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Osteoarthritis Severity Determination using Self Organizing Map Based Gabor Kernel

In The 2nd International Conference on Innovation in Engineering and Vocational Education (ICIEVE) held in Hotel Aryaduta Manado, North Sulawesi, Indonesia, on 25-26 October 2017.
This conference is organized by Universitas Pendidikan Indonesia (UPI, Indonesia) in collaboration with Universitas Negeri Manado (UNIMA, Indonesia) and Rajamangala University of Technology Thanyaburi (RMUTT, Thailand).

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Preface

The 2nd ICIEVE 2017, the International Conference on Innovation in Engineering and Vocational Education, held on October 25-26, 2017 at Aryaduta Hotel, Manado, North, Sulawesi, Indonesia, is hosted by Universitas Pendidikan Indonesia (Indonesia), Universitas Negeri Manado (Indonesia), and Rajamangala University of Technology Thanyaburi (Thailand).

The conference was a platform for scientists, scholars, engineers, industrial professionals, and researchers to exchange, share, and discuss their innovation, experiences, research works and problem solving techniques in all issues in engineering and vocational education.

The participants of ICIEVE 2017 were from around the world with a variety of background, including academics, industry, and even well-known enterprise. In general, there were 140 papers discussing such various topics as engineering and technology innovation (mechanical engineering, chemical engineering, civil engineering, etc.), engineering education (basic science in engineering education, engineering education reforms, new technologies in education, etc.), and vocational education and training (industry-driven training programs and collaborations, lifelong learning – reskilling and upskilling, government and policy, etc.).

We would like to thank all of those who helped and supported ICIEVE 2017. Each individual and institution's support was very important for the success of this conference. Specifically, we would like to acknowledge the advisory board, scientific committee, and organizing committee for their valuable advice, help, suggestions, and support in the organization and helpful peer-reviewing process of the papers. This year, we would like to express our deepest gratitude for all the co-hosts of ICIEVE 2017, UNIMA, Indonesia, and Rajamangala University of Technology Thanyaburi, Thailand for the collaboration. We would also extend our best gratitude to keynote speakers for their valuable contribution for sharing ideas and knowledge in the ICIEVE 2017.

We sincerely hope that ICIEVE 2017 will be a forum for excellent discussions for improving the quality of research and development in relation to innovation in engineering and vocational education. We also hope that this forum will put forward new ideas and promote collaborative researches among participants. We believe that the proceedings can serve as an important research source of reference and the knowledge. Indeed, the proceedings will lead to not only scientific and engineering progress but also other new products and processes for better science and technology in vocational education.

The Editors
Dr. Ade Gafar Abdullah
Dr. Eng. Asep Bayu Dani Nandiyanto
Dr. Isma Widiaty
Dr. Verry Palilingan, M. Eng

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Also the industry itself
global education mark
same time

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Table of contents

Volume 306

February 2018

Previous issue Next issue

2nd International Conference on Innovation in Engineering and Vocational Education25–26 October 2017, Manado, Indonesia

Accepted papers received: 25 January 2018
Published online: 22 February 2018

Open all abstracts

Preface

OPEN ACCESS 011001
2nd International Conference on Innovation in Engineering and Vocational Education (ICIEVE 2017)
+ Open abstract View article PDF

OPEN ACCESS 011002
Peer review statement
+ Open abstract View article PDF

Papers

OPEN ACCESS 012001
New Model of Information Technology Governance in the Government of Gorontalo City using Framework COBIT 4.1
A A Bouty, M H Koniyo and D Novian
+ Open abstract View article PDF

OPEN ACCESS 012002
Photodecomposition Profile of Curcumin in the Existence of Tungsten Trioxide Particles

A B D Nandiyanto, R Zaen, R Oktiani and A G Abdullah

+ Open abstract View article PDF

OPEN ACCESS 012003

E-Portfolio Web-based for Students' Internship Program Activities

A Juhana, A G Abdullah, M Somantri, S Aryadi, D Zakaria, N Amelia and W Arasid

+ Open abstract View article PDF

OPEN ACCESS 012004

Designing on-Board Data Handling for EDF (Electric Ducted Fan) Rocket

A Mulyana and L A A Faiz

+ Open abstract View article PDF

OPEN ACCESS 012005

Estimation of Compaction Parameters Based on Soil Classification

A S Lubis, Z A Muis, I P Hastuty and I M Siregar

+ Open abstract View article PDF

OPEN ACCESS 012006

Video Tutorial of Continental Food

A S Nurani, A Juwaedah and A Mahmudatussa'adah

+ Open abstract View article PDF

OPEN ACCESS 012007

Characterization of Co:TiO_2 Thin Film Grown by MOCVD Technique

A Saripudin and W Purnama

+ Open abstract View article PDF

OPEN ACCESS 012008

Effect of Higher Order Thinking Laboratory on the Improvement of Critical and Creative Thinking Skills

A Setiawan, A Malik, A Suhandi and A Permanasari

+ Open abstract View article PDF

OPEN ACCESS 012009

Identification of the Thickness of Nugget on Worksheet Spot Welding Using Non Destructive Test (NDT) – Effect of Pressure

A Sifa, A S Baskoro, S Sugeng, B Badruzzaman and T Endramawan

+ Open abstract View article PDF

OPEN ACCESS 012010

Analysis of Quality and Output of Entrepreneurship in the Field of Refractionist Optician

A Wesnita and M Dewi

+ Open abstract View article PDF

OPEN ACCESS 012011

Economic Evaluation of the Production Magnesium Oxide Nanoparticles via Liquid-Phase Route

A B D Nandiyanto, R Fariansyah, M F Ramadhan, A G Abdullah and I Widiaty

+ Open abstract View article PDF

OPEN ACCESS 012012

Engineering Analysis and Economic Evaluation of the Synthesis of Composite $CuO/ZnO/ZrO_2$ Nanocatalyst

A B D Nandiyanto, W R Hayati, T A Aziz, R Ragadhita, A G Abdullah and I Widiaty

+ Open abstract View article PDF

OPEN ACCESS 012013

Utilization of Baked-Smashed Sweet Potato and Vegetables on Patisserie Product

A Ana, S Subekti, S Sudewi, E N Perdani, F Hanum, T Suciani and V Tania

+ Open abstract View article PDF

OPEN ACCESS 012014

Rapid Measurement of Soil Carbon in Rice Paddy Field of Lombok Island Indonesia Using Near Infrared Technology

B H Kusumo, S Sukartono and B Bustan

+ Open abstract View article PDF

OPEN ACCESS 012015

Student's Entrepreneur Model Development in Creative Industry through Utilization of Web Development Software and Educational Game

B Hasan, H Hasbullah, S Elvyanti and W Purnama

+ Open abstract View article PDF

OPEN ACCESS 012016

Destination Information System for Bandung City Using Location-Based Services (LBS) on Android

B Kurniawan and H Pranoto

+ Open abstract View article PDF

OPEN ACCESS 012017
Teacher Professionalism in Technical and Vocational Education
B L L Tampang and D Wonggo
+ Open abstract View article PDF

OPEN ACCESS 012018
Learning Application of Astronomy Based Augmented Reality using Android Platform
B Maleke, D Paseru and R Padang
+ Open abstract View article PDF

OPEN ACCESS 012019
Study Orientation Ply of Fiberglass on Blade Salt Water Pump Windmill using Abaqus
B Badruzzaman and A Sifa
+ Open abstract View article PDF

OPEN ACCESS 012020
ADDIE Model Application Promoting Interactive Multimedia
B Baharuddin
+ Open abstract View article PDF

OPEN ACCESS 012021
Characteristics from Recycled of Zinc Anode used as a Corrosion Preventing Material on Board Ship
B Barokah, S Semin, D D Kaligis, J Huwae, M Z Fanani and P T D Rompas
+ Open abstract View article PDF

OPEN ACCESS 012022
How do the Polytechnic Students Cope with the Difficulties in Composing Abstracts for Their Final Projects?
C Niswatin, M A Latief and S Suharyadi
+ Open abstract View article PDF

OPEN ACCESS 012023
An Expert System for Diagnosing Eye Diseases using Forward Chaining Method
C P C Munaiseche, D R Kaparang and P T D Rompas
+ Open abstract View article PDF

OPEN ACCESS 012024

Green Building Implementation at Schools in North Sulawesi, Indonesia

D A J Harimu and M S S S Tumanduk

+ Open abstract View article PDF

OPEN ACCESS 012025

Student Learning Strategy and Soft-skill in Clothing Business Management

D Ampera

+ Open abstract View article PDF

OPEN ACCESS 012026

Blended Learning Implementation in "Guru Pembelajar" Program

D Mahdan, M Kamaludin, H F Wendi and M V Simanjuntak

+ Open abstract View article PDF

OPEN ACCESS 012027

Priority of VHS Development Based in Potential Area using Principal Component Analysis

D Meirawan, A Ana and S Saripudin

+ Open abstract View article PDF

OPEN ACCESS 012028

Teaching Quality and Learning Creativity in Technical and Vocational Schools

D R E Kembuan, P T D Rompas, M Mintjelungan, T Pantondate and B M H Kilis

+ Open abstract View article PDF

OPEN ACCESS 012029

The Use of Geometry Learning Media Based on Augmented Reality for Junior High School Students

D Rohendi, S Septian and H Sutarno

+ Open abstract View article PDF

OPEN ACCESS 012030

Designing Production Based Learning as a Basic Strategy for Creating Income Generating Units at Universitas Pendidikan Indonesia

D Suryadi and N Supriatna

+ Open abstract View article PDF

OPEN ACCESS 012031

Improvement of Students' Environmental Literacy by Using Integrated Science Teaching Materials

D Suryanti, P Sinaga and W Surakusumah

+ Open abstract View article PDF

OPEN ACCESS 012032

Internet Literacy of Vocational High School Teachers

D Vernanda, A G Abdullah and D Rohendi

+ Open abstract View article PDF

OPEN ACCESS 012033

Evaluation of an Affordable Wireless Node Sensor (Mote69) Designed for Internet of Thing (IoT) Device

Z F Ruhiyat, Y Somantri, D Wahyudin and D L Hakim

+ Open abstract View article PDF

OPEN ACCESS 012034

A Remote PLC Laboratory (RLab) for Distance Practical Work of Industrial Automation

E Haritman, Y Somantri, D Wahyudin and E Mulyana

+ Open abstract View article PDF

OPEN ACCESS 012035

Strategic Planning towards a World-Class University

E J Usoh, D Ratu, A Manongko, J Taroreh and G Preston

+ Open abstract View article PDF

OPEN ACCESS 012036

Design of Integrated Database on Mobile Information System: A Study of Yogyakarta Smart City App

E K Nurnawati and E Ermawati

+ Open abstract View article PDF

OPEN ACCESS 012037

The Relevance of Vocational High School Curriculum with the Requirement of the Heavy Equipment Industries

E P Asfiyanur, K Sumardi, Y Rahayu and R C Putra

+ Open abstract View article PDF

OPEN ACCESS 012038

Simulation and Failure Analysis of Car Bumper Made of Pineapple Leaf Fiber Reinforced Composite

E S Arbintarso, M Muslim and T Rusianto

+ Open abstract View article PDF

OPEN ACCESS 012039

Community Participation for Sustainable Tourism Model in Manado Coastal Area

F F Warouw, F W Langitan and A T Alamsyah

+ Open abstract View article PDF

OPEN ACCESS 012040

A Prospective Method to Increase Oil Recovery in Waxy-Shallow Reservoir

F Hidayat and M Abdurrahman

+ Open abstract View article PDF

OPEN ACCESS 012041

Analysis of Axial Turbine Pico-Hydro Electrical Power Plant in North Sulawesi Indonesia

F J Sangari and P T D Rompas

+ Open abstract View article PDF

OPEN ACCESS 012042

Project-Based Learning in Programmable Logic Controller

F R Seke, J M Sumilat, D R E Kembuan, J C Kewas, H Muchtar and N Ibrahim

+ Open abstract View article PDF

OPEN ACCESS 012043

The Influence of Training Strategy and Physical Condition toward Forehand Drive Ability in Table Tennis

F W Langitan

+ Open abstract View article PDF

OPEN ACCESS 012044

Data Model Performance in Data Warehousing

G C Rorimpandey, F I Sangkop, V P Rantung, J P Zwart, O E S Liando and A Mewengkang

+ Open abstract View article PDF

OPEN ACCESS 012045

Radio Frequency Identification (RFID) Based Employee Attendance Management System

G D P Maramis and P T D Rompas

+ Open abstract View article PDF

OPEN ACCESS 012046
The Effect of Alkaline Concentration on Coconut Husk Crystallinity and the Yield of Sugars Released
H F Sangian and A Widjaja
+ Open abstract View article PDF

OPEN ACCESS 012047
Industrial Internship and Entrepreneurship Competencies on Vocational High School Students
H F Wendi and I H Kusumah
+ Open abstract View article PDF

OPEN ACCESS 012048
Instructional Model and Thinking Skill in Chemistry Class
H H Langkudi
+ Open abstract View article PDF

OPEN ACCESS 012049
How to Improve Interest, IQ, and Motivation of Vocational Students?
H Sumual and D M Ombuh
+ Open abstract View article PDF

OPEN ACCESS 012050
Multimedia Content Development as a Facial Expression Datasets for Recognition of Human Emotions
N E Mamonto, H Maulana, D Y Liliana and T Basaruddin
+ Open abstract View article PDF

OPEN ACCESS 012051
Rubric Assessment on Science and Creative Thinking Skills of Students
H Ratnasusanti, A Ana, P Nurafiati and L Umusyaadah
+ Open abstract View article PDF

OPEN ACCESS 012052
Production-Based Education Model for Improving Technical and Vocational Teachers Ability
H Saputro, Suharno, I Widiastuti and B Harjanto

+ Open abstract View article PDF

OPEN ACCESS 012053
Entrepreneurship Education through Industrial Internship for Technical and Vocational Students
H Sumual and G J Soputan
+ Open abstract View article PDF

OPEN ACCESS 012054
Effect of Pertalite-Spiritus Blend Fuel on Performance of Single Cylinder Spark Ignition Engine
H Wibowo, A A P Susastriawan and D Andrian
+ Open abstract View article PDF

OPEN ACCESS 012055
Teacher's Perception about the Use of E-Learning/Edmodo in Educational Activities
H Yanti, A Setiawan, Nurhabibah and Yannuar
+ Open abstract View article PDF

OPEN ACCESS 012056
Optimization Placement of Static Var Compensator (Svc) on Electrical Transmission System 150 kV Based on Smart Computation
Hasbullah, Y Mulyadi, Y Febriana and A G Abdullah
+ Open abstract View article PDF

OPEN ACCESS 012057
Gender-Mainstreaming in Technical and Vocational Education and Training
I D A Nurhaeni and Y Kurniawan
+ Open abstract View article PDF

OPEN ACCESS 012058
A Multimetric Approach for Handoff Decision in Heterogeneous Wireless Networks
I Kustiawan and W Purnama
+ Open abstract View article PDF

OPEN ACCESS 012059
Evaluation Program on the Implementation of Industrial Apprenticeship (Prakerin) in Electrical Engineering
I Maulana, Sumarto, P Nurafiati and R H Puspita

+ Open abstract View article PDF

OPEN ACCESS 012060
Clay Stabilization Using the Ash of Mount Sinabung in Terms of the Value of California Bearing Ratio (CBR)
I P Hastuty, R Roesyanto and S M A Napitupulu
+ Open abstract View article PDF

OPEN ACCESS 012061
Three Tier-Level Architecture Data Warehouse Design of Civil Servant Data in Minahasa Regency
I R H T Tangkawarow, J P A Runtuwene, F I Sangkop and L V F Ngantung
+ Open abstract View article PDF

OPEN ACCESS 012062
The 3D Digital Story-telling Media on Batik Learning in Vocational High Schools
I Widiaty, Y Achdiani, I Kuntadi, S R Mubaroq and D Zakaria
+ Open abstract View article PDF

OPEN ACCESS 012063
The Design of Mechatronics Simulator for Improving the Quality of Student Learning Course in Mechatronics
J Kustija, Hasbullah and Y Somantri
+ Open abstract View article PDF

OPEN ACCESS 012064
Envisioning Science Environment Technology and Society
J Maknun, T Busono and I Surasetja
+ Open abstract View article PDF

OPEN ACCESS 012065
How to Improve Engineering Competencies for Students with Special Needs?
J Maknun, M S Barliana and D Cahyani
+ Open abstract View article PDF

OPEN ACCESS 012066
A Comparative Analysis of Extract, Transformation and Loading (ETL) Process
J P A Runtuwene, I R H T Tangkawarow, C T M Manoppo and R J Salaki
+ Open abstract View article PDF

OPEN ACCESS 012067
Higher Education Students' Behaviour to Adopt Mobile Learning
J R Batmetan and V R Palilingan
+ Open abstract View article PDF

OPEN ACCESS 012068
E-Learning Development Process for Operating System Course in Vocational School
J R Tuna, C T M Manoppo, D R Kaparang and A Mewengkang
+ Open abstract View article PDF

OPEN ACCESS 012069
Spatial Modeling of Tsunami Impact in Manado City using Geographic Information System
J C Kumaat, S T B Kandoli and F Laeloma
+ Open abstract View article PDF

OPEN ACCESS 012070
Designing Low-Income Housing Using Local Architectural Concepts
K Trumansyahjaya and L S Tatura
+ Open abstract View article PDF

OPEN ACCESS 012071
Osteoarthritis Severity Determination using Self Organizing Map Based Gabor Kernel
L Anifah, M H Purnomo, T L R Mengko and I K E Purnama
+ Open abstract View article PDF

OPEN ACCESS 012072
Vocational Students' Motivation for Professional Skills
L Sojow, A Wajong and N Sangi
+ Open abstract View article PDF

OPEN ACCESS 012073
Performance of Savonius Blade Waterwheel with Variation of Blade Number
L Sule and P T D Rompas
+ Open abstract View article PDF

OPEN ACCESS 012074
Designing an Elderly Assistance Program Based-on Home Care
L Umusya'adah, A Juwaedah, Y Jubaedah, H Ratnasusanti and R H Puspita

+ Open abstract View article PDF

OPEN ACCESS 012075
The Attitude of Construction Workers toward the Implementation of Occupational Health and Safety (OHS)
L Widaningsih, I Susanti and T Chandra
+ Open abstract View article PDF

OPEN ACCESS 012076
Motivation, Compensation, and Performance for Science and Technological Teachers
R M Abast, N M Sangi, M S S S Tumanduk and R Roring
+ Open abstract View article PDF

OPEN ACCESS 012077
A Comparative Study of the Traditional Houses Kaili and Bugis-Makassar in Indonesia
M F Suharto, R S S I Kawet and M S S S Tumanduk
+ Open abstract View article PDF

OPEN ACCESS 012078
Improved Information Retrieval Performance on SQL Database Using Data Adapter
M Husni, S Djanali, H T Ciptaningtyas and I G N A Wicaksana
+ Open abstract View article PDF

OPEN ACCESS 012079
The Evaluation of Industry Practical of Mechanical Engineering in Vocational Education: A CIPP Model Approach
M Kamaludin, W Munawar, D Mahdan, M V Simanjuntak and H F Wendi
+ Open abstract View article PDF

OPEN ACCESS 012080
Job and Workload Analysis System for Civil Servants in North Sulawesi Province, Indonesia
M Krisnanda, A Mewengkang, P T D Rompas and P V Togas
+ Open abstract View article PDF

OPEN ACCESS 012081
Performance Analysis of a Static Synchronous Compensator (STATCOM)
M M Kambey and J D Ticoh
+ Open abstract View article PDF

OPEN ACCESS 012082

Utilization of Multimedia Laboratory: An Acceptance Analysis using TAM

M Modeong and V R Palilingan

+ Open abstract View article PDF

OPEN ACCESS 012083

Web-Based Virtual Laboratory for Food Analysis Course

M N Handayani, I Khoerunnisa and Y Sugiarti

+ Open abstract View article PDF

OPEN ACCESS 012084

The Opinions about Relationship between Students and Teachers in the Class of Hands-on

M Pigultong

+ Open abstract View article PDF

OPEN ACCESS 012085

Priority Determination of Underwater Tourism Site Development in Gorontalo Province using Analytical Hierarchy Process (AHP)

M Rohandi, M Y Tuloli and R T Jassin

+ Open abstract View article PDF

OPEN ACCESS 012086

Numerical Simulation by using Soldiers Pile of the Embankment on Semarang-Solo Highway

M S S S Tumanduk, T S Maki, T U Y Pangkey and Y C Pandeiroth

+ Open abstract View article PDF

OPEN ACCESS 012087

The Development of Indonesian Labour Market Information System (LMIS) for Vocational Schools and Industries

M T Parinsi, V R Palilingan, Sukardi and H D Surjono

+ Open abstract View article PDF

OPEN ACCESS 012088

Industrial Student Apprenticeship: Understanding Health and Safety

M V Simanjuntak, A G Abdullah, R H Puspita, D Mahdan and M Kamaludin

+ Open abstract View article PDF

OPEN ACCESS 012089

Rambutan Seed (*Nephelium Lappaceum L.*) Optimization as Raw Material of High Nutrition Value Processed Food

M Wahini, M G Miranti, F Lukitasari and L Novela

+ Open abstract View article PDF

OPEN ACCESS 012090

A Design of Innovative Engineering Drawing Teaching Materials

Mujiarto, A Djohar and M Komaro

+ Open abstract View article PDF

OPEN ACCESS 012091

How does Socio-Economic Factors Influence Interest to Go to Vocational High Schools?

N F Utomo and D Wonggo

+ Open abstract View article PDF

OPEN ACCESS 012092

What are the Perspectives of Indonesian Students to Japanese Ritual during Solar Eclipse?

N Haristiani, A Rusli, A S Wiryani, A B D Nandiyanto, A Purnamasari, T N Sucahya and N Permatasari

+ Open abstract View article PDF

OPEN ACCESS 012093

Solar Eclipse: Concept of "Science" and "Language" Literacy

N Haristiani, R Zaen, A B D Nandiyanto, A N Rusmana, F Azis, A A Danuwijaya and A G Abdullah

+ Open abstract View article PDF

OPEN ACCESS 012094

Vocational High School Students' Profile and their English Achievement

N V F Liando, D M Ratu and V Sahentombage

+ Open abstract View article PDF

OPEN ACCESS 012095

Machine Maintenance Scheduling with Reliability Engineering Method and Maintenance Value Stream Mapping

N Sembiring and A H Nasution

+ Open abstract View article PDF

OPEN ACCESS 012096

Technical and Sociological Approaches for Curriculum Innovation on Clothing Education Department

N Tristantie

+ Open abstract View article PDF

OPEN ACCESS 012097

Analysis of ICT Literacy Competence among Vocational High School Teachers

Nurhabibah, A Setiawan, H Yanti, Y Z Miraj and Yannuar

+ Open abstract View article PDF

OPEN ACCESS 012098

Mobile-Based Dictionary of Information and Communication Technology

O E S Liando, A Mewengkang, D Kaseger, F I Sangkop, V P Rantung and G C Rorimpandey

+ Open abstract View article PDF

OPEN ACCESS 012099

Factors Affecting Optimal Surface Roughness of AISI 4140 Steel in Turning Operation Using Taguchi Experiment

O Novareza, D H Sulistiyarini and R Wiradmoko

+ Open abstract View article PDF

OPEN ACCESS 012100

Voltage Analysis Improvement of 150 kV Transmission Subsystem Using Static Synchronous Compensator (STATCOM)

P A Akbar, D L Hakim and T Sucita

+ Open abstract View article PDF

OPEN ACCESS 012101

4D Model on Assessing Psychomotor Aspect in Continental Food Processing Practice

P Nurafiati, A Ana, H Ratnasusanti and I Maulana

+ Open abstract View article PDF

OPEN ACCESS 012102

Validation of a Numerical Program for Analyzing Kinetic Energy Potential in the Bangka Strait, North Sulawesi, Indonesia

P T D Rompas, H Taunaumang and F J Sangari

+ Open abstract View article PDF

OPEN ACCESS 012103

Students Perception on the Use of Computer Based Test

R A Nugroho, N S Kusumawati and O C Ambarwati

+ Open abstract View article PDF

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Design Learning of Teaching Factory in Mechanical Engineering
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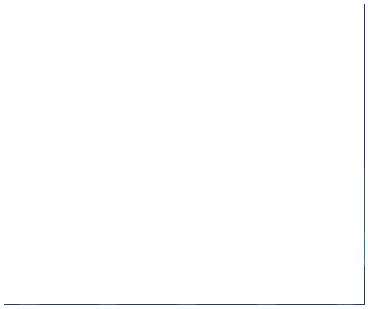

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Osteoarthritis Severity Determination using Self Organizing Map Based Gabor Kernel

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Abstract. The number of osteoarthritis patients in Indonesia is enormous, so early action is needed in order for this disease to be handled. The aim of this paper to determine osteoarthritis severity based on x-ray image template based on gabor kernel. This research is divided into 3 stages, the first step is image processing that is using gabor kernel. The second stage is the learning stage, and the third stage is the testing phase. The image processing stage is by normalizing the image dimension to be template to 50□200 image. Learning stage is done with parameters initial learning rate of 0.5 and the total number of iterations of 1000. The testing stage is performed using the weights generated at the learning stage. The testing phase has been done and the results were obtained. The result shows KL-Grade 0 has an accuracy of 36.21%, accuracy for KL-Grade 2 is 40,52%, while accuracy for KL-Grade 2 and KL-Grade 3 are 15,52%, and 25,86%. The implication of this research is expected that this research as decision support system for medical practitioners in determining KL-Grade on X-ray images of knee osteoarthritis.

1. Introduction

Approximately 13% of women and 10% of men at the age 60 years and older have symptomatic knee OA [1]. Based on data at the Ministry of Health of Indonesia, the number of patients with Osteoarthritis disease (OA) is quite high. From 1995 to 2007 the prevalence is 30 percent. So one of thirty Indonesians suffer osteoarthritis disease [2]. This is because the disease cannot be cured and the meet of tibia and femur bones causes pain for the sufferer. Knowing the status of the patient so it can be treated hopefully that the pain can be reduced [3-6]. Classification by Kellgren-Lawrence, based on the severity of osteoarthritis (normal, doubtful, minimal and moderate) [7].

X-rays, magnetic resonance imaging (MRI), osteo CT and arthroscopy are the usual methods used to determine the status of osteoarthritis [8, 9]. But in Indonesia has commonly used X-ray and Magnetic Resonance Imaging (MRI) to know the status of OA. Osteoarthritis has been studied by researchers all over the world. Research on the localization of the junction space area using delineation of cortical bone plates (active shape model) [10].

The classification using 20 pre-selected images of 150 × 150 is used as gold standard, to search for ROIdone by scanning used eucledian distance to predict junction area, while to find the status of

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osteoarthritis used fisher score from feature data [11], another research finding the distance between the femur and the tibia [12]. But the research that has been done is still difficult to classify KL-Grade 4. Another study is a novel hybrid of S2DPCA and SVM for knee osteoarthritis classification performed by Rima [13].

Some other studies are Osteoarthritis X-Ray Image Analysis Using Gray Level Co-occurrence Matrices Based Wavelet performed by Haryanto [14]. Automatic Segmentation of Impaired Joint Space Area for Osteoarthritis Knee on X-ray Image Using Gabor Filter Based Morphology Process [15]. Osteoarthritis Classification Using Self-Organizing Map Based on Gabor Kernel and Contrast-Limited Adaptive Histogram Equalization [16]. Research about performance evaluation of osteoarthritis X-ray image is investigated by Anifah [17].

The research that has been done above discussed ROI segmentation with various methods. Research that discussed the classification of osteoarthritis severity and classified image into KL-Grade 0, KL-Grade 1, KL-Grade 2, KL-Grade 3 and KL-Grade 4 but however the research is mostly texture feature-based. This research is done with feature-based template, hopefully this research can improve the result of previous research and become one of method to determine KL-Grade on x-ray image of knee osteoarthritis. The aim of this paper to determine osteoarthritis severity based on x-ray image template based on gabor kernel. This research is expected to contribute as decision support system for medical practitioners in determining KL-Grade on X-ray images of knee osteoarthritis. The novelty of this research is to determine KL-Grade based on template feature.

2. Methodology

2.1. Data

Please follow these instructions as carefully as possible so all articles within a conference have the same style to the title page. This paragraph follows a section title so it should not be indented. The data used in this research are 303 x-ray images, which consists of 25 data for training process and 258 data for testing. All data obtained from Osteoarthritis Initiative (OAI). The processed data is x-ray image of the knee fixed- flexion with 10□ image capture angle [18].

2.2. Methods

The diagram block of this research is illustrated in Figure 1. This research is divided into 3 stages, the first step is image processing that is using gabor kernel. The second stage is the learning stage, and the third stage is the testing phase. The image processing stage is by normalizing the image dimension to be template to 50□200 image. Learning stage is done with parameters initial learning rate of 0.5 and the total number of iterations of 1000. The testing stage is performed using the weights generated at the learning stage.

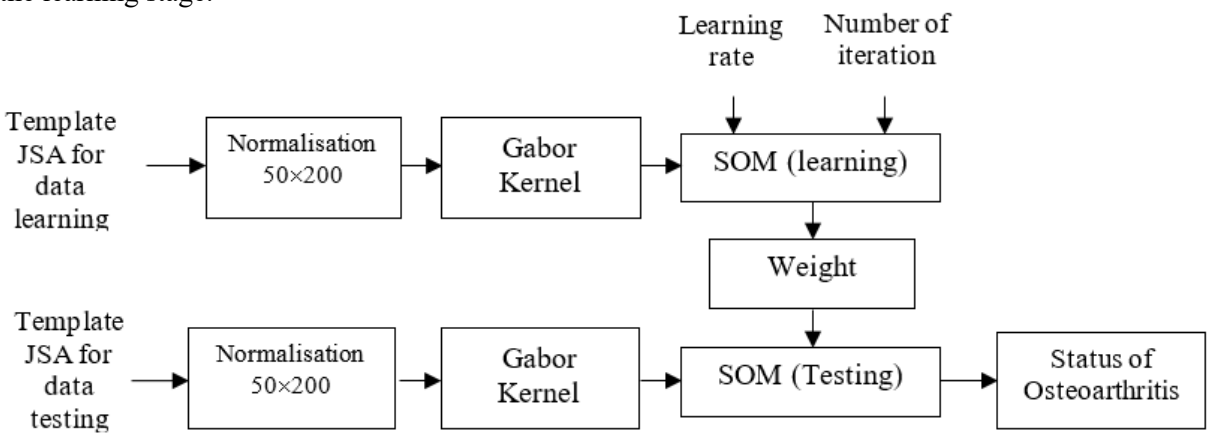

Figure 1. The diagram block of this research.

SOM algorithm used is illustrated in Figure 2. The learning step uses SOM with the following stages: initialization, determining the number of classes, setting up the learning rate parameters, determining the number of iterations and calculating the distance between the random data and the predetermined weights and obtaining the new weight (update weight). The purpose of using the gabor kernel here is to bring up the special features of x-ray images that have been convoluted to the gabor kernel. With the selection of the right parameters then get the typical image features.

The gabor complex formula is:

$$g(x,y) = s(x,y)w_r(x,y) \tag{1}$$

Where s (x, y) is a complex sinusoid (carrier), and w_r (x, y) a two-dimensional Gaussian-shaped function (envelope).

The sinusoid complex is defined as:

$$s(x,y) = \exp(j(2\pi(u_0 x + v_0 y) + P)) \tag{2}$$

Where (u_0, v_0) is defined as the spatial frequency and P as the phase of the sinusoid.

The real and imaginary part of the sinusoid is:

$$\begin{aligned} \Re(s(x,y)) &= \cos(2\pi(u_0 x + v_0 y) + P) \\ \Im(s(x,y)) &= \sin(2\pi(u_0 x + v_0 y) + P) \end{aligned} \tag{3}$$

Parameters u_0 and v_0 are defined in Cartesian coordinates. While spatial frequency is expressed in polar coordinates with peak F_0 and direction ω_0 as follows:

$$\begin{aligned} Fo &= \sqrt{u_0^2 + v_0^2} \\ \omega_0 &= \arctan\left(\frac{v_0}{u_0}\right) \\ u_0 &= Fo\cos(\omega_0) \\ v_0 &= Fo\sin(\omega_0) \end{aligned} \tag{4}$$

Complex sinusoid becomes:

$$s(x,y) = \exp(j(2\pi Fo(x\cos\omega_0 + y\sin\omega_0) + P)) \tag{5}$$

And gaussian envelope expressed as,

$$w_r(x,y) = K\exp(j(-\Pi(a^2(x-x_0)_r^2 + b^2(y-y_0)_r^2)) \tag{6}$$

Where K is the magnitude of the gaussian envelope, (x0, y0) is the peak of the function, a and b are the scale parameters of the envelope gaussian, whereas r is denoted as the rotation operator [17]. So:

$$\begin{aligned} (x-x_0)_r &= (x-x_0)\cos(\theta) + (y-y_0)\sin(\theta) \\ (y-y_0)_r &= (x-x_0)\sin(\theta) + (y-y_0)\cos(\theta) \end{aligned} \tag{7}$$

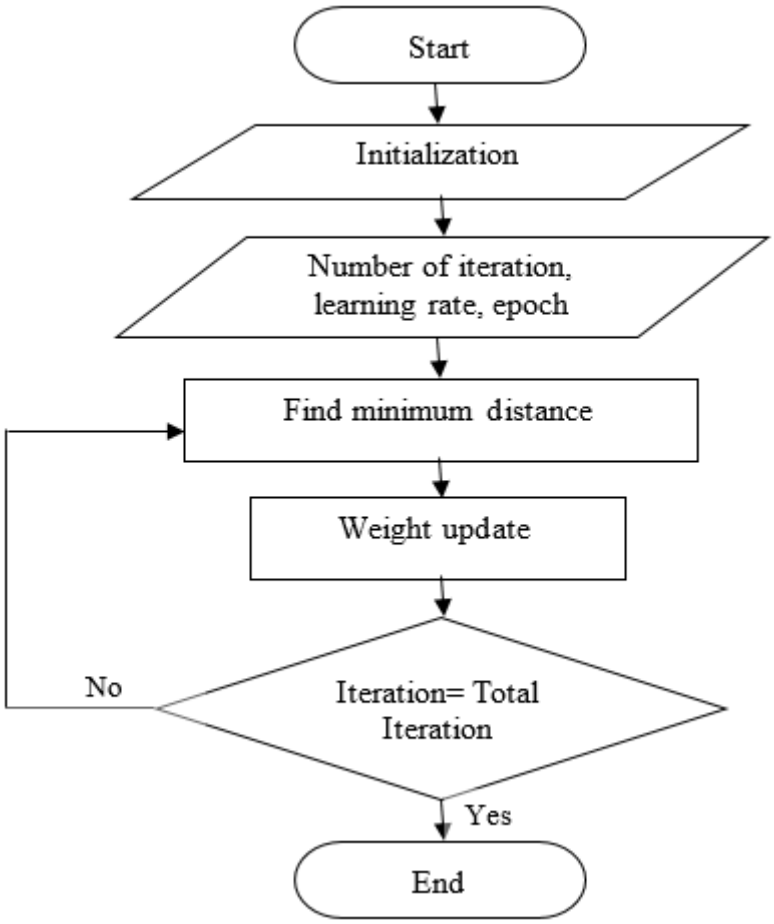

Figure 2. SOM algorithm used in this research.

3. Results and Discussion

Figure 3 is a template used in training process. Experimental results are strongly influenced by the intensity of the processed image, so that required normalization is not just normalization dimensions (size only). The first experiment using the image normalization of 10×40 is too small and possible the amount of missing image information, so image information has not been represented if using this normalization. The third experiment used templates based on gabor as a standardized gold standard to 50×200 and SOM parameters used initial learning rate 0,5 and total iteration 1000.

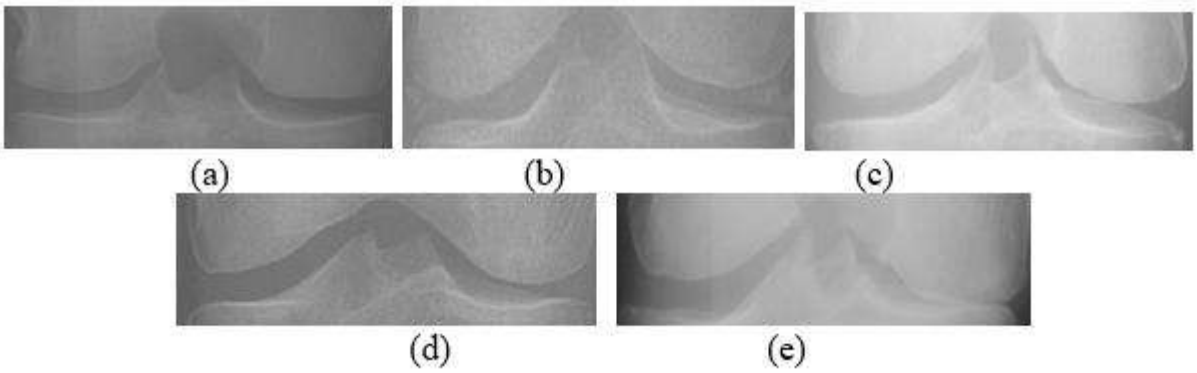

Figure 3. Template used in training process.

The experimental results still have not produced good results. Figure 4 is the result of the normalization of 50□200 previously edge detection using the Gabor Kernel, the five KL-Grades appear almost the same, allowing some information lost after the normalization process.

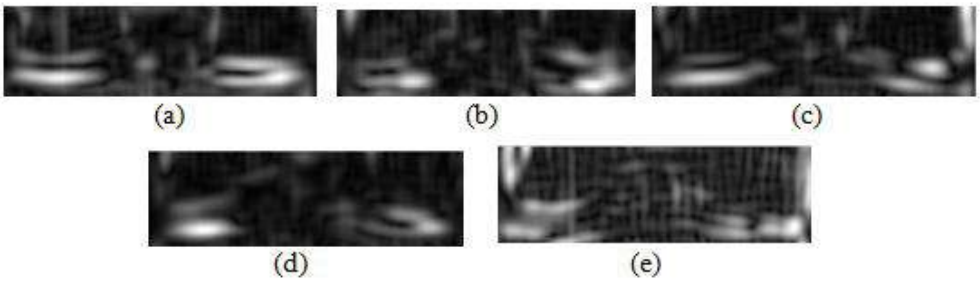

Figure 4. Result of 50×200 image using Gabor Kernel.

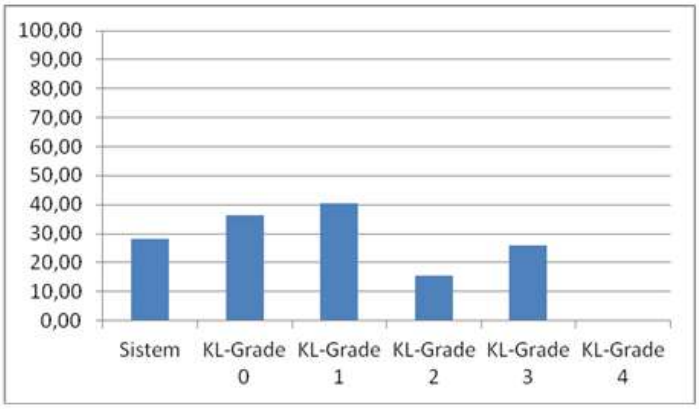

Figure 5. Accuracy of the system.

Figure 5 is illustrated of the system accuracy. KL-Grade 0 has an accuracy of 36.21% because 31.9% is classified as KL-Grade 1, 12.93% are classified as KL-Grade 2 and 18.97% as KL-Grade 3. Classified KL-Grade 1 as KL-Grade 0 is 14.66% while those read as KL-Grade 2 and KL-Grade 3 are 12.07% and 32.76% respectively. KL-Grade 2 which is read as KL-Grade 0 is 26.72%, and which is known as KL-Grade 1 is 44.83% and the remaining 12.93% is known as KL-Grade 3. KL-Grade 3 is recognized as KL-Grade 0, KL-Grade 1, and KL-Grade 2 were 14.66%, 44.83%, and 14.66%. While using this method has a weakness, it still cannot recognize KL-Grade 4, but KL-Grade 4 is known as KL-Grade 0 20%, known as KL-Grade 1 20% and is recognized as KL-Grade 3 32%. Some of the causes that cannot be detected correctly are some images of objects or medical instruments contained in the x-ray image, such as knee bond plate. This will affect the outcome of the kernel gabor process. This can be solved by re-checking the x-ray image before it is inserted into the system.

4. Conslusions

Osteoarthritis severity determination using Self Organizing Map based Gabor Kernel does not produce excellent results. KL-Grade 0 has an accuracy of 36.21%, accuracy for KL-Grade 2 is 40,52%, while accuracy for KL-Grade 2 and KL-Grade 3 are 15,52%, and 25,86%. The weakness of this system is still not able to classify KL-Grade 4. Based on this result, further research is needed to obtain higher accuracy.

Acknowledgments

This research was supported by Universitas Negeri Surabaya and DIKTI Indonesia. We would also like to show our gratitude to Osteoarthritis Initiative for sharing their data and biomarker for this research.

References

[1] B Heidari 2011 Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I *Caspian Journal of Internal Medicine* 2(2) p 205–212.
[2] Http://health.liputan6.com/read/2356525/1-dari-10-orang-indonesia-terkena-penyakit-sendi-osteoarthritis.
[3] Woolf A D, and Pfleger B 2003 Burden of major musculoskeletal conditions *Bull World Health Organ* **81**p 646-56.
[4] Elders M J The increasing impact of arthritis on public health *J Rheumatol* **60** p 6-8.
[5] Martel-Pelletier J, Lajeunesse D, Fahmi H, Tardif G, and Pelletier J P 2006 New thoughts on the pathophysiology of osteoarthritis: one more step toward new therapeutic targets *Curr Rheumatol Rep* **8** p 30-6.
[6] Brandt K D, Radin E L, Dieppe P A, and van de Putte L 2006 Yet more evidence that osteoarthritis is not a cartilage disease *Ann Rheum Dis* **65** p 1261-1264.
[7] Buckland-Wright 1997 Current status of imaging procedures in the diagnosis, prognosis and monitoring of osteoarthritis *Bailliere's Clinical Rheumatology* 11(4).
[8] Sing-Tze Bow 2002 *Pattern Recognition and Image Preprocessing* (Marcel Dekker).
[9] Gour Karmakar, Laurence Dooley, M. Manzur Murshed Dengsheng Zhang, Guojun Lu *Image Segmentation and Searching, Gippsland School of Computing & Info Tech Monash University*.
[10] P Podsiadlo, M Wolski, and G W Stachowiak 2008 Automated selection of trabecular bone regions in knee radiographs **35** p 1870–1882.
[11] Lior Shamir, Shari M. Ling, William W. Scott, Angelo Bos, Nikita Orlov 2008 Knee X-ray image analysis method for automated detection of *Osteoarthritis* p 1–10.
[12] Tati L. Mengko, Rachmat G. Wachjudi, Andriyan B. Suksmono, and Qonny Danudirdjo 2005 Automated Detection of Unimpaired Joint Space for Knee Osteoarthritis Assessment p 400–403.
[13] R T Wahyuningrum, Purnomo, L. Anifah, and Purnama 2016 A novel hybrid of S2DPCA and SVM for knee osteoarthritis classification, Computational Intelligence and Virtual Environments for Measurement Systems and Applications (CIVEMSA) *2016 IEEE International Conference on, 27-28 June 2016 Hungaria*.
[14] Haryanto, E M Rohman, Anifah 2016 Osteoarthritis X-Ray Image Analysis Using Grey Level Co-occurrence Matrices Based Wavelet *4th UPI International Conference on Technical and Vocational Education and Training* (Available at: http://tvet.conference.upi.edu/2016 15-16 November 2016).
[15] Anifah L, Purnomo, Hariadi, Purnama 2013 Osteoarthritis Classification Using Self Organizing Map Based on Gabor Kernel and Contrast-limited Adaptive Histogram Equalization *The Open Biomedical Engineering Journal* **7** p 18-28.
[16] Anifah L, Purnomo, Hariadi, Purnama 2011 *Automatic Segmentation of Impaired Joint Space Area for Osteoatritis Knee on X-ray Image using Gabor Filter Based Morphology Process IPTEK* **22**(3) p 117-176.
[17] Anifah L, Purnomo, Hariadi, Purnama 2012 Performance Evaluation of Osteoarthritis x-Ray Image Enhancement Using Clahe and Gabor Kernel *Proceeding of International Conference on Biomedical Engineering and Madical Applications (ICBEMA) BME-Days 2012*.
[18] Osteoarthritis Initiative 2009 *Osteoarthritis* Available at: www.OAI.com.