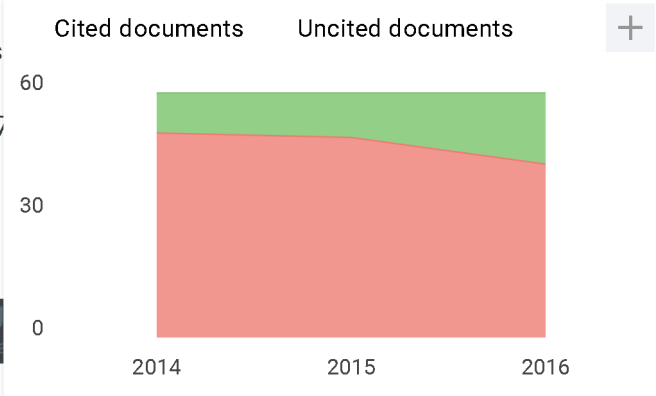

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(QUALITY in RESEARCH)

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QiR

Yogyakarta
25-28 June 2013

IEEE

IN CONJUCTION WITH :

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(The 2nd International Conference on Civic Space)

ORGANIZED BY :

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The 13th International Conference on QiR

25-28 June 2013
Yogyakarta, Indonesia

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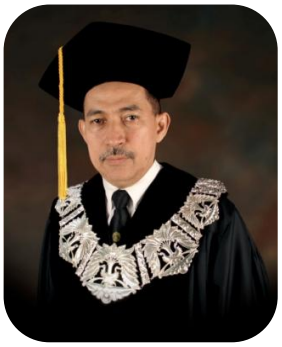

It is both a pleasure and honor for me to welcome you all to the 13th International Conference on QiR (Quality in Research) 2013. In this globalization era, mankind's competitive explorations to find new and better ways to enhance their life has often resulted in sacrificing the environment for their convenience. To preserve the environment for our future generations, steps must be made to ascertain that development and innovation of mankind must be more sustainable, balancing both mankind's' effort in enhancing their quality of life and fulfilling their needs, with its harmony with nature.

Today, scientists and experts, in particular, people in engineering, architecture and design are looking to develop new environmentally friendly technologies, or eco-technologies. Innovation in eco-based multidisciplinary knowledge and skills becomes the important key, and this central issue should be encouraged for the motivation of current and future development. Eco-technology can help protect, conserve and even restore our precious shared environment. To develop this technology, we need to combine engineering, scientific or technological approaches, with ecology, economics and the social sciences and humanities. The eco-innovation field is now wide open and offers exciting new territories to explore and develop. Creative thinking by our top technical and scientific researchers is giving us a more and more treasures of new workable ideas.

However, innovations require more than just brilliant ideas. Innovations require resources, skills, technology, knowledge, tools, techniques and so much more. But most of all, innovations require people. People are the driving force behind every need of change, changes that are aimed to improve mankind's quality of life, to enhance their living conditions or to simply make life easier and more comfortable. This conference is about learning of the fundamental aspects which can transform the world and society, thinking ahead to possible challenges facing the globe, discovering innovations related to opportunities for industry, and most importantly, this conference is about bringing together interdisciplinary people to accelerate activities in many areas simultaneously. This is what makes the conference exceptional this year in terms of potential impact from this networking.

I extend my sincere thanks to the Faculty of Engineering Universitas Indonesia, supporting parties and institutions for their participation and contributions in QiR 2013. I would also thank the people of Yogyakarta for their gracious support and hospitality. Additionally, I extend a hearty thank you to the members of the organizing committees for dedicating their valuable time so that each one of us enjoys an exceptional conference program over the next several days. May we have a successful, stimulating, fruitful and rewarding conference.

Prof. Dr. Ir. Muhammad Anis M.Met.
Rector
Universitas Indonesia

PREFACE

WELCOME FROM THE DEAN OF FACULTY OF ENGINEERING UNIVERSITAS INDONESIA

Welcome to the 13th International Conference on QiR (Quality in Research) 2013. The Faculty of Engineering Universitas Indonesia is thrilled that, together with our co-hosts IST-Akprind and Gadjah Mada University, we are able to present an international conference of this magnitude. This two-day conference speaks to the importance of fostering relationships among national and international front liners, thinkers, academics, executives, government and business officials, practitioners and leaders across the globe in an effort to share knowledge and best practices as part of a worldwide network.

The quest for knowledge has been from the beginning of time but knowledge only becomes valuable when it is disseminated and applied to benefit humankind. It is hoped that QiR 2013 will be a platform to gather and disseminate the latest knowledge in engineering, architectural design and community services. Academicians, scientist, researchers and practitioners of these fields will be able to share and discuss new findings and applications of their expertise. It is envisaged that the intellectual discourse will result in future collaborations between universities, research institutions and industry both locally and internationally. In particular it is expected that focus will be given to issues on innovations for the enhancement of human life and the environment.

In accordance to this year's theme, this conference will cover a wide range of sustainable design and technology issues, especially state of the art information and knowledge of new innovations, ideas, creative methods or applications which can be implemented to enhance the human life and also our environment. The itinerary of the conference over the two days has been carefully planned to ensure a lively exchange of ideas and the development of innovative strategies and there will be many opportunities for everyone in attendance to share their expertise with, and learn from, peers from around the world.

We urge you to spend the next two days in interesting discussions and exchanging ideas among yourselves. We foresee more and more challenges in our future. Challenges in how to improve our life, how can we enhance our society, how can we make our lives and the lives or our society better? These challenges should be answered together by developing collaborations for future research in various engineering and design areas. It is our hope and aim that this conference would be able to provide an international media for exchange of the knowledge, experience and research as well as the review of progress and discussion on the state of the art and future trend of prospective collaboration and networking in broad field of eco-based technology development.

My deepest appreciation to our sponsors, supported parties and various contributors for their never ending supports of this conference. I would also like to convey my humblest thankfulness to all of our distinguished speakers for making the time to share their knowledge with us. To our fellow researchers and/or practitioners from Indonesia and overseas, welcome and enjoy your stay in this amazing historical city, Yogyakarta. I would also like to invite all participants in expressing our appreciation to all members of the QiR 2013 organizing committee for their hard work in making this conference another success.

Prof. Dr. Ir. Bambang Sugiarto, M.Eng
Dean Faculty of Engineering
Universitas Indonesia

WELCOME FROM THE QiR 2013 ORGANIZING COMMITTEE

Welcome to the 13th International Conference on QiR (Quality in Research) 2013. It is a great pleasure for Faculty of Engineering Universitas Indonesia to be co-hosting this biennial event with IST-Akprind and Gadjah Mada University, in the spirit of strengthening of cooperation and mutual growth to be world class institution. For the first time, the QiR 2013 is held in one of the most historical city in Indonesia – Yogyakarta. It is with our utmost pleasure to hold this year's QiR 2013 in conjunction with the 2nd International Conference on Civic Space (ICCS 2013) and introducing the International Symposium on Community Development 2013 as a forum to share experience on engaging community for a better life and environment.

The aim of this International Conference with our selected theme, "Exploring Innovation for Enhancement of Human Life and Environment", is to provide an international forum for exchanging knowledge and research expertise as well as creating a prospective collaboration and networking on various fields of science, engineering and design. We hope this conference can be a kick-off for the strengthened action and partnerships on creating a platform for us; national and international thinkers, academics, government officials, business executives and practitioners, to present and discuss the pivotal role of engineers in innovative products which will reduce environmental impacts, applications in sustainable planning, manufacturing, architecture, and many more to grow and ensure the rising prosperity of our society going into the future. Under this theme, the conference focuses on the innovative contributions in science, engineering and design as well as their market perspectives to the existing and future enhancement of human life and environment quality.

Over the period of 15 years, this biennial conference has become an important place of encounter between scholars and practitioners from different countries, cultures and backgrounds discussing contemporary engineering and design issues dealt in their hometown, country or even region. Serving as a platform for an engineering and design dialogue, this conference will have 16 invited speakers and has gathered more than 500 papers from more than 20 countries all over the world:
92 papers on International Symposium on Civil and Environmental Engineering
51 papers on International Symposium on Mechanical and Maritime Engineering
97 papers on International Symposium on Electrical and Computer Engineering
111 papers on International Symposium on Materials and Metallurgy Engineering
31 papers on International Symposium on Architecture, Interior and Urban Planning
57 papers on International Symposium on Chemical and Bioprocess Engineering
71 papers on International Symposium on Industrial Engineering
25 papers on International Symposium on Community Development

My deepest gratitude to all of our speakers, participants and contributors who have given this conference their generous support. I would also like to thank all members of the Organizing Committee and our distinguished International Board of Reviewers for all of their support and advice. Our thanks to all of our sponsors, supporters, exhibitors, and professional associations for their great support and encouragement through committed funding and any other form of help and support. We also owe our success to the full support of the Rector of Universitas Indonesia and the Dean of Faculty of Engineering. Thank you to IEEE Indonesia Section that has supported QiR 2013 to be approved as IEEE Conference. Last but not least, a special thanks to our co-hosts, IST-Akprind and Gadjah Mada University for all of their immense supports in making this conference a success.

Allow me to wish all of you a meaningful and rewarding conference. We wish you a pleasant and memorable stay in Yogyakarta. Thank you and we hope to see you again at the QiR 2015.

Prof. Dr. Ir. Bondan T. Sofyan, M.Si.
Chairman of QiR 2013 Organizing Committee

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SYMPOSIUM : ELECTRICAL ENGINEERING

SESSION E1. Electronics
Chair: Prof. Eko Tjipto Rahardjo dan Dr. Ratno Nuryadi
Wednesday, 26 June 2013, 1.00 - 3.00 p.m
Venue: Mataram I Room

Time	No.	Authors	Affiliation	Title
1.00-1.30 pm	**E1.1 (Invited)**	**Prof. Koichi Ito**	**Chiba University, Japan**	**Simple Dual-Mode Wearable Antenna for Body-Centric Wireless Communications**
1.30-2.00 pm	**E1.2 (Invited)**	**Prof. Michiharu Tabe, Daniel Moraru, Earfan Hamid, Takeshi Mizuno**	**Shizouka University, Japan**	**Single-dopant Atom Devices for The Future of Nanoelectronics**
2.00-2.15 pm	E1.3	Yoshimasa Kawata, Yasunori Nawa, Wataru Inami	Shizuoka University, Japan	Nanophotonics for live cell observation with high resolution
2.15-2.30 pm	E1.4	Nuning Aisah, Lia Aprilia, Ratno Nuryadi	Indonesian Agency for the Assessment and Application of Technology (BPPT), Indonesia	Piezoresistive Microcantilever-Based Gas Sensor using Dynamic Mode Measurement
2.30-2.45 pm	E1.5	Hiroshi Inokawa, Hiroaki Satoh, Dedy Septono Putranto, Wei Du, Atsushi Ono, Purnomo Sidi Priambodo, Djoko Hartanto	Shizuoka University, Japan	Evolution of Photodetectors by Silicon-On-Insulator Material
2.45-3.00 pm	E1.6	A. Udhiarto, D. Moraru, S. Purwiyanti, T. Mizuno, M. Tabe	Faculty of Engineering, Universitas Indonesia	Observation of nanosize effect in nanoscale p-n and p-i-n junction solar cells

SESSION E2. Electronics
Chair: Dr.Eng. Arief Udhiarto S.T., M.T.
Wednesday, 26 June 2013, 3.30-6.00 p.m
Venue: Mataram I Room

Time	No.	Authors	Affiliation	Title
3.30-3.45 pm	E2.1	Ratnasari N. R, Th. Sri Widodo, Adhi Susanto, Maesadji Tj.	Gajah Mada University, Yogyakarta, Indonesia	Lung Tuberculosis Identification Based on Statistical Feature of Thoracic X-ray
3.45-4.00 pm	E2.2	Dedy Septono Catur Putranto, Wei Du, Hiroaki Satoh, Atsushi Ono, Purnomo Sidi Priambodo, Djoko Hartanto, Hiroshi Inokawa	Shizuoka University, Japan	Substrate Bias Effects on Noise and Minority Carrier Lifetime in SOI MOSFET Single-Photon Detector
4.00-4.15 pm	E2.3	Kestrilia Rega P, Sulistyo Emantoko, Eryanto	Ma Chung University, Malang, Indonesia	Microplate Luminescence Automated Digital Analyzer for Medicinal Plants Evaluation on Quorum Sensing Inhibition
4.15-4.30 pm	E2.4	Hiroya Ikeda, Yuhei Suzuki, Kazutoshi Miwa, Faiz Salleh	Shizuoka University, Japan	KFM Evaluation of Seebeck Coefficient in Thin SOI Layers
4.30-4.45 pm	E2.5	Sri Purwiyanti, Daniel Moraru, Takeshi Mizuno, Djoko Hartanto, Michiharu Tabe	Shizuoka University, Japan	Observation of Negative Differential Conductance in Nanoscale p-n Junctions
4.45-5.00 pm	E2.6	Hidenori Mimura, Toru Aoki, Yoichiro Neo, Tomoya Yoshida and Masayoshi Nagao	Shizuoka University, Japan	Development of Multi-gated Field Emitters
5.00-5.15 pm	E2.7	Futa Mochiduki, Keiichiro Kagawa, Min-woong Seo, Keita Yasutomi, Shoji Kawahito	Shizuoka University, Japan	Multi-aperture high-speed CMOS imager
5.15-5.30 pm	E2.8	Faiz Salleh, Yuhei Suzuki, Kazutoshi Miwa, Hiroya Ikeda	Shizuoka University, Japan	Variation of Seebeck Coefficient in Ultrathin Si Layer by Tuning Its Fermi Energy
5.30-5.45 pm	E2.9	Bernadeta Wuri Harini, Sri Agustini Sulandari	Sanata Dharma University, Yogyakarta, Indonesia	The Application of Spectrophotometry Method for Measuring Iron Levels of Groundwater after Merapi Mountain Eruption
5.45-6.00 pm	E2.10	M. Fitra, N. Gomesh, M. Irwanto, Y.M. Irwan	Universiti Malaysia Perlis, Malaysia	Dye Sensitized Solar Cell using Syzigium Oliena Organic Dye

SESSION E3. Poster Session for Multimedia and Telecommunication
Chair: Dr. Fitri Yuli Zulkifli S.T., M.Sc.
Wednesday, 26 June 2013, 10.00 - 10.30 a.m; 12.00 - 1.00 pm; 3.00 - 3.30 pm; 5.00 - 7.00 pm
Venue: Pre-Function Hall

Time	No.	Authors	Affiliation	Title
10.00 - 10.30 am; 12.00 - 1.00 pm; 3.00 - 3.30 pm; 5.00 - 7.00 pm	E3.1	Erina Letivina Anggraini, Nanik Suciati, Wahyu Suadi	Sepuluh Nopember Institute of Technology, Surabaya, Indonesia	Parallel Computing of WaveCluster Algorithm for Face Recognition Application
	E3.2	Albert Kurnia Himawan , Citra Ika Wibawati , Tatang Fanji Permana, Lulu C. Munggaran	Gunadarma University, Indonesia	Media Learning Organization Sequential File Based Multimedia
	E3.3	Stevan Ralianto, Nicholas T.P. Sirait, Yohannes Dewanto	Pancasila University, Indonesia	Design Simulator Detection Fuel Tank on Condition Genset use SMS Through Microcontroller ATMega 8535
	E3.4	Gunawan Santoso, Toni Prahasto, Achmad Widodo	Diponegoro University, Indonesia	Prognosis of Bearing Damage Performance to Systems Industry Using Nonlinear Autoregressive With Exogenous (NARX)
	E3.5	Subekti Ari Santoso, Suci Rahmatia	Al Azhar Indonesia University, Indonesia	Softswitch Network Elements to Support Next Generation Networks
	E3.6	Parulian, Yuslan Basir, Sariati, Hazairin Samaulah	Tridinanti Universitiy, Indonesia	Study of Power Element Management System via Radio Microwave at PT Smartfren Telecom Palembang
	E3.7	Wisnu Aditomo, Achmad Munir	Institute of Technology Bandung, Indonesia	Bandwidth Enhancement of Ultra-Wideband Microstrip Bandpass Filter Using Defected Ground Structure
	E3.8	Panjy Purtiasmawan, Iskandar Fitri	National University, Indonesia	E- Slot Microstrip Patch Array Atenna FED Microstripline with Multi Tuning Stub for Multiband and Wideband Characteristic

SESSION E4. Computers, Software and Hardware
Chair: Sri Chusri Haryanti
Thursday, 27 June 2013, 08.30-10.00 am
Venue: Mataram I Room

Time	No.	Authors	Affiliation	Title
08.30-08.45 am	E4.1	Lely Hiryanto	Tarumanagara University, Indonesia	Incorporating Dynamic Constraint Matching into Vertex-based Graph Coloring Approach for University Course Timetabling Problem
08.45-09.00 am	E4.2	Linggo Sumarno	Sanata Dharma University, Yogyakarta, Indonesia	Handwritten Word Segmentation Using Kaiser Window
09.00-09.15 am	E4.3	Aji Hanggoro, Mahesa Adhitya, Rizki Reynaldo, Riri Fitri Sari	Faculty of Engineering, Universitas Indonesia	Green House Monitoring and Controlling Using Android Mobile Application
09.15-09.30 am	E4.4	Sri Chusri Haryanti, Riri Fitri Sari	Faculty of Engineering, Universitas Indonesia	Task Execution Reliability of Resource Allocation with Tasks Replication in Mobile Ad Hoc Grid
09.30-09.45 am	E4.5	Supeno Mardi, Dwi Rolliawati, Mochamad Hariadi, Mauridhy Hery Purnomo	Sepuluh Nopember Institute of Technology, Surabaya, Indonesia	Multi Objective Optimization Based Intelligent Agent for NPC Behavior Decision
09.45-10.00 am	E4.6	Delta Ardy Prima, Bela Bima Ferial Java, Mochamad hariadi	Sepuluh Nopember Institute of Technology, Surabaya, Indonesia	Secondary Camera Placement in Machinema using Behavior Trees

SESSION E5. Computers, Software and Hardware
Chair: Muhammad Salman S.T., MIT
Thursday, 27 June 2013, 10.30-12.00 pm
Venue: Mataram I Room

Time	No.	Authors	Affiliation	Title
10.30-10.45 am	E5.1	Anak Agung Putri Ratna, Ahmad Shaugi, Prima Dewi Purnamasari, Muhammad Salman	Faculty of Engineering, Universitas Indonesia	Analysis and Comparison of MD5 and SHA-1 Algorithm Implementation in Simple-O Authentication based Security System
10.45-11.00 am	E5.2	Nur Shobi Mabrur, Windarto	Budi Luhur University, Jakarta, Indonesia	Application of Information Services for Student's Parents using DTMF Technology at Budi Luhur University
11.00-11.15 am	E5.3	Agung Fatwanto	Sunan Kalijaga Islamic University, Indonesia	Natural Language Processor for Software Requirements Specification
11.15-11.30 am	E5.4	Andrew Tanny Liem	Klabat University, Manado, Indonesia	P2P Locality Awareness Architecture In Ethernet Passive Optical Networks
11.30-11.45 am	E5.5	Eryco Putra, Angelia Debora Suryawan, Ayu Pratiwi	Bina Nusantara University, Jakarta, Indonesia	Strategic Information System: How to use and exploit the internet for small to medium business
11.45-12.00 pm	E5.6	Triyono Taqwa, Surya Thiono Wijaya	Gunadarma University, Indonesia	Designing Web-Based Virtual Learning For Supporting Student Comprehension

SESSION E6. Energy, Control and Robotic
Chair: Dr.-Ing. Eko Adhi Setiawan, ST., MT.
Thursday, 27 June 2013, 1.00-4.00 pm
Venue: Mataram I Room

Time	No.	Authors	Affiliation	Title
1.00-1.15 pm	E6.1	Ade Jamal	Al Azhar Indonesia University, Indonesia	On Robotic Behavioural Layer of an Agent in A Continuous Topography Agent Based Model for Traffic Simulation
1.15-1.30 pm	E6.2	Sony Sumaryo, K. Ramli, A. Halim	Faculty of Engineering, Universitas Indonesia	Improved Discrete Event Simulation Model of Traffic Light Control on A Single Intersection
1.30-1.45 pm	E6.3	Mariza Devega, Toni Prahasto, Achmad Widodo	Diponegoro University, Semarang, Indonesia	Rolling Element Bearing Fault Diagnosis Using Radial Basis Function Neural Network (RBFNN)
1.45-2.00 pm	E6.4	Indriarto Yuniantoro, Ridwan Gunawan dan Rudy Setiabudy	Faculty of Engineering, Universitas Indonesia	The pqr-coordinates in the Mapping Matrices Model of Kim-Akagi on Power Transformation based on Rotation in Euler Angle Method. Pre-
2.00-2.15 pm	E6.5	Hartono BS, Budiyanto, Rudy Setiabudy, Eko Adhi Setiawan	Faculty of Engineering, Universitas Indonesia	Review of Microgrid Technology
2.15-2.30 pm	E6.6	Doddy Irawan, Gusti Syabillah Muhammad	University of Muhammadiyah Pontianak, Indonesia	Modeling the Magnet Electric Power Planning as the Alternative Energy
2.30-2.45 pm	E6.7	D. Liyanage, K. Murakami	Shizuoka University, Japan	Formation of Fluorine Doped Tin Oxide Nanorods as the Front Electrode in Dye Sensitized Solar Cells
2.45-3.00 pm	E6.8	Wisnu Indrajit, Abdul Muis	Faculty of Engineering, Universitas Indonesia	Development Whole Body Imitation in Humanoid Robot
3.00-3.15 pm	E6.9	Syamsuri, Herlina, Taufik Akbar	Sriwijaya University, Indonesia	Comparative Analysis the Usage of Prepaid kWh Meters and Postpaid kWh Meters on R1Customers with 1300 VA
3.15-3.30 pm	E6.10	Arief Goeritno, Sofyan Rasiman, Zaky Komara	Ibn Khaldun University, Indonesia	Parameters Characterization that Influenced the Performance of Circuit Breaker Mediated by Gas of Sulphur Hexaflouride (SF6) (Case Study in the
3.30-3.45 pm	E6.11	Sujono	Budi Luhur University, Jakarta, Indonesia	Controlling Level of Stress and Displacement Speed at Metal Slab Processor Using Fuzzy Logic Controller
3.45-4.00 pm	E6.12	Wenty Eka Septia, Farizal	Faculty of Engineering, Universitas Indonesia	Environmental Evaluation of Photovoltaics System in Indonesia

SESSION E7. Poster Session for Electrical and Computer Engineering
Chair: Dr. Fitri Yuli Zulkifli S.T., M.Sc.
Thursday, 27 June 2013, 10.00 - 10.30 a.m; 12.00 - 1.00 pm
Venue: Pre-Function Hall

Time	No.	Authors	Affiliation	Title
10.00 - 10.30 am; 12.00 - 1.00 pm	E6.13	Dony Canisius Sirait, Basari, Fitri Yuli Zulkifli, Eko Tjipto Rahardjo	Faculty of Engineering, Universitas Indonesia	An Implanted Dipole Antenna for RFID-Based Patient Monitoring System
	E6.14	Ainil Syafitri, Ali Ngimron, Munnik Haryanti	Pancasila University, Indonesia	Modified Alternator 115/208 Volt, 400 Hz, 15 KVA on Fokker-27 Aircraft, At SKADRON 2nd
	E6.15	Arief Goeritno, Saidah, Winarta	Bogor Ibn Khaldun University, Indonesia	Simulation of Single Phase to Ground Fault Phenomena to Anticipate Against the Sympathetic Tripping
	E6.16	Melisa Chatrine Kamu	Gunadarma University, Indonesia	COMPARING WEB E-COMMERCE ONLINE CAKE SHOP
	E6.17	Triyono Taqwa, Surya Thiono Wijaya	Gunadarma University, Indonesia	Designing Web-Based Scheduling Assistant System of Basic Physics Lab
	E6.18	Elmansyah , Kalamullah Ramli	Faculty of Engineering, Universitas Indonesia	Development and Analysis of Bring Your Own Device (BYOD) Teaching Class System Based On Cloud Computing Using Smartphone Technology
	E6.19	Pratondo Busono	Indonesian Agency for the Assessment and Application of Technology (BPPT), Indonesia	Development of a Novel Method for Motion Artifact Reduction in a Pulse Oximeter

SESSION E8. Telecommunications
Chair: Prof. Eko Tjipto Rahardjo dan Elyas Palantei, PhD.
Wednesday, 26 June 2013, 1.00 - 3.00 p.m
Venue: West I Room

Note: Invited Lecture for Session E8 and E1 is jointly conducted. Participants of Session E8 please go to Mataram I Room to attend the Invited Lectures,and after that please return to West I Room to attend the next session (E8.1 - E8.4)

Time	No.	Authors	Affiliation	Title
1.00-1.30 pm	**E1.1 (Invited)**	**Prof. Koichi Ito**	**Chiba University, Japan**	**Simple Dual-Mode Wearable Antenna for Body-Centric Wireless Communications**
1.30-2.00 pm	**E1.2 (Invited)**	**Prof. Michiharu Tabe, Daniel Moraru, Earfan Hamid, Takeshi Mizuno**	**Shizouka University, Japan**	**Single-dopant Atom Devices for The Future of Nanoelectronics**
2.00-2.15 pm	E8.1	Mochamad Yunus, Fitri Yuli Zulkifli, Eko Tjipto Rahardjo	Faculty of Engineering, Universitas Indonesia	Analytical Approach of the Radiation Pattern of the Microstrip Antenna with Single Patch Spiral Resonator (SR) Shaped Structure
2.15-2.30 pm	E8.2	Achmad Munir	Institute of Technology Bandung, Indonesia	Multiple Slots Technique for Bandwidth Enhancement of Microstrip Rectangular Patch Antenna
2.30-2.45 pm	E8.3	Subuh Pramono, Sugihartono	State Polytechnic of Semarang, Indonesia	Signal to Leakage plus Noise Ratio Based MU-MIMO Downlink Beamforming
2.45-3.00 pm	E8.4	Elyas Palantei, Nadhifah Sakka, Andi Asmi Pratiwi, Bayu Topalaguna, Zakiy Ubaid and Syafruddin Syarif	Hasanuddin University, Indonesia	Lungs Patch Structures: Numerical Computation, Testing and Application

SESSION E9. Power and Energy System
Chair: Dr. Teti Zubaidah
Wednesday, 26 June 2013, 3.30-6.00 p.m
Venue: West I Room

Time	No.	Authors	Affiliation	Title
3.30-3.45 pm	E9.1	Phil Smith	Data Hoshin, Studio Hoshin, Manchester, United Kingdom	A Comparision of the Merits of Nuclear and Geothermal Energy in Indonesia
3.45-4.00 pm	E9.2	Andhika Prastawa, Rinaldy Dalimi	Faculty of Engineering, Universitas Indonesia	New Approach on Renewable Energy Solar Power Prediction in Indonesia based on Artificial Neural Network Technique: Southern Region of Sulawesi Island Study Case
4.00-4.15 pm	E9.3	Budi Sudiarto, Holger Hirsch	Faculty of Engineering, Universitas Indonesia	Voltage and Current Distortion Correlation Characteristics of Compact Fluorescent Lamp in Frequency Range of 2-150 kHz
4.15-4.30 pm	E9.4	Dany Perwita Sari	Indonesian Institute of Sciences (LIPI), Cibinong, Indonesia	Wind Powered Turbine for Urban Environment as an Adaptation to Climate Change
4.30-4.45 pm	E9.5	Hermagasantos Zein	State Polytechnic of Bandung, Indonesia	Cost Allocation of Transmission Usage Based on Current Magnitude
4.45-5.00 pm	E9.6	Teti Zubaidah, Bulkis Kanata, Paniran	Mataram University, Indonesia	Magneto-Static Flux Manipulator Prepared for Future Geomagnetic Power Plant
5.00-5.15 pm	E9.7	Abdul Multi, Iwa Garniwa	Faculty of Engineering, Universitas Indonesia	Design of Slotted Core Axial Flux Wound Rotor Synchronous Generator
5.15-5.30 pm	E9.8	Agus Sunyoto, Hadi Sutanto	Atma Jaya Catholic University, Jakarta, Indonesia	The Effect of Number of Blades on the Performance of Darrieus-type Wind Turbine
5.30-5.45 pm	E9.9	Aryuanto Soetedjo, Yusuf Ismail Nakhoda, Dana Suryadi	National Institute of Technology, Malang, Indonesia	Development of Data Acquisition System for Hybrid Power Plant
5.45-6.00 pm	E9.10	D. A. Asfani, Pressa Pradana Surya Saputra, I. M. Yulistya Negara, I.G.N. Satriyadi Hernanda, R. Wahyudi	Insitute of Technology Sepuluh Nopember, Surabaya, Indonesia	Simulation Analysis on High impedance temporary short circuit in Induction motor Winding

SESSION E10. Telecommunications
Chair: Dr. Ir. Muhamad Asvial M.Eng./Dr. Ir. Yuli Kurnia Ningsih MT
Thursday, 27 June 2013, 08.30-10.00 am
Venue: West I Room

Time	No.	Authors	Affiliation	Title
08.30-08.45 am	E10.1	Song Song, Keita Yasutomi, Keiichiro Kagawa, Isamu Takai, Shoji Kawahito	Shizuoka University	Optimization of light pulse response of CMOS image-based receiver for spatial communications
08.45-09.00 am	E10.2	Rastanto Hadinegoro, Indra Surjati, Yuli Kurnia Ningsih	Trisakti University, Indonesia	Ultra Wide Band Microstrip Antenna Using T-Shaped Stub Fed by Coplanar Waveguide
09.00-09.15 am	E10.3	Teti Zubaidah, Bulkis Kanata, Budi Irmawati, Cipta Ramadhani	Mataram University, Indonesia	Comprehensive Geomagnetic Signal Processings for Sucessful Earthquake Prediction
09.15-09.30 am	E10.4	Ambros Magnus Rudolf Mekeng and Iskandar Fitri	National University, Indonesia	Pi Slot Array Two Elements Multi Wide-band Microstrip Antenna Fed by Tunning Stub
09.30-09.45 am	E10.5	Ahmad Firdausi and Iskandar Fitri	National University, Indonesia	Dual E-Slot Microstrip Patch Antenna FED by Proximity Coupled with Combination of Matching Impedance for Multiband and Wideband
09.45-10.00 am	E10.6	Ahmad Zulkarnaen and Suci Rahmatia	Al Azhar Indonesia University, Indonesia	Building a VoIP Network at PT. Doosan CiptaBusana Jaya Company withComparing Star and Ring Topology

SESSION E11. Electronics
Chair: Dr. Ir. Purnomo Sidi Priambodo M.Sc.
Thursday, 27 June 2013, 10.30-12.00 pm
Venue: West I Room

Time	No.	Authors	Affiliation	Title
10.30-10.45 am	E11.1	Dadan Ramdan, Usman Harahap, Mohd Zulkifly Abdullah	University of Medan Area, Medan, Indonesia	Fluid/Structure Interaction Simulation in IC Encapsulation Process
10.45-11.00 am	E11.2	Anak Agung Ngurah Sapteka, Djoko Hartanto	Faculty of Engineering, Universitas Indonesia	Effect of Gauss Doping Profile on Electric Potential and Electric Field of P-N Diode
11.00-11.15 am	E11.3	Syahril Ardi, Akhid Amin Rohayat	Astra Manufacture Polytechnic, Indonesia	Color Detection on Car Component Knock Down using Microcontroller PIC 16F877A
11.15-11.30 am	E11.4	S. Iwan, S. Bambang, H.M. Fan, S.T. Tan, X.W. Sun	State University of Jakarta, Indonesia	Effects of Growth Temperature on Crystal Structure, Electrical, and Photoluminescence of ZnO Thin Films
11.30-11.45 am	E11.5	Subekti Ari Santoso, Fakhrurozi, Octarina Nur S, Ary Syahriar	Al Azhar Indonesia University, Indonesia	Dark and Bright Soliton in Fiber Optics
11.45-12.00 pm	E11.6	Erfan Handoko, Dede Djuhana, Azwar Manaf	State University of Jakarta, Indonesia	Investigation of electricity coercive behavior of LSFMTO system using ultrasonic mixing method

SESSION E12. Telecommunications
Chair: Dr. Iskandar Fitri, ST, MT.
Thursday, 27 June 2013, 1.00-4.00 pm
Venue: West I Room

Time	No.	Authors	Affiliation	Title
1.00-1.15 pm	E12.1	Binsar Erick L Girsang, Iskandar Fitri	National University, Indonesia	Optimalization of Multi Tunning Stub Proximity Coupled E-Slot Microstrip Patch Array Antenna for Enhance Multi-Wideband
1.15-1.30 pm	E12.2	O.M.Marchylo, Y.Nakanishi, L.V.Zavyalova, G.S.Svechnikov, A.E.Belyaev, H.Kominami, K.Hara	Shizuoka University	Investigation about Pr-effective concentration and influence of Al-addition on the luminescence properties of SrTiO3:Pr3+,Al phosphors
1.30-1.45 pm	E12.3	Muhammad Suryanegara, Cantika Felita	Faculty of Engineering, Universitas Indonesia	5G : Identifying Innovation Opportunity based on Key Technologies
1.45-2.00 pm	E12.4	Antonius Suhartomo	President Univeristy Kota Jababeka, Indonesia	Vulnerability and Economic Considerations in Designing Network Topology
2.00-2.15 pm	E12.5	Samudra, Suci Rahmatia, Boy Iswandi	Al Azhar Indonesia University, Indonesia	Computerized Monitoring System Kwh Meter 3 Phase using Star Topology Networkin PT. Multifabrindo Gemilang
2.15-2.30 pm	E12.6	Muhammad Fauzan Edy Purnomo, Edi Supriana, Vita Kusumasari	University of Brawijaya, Indonesia	Circularly Polarized Array Pentagonal Microstrip Antenna for Mobile Satellite Applications
2.30-2.45 pm	E12.7	Bekti Yulianty, Nur Wijayanti K.N, Yohannes Dewanto	Pancasila University, Indonesia	Design of Monitoring Status DVOR (Doppler OMNY VHF RANGE) in Desk at the Airport Tower Halim Perdanakusuma Using SMS (Short Message
2.45-3.00 pm	E12.8	Muhamad Asvial and Galih Dewandaru	Faculty of Engineering, Universitas Indonesia	Development and Measurement Analysis of Transceiver and TNC for IiNUSAT Nanosatellite Payload Communication
3.00-3.15 pm	E12.9	Yus Natali, Renni Chaerunnisa	Sandhy Putra Academy of Telecommunications Engineering, Indonesia	Call Processing Simulation in GSM Network
3.15-3.30 pm	E12.10	Suci Rahmatia, Muhammad Bujana Deva, Sofian Hamid	Al Azhar Indonesia University, Indonesia	UHF RFID Antenna Tag Design fot Product Attachment
3.30-3.45 pm	E12.11	Subekti Ari Santoso, Rahsanjani, Suci Rahmatia	Al Azhar Indonesia University, Indonesia	Design Yagi Antenna on Frequency 470 – 900 MHz Based Aluminium Foil for TV
3.45-4.00 pm	E12.12	Octarina Nur Samijayani	Al Azhar Indonesia University, Indonesia	Time Delay Analysis on Monostatic and Bistatic Radar for Breast Cancer Detection

SCHEDULE OF PARALLEL SESSION

Handwritten Word Segmentation Using Kaiser Window

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***Abstract*—In the field of handwritten word recognition field, word segmentation into letters is an approach that could be used. Using this approach, word segmentation would be a complicated task, especially when dealing with a cursive handwritten word. A simple method in word segmentation called oversegmentation could be used. This paper discusses a simple method using Kaiser window.**

In general, the word segmentation process in this paper can be described as follow: Input - Preprocessing - Segmentation - Output. The input is an image of isolated handwritten word in binary format, while the output is images of letter segment. The main purpose of preprocessing is to correct slant and slope. This preprocessing is necessary since the segmentation method used is sensitive with slant and slope. The main purpose of segmentation is to divide a word into some letter segments.

Based on a subjective test result, it was shown that the minimum parameters for the Kaiser window that can be used effectively for oversegmentation are 8 points in window's length and 10 in beta value. As its window's length is getting longer and its beta value is getting bigger, it can also be used effectively for oversegmentation. However, it must be noted that if the letter size is getting bigger, there will be more letter segments resulted.

Keywords— Handwritten word, segmentation, Kaiser window

I. INTRODUCTION

In the field of handwritten word recognition, recognizing a word by means of letter-by-letter recognition is a way that can be carried out. If the word is written in handprinted style, the word recognition will be simple, since the segmentation of the letters is obvious. However, if it is written in cursive style, the word recognition will be difficult, since the segmentation of the letters is not obvious. This difficulty is in line with Sayre's Paradox [1]: a word cannot be segmented before being recognized and cannot be recognized before being segmented.

According Bunke [2], segmentation is a process by which a given word was segmented into smaller entities. Before that, in line with Bunke, Bozinovic and Srihiari [3] have proposed a simple segmentation approach using possible segmentation points, which results the number of entities that greater than the number of letters in a word image, that called oversegmentation.

A simple method in oversegmentation can be carried out by dividing a word image uniformly, as proposed by Senior [4]. However, it tends to produce too many segments. Sumarno [5] has proposed a simple method in oversegmentation that divides a word image not uniformly, which based on vertical projection histogram, by using stationary wavelet. However, since the stationary wavelet can only process the input that has 2^n in length, so, it is less practical. Sumarno *et al* [6] have proposed another variation of oversegmentation that divides a word image not uniformly, which based on vertical projection histogram, by using a Gaussian filter. By using this filter, the segmentation results were similar with the stationary wavelet, but it was more practical since it have no 2^n limitation.

A Kaiser window [7] is a window that usually used in the design of FIR filters and spectrum analysis. If a Kaiser window is convoluted with a signal, so, the detail components of the signal will be reduced. On the other hand, a Kaiser window can be used as a low pass filter.

This paper proposes a new variation in handwritten word segmentation, which based on vertical projection histogram, by using Kaiser window. The segmentation method that will be discussed is the oversegmentation that divides a word image not uniformly.

II. THEORY

A. Segmentation

A simple strategy of segmentation is to use of explicit segmentation based on the dissection. In this strategy, a word image is divided into letter segments where the number of segments is equal to or greater than the number of letters in the image, without analyzing the class information or the shape of the letters. If the number of letter segments is greater than the number of letters in the word image, the segmentation is called oversegmentation. According Bunke [2], in oversegmentation there are some rules as follow.

- The image of a letter that occurs within a word may be broken into several segments.
- Merging two adjacent letters into the same segment must be avoided.
- Merging parts of two adjacent letters into the same segment must be avoided.

A strategy in explicit segmentation based on the dissection is to use vertical projection histogram of a word image. For example, Fig. 1(b) shows the shape of the histogram "hills" that represent the letter segments of the word image of Fig. 1(a). As a hypothesis, if the basic shape of the histogram hills can be made more obvious, the separation of letter segments can be made easier. The shape of the histogram hills in Fig. 1(b) still shows the rough shape (i.e. its basic shapes are less obvious), since there are details components shown. In order to make its basic shapes more obvious, a low pass filter is needed to remove the detail components. According Sumarno *et al* [6], a low pass filter for that purpose should have the following properties.

- It must be able to remove many detail components.
- It must be able to maintain histogram hills, which represent letter segments. On the other hand, it must have high localization property.

As shown in Fig. 1(c), the detail components have been removed by using a low pass filter. Fig. 1(d) shows the vertical lines that indicate the local minimum places. Finally, Fig. 1(e) shows the segmentation result where the segmentation places are based on the local minimum places.

B. Kaiser Window

Kaiser window $w(n)$ with the length N is defined by

$$w(n)=\begin{cases}\dfrac{I_0(\beta)\sqrt{1-((n-0.5N)/(0.5N)^2)}}{I_0(\beta)}, & 0\le n\le N\\ 0, & \text{otherwise}\end{cases} \quad (1)$$

where $I_0(\cdot)$ is the zero-th order Modified Bessel function of the first kind, which can be computed using

$$I_0(x)=1+\sum_{k=1}^{\infty}\left[\frac{(0.5x)^k}{k!}\right]^2 \quad (2)$$

C. Convolution

As described above, the Kaiser window can be used as a low pass filter. Low pass filtering of the signal $x(n)$ with a Kaiser window $w(n)$ is the convolution process between $x(n)$ with $w(n)$. Since the signal $x(n)$ has finite length, there will be distortion at the edges of filtering results. In order to overcome that problem, Misiti *et al* [8] have proposed a method by lengthening the signal $x(n)$ by means of signal repetition which called periodization. For example $x(n) = \{x(1), x(2), \ldots, x(M)\}$ is the signal to be convoluted with Kaiser window $w(n)=\{w(1), w(2), \ldots, w(N)\}$, where N is an even number, and $M > N$, so the signal repetition by means of periodization will be

$$x_{per}(n)=\{x(M-n+1),\ldots,x(M),x(1),\ldots,\\ x(M),x(1),\ldots,x(N-1)\} \quad (3)$$

The convolution of lengthen signal $x_{per}(n)$ with Kaiser window $w(n)$ will give output signal

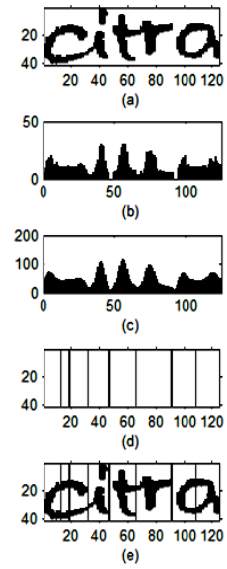

Fig. 1. An example of segmentation using vertical projection histogram; (a) Input image; (b) Vertical projection histogram; (c) Filtering result using Kaiser window 12 points with β value 10; (d) Vertical lines that indicate local minimum places; (e) Segmentation result. (Notes: Vertical and horizontal axes units are in pixels)

$$y(n)=x_{per}(n)*h(n) \quad (4)$$

or

$$y(n)=\sum_j x_{per}(j)\,h(n+1-j) \quad (5)$$

where the length of $M+N-1$ is greater than the length of $x(n)$. In order that the output signal has the same length with the input signal, so, only the certain parts of the output signal are selected. For example, the output of the convolution above is $y(n)= \{y(1), y(2), \ldots, y(L)\}$, where $L=M+N-1$, so, the selected certain parts of $y(n)$ are

$$y_{keep}(n)=\{y(N+1),\ldots,y(N+M)\} \quad (6)$$

III. Research Methodology

A. Materials and Equipments

Materials in this research were isolated handwritten word images in binary format. These materials came from the data acquisition sheets scanned at a resolution of 300 dpi. Data were taken from 10 writers from different ages and genders. They wrote the word "citra" as they usually write, i.e. handprinted, cursive, or mixed handprinted and cursive styles. Equipment in this research was a set of computer based on Intel processor Core2Duo E7500 (2,93GHz) and 2GB of RAM, which equipped with MATLAB software.

B. System Development

By using materials and equipments above, a handwritten word segmentation system has been developed (see Fig. 2). In this system, the input is an image of isolated handwritten word in binary format, while the output is images of letter segment.

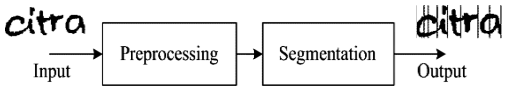

Fig. 2. A word segmentation system.

The main purpose of preprocessing is to correct slant and slope of the input image. This preprocessing is necessary since the segmentation process that uses vertical projection histogram is sensitive with slant and slope variation [6].

C. Preprocessing

Preprocessing steps in Fig. 2 are shown in Fig. 3 [6]. The slope and slant corrections are carried out by using the linear transform for shearing. See Halmos [9] for the detail of the linear transform. The slope and slant corrections will make the image template become bigger than its image. (Note: for the word image input, the image and its template have the same size). To overcome this, a cutting according to bounding box was applied.

The slope and slant correction in Fig. 3 are carried out sequentially by simultaneous slant correction method, as proposed by Slavik & Govindaraju [10]. Fig. 4 [6] shows the slant correction steps for the slope and slant correction. By using this method, first, slope correction using the horizontal projection histogram carried out. Then, followed by slant correction using the vertical projection histogram. Determining of shearing coefficient k_s is carried out by searching a highest variance value in the vertical/horizontal projection histogram. See TABLE I.

D. Segmentation

Segmentation steps are shown in Fig. 5 [6]. Low pass filtering is a convolution process between Kaiser window and vertical projection histogram, which has undergone periodization (see equations (3) to (6)). Letter segments cutting are a cutting of the input image in order to get letter segment images. The cutting places are based on the places of the local minimums in the vertical projection histogram that has undergone low pass filtering. An example of the segmentation steps is shown in Fig. 1.

IV. Results

A. Segmentation results on various Kaiser window parameters

Segmentation results on various Kaiser window parameters, for an example of the word "citra", shown in Fig. 6 and 7. It can be shown in Fig. 6 and 7, for all Kaiser

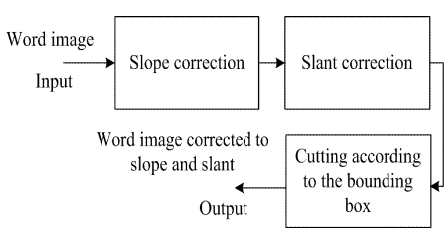

Fig. 3. Preprocessing steps.

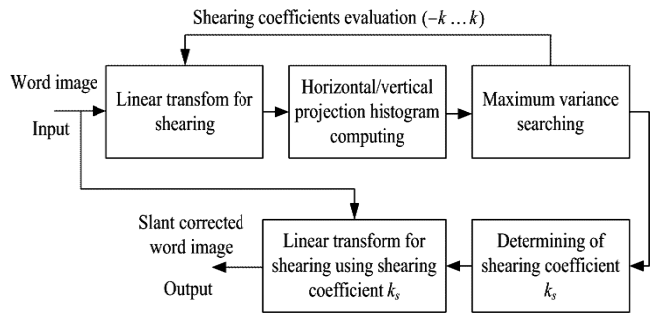

Fig. 4. Slant correction steps.

TABLE I. Parameters for slope and slant corrections.

Correction	Parameters
Slope	Shearing coefficient values for the evaluation of horizontal projection histogram at slope correction {-0.2, -0.15, …, 0.2}. In this case it is assumed that the slope of horizontal projection histogram is in the range of -0.2 … 0.2.
Slant	Shearing coefficient values for the evaluation of vertical projection histogram at slant correction {-0.4, -0.35, … , 0.4}. In this case, it is assumed that the slope of vertical projection histogram is in the range of -0.4 … 0.4.

windows with β value 0 and also with window's length 4 points, the segmentation results show parts of letter "c" and "i", or "i" and "t", or "r" and "a" are in the same segment. It means segmentation errors have been occurred, since they do not follow the oversegmentation rules [2].

As shown in Fig. 6 and 7, in order that oversegmentation can be effectively carried out, the minimum parameters of Kaiser window are 8 points in length and 10 in β value. As its window's length is getting longer and its β value is getting bigger, the oversegmentation can also be effectively carried out. In summary, the segmentation results from Fig. 6 and 7 can be seen in TABLE 2.

B. Segmentation results on various writing styles and sizes

The segmentation results on various writing styles and sizes of 10 words of "citra" which uses a sample of 12 points Kaiser window with β value 10 shown in Fig. 8(a). As a note, the 10 words came from 10 writers who wrote as they usually write. For comparison, segmentations results for the same 10 words of "citra", which uses 16 points Gaussian filter with standard deviation 4 which proposed by Sumarno *et al* [6] are shown in Fig. 8(b). As shown in Fig. 8(a) and 8(b), no segmentation errors occurred since they follow the oversegmentation rules.

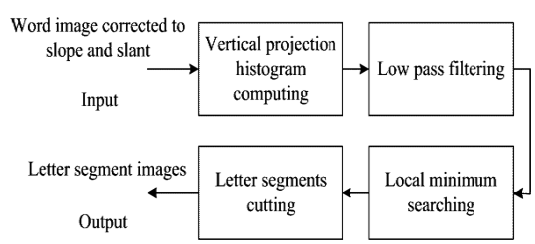

Fig. 5. Segmentation steps.

Fig. 6. Segmentation results on various parameters of Kaiser window; (a) – (f) Length: 4 points, β values: 0, 10, 20, 40, 80, and 160 respectively; (g) – (l) Length: 8 points, β values: 0, 10, 20, 40, 80, and 160 respectively; (m) – (r) Length: 12 points, β values: 0, 10, 20, 40, 80, and 160 respectively; (s) – (x) Length: 16 points, β values: 0, 10, 20, 40, 80, and 160 respectively. (Notes: Vertical and horizontal axes units are in pixels)

V. DISCUSSIONS

As shown in Fig. 6 and 7 there are three tendencies that started from 8 points window's length. First, if β value is getting bigger, it will lower the occurrence of segmentation errors. As an example, from Fig. 7(s) – 7(x), if β value is getting bigger, the occurrence of segmentation error will be lower. This one indicates that the histogram hills localization is getting lower, since the number of detail components in the vertical projection histogram that removed also getting lower. Therefore, basic shapes of letter entities which represented by histogram hills become more unobvious (since too many component details), so that, the separation between letter entities become more obvious.

TABLE 2. SUMMARY OF THE SEGMENTATION RESULTS FROM FIG. 6 AND 7.

β	Window's length							
	4	8	12	16	20	24	28	32
0	×	×	×	×	×	×	×	×
10	×	√	√	×	×	×	×	×
20	×	√	√	√	×	×	×	×
40	×	√	√	√	√	√	×	×
80	×	√	√	√	√	√	√	√
160	×	√	√	√	√	√	√	√

Notes: a. "×" indicates there are segmentation errors.
b. "√" indicates there are no segmentation errors.

Second, if window's length is getting longer, it will raise the occurrence of segmentation errors. As an example, from Fig. 6(h), 6(n), 6(t), and 7(b), if window's length is getting longer, the occurrence of segmentation error will be raise. This one indicates that the histogram hills localization is getting higher, since the number of detail components in the vertical projection histogram that removed also getting higher. Therefore, basic shapes of letter entities which represented by histogram hills become more unobvious, so that, the separation between letter entities become more unobvious also.

Third, if window's length is getting longer and β value is getting bigger, there is no segmentation errors occurred. As an example, from Fig. 6(n), 6(u), 7(d), and 7(k), if window's length is getting longer and β value is getting bigger, there is no occurrence of segmentation errors. This one indicates that the histogram hills localization can be maintained (not too high nor too low), since the number of detail components in the vertical projection histogram that removed can also be maintained. Therefore, basic shapes of letter entities which represented by histogram hills can be maintained obvious, so that, the separation between letter entities can also be maintained obvious.

Fig. 7. The Segmentation results on various parameters of Kaiser window; (a) – (f) Length: 20 points, β values: 0, 10, 20, 40, 80, and 160 respectively; (g) – (l) Length: 24 points, β values: 0, 10, 20, 40, 80, and 160 respectively; (m) – (r) Length: 28 points, β values: 0, 10, 20, 40, 80, and 160 respectively; (s) – (x) Length: 32 points, β values: 0, 10, 20, 40, 80, and 160 respectively. (Notes: Vertical and horizontal axes units are in pixels)

A summary of the segmentation results in TABLE 2 are come from a subjective test results, since they only use one writing variety of the word "citra". In order to get a more objective test results, the segmentation needs to be tested on even more writing variety of the word "citra". However, if the segmentation results were observed visually, it would be impractical, since we have to observe it one by one. Therefore, in order to make it more practical, it is not done visually, but by observing the results of the recognition rate of the whole handwritten word recognition. It can be assumed that at the highest recognition rate, the number of segmentation errors is the lowest. Milewski [11] has shown an example of recognizing a word by means of character segment by character segment, which made use of a graph.

Fig. 8(a) and (b) show the segmentation results of the 12 points Kaiser window with β value 10 and the 16 points Gaussian filter with standard deviation 4 respectively. They can be used effectively to segment nine various writing styles and sizes of the word "citra", since there are no segmentation errors. However, Fig. 8(a5), (a8), and (a10) show one additional segment compared to Fig. 8(b5), (b8), and (b10) respectively, which indicates that 12 points Kaiser window with β value 10 a bit worse than 16 points Gaussian filter with standard deviation 4. This case shows that if it is compared with Kaiser window, the Gaussian filter is a bit more able to conserve "small hills" at vertical projection histogram, which represent character entities.

In general, Fig. 8 shows that if the letter size is getting bigger there will be more letter segments resulted. For example, at Fig. 8(a9), (a10), (b9), and (b10), a low pass filtering that made use of the 12 points Kaiser window with β value 10 and also the 16 points Gaussian filter with standard deviation 4 were not "strong" enough to smooth the "big hills" at projection histogram which represent character entities, so that, more letter segments are resulted. Therefore, in order to deal with the letter sizes it is suggested to introduce some size correction steps in the segmentation system.

VI. CONCLUSION AND SUGGESTION

Based on what has been described above, it can be concluded the following.

- Based on the subjective test result, it was shown that the minimum parameters for the Kaiser window that can be used for oversegmentation effectively are 8 points in window's length and 10 in β value.
- For the Kaiser window, as the window's length is getting longer and its β value is getting bigger, it can also be used for oversegmentation effectively.
- If the letter size is getting bigger, there will be more letter segments resulted.

Here are some suggestions to further develop the segmentation system.

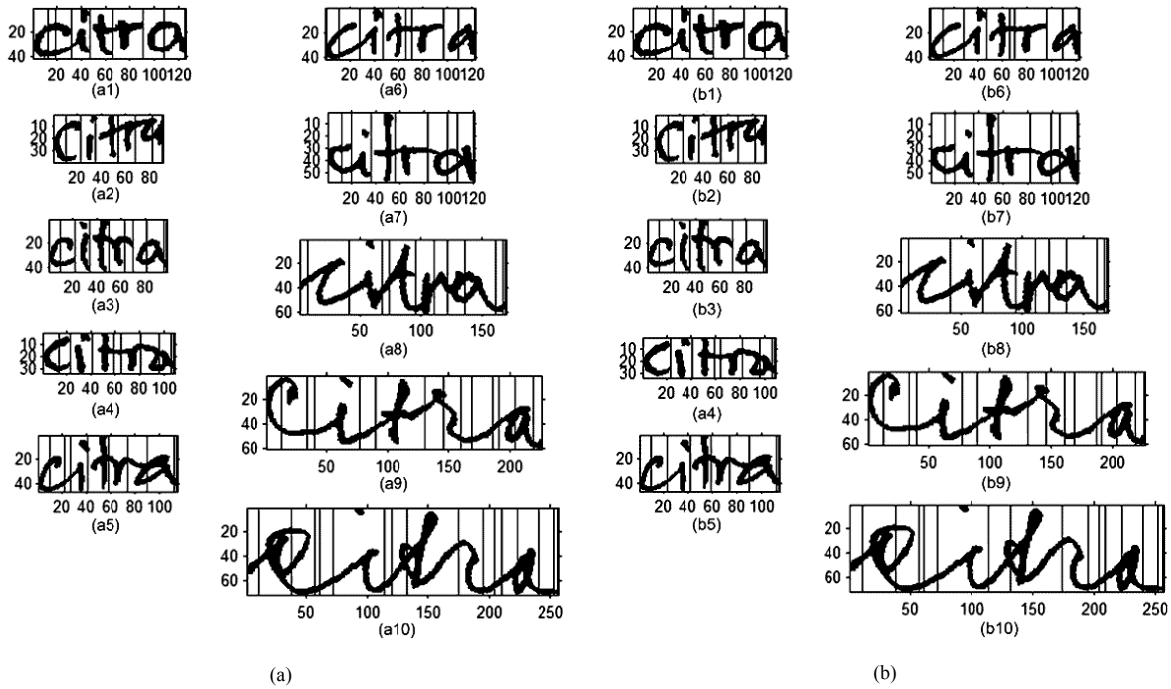

Fig. 8. Segmentation results for 10 writing styles and sizes of "citra"; (a) Using 12 points Kaiser window with β value 10; (b) Using 16 points Gaussian filter with standard deviation 4. (Notes: Vertical and horizontal axes units are in pixels)

- In order to obtain a more objective segmentation results, it is necessary to test more writing varieties and sizes of the word "citra" and for other words.
- In order to be more practical, it is suggested that the segmentation results are observed by observing the results of the recognition rate of the handwritten word recognition, which is the next process after the process of segmentation.
- In order to deal with the letter sizes it is suggested to introduce some size correction steps in the segmentation system.

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