The 6th Kumamoto University Forum

November 5-6, 2008 Surabaya, Indonesia

Innovation for New South-East Asia
— Beyond the 50th Anniversary of Friendship between Indonesia and Japan —

Institut Teknologi Sepuluh Nopember (ITS) / November 5
Sheraton Surabaya Hotel & Towers / November 6

Proceedings of the 6th Kumamoto University Forum
PROGRAM

November 5 (Wed)
Place: Auditorium, ITS

8:30-9:25 Registrations

Opening Remarks (9:30-9:40)

9:30-9:40 Opening Remarks from Vice Rector of ITS
Prof. Ir. Eko Budi Djatmiko, Vice Rector, ITS
Opening Remarks from Vice President of KU
Prof. Nobuo Sakaguchi, Vice President, KU

Keynote Speeches (9:40-10:40)

Chairied by: Prof. Isao Taniguchi, Graduate School of Science and Technology, KU

9:40-10:40 Keynote 1
"Effective Research and Education Tools"
Prof. Achmad Jazidie, Faculty of Industrial Technology, ITS

Keynote 2
"Flexible Learning and Teaching with Open-Source Learning Management Systems"
Prof. Toshihiro Kita, Institute for e-Learning Development, KU

10:40-11:00 Break (20min)

JICA Session (11:00-12:30)

Chairied by: Prof. Tsuyoshi Usagawa, Graduate School of Science and Technology, KU

JICA Session 1
"Hybridization of Fuzzy Q-Learning and Behavior-Based Control for Autonomous Mobile Robot Navigation in Cluttered Environment"
Mr. Khairul Anam, ITS

JICA Session 2
"Traffic Density Monitoring Based on Image Processing"
Mr. Arie Lumentra, Faculty of Engineering, UNSRAT

JICA Session 3
"ARMA Modeling from Rain Rate Measurement to Simulation Communication Channel Modeling for Millimeter Wave in Surabaya"
Mr. Made Sutha Yadnya, UNRAM

JICA Session 4
"Contribution of Uplifted Coral Rocks on the Formation of Timor Soils"
Mr. Welhelmus I. I. Mella, Faculty of Agriculture, UNDANA
JICA Session 5
"Determination of Critical Buses in Highest Voltage Java Power System Using Modal Analysis"
Mr. Herbert Innah, UNCEN

JICA Session 6
"Smart Early Warning System for Secure Power System Operation"
Mr. Adi Soeprijanto, Department of Electrical Engineering, ITS

JICA Session 7
"Identification Technique for Quality of Crude Palm Oil (CPO) Using Infrared and Artificial Intelligent"
Mr. Mochamad Ashari, Department of Electrical Engineering, ITS

JICA Session 8
"Mandibular Width Measurement on Dental Panoramic Radiographs Using Multistage Adaptive Thresholding and Genetic Algorithm"
Mr. Agus Zainal Arifin, Department of Informatics, ITS

12:30-14:00 Lunch Break (90 min)

Young Researchers Session (14:00-16:20)

Chaired by: Prof. Jun Otani, Graduate School of Science and Technology, KU

14:00-15:30 Oral Presentations

Oral Presentation 1 (KU-01)
"Motivation Design Based on ARCS Model for Mobile Media -What an SME Who Studied ID Theory Practiced-
Ms. Akiko Morita, Graduate School of Instructional Systems, KU

Oral Presentation 2 (KU-02)
"Advantages of e-Learning for Citizen Learning Community -- A Case of "Kumamoto Internet Shiminjuku" --"
Mr. Ryoichi Murashima, Graduate School of Instructional Systems, KU

Oral Presentation 3 (KU-03)
"Synthesis of Macroyclic Compounds Using the Manganese(III)-Based Radical Cyclization"
Mr. Yosuke Ito, Graduate School of Science and Technology, KU

Oral Presentation 4 (KU-04)
"Development of Catalytic Materials for Auto-emission Control"
Mr. Kosuke Uemura, Faculty of Engineering, KU

Oral Presentation 5 (KU-05)
"The Anti-Retroviral Potency of APOBEC1 Cytidine Deaminase from Small Animal Species"
Mr. Terumasa Ikeda, Faculty of Medical and Pharmaceutical Sciences, KU

Oral Presentation 6 (KU-06)
"A novel antidepressant-like effect of drugs possessing GIRK channel inhibiting action"
Mr. Sokichi Honda, Graduate School of Pharmaceutical Sciences, KU

Oral Presentation 7 (ITS-01)
"Performance Comparison of Air Displacement and Mixed Ventilation Systems in Office Room"
Mr. Bambang Iskandriawan, Faculty of Civil Engineering and Planning, ITS

Oral Presentation 8 (ITS-02)
"An Issue in Modified Distributed Video Coding Technique"
November 6 (Thu)
Place: Sheraton Surabaya Hotel & Towers

8:30-9:25 Registations

**Congratulatory Messages (9:30-10:05)**
Chaired by: Prof. Takashi Hiyama, Dean of the Graduate School of Science and Technology, KU
9:35-9:50 Mr. Yasuji Odoko, Consul-General, Consulate-General of Japan in Surabaya
9:50-10:05 Dr. Mohammad Nuh, Minister of Communication and Information Technology of the Republic of Indonesia (tentative)

**Plenary lectures (10:05-12:00)**
Chaired by: Prof. Takashi Hiyama, Dean of the Graduate School of Science and Technology, KU
10:05-10:45 “Japan’s New Policy for International Students and Indonesia”
Mr. Ryuichiro Shima, Advisor to DGHE, Ministry of National Education Directorate General of Higher Education

10:45-10:55 Break (10 min)

10:55-11:25 “Strengthening International Network for Quality Improvement of Indonesian Universities; Role and Contribution of ITS”
Prof. Ir. Priyo Suprobo, Rector of ITS

11:25-11:55 “National University Reform in Japan and Kumamoto University’s Effort toward a “Global Academic Hub”
Dr. Tatsuro Sakimoto, President of KU

**Signing Ceremony: (12:00-12:30)**
International Exchange Agreement between the Consortium of Institut Teknologi Sepuluh Nopember and Kumamoto University.

12:30-14:00 Lunch Break (90 min)

Invited Lectures (14:00-17:10)

Chairled by:  Prof. Tsuyoshi Usagawa, Graduate School of Science and Technology, KU

14:00-14:40 Invited Lecture 1
"PREDICT-ITS: a vehicle toward developing research university in Indonesia"
Dr. Ir. Achmad Affandi, DEA, Center of ICT & Multimedia, ITS

14:40-15:20 Invited Lecture 2
"Projects and activities of JICA-Indonesia"
Mr. Kiichi Tomiya, Senior Representative, JICA Indonesia Office

15:20-15:40 Break (20 min)

15:40-16:20 Invited Lecture 3
"Globalization of Indonesian Universities"
Prof. Daniel Mohammad Rosyid, Institute of Technology, ITS

16:20-16:40 Invited Lecture 4
"Industry-Academia-Government Collaboration, the Key of Economic growth in Asia/Kyushu (Japan)"
Mr. Shiro Takegami, Deputy Director General, Kumamoto Prefectural Government.

16:40-17:00 Invited Lecture 5
"Moving toward the Achievement of Each Other's Goal: Internationalizing Education and Research of Kumamoto University"
Prof. Nobuo Sakaguchi, Vice President, KU

Closing Ceremony (17:00-17:10)
Prof. Takashi Hiyama, Graduate School of Science and Technology, KU

Poster Exhibition (9:30-16:30)

Banquet (18:00-21:00)

Abbreviations:
ITS: Institut Teknologi Sepuluh Nopember, KU: Kumamoto University, UNCEN: Universitas Cenderawasih, UNRAM: Universitas Mataram, UNDANA: Universitas Nusa Cendana, UNSRAT: Universitas Sam Ratulangi
List of Guests and Participants
(in order of appearance)

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Mr. Yosuke Ito, Graduate School of Science and Technology, KU
Mr. Kosuke Uemura, Faculty of Engineering, KU
Mr. Terumasa Ikeda, Faculty of Medical and Pharmaceutical Sciences, KU
Mr. Sokichi Honda, Graduate School of Pharmaceutical Sciences, KU
Mr. Bambang Iskandriawan, Faculty of Civil Engineering and Planning, ITS
Mr. I M. O. Widyantara, Department of Electrical Engineering, ITS
Mr. Yoyon K. Suprapto, Department of Electrical Engineering, ITS
Ms. Fikawati, D., Faculty of Industrial Technology, ITS
Mr. Yohanes Oscarino N. S, Faculty of Marine Technology, ITS

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Signing Ceremony

Kumamoto University
The Consortium of Institut Teknologi Sepuluh Nopember
  Institut Teknologi Sepuluh Nopember
  Universitas Cenderawasih
  Universitas Mataram
  Universitas Nuse Cendana
  Universitas Sam Ratulangi

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Prof. Nobuo Sakaguchi, Vice President, KU

Closing Ceremony

Prof. Takashi Hiyama, Graduate School of Science and Technology, KU
Mandibular Width Measurement on Dental Panoramic Radiographs Using Multistage Adaptive Thresholding and Genetic Algorithm

Agus Zainal Arifin*, Dini Adni N', Anny Yuniarti', Wijayanti Nurul K', Arifzan Razak², Akira Asano³, Akira Taguchi⁴

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2 Faculty of Dentistry, Airlangga University, Surabaya, Indonesia
3 Graduate School of Engineering, Hiroshima University, Japan
4 Matsumoto Dental University, Nagano, Japan

Abstract - A vast amount of dental panoramic radiographs have been used by general practitioners in their routine work. Actually, based on those images valuable information about osteoporotic status of patients might be obtained. One of the most problems was the disruption in lengthy manual assessment. We have developed a computer-aided measurement of mandibular width based on multistage adaptive thresholding and genetic algorithm. This measurement might be useful as one of mandibular parameters for diagnosing osteoporosis. We compare our measurement results with manually measurement on the same area of interest. The comparison between automatic and manual measurement achieve the accuracy of 90%. We concluded that our automatic measurement of mandibular width can be used as a substitution of manual measurement.

Index Terms- mandibular width, dental panoramic radiographs, osteoporosis, thresholding, genetic algorithm.

I. INTRODUCTION

OSTEOPOROSIS is called as the silent epidemic, because the osteoporotic process of general skeletons continues for many years with no symptoms. Bone fragility is mainly dependent on skeletal bone mass or bone mineral density (BMD). Assessment of BMD at the lumbar spine and femoral neck are typically conducted using dual-energy X-ray absorptiometry (DXA) [1]. While DXA scanner are often limited, a vast amount of dental panoramic radiographs are taken every year. Mandibular cortical width and shape measured on dental panoramic radiographs are significantly correlated with bone mineral density at the lumbar spine and femoral neck [2,3,4]. Other parameters should be included to improve accuracy of the diagnosis. One of the parameters which is possible to measure from mandible is mandibular width which correspond with cortical width.

In this paper we propose a computer-aided measurement of mandibular width based on multistage adaptive thresholding [5] and genetic algorithm [6]. Measurement of mandibular width on dental panoramic radiographs consists of selecting area of interest, thresholding using multistage adaptive thresholding, and improving the edges of the boundary using genetic algorithm.

II. MULTISTAGE ADAPTIVE THRESHOLDING (MAT)

Given an input image f(x) as the area of interest, thresholding may be viewed as an operation that involves tests against a function of t(x). A thresholded image g(x) is defined as

\[ g(x) = \begin{cases} 
0 & \text{if } t(x) \geq 0 \\
1 & \text{if } t(x) < 0 
\end{cases} \]

Label of 1 and 0 correspond to object and background, respectively. In global threshold algorithm, we first compute a fixed threshold T and then define the threshold function as

\[ t(x) = f(x) - T. \]

The threshold function is defined as

\[ t(x) = f(x) - \mu - k.\sigma(x), \]

where

\[ \mu(x) = \frac{1}{N} \sum_{x \in S} f(x) \quad \text{and} \quad \sigma(x) = \frac{1}{N-1} \sum_{x \in S} (f(x) - \mu(x))^2 \]

are the mean and the standard deviation, respectively. In a neighborhood region S with the size of b x b centered at \( x \), N = b x b, and \( k \) is a constant coefficient. The threshold function is

\[ t(x) = p(x) - \mu - k.\sigma(x). \]

A. Bilateral Filtering

Bilateral filtering smoothes images while preserving edges using combination of range filter and domain filter. The idea underlying bilateral filtering is to do in the range of an image what traditional filters do in its domain [7]. It combines gray levels or colors based on both their geometric closeness and their photometric similarity.

B. Multistage Thresholding

Global threshold method does not solve the problem in which some part of an object has higher intensity than background but lower than other part in same object. So, we need two global thresholds, i.e. low threshold \( T_0 \) and high threshold \( T_f \). Pixels with gray value less than \( T_0 \) are classified...
as background, whereas pixels with gray value more than $T_j$ are classified as object. Strategy for resulting two global threshold $T_i$ and $T_j$ is using a modified multilevel thresholding Otsu method [8].

III. EDGE ENHANCEMENT USING GENETIC ALGORITHM

Before enhancing the edges with genetic algorithm, we detect the edges by morphological operation using octagonal structuring element with radius 3. The result of this operation is an image with pixel value of 1 for edges and pixel value of 0 for non-edges. Then, we enhance the edges using genetic algorithm and we start from generating an initial population.

The initial population is generated by producing a number of chromosomes based on the population size. The individual is a 3x3 window of edge pixels and the size of population varies and depends on the number of edges. Evaluation process is executed by computing fitness value of each chromosome. In this case, fitness value is computed by adding the grayscale pixels corresponding to an individual. The goal of genetic algorithm is to maximize the fitness value.

Selection or reproduction is a process of selecting a new member of the population which later becomes new in the new population. In many cases the selection approach using roulette wheel is used. Cross over is used as a chromosome cut method, which randomly chooses cutting-point on the chromosome and replaces some part of two parent chromosomes with two offspring chromosomes. Another process in genetic algorithm is mutation which aims to prevent premature convergence on the local optima by randomly testing a new point in the search space. Mutated chromosome will have one or more genes change. Genes that have mutation probability smaller than mutation value will be mutated. The algorithm terminates after it reaches a particular generation. The individual of the last generation will be considered as edges and later will be mapped to the grayscale image.

IV. RESULT AND DISCUSSION

We use dental panoramic radiographs as shown in Figure 1 for the experiment. Each mandible is extracted two regions of interest which are left and right hand-sides around mental foramen as shown in Figure 2(a). Mandibular width is measured between lower mandible and upper boundary of alveolar. Lower boundary can be easily recognized but upper boundary lies among teeth. Therefore, we need the MAT and GA to determine it well. Figure 2 (b) and (c) show the upper and lower boundary after applying GA and measuring the width, respectively.

In order to confirm the accuracy of this automatic measurement, we need to compare the results of automatic measurement with those of manually measurement. From 108 experimental images, the correlation between automatic measurement and manual measurement achieve 90%.

The proposed method is the first attempt to get mandibular width automatically. This is important because manual measurement may be difficult and inconsistent for different observers. This work may be used as one of the mandibular parameters obtained from mandible for Computer Aided Diagnosis system.

Figure 1. Dental panoramic radiographs.

Figure 2. Area of interest.

V. CONCLUSION

MAT was effective for thresholding dental panoramic radiograph. However, we need more attempt to enhance the edges to achieve more accurate measurement. In this paper, we have shown that genetic algorithm was able to enhance the edges well. The automatic and manual measurement achieved the correlation of 90%. The result of the proposed system may be combined with other mandibular parameters for Computer Aided Diagnosis systems.

VI. REFERENCES