PROGRAMME BOOK

UNIVERSITY OF MALAYA

2019 IC2SE

International Conference on Computer Science and Engineering

Proceedings International Conference on Computer Science and Engineering

INDUSTRIAL REVOLUTION 4.0
OPPORTUNITIES & CHALLENGES

26-27 April 2019
UPI Convention Center,
Universitas Putra Indonesia "YPTK"
Padang, Indonesia

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MESSAGE FROM THE PRESIDENT OF UNIVERSITAS PUTRA INDONESIA YPTK PADANG

Assalamualaikum Wr. Wb, Thanks and gratitude to Allah who has given us mercy and blessing until Universitas Putra Indonesia YPTK Padang can held International event about Computer Science and Engineering. International Computer Science and Engineering (IC2SE) 2019 is held by collaboration between Universitas Putra Indonesia YPTK Padang with University of Malaya, thank's to all who has support us. We are from Yayasan Perguruan Tinggi Ilmu Komputer Padang always support every activity which is support Tri darma perguruan tinggi . I hope this event give so much benefit for domestic and overseas lecturers and Students, thank's to all Committee of IC2SE, Rector and all vice Rector of UPI YPTK, Rector and all vice rector of UM and Speciall thank's to all of participants from the overseas (Malaysia, New Zealand, Bangladesh, United Kingdom, Bahrain, Zambia, Nigeria, Saudi Arabia, Uganda, Pakistan, Iraq, Palistine). Thank you very much for participating in our event and we wish you get the wonderfull and unforgetable experiences in Minangkabau.

MESSAGE FROM THE CONFERENCE GENERAL CHAIR

Billy Hendrik, S.Kom., M.Kom.
General Chair of IC2SE 2019

Dear Conference Delegates
On behalf of the organizing committee, I am honored and delighted to welcome you to the 1st International Conference on Computer Science and Engineering (IC2SE) 2019 at Universitas Putra Indonesia YPTK, Padang, Indonesia. We are delighted to have you with us to participate in our pioneer conference. Thank you for coming.
The conference theme, "Industrial Revolution 4.0 Opportunities & Challenges", has been chosen with the aim to investigate the elements, issues, benefits, challenges, progress and relevance of Industry 4.0 implementation in today's context. We have received 200 submissions from 13 countries including Indonesia and other countries are Malaysia, New Zealand, Bangladesh, United Kingdom, Bahrain, Zambia, Nigeria, Saudi Arabia, Uganda, Pakistan, Iraq and Palestine. All submissions went through a careful review process aided by the Technical Program Committee members. From the total submission, 86 papers are accepted for oral presentation.

Our one day technical program is rich and varied with 3 keynote speeches and 8 sessions of parallel presentation. It gives a chance to share your knowledge, ideas, network and build relationships with each other. We encourage you to engage with your fellow colleagues from around the world, learn from one another, and develop collaborative research together. On the second day, delegates will enjoy a day trip visiting several tourist attractions in West Sumatra.

As a conference general chair of IC2SE 2019, I know that the success of the conference depends ultimately on the many people who have worked with us in planning and organizing especially our patron and both the organizing & technical committees.
In this time of gratitude, I would like to convey a special thanks to Mr. H. Herman Nawas and Dr. Hj. Zerni Melmusi, MM, Ak, CA as President of UPI "YPTK" Padang who have kindly contributed both financially and non-financially, to make this a memorable conference. We value your patronage and appreciate your confidence in us.

In particular, we would like to acknowledge with much appreciation the crucial role of University Malaya as the IC2SE co-organiser, which are represented by: Dr. Suraya Binti Hamid, Associate Professor Dr. Sri Devi Ravana, Associate Professor Dr. Salimah Binti Mokhtar, Dr. Mohd Khalit Bin Othman, and the Information Systems department team members for their wise advice and remarkable effort in planning and coordinating this event with us.

I would to express my appreciation and gratitude to all international reviewers (Malaysia, Indonesia, Pakistan, Saudi Arabia), your contributions are very important for the fulfillment of the conference goals.

I would also like to take this opportunity to express sincere gratitude to our keynote speakers: Prof. Dr. Erry Yulian Triblas Adesta from International Islamic University Malaysia, Malaysia; Dr. Fariza Hanum Binti Md Nasaruddin from University of

Malaya, Malaysia; and Prof. Dr. H. Sarjon Defit from Universitas Putra Indonesia YPTK Padang, Indonesia. Thank you for coming as keynote speakers. We wish you a wonderful experience during your stay in Indonesia.

I would also like to thank my colleagues in the organizing committee from UPI "YPTK" and KO2PI. I really appreciate your hard work and support in preparing this big event.

So welcome to Padang for IC2SE 2019. Thank You for your participation. We sincerely hope you enjoy the conference.

Warmest greetings

ABSTRACT KEYNOTE SPEAKER 1 (IC2SE 2019)

Erry Yulian Triblas Adesta
University Islam Antarabangsa, Malaysia

Industrial Revolution 4.0: Opportunities, Challenges and Way Forward

Industry 4.0 introduces an era where computers are inter-connected and communicating with one another to ultimately make decisions without very much human intervention. Industry 4.0 also offers the opportunity for producers to optimize their operations rapidly and efficiently by knowing what needs attention and to be prioritized. It shall be marked by the ability to interconnect various tools communicating on various protocols with only one chip, while semiconductor manufacturers must be very careful in their selection process. Shortly, Industry 4.0 moves into product marking and coding. On the other hand, composite materials and parts require specialized development processes because of their complexity to fit into this Industry 4.0 environment. It has also been said that the 4th industrial revolution shall digitize and vertically integrates processes across the entire organization. Furthermore, it integrates horizontally all the internal processes from suppliers' suppliers to customers' customers. It simply represents a paradigm shift from 'centralized' to 'decentralized' production, whereby machines no longer just 'processing' the product, but they are seamlessly integrating them within business partnership of suppliers and customers through information network. In other words, the idea of consistent digitization and linking of all productive units in an economy is emphasized in the 4th industrial revolution age. Due to the self-organization, they choose each time methods, such as planning and control methods, and use machines and robots that are suitable for carrying out specific tasks. However, the management and creation of such a structure is becoming more and more difficult while at the same time the requirements towards individual employees or groups are getting more and more sophisticated. The creation and management of such information and communication networks shall be customized or personalized and will become organizational and technical challenge for the future. It is understood that very large manufacturing companies and multinational groups already consider the topic very important. However, small and medium sized companies do not yet appear to consider industrial 4.0 to be great relevance to them, even though these companies are most likely to be the big winners from the shift. It is a fact that Small and Medium sized companies are often able to implement the digital transformation more rapidly because they can develop and implement the new IT structures from the scratch easier. Very large manufacturing companies and multinational groups in the contrary, have more complexity to deal with in terms of their existing, organically grown structures. Hence it can be claimed that the digital transformation to industry 4.0 of equal importance to all sectors. Companies, ranging from Mechanical and Electrical engineering industries and the chemical sector see it as having the greatest potential while companies in metalworking industries and construction sector currently see it as less important. Industry 4.0 will se digital networks spreading across all global locations structure.

ABSTRACT KEYNOTE SPEAKER 2 (IC2SE 2019)

Fariza Hanum Binti Md Nasaruddin
University Of Malaya, Malaysia

Dr. Fariza Hanum Md Nasaruddin is currently a Senior Lecturer with the Department of Information Systems, Faculty of Computer Science and Information Technology, University of Malaya. She received her B.Sc. degree in computer science and the M.Sc. degree in MIS from Northern Illinois University, USA, and her Ph.D. degree from University of Malaya. She was with the industry as a Systems Analyst for 10 years before joining the academia in 1997. She became involved in multi-disciplined research but her main focuses are in databases, data analytics, information systems, big data and data science. Recent advancements in data science and big data have sparked her interest and she has kept herself up-to-date with various software and data science courses. She also completed a 10 months course in Data Science Certification by John Hopkins University.
The topic to be presented at International Conference Computer Science Engineering 2019 is **"The role of Big Data and Data Science in the Fourth Industrial Revolution "**

The world is abuzz with the presence of the Fourth Industrial Revolution (IR4.0). Although the industry 4.0 is geared towards automation and data exchange in manufacturing technologies, the main lifeline for IR4.0 is very much information technology (IT) related. Therefore, can IR4.0 be totally separated from big data and data science; which are the current buzzwords in the IT field? This talk will present some views and discussions on how data science can be useful in the Fourth Revolution, if at all. It will present a basic introduction to big data and data science, and later proceed to provide examples on data science and big data applications that are useful to the community. Audience will be given a closer view into some problems that may solved in various manufacturing and other industries using data science approach during this phase we call the Fourth Industrial Revolution.

ABSTRACT KEYNOTE SPEAKER 3 (IC2SE 2019)

Sarjon Defit
Universitas Putra Indonesia YPTK – Indonesia

Prof. Dr. Sarjon Defit, S.Kom, M.Sc Rector of Universitas Putra Indonesia YPTK Padang. Educational Background: Inpres I 3/76 Primary School Padang Sibusuk, graduated in 1983. Madarasah Tsanawiyah Negeri Padang Sibusuk, finished in 1986. Madrasah Aliyah, Koto Baru State, Padang Panjang, graduated in 1989. College of Information and Computer Management (STMIK "YPTK" Padang), graduated in 1993. Universiti Teknologi Malaysia, Johor Bahru (S2), graduated in 1998 Universiti Teknologi Malaysia, Johor Bahru (S3), graduated in 2003.

Conference Schedule

INTERNATIONAL CONFERENCE COMPUTER SCIENCE AND ENGINEERING
(IC2SE 2019)
PADANG, APRIL 26-27 2019

Conference Day : Friday 26th April 2019
Venue : UPI Convention Center

TIME	ACTIVITY
08.00 - 08.30 am	Registration + Coffee & Snack Box
08.30 - 08.35 am	Opening (Shalawat Nabi)
08.35 - 08.45 am	Recitation of the Holy Qur'an and Translation
08.45 - 08.50 am	Recitation of Doa
08.50 - 09.05 am	Dzikir Asma Ul-Husna
09.05 - 09.10 am	National Anthem
09.10 - 09.15 am	Traditional Dance
09.15 - 09.30 am	Signing of MOA (UPI YPTK & UM)
09.30 - 10.30 am	**Welcoming Speech:** 1. Prof. Dr. H. Sarjon Defit. S.Kom., M.Sc (Rector of Universitas Putra Indonesia YPTK Padang) 2. Bapak H. Herman Nawas (Head of Institution) 3. Prof. Dr. Herri, SE, MBA (Head of LLDIKTI X ten region) 4. Prof. Dr. H. Irwan Prayitno, S.Psi, M.Sc (Governor of West Sumatera Province)
10.30 - 11.00 am	**Keynote Speakers:** 1. Prof. Erry Yulian Triblas Adesta, Ph.D., C.Eng., M.I.Meche., IPM.- (University Islam Antarabangsa) 2. Dr. Fariza Hanum Binti Md Nasaruddin - (University Of Malaya) 3. Prof. H. Sarjon Defit. S.Kom., M.Sc - (Universitas Putra Indonesia YPTK Padang)
11.15 - 11.25 am	Q & A
11.25 - 11.35 am	Group Photo Session
11.35 - 12.00 pm	Lunch
12.00 - 13.30 pm	Sholat Zohor
13.30 - 15.30 pm	Parallel Session (Room 1 – Room 9)
15.30 - 16.00 pm	Coffee Break & Sholat Asar
16.00 - 17.30 pm	Parallel Session (Room 1 – Room 9)

DETAILS SESSION PROGRAMME

Friday, 26th April 2019

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6	Design of Bicycle's Speed Measurement System Using Hall Effect Sensor	Ratna Aisuwarya, Muhammad Azmi Riyan, Rahmi Eka Putri
54	Prediction of Corn Productivity in Indonesia as Anticipation Efforts to Import Using Backpropagation Neural Network	Anjar Wanto, Dedy Hartama, Risma Nurhaini Munthe, Pawer Darasa Panjaitan, Elfina Okto Posmaida Damanik, Agus Perdana Windarto
22	The Framework Accommodation of Systems Recommendation Via Social Media	Doni Ariyanto, Lukito Edi Nugroho, Adhistya Erna Permanasari
37	Practicality of E-Learning as Learning Media in Digital Simulation Subjects at Vocational School in Padang	Monica Fransisca, Yuliawati Yunus, Aminda Dewi Sutiasih, Renny Permata Saputri
Session 2, 04.00 – 05.30 pm Room 1, Ground Floor Session Chair : Billy Hendrik		
Paper ID	**Title of Paper**	**Author**
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42	Breast cancer classification using digital biopsy histopathology images through transfer learning	Ghulam Murtaza, Liyana Shuib, Ainuddin Wahid Abdul Wahab, Ghulam Mujtaba, Ghulam Mujtaba, Ghulam Raza, Nor Aniza Azmi
49	Enhancement of OTP Stream Cipher Algorithm Based on Bit Separation	Arisman, Mahyuddin K M Nasution, Syahril Efendi
53	Online Management System of Praktik Lapangan Kerja (PLK) UPI YPTK Padang	Astri Indah Juwita, Muhammad Ikhlas
60	Implementation and Design User Interface Layout Use Leap Motion Controller with Hand Gesture Recognation	Billy Hendrik, Fauziah, Mardhiah Masril, Yunan Fauzi Wijaya, Silfia Andini.

Session 1, 1.30 – 03.30 pm Room 2, Ground Floor Session Chair : Associate Professor Dr. Maizatul Akmar Ismail		
Paper ID	**Title of Paper**	**Author**
12	Supplier Selection by Using Analytical Hierarchy Process (AHP) and Techniques for Order Preference Methods with Similarities to Ideal Solutions (TOPSIS)	Ikhsan Siregar
39	Prediction of Canal Erosion on Tidal Swamp Delta Telang I, Banyuasin Regency, South Sumatra	Achmad Syarifudin, Henggar Risa Destania, Yunan Hamdani
64	Disaster risk management strategy in the environment and disaster mitigation-based school (SWALIBA)	Sindhung Wardana , Herdis Herdiansyah , Adam Wicaksono
68	Smart IoT Flood Monitoring System	Shahirah Binti Zahir, Phaklen Ehkan, Thennarasan Sabapathy, Muzammil Jusoh and Mohd Nasrun Osman, Mohd Najib Yasin, Yasmin Abdul Wahab, Hambali and N. Ali, A.S. Bakhit,F.Husin,M.K.Md.Kamil and R.Jamaludin
73	Shallow Well Water Salinity Viewed from Distance Of Well To CoastLine And Ground Water Level Elevation In Purus Padang Village	M Chairi, W Purba, W Boy, R Imani, J Melasari
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Paper ID	**Title of Paper**	**Author**
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81	Standard Operational Procedure Fund Distribution System of Zakat Infaq and Shodaqah for Zakat Foundations	Inge Handriani, Bagus Priambodo, Al Hamidy Hazidar , Mardhiah Masril, Zico Pratama Putra , Asama Kudr Nseaf, Emil Naf'an
77	Automatic System to Fish Feeder and Water Turbidity Detector Using Arduino Mega	H Hendri , S Enggari , Mardison , M R Putra, L N
67	The Application of Data Mining in Determining Patterns of Interest of High School Graduates	Dedy Hartama, Agus Perdana Windarto, Anjar Wanto
36	Model Development Measurement of Interests Based on Expert System	Erdisna, Ganefri, Ridwan, Rice Novita , Wanayumini

Session 1, 1.30 – 03.30 pm Room 3, Ground Floor Session Chair : Halifia Hendri		
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43	Bandit algorithms in information retrieval evaluation and ranking	Sinyinda Muwanei, Hoo Wai Lam, Sri Devi Ravana , Douglas Kunda
38	Analysis of Multiple Channel Multiple Phase System for Priorities Queuing Model (N-P) with Simple Adaptive Weighting	Herman Putra Rajagukguk, Muhammad Zarlis, Sutarman
28	Application Of Ahp Analysis To Increase Employee Career Paths In Decision Support Systems	Julius Santony , Faisal Amir, Sumijan , Rice Novita
23	Text Mining For Hotel Classification Using Naïve Bayes Algorithm	Ahmad Afif, Lukito Edi Nugroho , Adhistya Erna Permatasari
79	Design Of Expert System For Diagnosis Damage Computer Hardware	Retno Devita , Eva Rianti , Sri Rahmawati
Session 2, 04.00 – 05.30 pm Room 3 Ground Floor Session Chair : Dr. Azah Anir Norman		
Paper ID	**Title of Paper**	**Author**
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35	Expert Systems Diagnosing Of Banana Pests And Diseases Use Case-Based Reasoning Method With Android	Hezy Kurnia, Vicky Ariandi, Heriyanto, Yesri Elva
11	Technology Acceptance Among Older Adults With Mild Cognitive Impairement	Nita Rosa Damayanti, Nazlena Mohamad Ali, Ely Salwana Mat Surin
74	Expert System to Diagnose Child Development Growth Disorders with Forward Chaining Method	A P Gusman, H Hendri
21	Design Chipless Textile Tag For RFID Application	Mirza Anuar, Lee Yeng Seng, M. S. Shakhirul, F.H. Wee, Hong Seng Gan, Muzammil Jusoh, Thennarasan Sabapathy , M.N. Osman

Session 1, 1.30 – 03.30 pm Room 4, Ground Floor Session Chair : Dr. Norizan Mohd Yasin		
Paper ID	**Title of Paper**	**Author**
03	A comparative analysis of detection mechanisms for emotion detection	Vimala , Marian Cynthia Martin, Wandeep Kaur, Amir Javed
55	Determination of the Shortest Route Towards the Tourist Destination Area Using the Ant Algorithm	Ni Luh Wiwik Sri Rahayu Ginantra , T , Gita Widi Bhawika , Ida Bagus Ary Indra Iswara , Anjar Wanto
18	Multiple Thresholding Methods For Extracting & Measuring Human Brain And 3d Reconstruction	Sumijan , Pradani Ayu Widya Purnama , Syafri Arlis
44	A Comparative Review of ISMS Implementation Based on ISO 27000 Series in Organizations of Different Business Sectors	Zaidatulnajla Hamdi , Azah Anir Norman , Nurul Nuha Abdul Molok
85	Improving the modelling of Robot Bunker with camera	Emil Naf`an , Riza Sulaiman , Nazlena Mohamad Ali , Bagus Priambodo , Al Hamidy Hazidar , Asama Kudr Nseaf , Zico Pratama Putra , Harry Theozard Fikri, Inge Handriani
Session 2, 04.00 – 05.30 pm Room 4 Ground Floor Session Chair : Rahmatul Husna Arsyah		
Paper ID	**Title of Paper**	**Author**
66	The Impact Analysis Of Flood Disaster In DKI Jakarta: Prevention And Control Perspective	Adam Wicaksono, Herdis Herdiansyah
08	Minimization of Palm Oil Losses on Sterilization Process by Optimization Boiling Pressure and Boiling time	Wetri Febrina , Yusrizal
13	Application of Theory of Constraints in Bottleneck Work Stations Optimization	Ikhsan Siregar
30	Designing Engineering Data Management System in Research and Development Company	Muhammad Nur, Luciana Andrawina
31	Risk Assestment of Housing Reconstruction Project Community-Based Construction after The Earthquake	Wendi Boy, Rafki Imani , Mayozi Chari

Paper ID 16

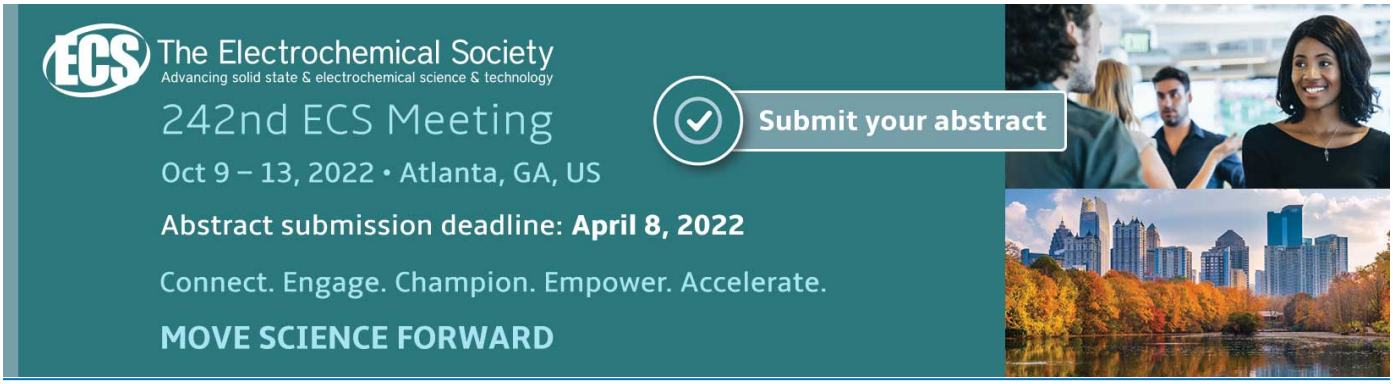
MULTIPLE THRESHOLDING METHODS FOR EXTRACTING & MEASURING HUMAN BRAIN AND 3D RECONSTRUCTION

Sumijan, Pradani Ayu Widya Purnama, and Syafri Arlis
Universitas Putra Indonesia YPTK Padang, Indonesia
Email : sumijan@upiyptk.ac.id (*Sumijan*)

Abstract
Thresholding changes the gray image to binary imagery and improves image quality. This study applies the multiple thresholding method to extract and calculate the area of bleeding in the human brain. 10 samples of human brain image using multiple threshold method (Otsu and hybrid thresholding). The results of the Otsu method that still have noise can be overcome by the hybrid thresholding method. The results of the original image research with images that have been processed using the multiple thresholding method yield the optimum threshold value, the method applied produces excellent image quality. Results of calculation of MSE, RMSE and PSNR. the average PSNR Otsu thresholding: an average of 60.93 db, the average PSNR Hybrid thresholding: 59.06 db, and the average PSNR Multiple thresholding: 56.96 db, the average MSE Otsu thresholding: 38.27, the average MSE Hybrid thresholding 36.15 , mean MSE multiple thresholding: 34.30, mean RMSE Otsu: 9.49, mean RMSE Hybrid thresholding: 8.88, average RMSE Multiple thresholding: 7.58. The results of the calculation of the area of cerebral hemorrhage and the level of accuracy indicate a better multiple thresholding method. The results of the calculation of the Brain Cerebral Hemorrhage area were carried out 3D reconstruction with linear interpolation method.

Keyword : Multiple Thresholding, Brain Cerebral Hemorrhage, MSE, RMSE & PSNR, 3D Reconstruction
Topic : Computer Science

Multiple Thresholding Methods for Extracting & Measuring Human Brain and 3D Reconstruction



Multiple Thresholding Methods for Extracting & Measuring Human Brain and 3D Reconstruction

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Abstract. Thresholding changes the gray image to binary imagery and improves image quality. This study applies the multiple thresholding method to extract and calculate the area of bleeding in the human brain. 10 samples of human brain image using multiple threshold method (Otsu and hybrid thresholding). The results of the Otsu method that still have noise can be overcome by the hybrid thresholding method. The results of the original image research with images that have been processed using the multiple thresholding method yield the optimum threshold value, the method applied produces excellent image quality. Results of calculation of MSE, RMSE and PSNR. the average PSNR Otsu thresholding: an average of 60.93 dB, the average PSNR Hybrid thresholding: 59.06 dB, and the average PSNR Multiple thresholding: 56.96 dB, the average MSE Otsu thresholding: 38.27, the average MSE Hybrid thresholding 36.15 , mean MSE multiple thresholding: 34.30, mean RMSE Otsu: 9.49, mean RMSE Hybrid thresholding: 8.88, average RMSE Multiple thresholding: 7.58. The results of the calculation of the area of cerebral haemorrhage and the level of accuracy indicate a better multiple thresholding method. The results of the calculation of the bleeding area were carried out by 3D reconstruction using linear interpolation method.

1. Introduction

Image segmentation is the process of getting objects in the image area or dividing images into several areas with each object or area having similar attributes. In an image that has only one object, the object is distinguished from the background and object [1]. Thresholding is the process of converting images from gray intensity to binary imagery, it is expected that it can be known between areas including objects and the image background clearly that can be used in the next process. The image resulting from thresholding will be used for the process of identifying or detecting objects and feature extraction. In the thresholding method, it is divided into two. First, global thresholding by using a histogram partition, a global threshold is called T, all image areas are used by this global thresholding. Both adaptive thresholding by dividing images are grouped into sub-images. Then in each sub-image segmentation is done using a different threshold, according to the characteristics of noise [2]. The method of image segmentation can be based on two properties, namely the value of gray intensity: discontinuity and similarity between pixels. The first method of image separation is based on automatic changes to the intensity of grayscale. For example by using the line detector and edge detector approaches to the image. The second method is based on the level of similarity between pixels in a different area according to the characteristics of noise [3]. The two methods described are: thresholding based on histograms; number of object areas; separation and merging of object areas;

grouping or classification; graph theory approach; knowledge-based or rule-based approaches. Based on the techniques used, segmentation can be divided into the following four categories [4]: thresholding techniques; threshold based method; method based on object area; hybrid method that combines threshold criteria and object area.

Image acquisition of brain CT is generally carried out in 2-dimensional (2D) form recorded in the form of slices with a certain distance between one slice and another. At each slice the image represents the state of the brain in the position of the slice. The representation of visual information is in the form of variations in the intensity of color or gray level of the brain slices and other objects (if any), as shown in Figure 1. Figure 1 (a) shows one slice of normal brain image and image 1. (b) is a slice abnormal brain image and white area in the brain is the bleeding area [5].

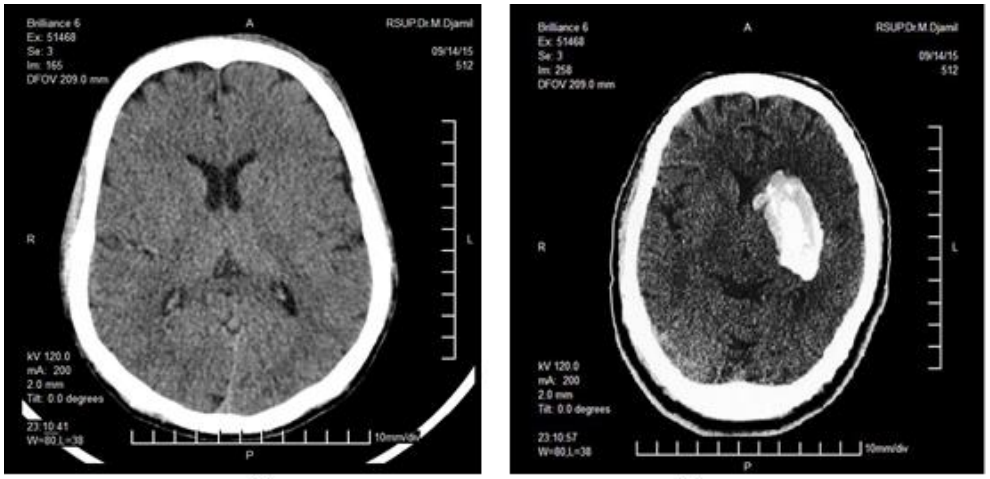


Figure 1. (a). Normal Brain Image, (b). Brain Image Bleeding
Source: RSUP M. Djamil Padang West Sumatra, 2015

A system of brain hemorrhage detection using image processing was used to classify cerebral hemorrhage in CT scan. Implement with MATLAB by making a procedure. In image processing procedures, such as the process of pre-processing, segmentation and feature extraction are carried out in detail. Produce more accurate processed images using various segmentation and refinement techniques [6]. The cancer detection scheme consists of four stages. Starting from Preprocessing, segmentation, classification and feature extraction. These four levels are used in image processing to improve precision tumor identification. The end result of this work is to find cancerous tumors as benign (or) malignant [7].

The function of restoration on CT scans in detecting both intracranial cranial cavity and additional skull lesions in patients with head injury is the most common cause, while the most frequent lesions are cerebral contusion [8]. Improving the quality of brain CT images with the aim of clarifying the contrast between parts of the brain through coloring with the help of the histogram algorithm. This research has not been oriented to the detection of brain injury. Karuna and Joshi [9] research has been conducted on the segmentation of the brain tumor area using texture analysis: Angular Second Moment (ASM), contrast, inverse difference moment (Homogeneity), dissimilarity and entropy [9]. Gillebert et al. In their study proposed an automated delineation algorithm that can automatically describe infarction and cerebral hemorrhage in CT (Scan Brain Stroke) images [10].

Subsequent research identified and extracted brain images from CT-Scan images to classify the brain that occurs bleeding and did not occur brain hemorrhage using the k-means algorithm classification method examined by Sharma [11]. The next study of Wenan et al. [12] in this study proposed the ICM (Iterated Conditional Mode) algorithm and Maximum A Posteriori Spatial Probability (MASP) to compare the two algorithms to analyze traumatic brain hemorrhage. The results focus on automatic processing of CT-scan brain images for segmentation and identifying brain ventricular bleeding [12]. Improving the quality of brain CT images with the aim of clarifying the

contrast between parts of the brain through coloring with the help of the histogram algorithm. This study has not been oriented to the detection of brain injury [13].

This study applies a multiple thresholding method, namely the otsu method and hybrid method (P-File and canny), the results of the Otsu method segmentation that still have noise, so there needs to be a hybrid thresholding method to overcome the noise on the Otsu. The hybrid thresholding method combines the P-File edge detection method with Robert, Canny, Sobel, LoG, and Prewitt. The results of the original image research with images that have been processed using the multiple thresholding method to obtain the optimum threshold value, so that this method is expected to produce better image quality. By combining the otsu and hybrid thresholding method (combining the P-File and Canny method) to extract the cerebral hemorrhage area in each slice of the CT scan image and calculate the area of bleeding. With the multiple thresholding method, the Otsu method segmentation that still contains noise can be overcome by the hybrid thresholding method.

2. Research Methods

The method or sequence of research conducted in this study is illustrated in Figure 2. This study consisted of 7 stages, namely:

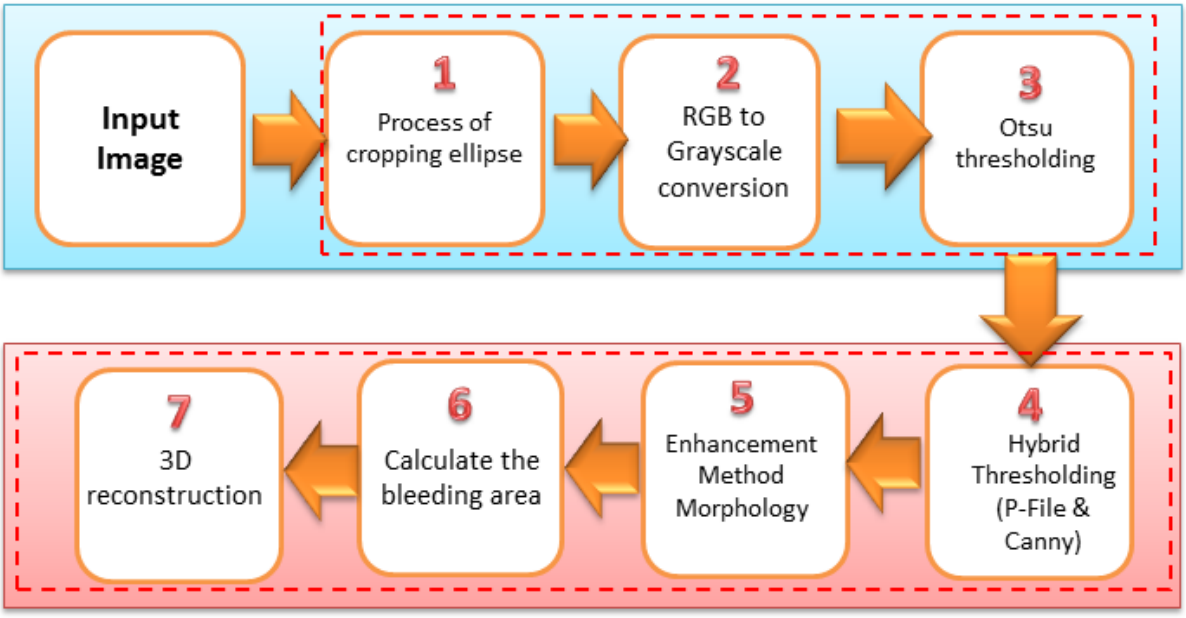


Figure 2. Research Framework

The main contribution proposed in this study is the merging of the Otsu method, the hybrid method, where the hybrid is a combination of the P-File method and the canny method (can be seen in Figure 2. which is marked by a dashed line box).

1. Input Image

The data used in this study were CT scan brain data from 10 patients with 8 images of brain hemorrhage (abnormal brain) and 2 images without bleeding (normal brain). The image used consists of 9 abnormal brain image images (image 1 s.d image 9), 1 image of a normal brain image (image 10). Brain image image data in file format in the form of "bitmap image (.bmp)", can be seen in Figure 3.

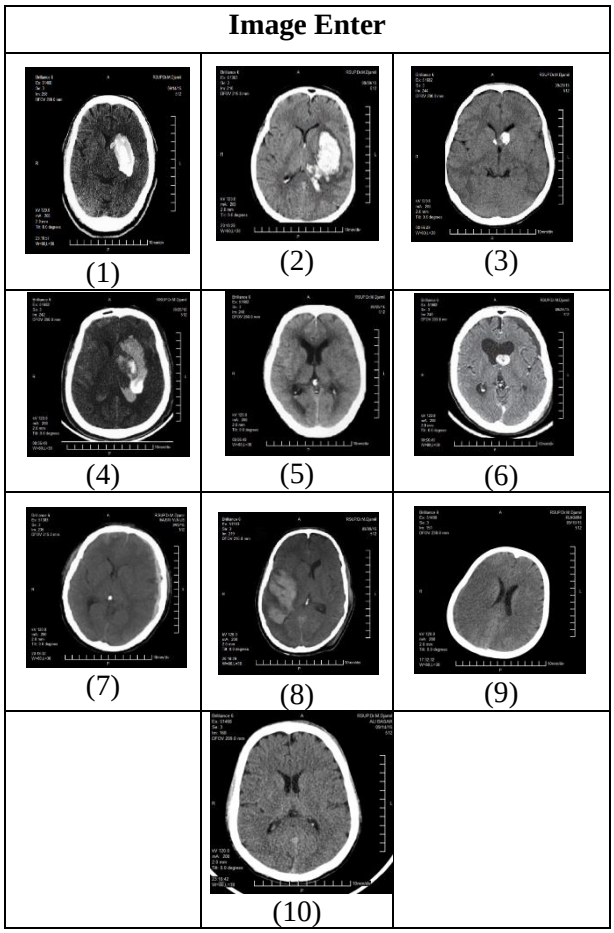


Figure 3.
CT-Scan Brain Imagery; Input Image (1), Input Image (2), Input Image (3), Image (4), Input Image (5), Input Image (6), Input Image (7), Input Image (8), Input Image (9) Image of brain input is not normal; and Input Image (10) Normal brain input image

2. *The first stage of cropping the input area:*
The cropping process aims to eliminate unnecessary noise outside the object of research, the cropping process is done automatically by using elipse logic to determine the image of the research object to be analyzed and processed, and to reduce the size of the original brain image easily processed and analyzed.

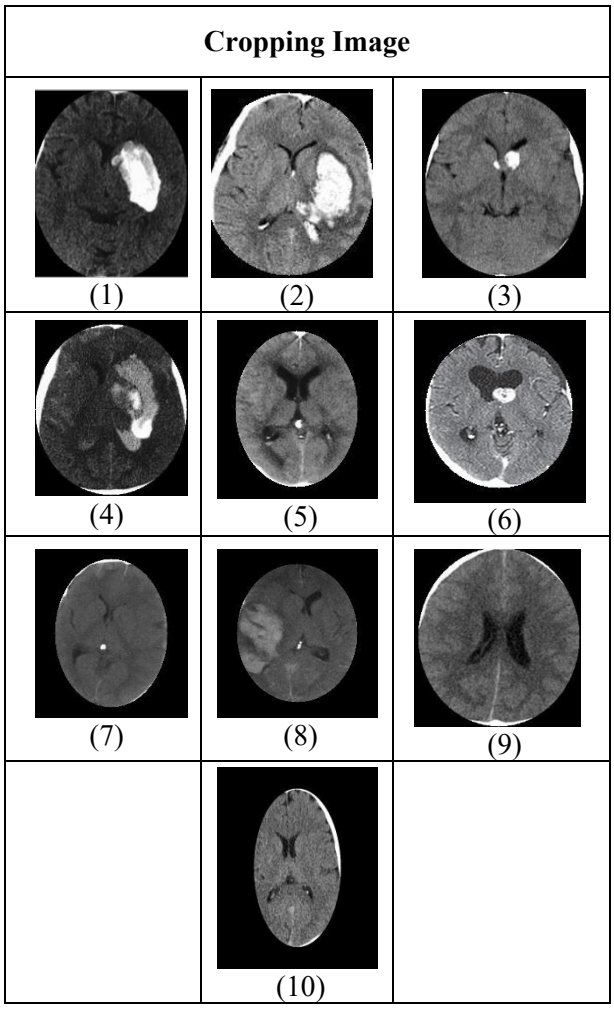


Figure 4.
Brain Image CT scan results from cropping; Image (1), Image (2), Image (3), Image (4), Image (5), Image (6), Image (7), Image (8), Image (9) Brain image is not normal; and Image (10) Normal brain image

3. *The process of converting images to grayscale aims to convert color images into gray-scale imagery considering that many image processing works on a gray scale.*
However, sometimes gray scale imagery also needs to be converted to binary imagery, considering that some operations in image processing run on binary imagery. How do you change the color image into a gray scale image? In general, color images can be converted to gray scale images through formulas:

$$I = 0{,}2989 \text{ x } R + 0{,}5870 \text{ x } G + 0{,}1141 \text{ x } B \quad (1)$$

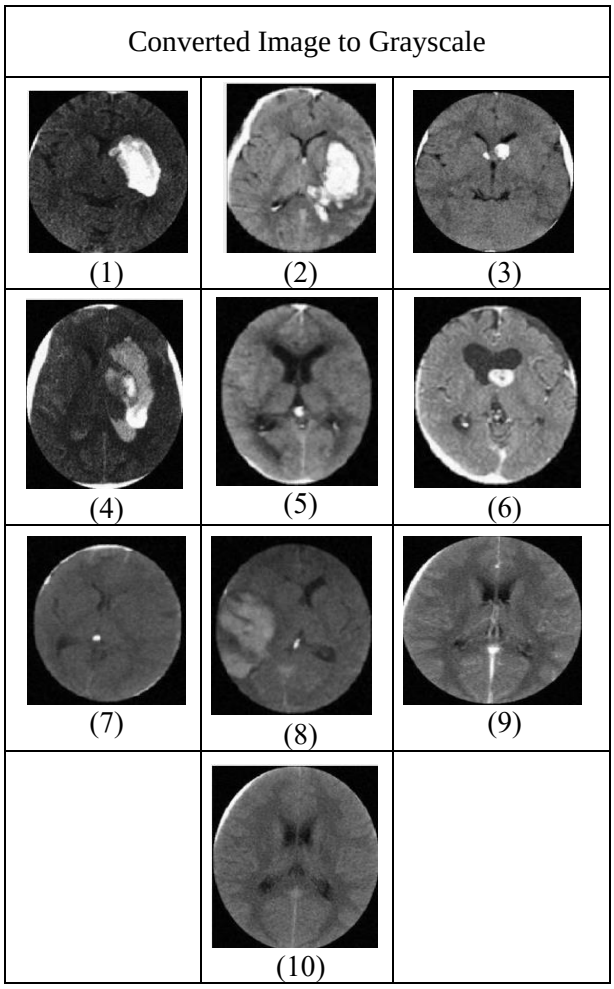


Figure 5.
Brain Image Scan results from conversion to grayscale images; Image (1), Image (2), Image (3), Image (4), Image (5), Image (6), Image (7), Image (8), Image (9) Brain image is not normal; and Image (10) Normal brain image

4. Multiple Thresholding Method

The multiple thresholding method is a method for digital image segmentation by combining the Otsu method and hybrid thresholding where this method combines the P-file and Canny methods.

a. The otsu method for digital image segmentation by using a threshold value automatically, the image used in the otsu method is a binary image (black and white cira), the process carried out is to compare the threshold value with the pixel color value of a digital image. The Otsu thresholding method was first introduced by Nobuyuki Otsu, in his scientific journal entitled "A Threshold Selection Method from Grayscale Histogram" in 1979 [14]. The threshold value is obtained from the calculation as follows: The first step that must be done is to make a histogram. The next step results from the histogram will be known the number of pixels for each gray level. Then the gray level of the image is expressed with i to L. The otsu method can be expressed by equation (2):

$$\sigma_B^2(k) = \frac{[m_G P_1(k) - m(k)]^2}{P_1(k)[1 - P_1(k)]} \quad (2)$$

Keep in mind that the value of k is at the time $\sigma_B^2(k)$ Maximum

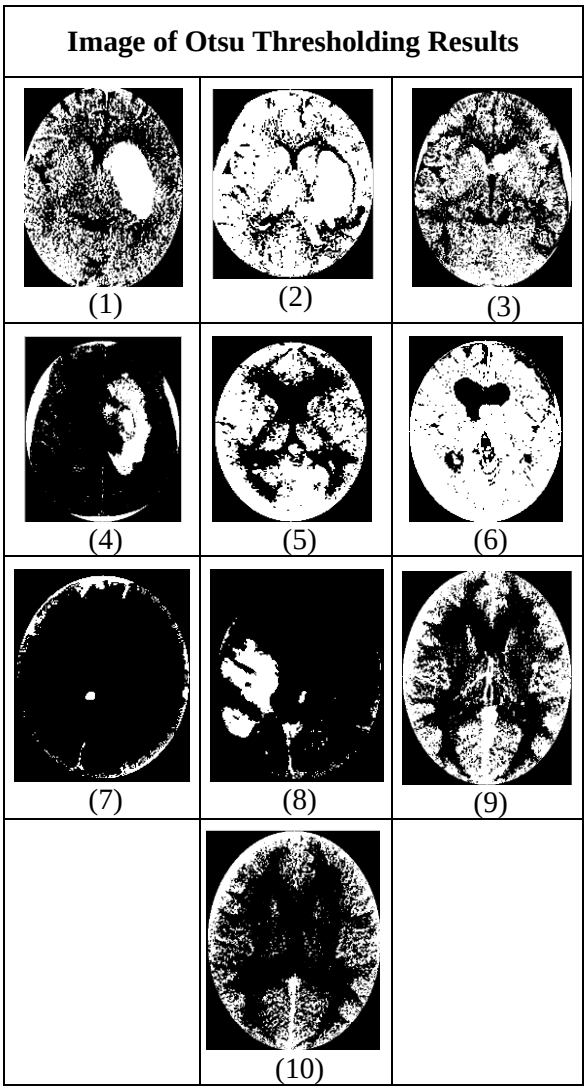


Figure 6.
CT-Scan Brain Image results from the Otsu thresholding method; Image (1), (2), (3), Image (4), Image (5), Image (6), Image (7), Image (8), Image (9) Brain image is not normal; and Image (10) Normal brain image

b. Hybrid Thresholding (P-file and Canny)
The purpose of the hybrid image thresholding method is to utilize image characteristics to help the process of calculating the threshold value. This method was developed by Samopa [15] with the aim of carrying out a thresholding process based on a combination of the P-tile method and the edge detection method. As in his paper entitled "Hybrid Image Thresholding Method Using Edge Detection", Samopa stated that the results of segmentation of objects obtained were more accurate than the usual method and also the Otsu method. Figure 3. shows an example of some edge detection methods used to calculate object area ratios by comparing the differences between the edges of the map and the original image with the threshold image. Try all possible object area threshold ratio values for an image and compare the edges of each edge of the original map image, the best estimate of the area of the ratio value object is determined as the value where the resulting edge has the smallest difference map with the original image. Application of MSE (Mean Squared Error) to calculate the difference between the edge of the threshold Map of the edge Map image and the original image. Giving the image I value to its original image and G to the threshold value threshold that is looking for [15], the Hybrid algorithm Thresholding Image method is as follows:

1. O ← EdgeMap (I) # EdgeMap count from image I #
2. v ← initial_Value
3. e ← RealMax # Set e as the maximum image value #
4. Loop until v = max_Value in Step increment.
5. T ← P-tile (I, v) # threshold I uses the method tile and v as the threshold value #
6. C ← EdgeMap (T) # Calculate Edge Map from image T #
7. r ← MSE (O, C) # Calculate the value of MSE in O and C #
8. If r <e # if the MSE value is smaller than e #
9. e ← r # exchange e value with MSE #
10. G ← v # set v as search value #

This method is simple and is suitable for all types of edge detection, because it only iterates continuously (determining value step by step). This method does not add to the T-tile complexity method and edge detection makes this hybrid approach. In the Hybrid Image Thresholding method, it is necessary to find the best edge to be combined with the edge detection of the P-tile method. This method tries to combine the P-tile method with five types of edge detection, canny, Prewitt, Roberts, Sobel and Laplacian from Gaussian (LOG) [15].

Image of hybrid threshold results

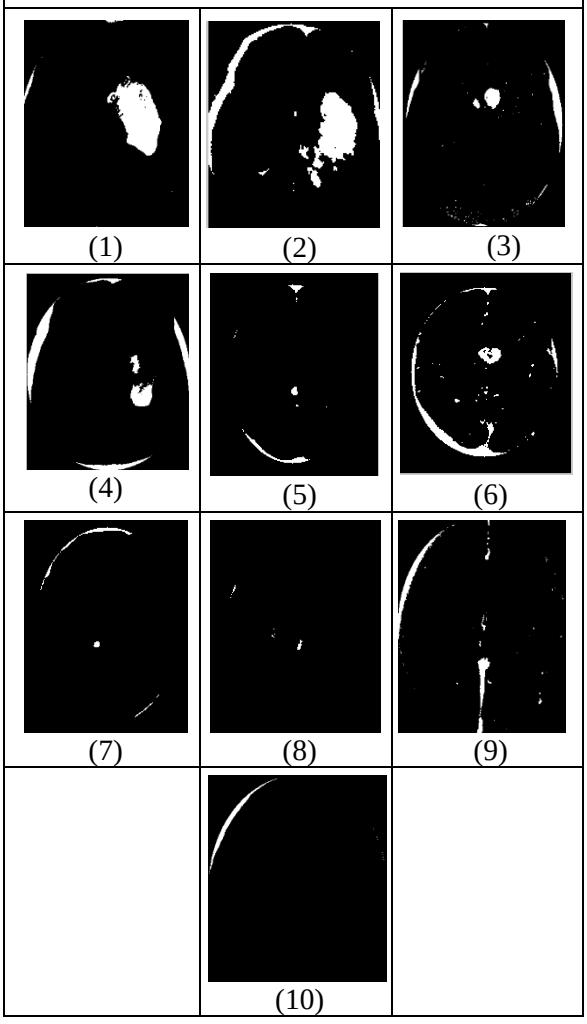


Figure 7.
Brain Image CT Scan results of Hybrid thresholding method; Image (1), Image (2), Image (3), Image (4), Image (5), Image (6), Image (7), Image (8), (9) Brain image is not normal; and Image (10) normal brain

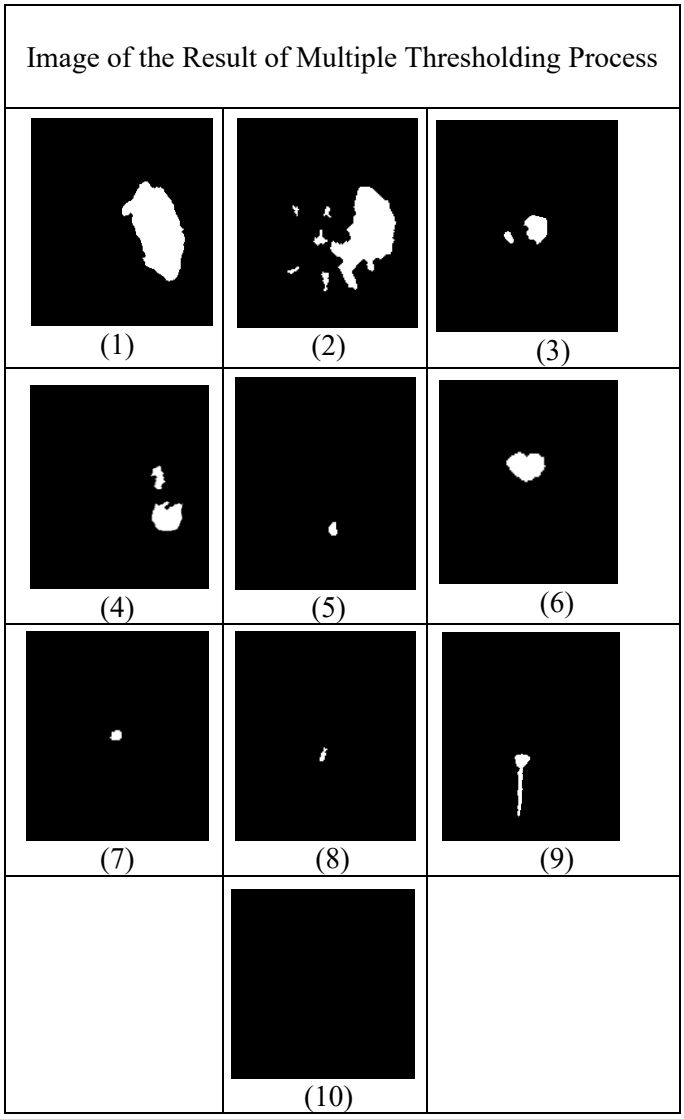


Figure 8.
Brain Image CT Scan results of the Multiple thresholding method; Image (1), Image / 92), Image (3), Image (4), Image (5), Image (6), Image (7), Image (8), Image (9) brain is not normal; and Image (10) normal brain

Figure 6. Shows the results of the merging segmentation of the Otsu method with the hybrid thresholding method which is a combination of P-File edge detection methods with Robert, Canny, Sobel, LoG, and Prewitt. In Figure 6, the original image with an image that has been processed using the multiple thresholding method gets the optimum threshold value, this indicates that this method produces good image quality.

4. *The enhancement phase of the morphology method aims to remove the black spot on the bleeding of the brain image from the detection of the bleeding area based on the Morphology method (delation process).*

The mathematical morphology method is a branch of image processing that is very useful for analyzing shapes in images. Mat lab has many tools for binary morphology in the box of image processing equipment; most of which can be used for greyscale morphology as well [17]. The morphological theory of mathematics can be developed in many different problems. We will adopt one of the standard methods that use operations on set points [17]. 2 Basic concepts of operating morphological methods are dilation and erosion. Two other operations that are very important in image processing are opening and closing formed through these two basic operations. (a) Opening: to smooth out the lines of the object area, eliminate narrow parts, and eliminate, (b) Closing: Tends to smooth out lines of shape but is opposite of opening, rejecting narrow fragments and long, thin bays , removing small holes and filling gaps in contour lines.

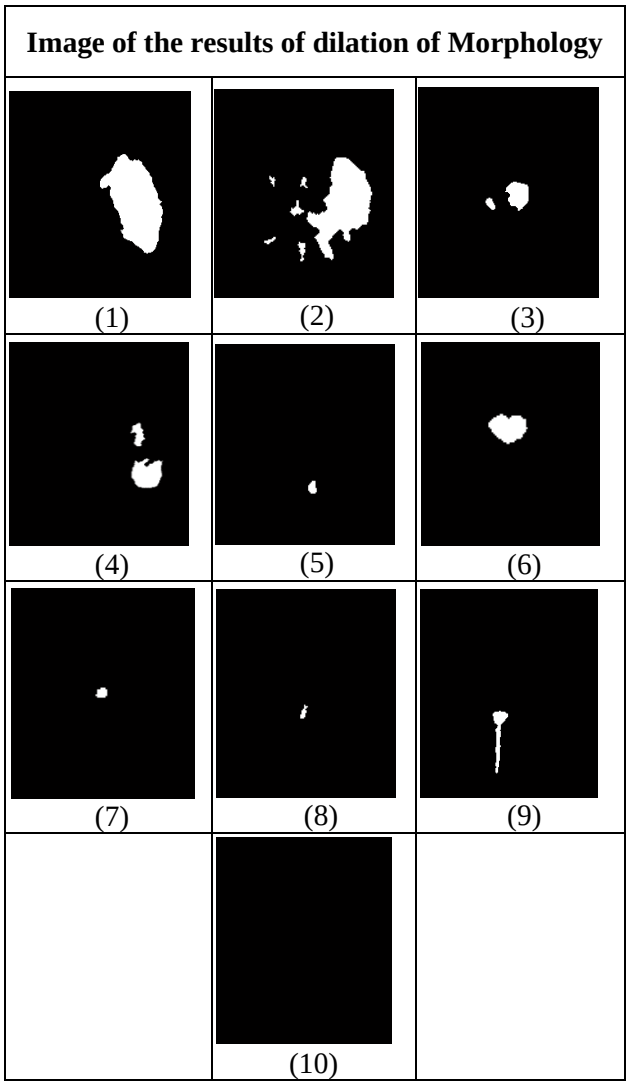
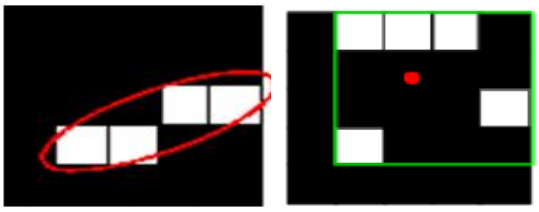


Figure 9.
Brain Image CT Scan results from the mathematical morphology method; Image (1), Dilated Result Image (2), Image (3), Image (4), Image (5), Image (6), Image (7), Image (8), Image (9) brain is not normal; and Image (10) normal brain

5. *The measurement area of the lighting area (Region Properties) to calculate the bleeding area of the brain per slice that has been extracted to calculate the bleeding area of the brain used the Region Feature method.*

   The feature region method of an object is represented as a region with an elliptical approach. Figure 8. shows a region of a collection of white pixels that is represented by an elliptical shape approach. In Figure 5. there is a blue line that shows the major axis and the minor axis and the white point as the foci of the ellipse [16].



(a) (b)

Source: Duin, et al. [16]

Figure 10. (a). Region representation with elliptical form approach and (b). Region representation with a rectangular shape approach

6. *The stage of calculating the bleeding area to calculate the area of the object in pixels into square centimeters using the morphological method.*

   Calculation of objects (objects count) by displaying the values of images that have been labeled, more than one object that is in the image and in the form of numbers can be done by making the script or from the command prompt. Labeling is done simultaneously with the object calculation process, the results of labeling and calculation of objects will produce the number of objects from the region properties process. Objects count functions to determine the level of accuracy in calculating objects that are in the processed image [17]. Calculate the accuracy level to calculate the accuracy of MSE, RMSE and PSNR Mean Square Error (MSE), Root Mean Squared Error (RMSE), and Peak Signal-to-Noise Ratio (PSNR) are parameters used to measure the similarity of two images . Parameters needed to compare the results of image processing with the original image. To calculate the three parameters, use the following equation:

$$MSE = \frac{1}{m\,x\,n}\sum_{i-0}^{n-1}\sum_{j-0}^{m-1}[f(i,j) - g(i,j)]^2 \quad (3)$$

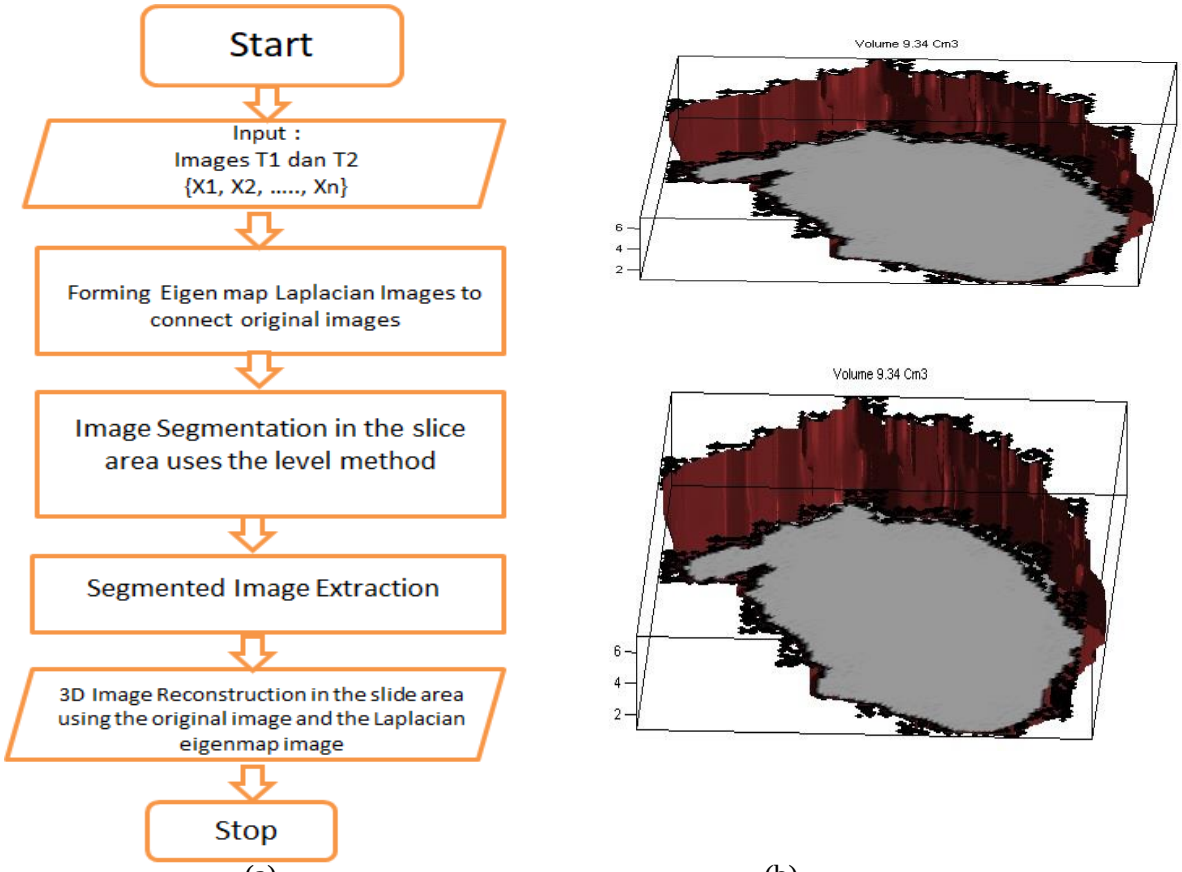
$$RMSE = \frac{1}{m\,x\,n}\sum_{i-0}^{n-1}\sum_{j-0}^{m-1}[f(i,j) - g(i,j)]^2 \quad (4)$$

$$PSNR = 10\log_{10}\frac{255^2}{MSE} \quad (5)$$

MSE and RMSE do not have units while units from PSNR are decibels. The more similar the two images, the MSE and RMSE values are getting closer to zero. Whereas in PSNR, two images are said to have a low level of similarity if the PSNR value is below 30 dB

7. *Phase 3D reconstruction of linear interpolarization methods*

   Reconstructing a 3-dimensional image formed from a 2-dimensional image of brain hemorrhage that has been completely detected resulting from the extraction process using morphological methods.



(a) (b)

Figure 11. (a). 3D Reconstruction Flowchart and (b). Results of the 3D Reconstruction Process

Figure 11. is a step in the 3D reconstruction process using the results of the otsu method and morphological images consisting of 6-10 slices. Previously, image segmentation and extraction had been carried out to obtain information on the area of cerebral haemorrhage in each slice. Next, 3D reconstruction is carried out using 6-10 slices of brain haemorrhage images per patient previously obtained. The 3D reconstruction process is carried out using interpolation. In this study, the Slice method is used to connect these images. 3D reconstruction is used to obtain the volume of brain haemorrhage area.

3. Results and Discussion

3.1 Calculation of Bleeding Area

Previous discussions and trials such as cropping with the elliptical cropping process, image segmentation using the multiple thresholding method by combining the Otsu method and hybrid thresholding, image extraction with mathematical morphology methods, calculation of bleeding area with region properties feature. Then calculate the level of accuracy of a series of processes that have an influence on the accuracy of the determination of the threshold (threshold). By analysing the data the accuracy of the image in the form of PSNR, MSE, and RMSE values extracted from the characteristics of objects in the image of cerebral haemorrhage, abnormalities in the brain can be detected. The calculation process for the level of accuracy can be seen in table 1 as follows:

Table 1.
Brain Image CT scan results from the calculation of the bleeding area; Image (1), Image (2), Image (3), Image (4), Image (5), Image (6), Image (7), Image (8), Image (9) brain is not normal; and Image (10) normal brain

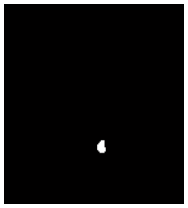
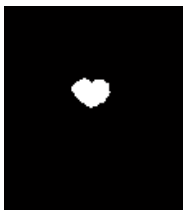
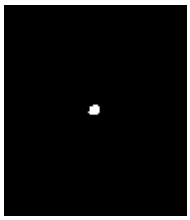
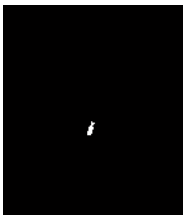
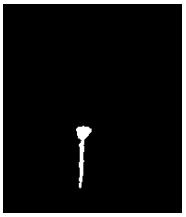
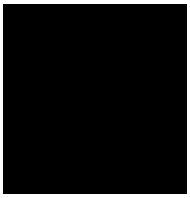
Image extraction results and calculation of the area of bleeding		
 (1) Luas area : 3.314 pixel, PSNR : 31.18, MSE: 19.15, RMSE : 5.21	 (2) Luas area : 2.485 pixel, PSNR : 31.21, MSE: 19.16, RMSE : 5.09	 (3) Luas area : 1.071 pixel, PSNR : 31.22, MSE: 19.16, RMSE : 4.97
 (4) Luas area : 1.974 pixel, PSNR : 31.23, MSE: 19.17, RMSE : 4.85	 (5) Luas area :458 pixel, PSNR : 31.22, MSE: 19.19, RMSE : 4.73	 (6) Luas area : 985 pixel, PSNR : 31.23, MSE: 19.23, RMSE : 4.25
 (7) Luas area : 101 pixel, PSNR : 31.27, MSE : 19.24, RMSE : 4.13	 (8) Luas area :58 pixel, PSNR : 31.23, MSE : 19.20, RMSE : 5.61	 (9) Luas area : 993 pixel, PSNR : 31.22, MSE : 19.17, RMSE : 4.49
	 (10) Luas area :0.0, PSNR : 0.0, MSE : 0.0, RMSE : 0.0	

Table 1. shows the results of extraction and calculation of the bleeding area consisting of: Area of bleeding, PSNR value, MSE value and RMSE value, from the calculation results obtained: patient 1 Area: 3.314 pixels, PSNR: 31.18, MSE: 19.15, and RMSE: 5.21, Patient 2 Area: 2,485 pixels, PSNR: 31.21, MSE: 19.16, and RMSE: 5.09, patient 3 Area: 1,071 pixels, PSNR: 31.22, MSE: 19.16, RMSE: 4.97, patient 4: Area : 1,974 pixels, PSNR: 31.23, MSE: 19.17, and RMSE: 4.85, patient 5: Area: 458 pixels, PSNR: 31.22, MSE: 19.19, and RMSE: 4.73, patient 6: Area: 985 pixels, PSNR: 31.23, MSE: 19.23, RMSE: 4.25, patient 7: Area: 101 pixels, PSNR: 31.27, MSE: 19.24, and RMSE: 4.13, patient 8: Area: 58 pixels, PSNR: 31.23, MSE: 19.20, and RMSE: 5.61, patient 9: Area: 993 pixels, PSNR: 31.22, MSE: 19.17, RMSE: 4.49, patient 10: Area: 0.0, PSNR: 0.0, MSE: 0.0, RMSE: 0.0.

Table 2.
The calculation results for the accuracy of MSE, RMSE and PSNR for the Otsu, Hybrid and Multiple Thresholding methods

#	PNSR			MSE			RMSE		
	Otsu	Hybrid	Multiple	Otsu	Hybrid	Multiple	Otsu	Hybrid	Multiple
1	32,21	31,22	30,11	20,22	19,10	18,12	6.385	5.234	4.011
2	32.24	31.25	30.14	20.23	19.11	18.13	6.125	5.132	4.012
3	32.25	31.26	30.15	20.23	19.11	18.13	5.865	5.030	4.017
4	32.26	31.27	30.16	20.24	19.12	18.14	5.605	4.928	4.017
5	32.25	31.26	30.15	20.26	19.14	18.16	5.345	4.826	4.017
6	32.26	31.27	30.16	20.27	19.15	18.17	5.085	4.724	4.013
7	32.24	31.25	30.14	20.23	19.11	18.13	4.825	4.622	4.017
8	32.25	31.26	30.15	20.24	19.12	18.14	4.565	4.520	4.017
9	32.26	31.27	30.16	20.30	19.18	18.20	4.305	4.418	4.043
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	290.31	281.40	271.41	182.31	172.23	163.41	45.77	42.52	36.12
Average	60.93	59.06	56.96	38.27	36.15	34.30	9.49	8.88	7.58

Table 2. shows the results of the calculation of the accuracy of the Otsu thresholding method, Hybrid thresholding, and multiple thresholding. These results indicate that the multiple thresholding method is better both from the calculation level of PSNR, MSE and RMSE, the average PSNR Otsu thresholding: an average of 60.93 db, the average PSNR Hybrid thresholding: 59.06 db, and the mean PSNR Multiple thresholding: 56.96 db, the mean MSE Otsu thresholding: 38.27, the average MSE Hybrid thresholding 36.15, the average MSE multiple thresholding: 34.30, average RMSE Otsu: 9.49, RMSE Hybrid mean thresholding: 8.88, RMSE multiple thresholding average: 7.58.

The results of the calculation of the area of cerebral hemorrhage and the level of accuracy show the level of accuracy of the Otsu thresholding method, Hybrid thresholding, and multiple thresholding. These results indicate that the multiple thresholding method is better, the PSNR results of the three methods show good results, but multiple thresholding methods well.

3.2 3D reconstruction of the Linear Interpolarization method

The stage of 3D image reconstruction for patient 3 is done by arranging pieces (slices) of available images. The results of the preparation of 10 slices of the image of patient 3 as in figure 9.(a) 90^{o} and 9.(b) 180^{o}.

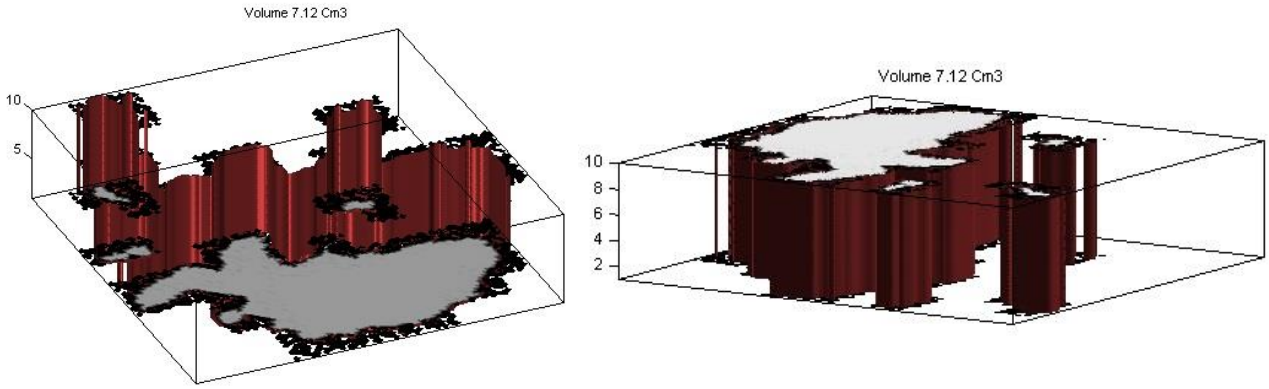


Figure 12. Reconstruction of 3D Imagery Brain Bleeding Area Volume using 10 slices

Table 3. Shows Calculation Results of Area and Volume of Brain Bleeding Area in mm^3 and cm^3

No.	No. Slice	Luas Area[2]	Volume	
			Area mm^3	**Area Cm^3**
1.	Slice 1	2.849	712,2500	0,7123
2.	Slice 2	2.840	710,0000	0,7100
3.	Slice 3	2.831	707,7500	0,7078
4.	Slice 4	2.831	707,7500	0,7078
5.	Slice 5	2.840	710,0000	0,7100
6.	Slice 6	2.849	712,2500	0,7123
7.	Slice 7	2.840	710,0000	0,7100
8.	Slice 8	2.831	707,7500	0,7078
9.	Slice 9	2.840	710,0000	0,7100
10.	Slice 10	2.831	707,7500	0,7078
	Total	***28,382***	***7.095,5000***	***7,0955***

Figures 9. (a) and 9. (b) show the results of 3D image reconstruction volume of cerebral haemorrhage area using 10 slices with the Slice technique in the Matlab program produced from algorithm 9 in chapters 3, 3 can be visualized in the bleeding area and volume of bleeding areas such as seen in Figure 4.16. Furthermore, in the same way interpolation between slices is made, the number of slices from the reconstruction results is 10 slices, as shown in figure 9. (a) and 9. (b) and calculation of the area and volume of the bleeding area in table 1.

4. Conclusion

In this research, image segmentation process has been done using threshold, calculation of cerebral hemorrhage area, and Multiple Thresholding method, which is a combination of the Otsu thresholding and hybrid thresholding method, where the hybrid thresholding method combines the P-File edge detection method with Canny to improve quality CT-scan images in cases of brain hemorrhage.

1. The brain image used is 10 brain images, consisting of 9 abnormal brain images and 1 normal brain image. By choosing the right k value, the Multiple Thresholding segmentation method is able to provide output images with better quality compared to the other two methods.
2. The results of the analysis of the level of accuracy and visualization of the texture features found that the images of cerebral hemorrhage indicated by bleeding had the greatest PSNR, MSE, and RMSE values compared to other brain images. The smallest average PSNR, MSE, and RMSE values are found in brain images with small area values.

3. The results of the original image research with images that have been processed by the multiple thresholding method get a minimum threshold value, this indicates that this method produces good image quality.
4. The area and volume calculation algorithm can calculate the area of cerebral bleeding per slice and volume of all slices through the 3D reconstruction of the bleeding area. The 3D reconstruction algorithm of the cerebral hemorrhage area used is referring to a linear interpolation algorithm between two adjacent slices. For example, in the case of test images shown in chapter 4, the bleeding area is between 2,831 - 2,849 square pixels with a total area = 28,382 pixels^2 of the total slice. The volume of the cerebral bleeding area is obtained after converting from square pixel to cubic centimeter, so the volume of bleeding area = 7.0955 cm^3.
5. The resulting 3D reconstruction results can help the medical authorities in deciding which patients have abnormalities in bleeding in the brain.

References

[1] S. Sumijan, S. Madenda, J. Harlan, and E. P. Wibowo, "Hybrids Otsu method, Feature region and Mathematical Morphology for Calculating Volume Hemorrhage Brain on CT-Scan Image and 3D Reconstruction," TELKOMNIKA (Telecommunication Comput. Electron. Control., Vol.15, No.1, March 2017, pp. 283~291, ISSN: 1693-6930, accredited A by DIKTI, Decree No: 58/DIKTI/Kep/2013, DOI: 10.12928/TELKOMNIKA.v15i1.3146, http://journal.uad.ac.id/index.php/TELKOMNIKA/article/view/3146

[2] J. Na`am, J. Harlan, S. Madenda, and E. P. Wibowo, "The Algorithm of Image Edge Detection on Panoramic Dental X-Ray using Multiple Morphological Gradient (mMG) Method," Int. J. Adv. Sci. Eng. Inf. Technol., Vol.6, No. 6, 2016, ISSN: 2088-5334, pp : 1012-1018, www.insightsociety.org/ojaseit/index.php/ijaseit/article/download/1480/929

[3] Acharya, T.; Ray, A.K; Image Processing Principles and Applications; New Jersey: John Wiley & Sons, Inc, 2005

[4] Rangayyan, R.M, Biomedical Image Analysis. Boca Raton: CRC Press, 2005

[5] Alvia Ferry Mandalasari. Segmentasi Citra Medis menggunakan Metode Otsu dan Iterasi. Skripsi Thesis. Yogyakarta. Teknik Informatika Fakultas Sains dan Teknologi UIN Sunan Kalijaga; 2013.

[6] Rajendran P. and Madheswaran M. Hybrid Medical Image Classification Using Association Rule Mining with Decision Tree Algorithm. Journal of Computing. VOLUME 2, ISSUE 1,2010, ISSN 2151-9617, pp. 127-136, https://sites.google.com/site/journalofcomputing/

[7] Karuna M. and Joshi A., Automatic Detection And Severity Analysis Of Brain Tumors Using Gui In Matlab, IJRET: International Journal of Research in Engineering and Technology, Volume: 02, ssue: 10, Oct-2013, eISSN: 2319-1163 | pISSN: 2321-7308, pp. 586-594, http://www.ijret.org

[8] Gillebert R. C., Glyn W. Humphreys, Dante Mantini, 'Automated delineation of stroke lesions using brain CT images', The Authors. Published by Elsevier Inc, Volume: 02, ssue: 17, Oct-2013, eISSN: 1214-1143 | pISSN: 2421-5108, pp. 300-308, (http://creativecommons.org/licenses/by/3.0/) , 2014.

[9] Sharma B. and Venugopalan K., 2012, Automatic Segmentation of Brain CT Scan Image to Identify Hemorrhages, International Journal of Computer Applications, Volume 40– No.10, February 2012 , ISSN : 0975 – 8887, pp. 1-5, http://citeseerx.ist.psu.edu/

[10] Wenan Chen, Rebecca Smith, Soo-Yeon Ji, Kevin R Ward and Kayvan Najarian, 2009, Automated ventricular systems segmentation in brain CT images by combining low-level egmentation and high-level template matching, Volume 02 No.13, February 2009 , ISSN : 0372 – 2347, pp. 1-14, doi:10.1186/1472-6947-9-S1-S4 https://www.ncbi.nlm.nih.gov/pubmed/19891798

[11] Xuguang Qi, Ashwin Belle, Sharad Shandilya, Wenan Chen, Charles Cockrell, Yang Tang, Kevin R. Ward, Rosalyn H. Hargraves, Kayvan Najarian, 2013, Ideal Midline Detection, Open Journal of Medical Imaging, Volume 03 No.12, 2013 , ISSN : 0372 – 2347, pp. 51-59, http://dx.doi.org/10.4236/ojmi.2013.32007,

https://www.scirp.org/Journal/PaperInformation.aspx?paperID=32477
[12] Otsu, N., "A Threshold Selection Method from Gray-Level Histograms," IEEE Transactions on Systems, Man, and Cybernetics, Vol. 9, No. 1, 1979, pp. 62-66.
[13] Samopa F. and Asanoa A., Hybrid Image Thresholding Method using Edge Detection, IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.4, April 2009
[14] Duin, R.P.W.; Juszczak, P.; Paclik, P.; Pekalska, E.; de Ridder, D.; Tax, D.M.J.; and Verzakov, S. 2007. PRTools4.1, A Matlab Toolbox for Pattern Recognition. Delf University of Technology.
[15] Haralick, R.M., Shanmugam, K., and Dinstein, I., 1973, “Textural Features for stroke lesions using brain CT images, IEEE Transactions on Neural Neiwotis. 13(2)^415-425.2002.

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