CITACEE 2013

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(CITACEE 2013)

Department of Computer Engineering, Diponegoro University
Semarang, November 16th, 2013

Ir. Bambang Pudjianto, M.T.
Dean of Faculty Engineering, Diponegoro University

Dr. R. Rizal Isnanto, S.T., M.M., M.T.
General Chair

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COVER

The 1st Conference on Information Technology, Computer, and Electrical Engineering
(CITACEE 2013)

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INNER COVER

The 1st Conference on Information Technology, Computer, and Electrical Engineering (CITACEE 2013)

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PREFACE

Dear Collegues,

On behalf of Technical Committee and Organizing Committee of CITACEE 2013, I am honored to welcome you to **The 1st Conference on Information Technology, Computer, and Electrical Engineering (CITACEE)**. The conference is planned to be conducted annually. This conference program is organized by Computer Engineering Department, Faculty of Engineering, Diponegoro University, Semarang. The main theme of the conference is "Information Technology and its Application towards the Implementation of Green Technology".

The conference aims to provide a forum for researchers, academicians, professionals, and industries to expose and exchange innovative ideas, methods, and experience in information technology, computer engineering, as well as in electrical engineering, and their applications, related with the aspects of green technology. Papers in this conference are presented in both in international or Bahasa Indonesia session. This conference also provides forum for researchers, scientists, and engineers to exchange ideas and their current achievements.

In this year we have received 98 paper submissions from various universities, research centers, and as well as from industries. However, after indepth review, the Technical Committee accepted 67 selected papers will be presented in this conference. From this 67 papers, 17 papers will be in International Session (conducted in English). While, 50 papers will be presented in the National Session (conducted in Bahasa Indonesia). The accepted papers are categorized into five groups**,** there are: Information Technology and System, Signal and Circuit, Power and Control Engineering, General Papers, and Interdisciplinary Papers related to Green Technology. The Proceedings of this conference is highly expected to be used as reference for Academics, Practitioners, as well as for Researchers.

We thank all authors and all parties which cannot be mentioned here who have contributed and participated in presenting their works at this conference. We also gratefully acknowledge the important review supports provided by the 10 members of Conference Committee from Indonesia or abroad. Their efforts were crucial to the success of the conference. We are also so blessed by the presence of 3 (three) invited Keynote Speakers from different institutions which will address the important trends relating to information technology and its application towards the implementation of Green Technology.

Finally, we wish you all can enjoy one day discussion through this conference and could spend to enjoy the beauty of Semarang City and Undip Campus. We hope to meet you again in the next conference, the 2nd Conference on Information Technology, Computer, and Electrical Engineering (CITACEE 2014).

General Chair of CITACEE 2013

Dr. R. Rizal Isnanto, S.T., M.M., M.T.

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SAMBUTAN

Dekan Fakultas Teknik
Universitas Diponegoro

Bapak Rektor Universitas Diponegoro, Ketua APTIKOM, para pembicara kunci, para pemakalah, para peserta *conference*, para mitra pendukung, para tamu undangan, Ketua Program Studi Sistem Komputer dan panitia *conference* yang saya hormati.

Assalamu'alaikum wa rahmatullahi wa barakatuh

Rasa syukur yang paling dalam kita panjatkan kehadirat Allah *subhanahu wa ta'ala* atas rahmat, taufiq, hidayah, dan inayah-Nya sehingga kita dapat hadir dalam *conference* di bidang teknologi informasi, komputer, dan Teknik Elektro sebagai ajang silaturahmi ilmiah dalam keadaan sehat wal afiat, semangat dan bahagia. Kegiatan ini merupakan upaya Fakultas Teknik Program Studi Sistem Komputer Universitas Diponegoro untuk melaksanakan Misi UNDIP dalam rangka mewujudkan Visi UNDIP menjadi universitas riset yang unggul di tahun 2020. Kita sadar bahwa peran teknologi sebagai upaya budi daya manusia dalam mewujudkan kesejahteraannya sangatlah penting. Bahkan dalam kenyataannya dengan perkembangan teknologi yang sangat cepat perkembangan dan perubahan diberbagai aspek kehidupan menunjukkan percepatan yang sangat tinggi. Lebih-lebih dengan perkembangan teknologi di bidang komputer dan teknologi informasi lebih besar dan lebih cepat lagi pengaruhnya bahkan terhadap perubahan sosial dan budaya. Netralitas teknologi ibarat sebilah pisau bermata dua, kalau tidak kita gunakan dengan benar dan bijaksana teknologi bisa menjadi bumerang bagi kehidupan umat manusia sendiri. Namun, betapa pun teknologi tidak dapat kita bendung perkembangannya dan tetap sangat kita butuhkan. Sejalan dengan Visi Misi UNDIP, ajang silaturahmi ilmiah seperti ini menjadi penting artinya untuk senantiasa kita lakukan untuk mensinergikan potensi kita untuk mengembangkannya dan mensikapinya secara arif dalam menerapkannya agar harmonisasi terhadap perubahan sosial, budaya, dan bersahabat dengan lingkungan dapat kita wujudkan. Pada kesempatan yang sangat baik ini perkenankanlah kami mengucapkan selamat datang di kampus utama UNDIP ini untuk berdiskusi berbagi pemikiran, pengetahuan, dan pengalaman, yang memberi manfaat tidak saja bagi peserta *conference* yang hadir pada saat ini, tetapi lebih luas bagi dunia industri dan masyarakat pada umumnya.

The 1st Conference on Information Technology, Computer, and Electrical Engineering (CITACEE 2013) adalah *conference* di bidang Teknologi Informasi, Komputer, dan Teknik Elektro perdana yang diselenggarakan oleh Program Studi Sistem Komputer Fakultas Teknik UNDIP dengan tema "*Information Technology and its Application towards the Implementation of Green Technology*". *Conference* ini diselenggarakan bertepatan dengan Dies Natalis Fakultas Teknik UNDIP yang ke 55 dan Dies Natalis UNDIP yang ke 56. *Conference* ini diselenggarakan agar dapat dijadikan sebagai ajang silaturahmi ilmiah bagi para peneliti, akademisi, mahasiswa, profesional, dan dunia industri untuk berdiskusi dan secara lebih luas berbagi pemikiran, ide-ide inovatif, metode-metode, dan pengalaman di bidang Teknologi Informasi, Komputer, dan Teknik Elektro serta aplikasinya terkait dengan penerapan teknologi hijau (*green technology*). Dengan demikian, temuan-temuan dan simpulan-simpulan baru dari *conference* ini diharapkan akan diperoleh. Pada gilirannya dapat untuk mengembangkan teknologi dan aplikasinya secara berkelanjutan di masa yang akan datang.

Alhamdulillah, *conference* ini telah mampu menghimpun makalah dalam berbagai topik: teknologi informasi, sistem informasi, sistem ketenagaan, sistem, sinyal dan rangkaian, rekayasa biomedik, sistem komunikasi, dan berbagai bidang yang terkait. Makalah juga mencakup berbagai aspek dari wilayah penelitian yang fundamental, eksperimental, sampai dengan inovasi-inovasi penerapannya. Selamat ber-*conference*, semoga sukses memberi manfaat bagi kita semua dalam keberkahan.

Wassalamu'alaikum wa rahmatullahi wa barakatuh

Dekan Fakultas Teknik
Universitas Diponegoro

Ir. Bambang Pudjianto, M.T.

SAMBUTAN

Ketua Program Studi Sistem Komputer
Universitas Diponegoro

Assalamu 'alaikum Wr. Wb.

Segala puji syukur kita panjatkan kehadirat Allah *subhanahu wa ta'ala*, Tuhan yang Mahakuasa, atas berkat rahmat dan hidayah-Nya, Konferensi tentang Teknologi Informasi, Teknik Komputer dan Teknik Elektro (CITACEE) 2013 yang diselenggarakan oleh Program Studi Sistem Komputer, Fakultas Teknik, Universitas Diponegoro Semarang berhasil diselenggarakan untuk pertama kalinya.

Seminar/konferensi ini mengambil tema *Information Technology and its Applications towards the Implementation of Green Technology*, yang diharapkan menjadi wadah penyebaran keilmuan bagi para akademisi, peneliti, praktisi, serta para pengguna teknologi informasi. Selain itu saya juga berharap konferensi ini menjadi sarana berbagi pengetahuanbagi perkembangan teknologi informasi, khususnya teknologi informasi yang ramah lingkungan.

Ucapan terima kasih saya sampaikan kepada para pembicara tamu dan seluruh peserta konferensi, terima kasih atas segala partisipasinya. Semoga konferensi ini memberikan kontribusi dalam pengembangan ilmu dan teknologi khususnya teknologi informasi yang ramah lingkungan. Ucapan terimakasih juga tidak lupa saya sampaikan kepada semua pihak yang ikut membantu terlaksananya konferensi ini.

Selamat berkonferensi, semoga kita mampu berkontribusi nyata pada kemajuan bangsa dan negara kita tercinta, utamanya dalam bidang pengembangan teknologi informasi yang ramah lingkungan, sertamampu menangkap berbagai peluang yang sangat menjanjikan di masa yang akan datang, Amiin.

Wassalamu 'alaikum Wr. Wb.

Ketua Program Studi Sistem Komputer
Universitas Diponegoro Semarang

Ir. Kodrat Iman Satoto, M.T.

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SAMBUTAN KETUA APTIKOM WILAYAH VI JAWA TENGAH

Yth. para Profesor, Narasumber, Tamu Undangan, dan para peserta *"The 1st Conference on Information Technology, Computer, and Electrical Engineering"* (CITACEE 2013) di Universitas Diponegoro.

Dengan memanjatkan puji syukur ke hadirat Allah *subhanahu wa ta'ala* kami merasa berbangga hati atas terselenggaranya kegiatan *conference* yang pertama dengan bertemakan *"Information Technology and Its Application Toward the Implementation of Green Technology"* ini.

Kegiatan *conference* ini semakin melengkapi beberapa kegiatan APTIKOM Wilayah VI Jawa Tengah baik itu *conference*, *workshop*, dan ADB. Kegiatan *conference* dalam waktu dekat antara lain ICISBC 2013 Magister Sistem Informasi UNDIP pada tanggal 5-6 Desember 2013. Kegiatan Workshop seperti Workshop Kurikulum, KKNI, LAM dan PJJ yang diselenggarakan di UMM Magelang 26 Oktober 2013 lalu, adalah merupakan tindaklanjut Hasil Workshop 1 Jakarta 12.12.12 (12 Desember 2012). Seperti diketahui, APTIKOM Jawa Tengah diminta melaksanakan kegiatan ini. Hasil rumusan tersebut ditindaklanjuti pada Rakornas APTIKOM di Samarinda 31 Oktober – 2 November 2013 lalu. Selanjutnya akan diteruskan dengan kegiatan APTIKOM *Doctoral Booth Camp* VII (ADB VII) di Jawa Tengah tahun 2014. Kegiatan ini merupakan wujud proker APTIKOM dengan melatih peserta untuk menyusun proposal penelitian doktoral di bawah bimbingan Profesor, sehingga mendorong para Dosen APTIKOM lainnya untuk meningkatkan kemampuan akademik agar bergelar Doktor.

Kami menyambut baik permintaan panitia CITACEE untuk sekadar memberikan sekapur kata pengantar pada Prosiding *Conference* ini, dengan mengucapkan selamat datang kepada nara sumber dan tamu undangan, serta selamat ber-*conference* kepada para peserta.

Kami berharap *conference* ini dapat dilakukan secara kontinu, dapat memacu dan merangsang penelitian dalam rangka *sharing* informasi, khususnya perkembangan teknologi informasi dan implementasinya, serta merupakan agenda rutin di APTIKOM Wilayah VI Jawa Tengah.

Demikian yang dapat kami informasikan, dan sekali lagi selamat ber-*conference*, semoga Tuhan YME memudahkan dan meringankan langkah kita untuk mendarmabaktikan pengetahuan agar benar-benar bermanfaat dan bermartabat bagi sesama manusia dan "*go green*" bagi lingkungannya. Terima Kasih.

Semarang, 4 November 2013

Ketua APTIKOM
Wilayah VI Jawa Tengah

Drs. Eko Adi Sarwoko, M.Kom.
NIDN : 0007116503 / NA : 04-105

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The 1st Conference on Information Technology, Computer, and Electrical Engineering
Department of Computer Engineering, Diponegoro University

SCHEDULE OF EVENTS

Ruang Sidang SNMPTN, Gedung Widya Puraya Lt. 2
Universitas Diponegoro
Semarang, Indonesia

Saturday, 16 November 2013

07.30 – 08.00 : Registration
08.00 – 08.05 : Welcome greetings from MC
08.05 – 08.10 : Report from General Chair
08.10 – 08.20 : Opening speech from Dean of Engineering Faculty, Diponegoro University
08.20 – 08.45 : Cisco Networking Academy at a glance
08.45 – 09.00 : Morning coffee break
09.00 – 10.30 : Plenary Session
Moderator: Dr. Mohd. Facta, S.T., M.T.
Keynote Speaker:

1. **Prof. Dr. Richardus Eko Indrajit**
   "Presentation from Prof. Dr. Richardus Eko Indrajit"
2. **Prof. Dr. Ir. Tarcisius Haryono, M.Sc.**
   "Protection Characteristic of Z_nO Block Lightning Arrester Used in 20 kV Distribution System Against Multiple Lightning Strikes"
3. **Prof. Drs. Mustafid, M.Eng., Ph.D.**
   "Green Information System : Innovation for Environmental Sustainability"

10.30 – 11.45 : Parallel Session I
11.45 – 12.45 : Lunch Break
12.45 – 15.45 : Parallel Session II
15.45 – 15.50 : Closing speech from each moderator of Parallel Session II.
Certificate for speakers will be given after the Closing Speech
15.50 – 16.05 : Afternoon coffee

Parallel Session

Room 1 **Moderator: Dr. Ir. Hermawan, DEA**	
Parallel Session 1 (10.30 – 11.45)	
1	**Desain dan Realisasi Antena Mikrostrip untuk Tag dan Reader RFID pada Frekuensi UHF 923 – 925 MHz** *Dina Angela, Yuyu Wahyu, Vito Andri Lukito, Andi Ilham Syalaby*
2	**High Performance Low Complexity Interference Canceller for High Throughput WLAN 802.11n System** *Wahyul Amien Syafei, Anky Setyadewa, Imam Santoso*
3	**Accurate Channel Estimation in Low SNR Channel for WLAN 802.11n System** *Wahyul Amien Syafei, Grifina Nuzulia, Sukiswo*
4	**Optimized Pilot Alocation using Genetic Algorithm for Better Performance of Wi-Fi IEEE 802.11n** *Wahyul Amien Syafei, Yunda Kumala Nasution, Sukiswo*
Parallel Session 2 (12.45 – 15.45)	
1	**Iris Feature Extraction using Daubechies Wavelet Transform and its Recognition using Normalized Euclidean Distance** *R. Rizal Isnanto, Achmad Hidayatno, Antonius Dwi Hartanto*
2	**High Performance Interference Canceller for 600 Mbps HT WLAN IEEE 802.11n** *Wahyul Amien Syafei, Sukiswo, Imam Santoso*
3	**Klasifikasi dan Pengenalan Pola pada Sinyal EKG Berdasarkan Sifat Keacakan (*Entropy*) dengan 6 Channel** *Jaenal Arifin, Oyas Wahyunggoro, Rudy Hartanto*
4	**Rancang Bangun Generator Suara Digital untuk Meningkatkan Produktivitas Hasil Pertanian** *Didik Widianto, Priguna Septia Putra, Budi Setyawan, Arena Bayu Chandra P*
5	**Model Sistem Akuisisi Data Multiplatform Menggunakan Aplikasi Antarmuka Pengguna Berbasis Bahasa Pemrograman Processing** *Arief Hendra Saptadi, Paulus Insap Santosa, Bambang Sutopo*
6	**Aplikasi Pembelajaran Pengucapan Nama Hewan (Satu Suku Kata) Dalam Bahasa Inggris** *Ajub Ajulian Zahra M, Achmad Hidayatno*
7	**Perancangan Sistem SCADA Beban Penerangan pada Prototype Gedung A Teknik Elektro Fakultas Teknik Universitas Diponegoro** *Rizky Adi Nugraha*

Room 2 **Moderator: Ir. Kodrat Iman Satoto, M.T.**	
Parallel Session 1 (10.30 – 11.45)	
1	**Optimasi MPPT (*Maximum Power Point Tracker*) Pada Sistem *Photovoltaic* menggunakan Algoritma *Incremental Conductance*** *Harmini, Titik Nurhayati*
2	**Optimalisasi Engine Power Mode HD785-7** *Adityo Dharma S, Erwin Dermawan*
3	**Studi Empiris Komponen Dasar Sistem Pemanen Energi Vibrasi dengan Tranduser Piezoelektrik** *Deddy Susilo, Eka Firmansyah, Litasari*
4	**Perancangan Sistem Kontrol *Auto Tuning* PID Menggunakan *Fuzzy Logic*: Studi Kasus pada *Exhaust Gas Recirculation Heavy Duty Diesel Engine*** *Ulinnuha Latifa, Aris Triwiyatno, Sumardi*
Parallel Session 2 (12.45 – 15.45)	
1	**Perancangan Sistem Kendali Logika *Fuzzy* Menggunakan Algoritma Genetika: Studi Kasus pada *Exhaust Gas Recirculation* (EGR) *Heavy Duty Diesel Engine*** *Fildzah Imanina, Aris Triwiyatno, dan Sumardi*
2	**Operating a Four-Leg PWM Converter as a Three-Phase Controlled Current Source** *Slamet Riyadi*
3	**Desain Sistem Kontrol *Fuzzy Model Reference Learning Control* (FMRLC) Studi Kasus: Pengontrolan Ketinggian Air pada *Conical Tank*** *M Arif Syukur D, Aris Triwiyatno, dan Wahyudi*
4	**Desain dan Implementasi Digital Maximum Power Point Tracker Berbasis Mikrokontroller ATMEGA8535** *Lukas Aditya M, Leonardus H. Pratomo*
5	**Estimasi Sudut Orientasi Benda Menggunakan Sensor *6 DoF IMU* dan Sensor Magnetometer 3 Aksis** *Rahadian Nurfansyah, Wahyudi, dan Budi Setiyono*
6	**Switching Table Based on Space Vector Modulation for Three Phase Inverter using dsPIC** *Arifin Wibisono, Slamet Riyadi*
7	**Paralel Dua Inverter Sumber Tegangan Berbasis Mikrokontroler ATmega 8535** *Ram Karliutama dan Leonardus. H. Pratomo*

Room 3 **Moderator: Adian Fatchur Rochim. S.T., M.T.**	
Parallel Session 1 (10.30 – 11.45)	
1	**Web Based Map Generations of Mobile Robot Movement using Scalable Vector Graphic** *Harindra Wisnu Pradhana, Achmad Widodo, Suryono*
2	**Fleksibel *Input – Output* (Fleksi IO) Berbasis *Web Client – Server*** *Tamas Riyo Sesono, Darmawan Utomo, Hartanto Kusuma Wardana*
3	**Evaluation of Hidden Terminal Problem in Wireless Local Area Network Using Network Simulator Version 3** *Alexander William, Antonius Suhartomo*
4	**Physics Analysis of Erbium Doped Fiber Amplifier (EDFA)** *Alexander William, Antonius Suhartomo*
Parallel Session 2 (12.45 – 15.45)	
1	**Rancang Bangun Alat Kendali Sistem Keamanan Rumah** *Wahyu Kusuma, Jamilah, Rizky Satrio Putro*
2	**Desain Kontroler *Fuzzy* pada Model *Automatic Braking System* dengan *Antilock*** *Rezki Ahmaliansyah, Aris Triwiyatno, dan Budi Setiyono*
3	**Miniatur Sistem Palang Perlintasan Otomatis Kereta Api Menggunakan Sensor Infra Merah dan Mikrokontroler AT89S51** *Ferry Sudarto, Indrianto, Satriyo Budi Santoso*
4	**Perbandingan Standar Nasional Indonesia (SNI) terhadap Standar Internasional pada Produk *Biomedical Implant Plate*** *Budi Setiyana, Muhammad Khafidh, Rifky Ismail, M. Tauviqirrahman, dan Jamari*
5	***Environment Monitoring System* (EMS) Berbasis Jaringan GPRS** *Dina Angela, Tunggul A. Nugroho, Sinung Suakanto, Herry I. Sitepu*
6	**Pengaruh Durasi Paparan Sinar Ultraviolet terhadap Arus Bocor Permukaan Bahan Isolator Resin Epoksi dengan Bahan Pengisi Silane dan Pasir Silika** *Abdul Syakur, Hermawan, Tommy Perdana Putra*
7	**Analisis Pengaruh Sudut Kemiringan Panel Surya Tipe *Array* Tetap terhadap Energi yang Dihasilkan pada *Solar Home System* (SHS)** *Pangestuningtyas Diah L., Hermawan, dan Karnoto*

Room 4 **Moderator: Rinta Kridalukmana, S.Kom., M.T.**	
Parallel Session 1 (10.30 – 11.45)	
1	**Kajian Perancangan Aplikasi *Helpdesk and Ticketing* Studi Kasus AJB Bumiputra** *Farham Harvianto, Akbar Muchbarak, Ahmad Pudoli, Sofian Lusa*
2	**Kendali Mobil Remote Control Menggunakan Handphone Android** *Ferry Sudarto, Sudaryono, Hendra Kusumah*
3	**Dynamics System Modeling Approach in Node Mobility on Mobile Ad-hoc Network** *S.N.M.P. Simamora*
4	**Analysis of the Application current X2 Interface Handover Process in LTE Technology** *Uke Kurniawan Usman*
Parallel Session 2 (12.45 – 15.45)	
1	**Perencanaan Strategis E-Government Pada Pemerintah Daerah Provinsi Maluku Utara Untuk Mewujudkan Good Governance** *Muhammad Ridha Albaar*
2	**Desain Sistem Keamanan Pada Infrastruktur Berbasis Jaringan Komputer di Universitas Kristen Petra** *Ibnu Gunawan, Agustinus Noertjahyana*
3	**Aplikasi Deteksi Plagiarisme Berbasis Web Menggunakan Framework CodeIgniter** *Agung Toto Wibowo, Adeva Oktoveri, Ari Moesriami Barmawi, Anditya Arifianto*
4	**Firewall Session accelerate QoS, NAT and Routing using Decision Tree** *Budi Dwi Satoto*
5	**Deteksi Jumlah Kendaraan di Jalan dengan Transceiver SRF02 dan Mikrokontroller ATmega8A** *Joko Lianto Buliali, Victor Hariadi, Karisma Trinanda Putra, Syahri Muharom*
6	**Klasifikasi Spermatozoa Pembawa Kromosom X atau Y dengan Metode Naïve Bayes** *Muhammad Hasan Wahyudi*
7	**Perancangan dan Implementasi Virtual Hosting Menggunakan Linux** *Dahlan Abdullah*

Room 5 **Moderator: Teguh Kurniawan Martono, S.T., M.T.**	
Parallel Session 1 (10.30 – 11.45)	
1	**Estimasi Jarak Berbasis Konektivitas Untuk Penentuan Posisi Node pada Jaringan Sensor Nirkabel** *Aries Pratiarso, Prima Kristalina, Ninis Ari Fianti*
2	**Learning Support Application of Gesture Language for Mute and Deaf Case Study in SLB-B YRTRW (Yayasan Rehabilitasi Anak Tuna Rungu Wicara) Surakarta** *Aris Rakhmadi, Anwar Dwi Harnanto, Fajar Suryawan*
3	**Audit Kesiapan Organisasi dalam Implementasi *Knowledge Management System:* Studi Kasus Perusahaan di Bidang Jasa Keuangan** *Dewi Puspasari, Ovi Novianto, Bayu Kelana*
4	**Distance Regularized Level Set Evolution for Medical Image Segmentation** *Indra Rianto, Pranowo*
Parallel Session 2 (12.45 – 15.45)	
1	**A New Model of Information Processing based on Human Brain Mechanism: Toward a Cognitive Intelligent System** *Arwin Datumaya Wahyudi Sumari*
2	**Perancangan *Dashboard System* untuk Sekolah Musik dengan Menggunakan *Key Performance Indicator* (Studi Kasus: Sekolah Musik XYZ)** *Yosi Yonata, Arief Samuel Gunawan, Samuel Deyunior*
3	**Aplikasi Presensi Kelas Kuliah Dengan Near Field Communication (NFC) Pada Android** *Andreas Handojo, Julius Wonodihardjo, Justinus Andjarwirawan*
4	**Pengembangan Simulasi Peternakan Sapi Perah dengan Game Maker Berbasis Windows** *Prima Widyaningrum, R Rizal Isnanto, Kurniawan Teguh Martono*
5	**Sistem Cerdas untuk Klasifikasi Kemampuan Kognitif dengan *Adaptive Neuro Fuzzy Inference System* (ANFIS)** *Muhamad Afif Effindi, I Nyoman Sukajaya, I Ketut Eddy Purnama, Mauridhi Hery Purnomo*
6	**Pembangunan E-Commerce UKM Gamelan di Kecamatan Serengan Surakarta** *Abdul Aziz, Meiyanto Eko Sulistyo*
7	**Pengembangan Lingkungan Pembelajaran Berbasis Digital Berbasis Kerangka Kerja QoS Adaptif** *Ratna Wardani, Lukito Edi Nugroho*

Room 6 **Moderator: Dr. Munawar Agus Riyadi, S.T., M.T.**	
Parallel Session 1 (10.30 – 11.45)	
1	**Pengembangan Sistem Pemrograman Acara pada Stasiun TV9 Surabaya** *Khakim Ghozali, Feby Artwodini Muqtadiroh, Angga Kusumandaru*
2	**SMS sebagai Perubah Informasi Matriks LED Berbasis AVR ATMega8 pada Perguruan TInggi Raharja** *Asep Saefullah, Ferry Sudarto, Sigit Maulana Kuncoro*
3	**Perancangan Permainan Mengasah Daya Ingat "Memory Training" Menggunakan Greenfoot** *Yessy Kurniasari, R Rizal Isnanto, Oky Dwi Nurhayati*
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Distance Regularized Level Set Evolution for Medical Image Segmentation

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Abstract—**Medical image is an important tool because it can be used for surgical planning and simulation, radiotherapy planning, and tracking the progress of disease. To analyze the medical image, it must partitioned into different segment using image segmentation methods. Many methods are introduced to perform that segmentation, one of them is DRLSE. DRLSE are the development of level set method and maintained by forward-and-backward (FAB) diffusion derived from distance regularization term. Because of that DRLSE eliminates the need for re-initialization and avoid the undesirable side effect. This research use DRLSE for medical image segmentation. DRLSE can be used in medical image segmentation.**

Keywords-segmentation; medical image; DRLSE

I. INTRODUCTION

Medical image is important tool because it can be used for surgical planning and simulation, radiotherapy planning, and tracking the progress of disease [1]. Medical image is analyzed depending by experience of doctor and takes a long time [2]. The solution to the problem is by using computer to segment the medical image with image segmentation methods.

Many method are introduced to perform image segmentation, such as distance regularized level set (DRLSE) [3], [4], [5], level set approach [6], [7], [8], [9], region-based [10], particle swarm optimization (PSO) [11], a pyramidal segmentation algorithm [12], edge detection [13], wavelet-based [14], and others method. This research will used DRLSE method for image segmentation.

DRLSE use level set method approach. DRLSE is proposed because level set function (LSF) in level set method typically develops irregularities during its evolution, which cause numerical errors and destroy stability of level set evolution. To solve these problem, re-initialization method was introduced to restore the regularity of level set function and maintain stable of level set evolution. But it has some theoretical and practical problem in practice of re-initialization [3]. DRLSE method proposed different approach to solve these problem. Consistent of level set function in DRLSE is maintained by a forward-and-backward (FAB) diffusion derived from the distance regularization term. DRLSE eliminates the need for initialization and avoids the undesirable side effect. DRLSE formulation also significantly reduce iteration number and computation time, while maintaining sufficient numerical accuracy in both full domain and narrowband implementation.

In this research, DRLSE method be used to perform medical image segmentation. This research hoped it can be useful in medical image segmentation. It will be easier to perform medical image segmentation.

II. MEDICAL IMAGE

Image is picture that represent something. Image can be picture of people, animals, scene of the outside, microphotograph of electronic device or result of medical image [15]. Medical image is an image which created with different technologies in order to diagnose, monitor and analyze medical condition. Each technology can give different information about body part witch will be studied or treated, related to the diseases, accidents, or to track the development of medical treatment.

One of the tools which can be used for medical image are Magnetic Resonance Imaging (MRI). MRI makes temporary magnetic field around the patient's body. Radio waves transmitted and received to transmitter or receiver in the machine, then the signal will create a digital image of the desired area. Figure 1 shows an example of MRI scan image on knee.

Figure 1. MRI Scan Image on Knee

III. SEGMENTATION

Segmentation is process to dividing the digital image into multiple segments. The purpose are to make the image more meaningful and easier to analyze. There are many methods to do image segmentation, which are intensity thresholding, region growing and region splitting, edge detection, interest operators, watershed segmentation, and markov random models [16].

Region growing approach by making grouping of pixels into large region based on common criteria. Region splitting making the image into one region and divided into smaller region then found the desired results. Level set method used this approach for image segmentation. Distance regularized level set evolution was one of many level set method evolution which is used for image segmentation.

IV. DISTANCE REGULARIZED LEVEL SET EVOLUTION (DRLSE) METHOD

Distance Regularized Level Set Evolution is a development of level set method. It is developed because level set function develops irregularities that cause numerical errors and destroy the stability of level set evolution. To overcome the problem, distance regularization term is added into PDE, then it becomes a DRLSE formulation

$$\frac{\partial \phi}{\partial t} = \mu\, div(dp(|\nabla\phi|)\nabla\phi + F|\nabla\phi| + A.\nabla\phi \quad \ldots(1)$$

With distance regularization term, numerical scheme is stable without the need for re-initialization. DRL. DRLSE can be used for image segmentation including region-based or edge-based image formation to define the external energy. Li in his paper [3] introduced the DRLSE application to an active contour model using edge-based information.

This algorithm first filter the image using Gaussian Kernel Filter to smooth the image to reduce the noise.

Then calculate the energy function:

$$\varepsilon(\phi) = \mu\mathcal{R}_p\phi + \lambda\mathcal{L}_g(\phi) + \alpha A_g(\phi) \quad \ldots(2)$$

Where $\mathcal{R}_p$ is level set regularization, $\lambda > 0$, and $\alpha \in R$ are coefficient of the energy functional $\mathcal{L}_g(\phi)$ and $A_g(\phi)$

$$R_p(\phi) \triangleq \int_\Omega p(|\nabla\phi|)dx \quad \ldots(3)$$

Where P is potential energy

$$\mathcal{L}_g(\phi) \triangleq \int_\Omega g\delta(\phi)(|\nabla\phi|)dx \quad \ldots(4)$$

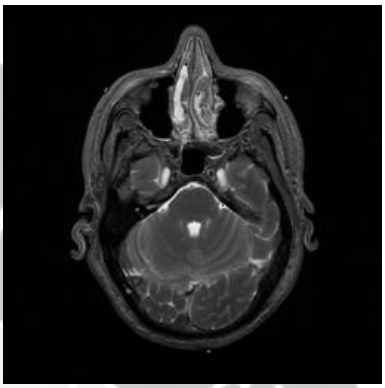
$$A_g(\phi) \triangleq \int_\Omega gH(-\phi)dx \quad \ldots(5)$$

A_g is speed of level set function accelerated. $\mathcal{L}_g$ is minimum when level set function at object boundary.

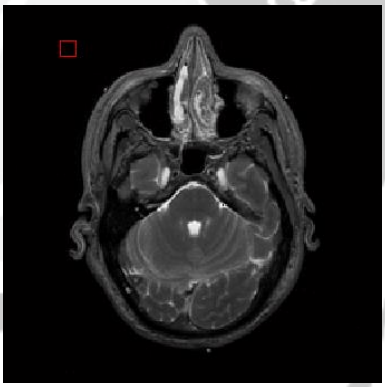
V. RESULT

Distance Regularized Level Set Evolution (DRLSE) method is used in this research for medical image segmentation. Medical image that is used is a MRI Scan of brain and the size of this image is 256x256 pixels. This research shows that DRLSE can be used for image segmentation and the segmentation result is good.

Figure 2 shows the image segmentation result using DRLSE method. First, select the input image. In this research, we using brain scan image (a). After that, initialize the contour of level set function (b). Then the level set function will evolve, moving the zero level set toward the desired object boundary. Curve evolution process of DRLSE model, it is display the zero level contours at iterations 100 (c), 500 (d), 1000 (e) and 1600 (f) which is the segmentation result. The CPU times consumed in this research is 2 minute 20 second. The CPU times were obtained by running the program on HP 431 notebook with Intel Core i3 (2nd Generation) CPU, 2.1 GHz, 2 GB RAM, with Matlab 7.11 on windows 7.

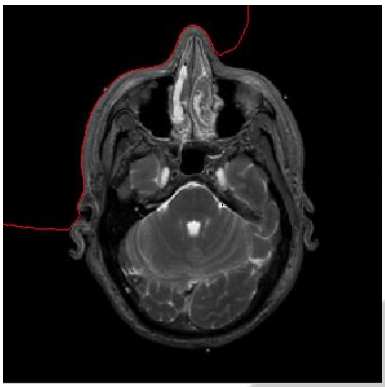


a) Image of Brain Scan

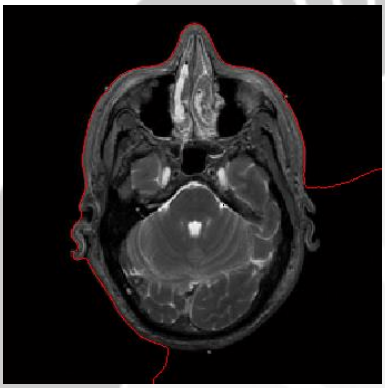


b) Initial Contour of Level Set Function

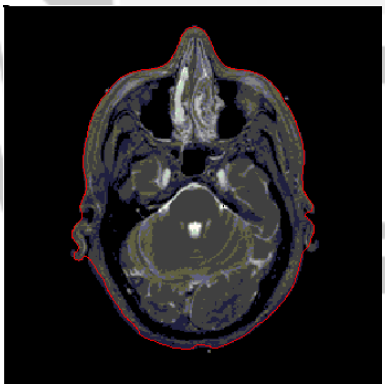
c) Contour at Iteration 100



d) Contour at Iteration 500



e) Contour at Iteration 1000



f) Contour at Iteration 1600, also the image segmentation result

Figure 2. Image Segmentation Result using DRLSE Method

VI. CONCLUSION

DRLSE are one of many method that is used for image segmentation in order to analyze the medical image. DRLSE do not need to re-initialization so the computation time can be faster than level set method. But, if medical image has a big size then time that is need to compute will take longer. To minimize the computational time, maybe in next research, image segmentation with DRLSE method are done in parallel computation. Parallel computation can be done in GPU in order to speed-up the computational time.

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REFERENCES

[1] T. McInerney and D. Terzopoulos, "Deformable Models in Medical Image Analysis: A Survey," Medical Image Analysis, vol. 1, no. 2, pp. 91-108, 1996.

[2] D. D. Patil and S. G. Deore, "Medical Image Segmentation: A Review," International Journal of Computer Science and Mobile Computing, vol. 2, no. 1, pp. 22-27, 2013.

[3] C. Li, C. Xu, C. Gui and M. D. Fox, "Distance Regularized Level Set Evolution and Its Application to Image Segmentation," IEEE Transactions on Image Processing, vol. 19, no. 12, pp. 3243-3254, 2010.

[4] U. R. N., P. V. Subbaiah, D. V. Rao and N. K, "Optimal Segmentation of Brain Tumors using DRLSE Levelset," International Journal of Computer Application, vol. 29, no. 9, pp. 6-11, 2011.

[5] J.-q. Liu and W.-w. Liu, "Adaptive Medical Image Segmentation Algorithm Combined with DRLSE Model," Procedia Engineering, pp. 20634-2638, 2011.

[6] D. K. Lakovidis, M. A. Savelonas, S. A. Karkanis and D. E. Maroulis, "A Genetically Optimized Level Set Approach to Segmentation of Thyroid Ultrasound Images," Appl Intell, pp. 192-203, 2007.

[7] C. Li, R. Huang, Z. Ding, J. C. Gatenby and D. N. Mataxas, "A Level Set Method for Image Segmentation in the Presence of Intensity Inhomogeneities With Application to MRI," IEEE Transactions on Image Processing, vol. 20, no. 7, pp. 2007-2016, 2011.

[8] S. Yu, Y. Mou, D. Xu, X. You, Zou Long and W. Zeng, "A New Algorithm for Shoreline Extraction from Satellite Imagery with Non-Separable Wavelet and Level Set Method," International Journal of Machine Learning and Computing, vol. 3, no. 1, pp. 158-163, 2013.

[9] D. Jayadevappa, S. S. Kumar and D. S. Murty, "A New Deformable Model Based on Level Sets for Medical Image Segmentation," IAENG International Journal of Computer Science, 2009.

[10] T. Schoenemann, F. Kahl, S. Masnou and D. Cremers, "A Linear Framework for Region-Based Image Segmentation and Inpainting Involving Curvature Penalization," Int J Comput Vis, pp. 53-68, 2012.

[11] S. P. Duraizamy and R. Kayalvizhi, "A New Multilevel Thresholding Method Using Swarm Intelligence Algorithm for Image Segmentation," J. Intelligent Learning System & Applications, vol. 2, pp. 126-138, 2010.

[12] P. A. Chochia, "A Pyramidal Image Segmentation Algorithm," Journal of Communications Technology and Electronics, vol. 55, no. 12, pp. 1550-1560, 2010.

[13] N. Senthilkumaran and R. Rajesh, "Edge Detection Techniques for Image Segmentation - A Survery of Soft Computing Approaches," International Journal of Recent Trends in Engineering, vol. 1, no. 2, pp. 250-254, 2009.

[14] S. W. Yoon, C. Lee, J. K. Kim and L. Myoungho, "Wavelet-based Multi-resolution Deformation for Medical Endoscopic Image Segmentation," J Med Syst, pp. 207-214, 2008.

[15] A. McAndrew, An Introduction to Digital Image Processing with MATLAB, Victoria University of Technology, 2004.

[16] C. Solomon and T. Breckon, Fundamental of Digital Image Processing: A Practical Approach with Examples in Matlab, Chichester, West Sussex: Wiley Blackwell, 2011.

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