

An Immune-Inspired Algorithm for Vehicle Routing Problem

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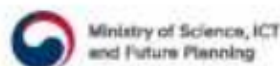
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Conference Schedule Overview

● Registration

- Time : 9:00 ~ 12:00 (26th ~ 27th June, 2019)
- Place : Royton Sapporo Hotel, Japan

● Opening Ceremony / Keynote Speech

- Time : 17:00 ~ 18:30 (25th June, 2019)
- Place : Regent Hall, Royton Sapporo Hotel, Japan
- Keynote Speech (Chair. Hee-Cheol Kim)
Title : ERP Implementation and Performance Evaluation in Indian Small Manufacturing Enterprises (SMEs)
Speaker : Srikanta Patnaik(SOA University, India)

● Luncheon / Business Meeting

- Time : 12:00 ~ 13:00 (26th ~ 27th June, 2019)
- Place : Royton Sapporo Hotel, Japan

● Technical Session

- Time : 9:00 ~ 12:00 (26th ~ 27th June, 2019)
- Place : Crystal Room #1~2, Royton Sapporo Hotel, Japan

ICFICE 2019		
25th ~ 27th June, 2019, Royton Sapporo Hotel, Japan		
	26th June, 2019	27th June, 2019
Registration Open 09:00 ~		
Technical Session : Oral		
	Crystal Room #1	Crystal Room #1
	Session IT-A, SC-A Jong-Wook Jang (Dong-eui University)	Session IS-A Hee-Cheol Kim (Inje University)
09:00~ 09:15	IT-1	IS-1
09:15~ 09:30	IT-2	IS-2
09:30~ 09:45	IT-3	IS-3
09:45~ 10:00	IT-4	IS-4
10:00~ 10:15	SC-1	IS-5
10:15~ 10:25	Coffee Break	
	Session IB-A, NS-A, CA-A Jeong-Wook Seo (Namseoul University)	Session IB-B, MD-A, DA-A Dong-Sik Jo (Wonkwang University)
10:25~ 10:40	IB-2	IB-1
10:40~ 10:55	IB-3	MD-1
10:55~ 11:10	IB-4	MD-2
11:10~ 11:25	NS-1	MD-3
11:25~ 11:40	CA-1	DA-1

※ IT : IT Fusion Technology / CA : Communication System and Application
 NS : Networking and Services / IS : Intelligent Information System
 MD : Multimedia and Digital Convergence / DA : Database and Internet Application
 SC : Semiconductor and Communication Services / IB : IoT and Big Data

ICFICE 2019			
25th ~ 27th June, 2019, Royton Sapporo Hotel, Japan			
26th June, 2019			
Registration Open 09:00 ~			
Technical Session : Poster			
Crystal Room #2			
Session IT-B, NS-B, BI-A Dae-Sung Lee (Catholic University of Pusan)			
09:00~ 09:50	IT-5	IT-11	NS-5
	IT-6	IT-12	NS-6
	IT-7	IT-13	BI-1
	IT-8	NS-2	BI-2
	IT-9	NS-3	BI-3
	IT-10	NS-4	
09:50~ 10:00	Coffee Break		
Session IT-C, SC-B, UN-A Chang-Pyo Yoon (Gyeonggi College of Science and Technology)			
10:00~ 10:50	IT-14	IT-20	SC-2
	IT-15	IT-21	SC-3
	IT-16	IT-22	SC-4
	IT-17	IT-23	UN-1
	IT-18	IT-24	
	IT-19	IT-25	
10:50~ 11:00	Coffee Break		

※ IT : IT Fusion Technology / CA : Communication System and Application
 NS : Networking and Services / BI : Biomedical Imaging and Engineering
 SC : Semiconductor and Communication Services

ICFICE 2019			
25th ~ 27th June, 2019, Royton Sapporo Hotel, Japan			
26th June, 2019			
Registration Open 9:00 ~			
Technical Session : Poster			
Crystal Room #2			
Session CA-B, SC-C			
Se-Min Kim (Jeonju National University of Education)			
11:00~ 11:50	CA-2	CA-8	SC-7
	CA-3	CA-9	SC-8
	CA-4	CA-10	SC-9
	CA-5	CA-11	
	CA-6	SC-5	
	CA-7	SC-6	

※ IT : IT Fusion Technology / CA : Communication System and Application

SC : Semiconductor and Communication Services / UN : Ubiquitous Sensor Network

ICFICE 2019			
25th ~ 27th June, 2019, Royton Sapporo Hotel, Japan			
27th June, 2019			
Registration Open 9:00 ~			
Technical Session : Poster			
Crystal Room #2			
Session IS-B, IB-C Sung-Hee Woo (Korea National University of Transportation)			
09:00~ 09:50	IS-6	IS-12	IB-9
	IS-7	IS-13	IB-10
	IS-8	IB-5	IB-11
	IS-9	IB-6	IB-12
	IS-10	IB-7	IB-13
	IS-11	IB-8	
09:50~ 10:00	Coffee Break		
Session IS-C, MD-B, NS-C Young-Woon Woo (Dong-eui University)			
10:00~ 10:50	IS-14	IS-20	NS-7
	IS-15	MD-4	
	IS-16	MD-5	
	IS-17	MD-6	
	IS-18	MD-7	
	IS-19	MD-8	
10:50~ 11:00	Coffee Break		

※ IS : Intelligent Information System / IB : IoT and Big Data

MD : Multimedia and Digital Convergence / NS : Networking and Services

ICFICE 2019			
25th ~ 27th June, 2019, Royton Sapporo Hotel, Japan			
27th June, 2019			
Registration Open 9:00 ~			
Technical Session : Poster			
Crystal Room #2			
Session MD-C, DA-B			
Seong-Yoon Shin (Kunsan National University)			
11:00~ 11:50	MD-9	DA-2	DA-8
	MD-10	DA-3	DA-9
	MD-11	DA-4	
	MD-12	DA-5	
	MD-13	DA-6	
	MD-14	DA-7	

※ MD : Multimedia and Digital Convergence / DA : Database and Internet Application

26th June, 2019

Session IT-A : IT Fusion Technology

Session SC-A : Semiconductor and Communication Services

Session Chair : Jong-Wook Jang(Dong-eui University)

09:00~10:15 (Crystal Room #1)

- IT-1 : Design of Vehicle Tracking Systems for Public Safety in Indonesia**
A.M. Ilham, Jin-uk Jung, Kyo-hong Jin, and Min-tae Hwang
(Changwon National University)
- IT-2 : Traceability System for Fire Fighting Equipment using GS1 and EPCIS:
Production, Inspection, and Recycling**
Heum Park and Chang Min Park (Yongsan University)
- IT-3 : Proposal of LoRa Network Control System**
Jae-Ung Lee and Jong-Wook Jang(Dong-eui University)
- IT-4 : Performance Analysis & Evaluation of ERP: A Case Study of Indian Small
Manufacturing Enterprises**
Bhagyashree Mohanta and Srikanta Patnaik(Siksha 'O' Anusandhan)
- SC-1 : Electrical Characteristic of Monolithic 3D Inverter Consisting of JLFET with
Interface Charge**
Tae-Jun Ahn^{1,2}, Jong Ho Lee², Young Baek Kim², and Yun Seop Yu¹
(¹Hankyong National University, ²Korea Institute of Industrial Technology)

Session IB-A : IoT and Big Data

Session NS-A : Networking and Services

Session CA-A : Communication System and Application

Session Chair : Jeong-Wook Seo(Namseoul University)

10:25~11:40 (Crystal Room #1)

- IB-2 : A CNN data configuration method for Multivariate Time Series IoT Data**
Ji-Soo Kim¹, Chul-Hyun Hwang², and Sung-Ock Lee³
(¹Kookmin University, ²Data Maroo co, ³Global HRD Inc)

- IB-3 : Deep Learning Model Architecture for Rare Event Time Series Prediction**
 Ji-Soo Kim¹, Chul-Hyun Hwang², and Hyunok Song³
 (¹Kookmin University, ²Data Maroo co, ³DASOMSOFY)
- IB-4 : Analysis of Factors Affecting the Filling rate of each type of daycare center Using Bigdata Technology**
 Jeongwon Lee¹, Byungil Jeon¹, Semin Kim², Gyujeong Lee¹, and Choong Ho Lee¹(¹Hanbat National University, ²Jeonju National University of Education)
- NS-1 : Interference Levels Between Closely Spaced Dual Polarized Geostationary-Satellite Networks**
 Wonjun Choi¹ and Jongwon Eun²
 (¹National Institute of Environmental Research, ²Namseoul University)
- CA-1 : Asymptotic Stability and Stability Switching for a System of Delay Differential Equations**
 Wataru Saito and Ikki Fukuda (Hokkaido University)

Session IT-B : IT Fusion Technology

Session NS-B : Networking and Services

Session BI-A : Biomedical Imaging and Engineering

Session Chair : Dae-Sung Lee(Catholic University of Pusan)

09:00~09:50 (Crystal Room #2)

- IT-5 : A Study of System Design of Automatic Vehicle Passengers Number Count for High Occupancy Vehicle Lanes**
 Minyoung Kim and Jongwook Jang(Dong-eui University)
- IT-6 : Branch processing system using WebAssembly and Javascript**
 Moon-Hyuk Choi, Jin-Tae Park, Hyun-Gook Kim, and Il-Young Moon
 (KOREATECH)
- IT-7 : The Utilization of ICT for Support of the Elderly - Based on the Case of Nordic Countries-**
 Jin Ah Lee(Catholic University of Pusan)
- IT-8 : A Study on Motion Tracking Method and Moving Path Estimation in Virtual Reality Environments**
 Dong-Min Kim, Ji-Yong Lim, Sung-Uk Heo, Gwan-Hyung Kim, and Am-Suk Oh (Tongmyong University)

- IT-9 : Design of a Control Module for an Automatic Agricultural Planter**
Byung-Chul Kim¹, Moon-Sun Shin², and Seon-Min Hwang²
(¹Baekseok University, ²Konkuk University)
- IT-10 : Design of Wi-Fi based Indoor Positioning System using Machine Learning**
Chang-Pyo Yoon¹ and Chi-Gon Hwang² (¹Gyeonggi College of Science and
Technology, ²Kwnagwoon University)
- IT-11 : Sequential Location Data Generation Method of RNN Model using Wi-Fi
Fingerprint Data**
Hong-Gi Shin¹, Yong-Hoon Choi¹, and Chang-Pyo Yoon²
(¹Kwangwoon University, ²GyeongGi College of Science and Technology)
- IT-12 : A Study on Development of Fire Disaster Response Virtual Training System
Scenario Reflecting Trainee Behavior Patterns**
Eun-Jee Song(Namseoul University)
- IT-13 : Development of Warning Message Transmission Service for Efficient
Maintenance of Manufacturing Facility**
Jin-Uk Jung and Kyo-Hong Jin(Changwon National University)
- NS-2 : Prime Block based Asynchronous Neighbor Discovery Protocol for Wireless
Sensor Networks**
Jong-Hoon Youn¹, Woosik Lee², and Teuk-Seob Song³
(¹University of Nebraska at Omaha, ²Social Security Information Service,
³Mokwon University)
- NS-3 : Ultra Dense Network for High Speed Railway System**
Young-Dong Kim(Dongyang University)
- NS-4 : A Flow Mobility Management Framework for 5G Multi-access Networks**
Kyounghee Lee¹, No-Ik Park² and Jae-Ho Kim²(¹Pai Chai University, ²ETRI)
- NS-5 : Cluster configuration method using fuzzy in Wireless sensor network**
Jong-Yong Lee¹ and Daesung Lee²
(¹KwangWoon University, ²Catholic University of Pusan)
- NS-6 : Cluster-based Protocol with Improved Cluster Formation Method**
Jong-Yong Lee¹ and Daesung Lee²
(¹KwangWoon University, ²Catholic University of Pusan)
- BI-1 : Detection of Pneumonia from Chest X-Rays using a Convolutional Neural
Network Architecture.**
Sabyasachi Chakraborty, Satyabrata Aich, Jong Seong Sim, and Hee-Cheol
Kim(Inje University)

BI-2 : Rolling Boll System Design with BLE Communication for Pets

Young Bin Kim and Conan K.R. Ryu(Mokwon University)

BI-3 : Auto-segmentation of Intima/Adventitia of the Vessel by Subtracting Different types of Binarization Results

Kwang Baek Kim¹, Jong Hee Lee¹, Hyun Jun Park², and Doo Heon Song³
(¹Silla University, ²Cheongju University, ³Yong-In SongDam College)

Session IT-C : IT Fusion Technology**Session SC-B : Semiconductor and Communication Services****Session UN-A : Ubiquitous Sensor Network**

Session Chair : Chang-Pyo Yoon(Gyeonggi College of Science and Technology)

10:00~10:50 (Crystal Room #2)**IT-14 : Simulation Tools to Support the Design of Equipment in Logistics Center**

Doo-Jin Park¹, Yong-Seok Choi², and Jae-Eun Lee²
(¹Tongmyoung University, ²Sunchon National University)

IT-15 : Design and Implementation of a system for monitoring and controlling farm conditions

Si-Woong Jang and Dong-Hun Jung(Dong-eui University)

IT-16 : Development of Software Education Board Game to improve algorithmic thinking ability

Ji-Yeon Hong(Korea National University of Education)

IT-17 : A Development of Learning Model to Industry Education for Appropriate Technology using Open Source

Semin Kim¹, Jeongwon Lee², Byungil Jeon², and Choong Ho Lee²
(¹Jeonju National University of Education, ²Hanbat National University)

IT-18 : Development of STEAM-Based Software Education Program

Jeong-Beom Song
(Chungcheongnamdo office of Education Research and Information Institute)

IT-19 : Analysis of Learning Satisfaction in Programming Classes by Types of Programming Language and Tools

Semin Kim¹ and Kangsoo You²
(¹Jeonju National University of Education, ²Jeonju University)

- IT-20 : Visualization of Remote Monitoring of Structural Displacement**
Young-Dal Son and Chang-Soo Eun(Chungnam University)
- IT-21 : Electric Signal Measuring Device Using Android Smartphone Application**
Young-Dal Son and Chang-Soo Eun(Chungnam University)
- IT-22 : Design of Prediction of Student Career Model Using Tensorflow based Deeplearning**
Geun-Ho Kim and Eui-Jeong Kim(Kongju National University)
- IT-23 : Introduction of Auto-Ethnography as a means to assess Novel Engineering**
Ki-Cheon Hong(Jeonju National University of Education)
- IT-24 : Implement of Smart Statistical Information System for Companies in Distripark**
Doo-Jin Park¹, Jung-Yee Kim², and Eun-soo Kim¹
(¹Tongmyong University, ²Korea Maritime Institute)
- IT-25 : Development and Application of Robotics Education Program based on Entrepreneurship for Engineering College Students in IT major**
Sungae Kim¹, Chang-Hae Kim², and Soon-Duk Jee³(¹Osan University, ²Korea Research Institute of Chemical Technology, ³Jongchon middle school)
- SC-2 : One-Dimensional Analytical Model of L-Shaped Tunnel Field-Effect Transistor**
Yun Seop Yu¹ and Nam Ho Kim²
(¹Hankyong National University, ²Korea Institute of Industrial Technology)
- SC-3 : Effects of rubbing condition on solution-derived zinc oxide surface for liquid crystal alignment**
Hong-Gyu Park and Bong-Jin Ko(Changwon National University)
- SC-4 : Effect of nanoparticle size on the alignment of nanoparticle/liquid crystal mixtures**
Chan-Woo Oh and Hong-Gyu Park(Changwon National University)
- UN-1 : Power based MAC protocol for Relay Node Selection in Energy-Harvesting Wireless Sensor Networks**
Kyuwook Shim, Hanjong Kim, and Hyung-Kun Park(KOREATECH)

Session CA-B : Communication System and Application**Session SC-C : Semiconductor and Communication Services**

Session Chair : Se-Min Kim(Jeonju National University of Education)

11:00~11:50 (Crystal Room #2)

CA-2 : App Inventor Programming Based on Software Engineering
Kie-Sung Oh(Tongwon University)

CA-3 : Development and Effect of Stepwise Simulation-based Communication Education Program for Nursing Students
Hyun-Ju Kim(Catholic University of Pusan)

CA-4 : Automatic Channel Selection of Radio Broadcasting using Bigdata Analysis
O. Bayarmaa¹, Eun kyoung Chae¹, Jeongwon Lee^{1,2}, and Won jong Park¹
(¹Euclidsoft, ²Hanbat National University)

CA-5 : LoRa Class C based Data Collection Speed Improvement Algorithm for Extending LPWA Coverage
Hyuk Kwon, Kyoung-Bog Jin, and Chang-Heon Oh(KOREATECH)

CA-6 : Design of Low Power Operation Algorithm based on LPWA to Continue Localization of Buoys Located in the Ocean
Min-Ho Jeon¹, Hyung-Dong Choi¹, Choon-Sik Yim¹, and Chang-Heon Oh²
(¹RCN, ²KOREATECH)

CA-7 : LPWA 920 MHz Antenna for Subminiature IoT Sensors
Seong-Real Lee(Mokpo National Maritime University)

CA-8 : Theoretical Bound for Sparse Defects in Group Testing Problems
Jin-Taek Seong(Mokpo National University)

CA-9 : An Efficient Radio Communication for Fire Fighting Communication Using DMR(Digital Mobile Radio)
Hyun-Yul An and Chang-Kyu Kim(Dong-eui University)

CA-10 : Design of Automatic Inspection System for Maintenance of Unmanned Security Facility
Chae-young Moon¹, Semin Kim², and Kwang-ki Ryoo¹
(¹Hanbat National University, ²Jeonju National University of Education)

CA-11 : Use of Web-based Counseling and Psychological test in South Korea
Jisun Park(Catholic University of Pusan)

- SC-5** : **Effects of heat treatment on ion-beam irradiated polydimethylsiloxane layers for liquid crystal alignment**
Hong-Gyu Park and Jung-Keyng Choi(Changwon National University)
- SC-6** : **Modification of poly(dimethylsiloxane) for surface wrinkle structure formation**
Hong-Gyu Park and Seung-Yub Park(Changwon National University)
- SC-7** : **A Multi-Functional Cryptography Accelerator Supporting ARIA/AES-based GCM, ECC and SHA-256**
Kyung-Wook Shin¹, Sang-Hyun Lee¹, and Byung-Yoon Sung²
(¹Kumoh National Institute of Technology, ²Nextchip Co)
- SC-8** : **Design of a gate drive chip for driving active balancing circuit devices and its measurement**
Younghee Kim¹, Hongzhou Jin¹, Juwon Baek², and Panbong Ha¹
(¹Changwon National University, ²Korea Electrotechnology Research Institute)
- SC-9** : **Design of Ionizer Module Circuit with Fault Detection Function**
Hongzhou Jin, Panbong Ha, and Younghee Kim(Changwon National University)

27th June, 2019

Session IS-A : Intelligent Information System

Session Chair : Hee-Cheol Kim(Inje University)

09:00~10:15 (Crystal Room #1)

- IS-1 : Engine State Monitoring System Using ID Priority Allocation of CAN network**
Hyun Lee(Korea Polytechnic)
- IS-2 : Study on Recognition of Hand Gestures Using Convolutional Neural Network**
Buemjun Kim and Kyounghee Lee(Pai Chai University)
- IS-3 : A Web Server Implementation Providing Tensorflow-based Artificial Intelligence Platform**
Hyun-Jun Park and Kyounghee Lee(Pai Chai University)
- IS-4 : HPC/HC opt-aiNet-based Scheduling**
Arief Zulianto, Kuspriyanto, and Yudi S. Gondokaryono
(Institut Teknologi Bandung)
- IS-5 : An Immune-Inspired Algorithm for Vehicle Routing Problem**
Ayi Purbasari¹, Handoko Supeno¹, and Achmad Nizar Hidayanto²
(¹Universitas Pasundan, ²Universitas Indonesia)

Session IB-B : IoT and Big Data

Session MD-A : Multimedia and Digital Convergence

Session DA-A : Database and Internet Application

Session Chair : Dong-Sik Jo(Wonkwang University)

10:25~11:40 (Crystal Room #1)

- IB-1 : Multi-index Approach to Search Chinese, Japanese, and Korean Text with Elasticsearch 6.6**
Kiju Kim¹ and Youngbok Cho²(¹Elastic, ²Daejeon University)
- MD-1 : Human Activity Recognition Techniques using Deep Learning under Smartphone Acceleration Sensor**
Teuk-Seob Song(Mokwon University)

MD-2 : An Analysis Keyword in SNS Environment Utilizing Big Data

Soo-Tai Nam¹, Seong-Yoon Shin², and Chan-Yong Jin¹
 (¹Wonkwang University, ²Kunsan University)

MD-3 : Analysis of Student Teachers' Requirement of Software Education at National Universities of Education

Young-Sik Jeong(Jeonju National University of Education)

DA-1 : Factors Improving the Performance of IT Investment in Corporates: Focusing on the Moderating Effect of IT Savviness

Moon Junghoon¹, Yoo Sunggoo¹, and Lee Jongtae²
 (¹Seoul National University, ²Seoul Women's University)

Session IS-B : Intelligent Information System**Session IB-C : IoT and Big Data**

Session Chair : Sung-Hee Woo(Korea National University of Transportation)

09:00~09:50 (Crystal Room #2)

IS-6 : Change of malicious code API call pattern extraction using RNN and LSTM

Young-Bok Cho¹, Ki-Ju Kim², Jeong-Ah Ku¹, and Sung-Hee Woo³
 (¹Daejeon University, ²Elastic, ³Korea National University of Transportation)

IS-7 : Drowsiness Preventing System using YOLO

Tan Xujie¹ and Seong-Yoon Shin²
 (¹Jiujiang University, ²Kunsan National University)

IS-8 : Improving Text Classification Technique

Liu Xiao-Wen¹, Guangxing Wang², Abdur Razzaq Fayjie³, Hyun-Chang Lee⁴,
 and Seong-Yoon Shin⁵(¹Hebei Normal University for Nationalities, ²Jiujiang
 University, ³Dibrugarh University, ⁴Wonkwang University, ⁵Kunsan National
 University)

IS-9 : Performance and energy efficiency analysis of Cache Memory Architecture in GPGPU

Cheol-Won Jo, Seong-Hun Lee, and Kwang-Yeob Lee(Seokyeong University)

IS-10 : Gaussian denoiser: Noise prediction using U-Net with additional skip connection.

Sung-Hun Lee, Cheol-Won Jo, and Kwang-Yeob Lee(Seokyeong University)

- IS-11 : Performance Analysis of Spatiogram based Tracking Method**
Jeongin Kwon¹, Sohee Son¹, Jinwoo Jeon², Injae Lee², and Haechul Choi¹
(¹Hanbat National University, ²Electronics and Telecommunications Research Institute)
- IS-12 : Optical Flow-based Unmanned Aerial Vehicles Tracking**
Sohee Son¹, Jinwoo Jeon², Injae Lee², and Haechul Choi¹(¹Hanbat National University, ²Electronics and Telecommunications Research Institute)
- IS-13 : Attitude and Position Control using Dynamic Modeling of Quadrotor Flight**
Sangsin Jeon and Taeseok Jin(Dongseo University)
- IB-5 : Multilevel Analysis on Factors Affecting Fundus Examination Using Big Data**
Min-Kyoung Kim¹ and Young-Bok Cho²(¹SONOUM, ²Daejeon University)
- IB-6 : Design of Dataset for Analyze the Learning Patterns of Students who Passed the Test**
Yu-Doo Kim and Pil-Du Hong(Korea Polytechnics)
- IB-7 : Blockchain-based Contract Mechanism using DHT for Privacy**
YongJoo Lee¹, Keon Myung Lee¹, and Sung-Hee Woo²
(¹Chungbuk National University, ²Korea National University of Transportation)
- IB-8 : Design of Selective Deduplication Algorithm for Various File Format**
In-Cheol Hwang and Oh-Young Kwon(KOREATECH)
- IB-9 : Implementation of a Real Time Object Control System Using Open Source Hardware**
Chang-Gyu Seong¹, Jung-Yee Kim¹, and Doo-Jin Park²
(¹Pusan National University, ²Tongmyong University)
- IB-10 : A Study on the Automatic Detection of Wild Animals that Cause a Great Damage to the Crops**
Byungil Jeon¹, Semin Kim², Jeongwon Lee¹, and Choong Ho Lee¹
(¹Hanbat National University, ²Jeonju National University of Education)
- IB-11 : Implement of Last-Mile Delivery System Based on IoT**
Doo-Jin Park(Tongmyong University)
- IB-12 : A Study on the Pricing of Parallel Importation Products Using Big Data**
Doo-Jin Park¹ and Woo-Sun Kim²
(¹Tongmyong University, ²Korea Maritime Institute)

IB-13 : On Recommending Additional Speed Cameras for Reducing Accidents Based on Sections and Existing Speed Cameras

Athita Onuean¹, Hanmin Jung^{1,2}, and Daesung Lee³

(¹University of Science and Technology, ²Korea Institute of Science and Technology Information, ³Catholic University of Pusan)

Session IS-C : Intelligent Information System

Session MD-B : Multimedia and Digital Convergence

Session NS-C : Networking and Services

Session Chair : Young-Woon Woo(Dong-eui University)

10:00~10:50 (Crystal Room #2)

IS-14 : Adult Access Detection System based on Clothing Information

Seong-Yoon Shin¹ and Hyun-Chang Lee²

(¹Kunsan National University, ²Wonkwang University)

IS-15 : An IoT-Based Object Detection and Alerting System for Livestock Disease Prevention

Wonseok Jung¹, Hyeon Park², Se-Han Kim², and Jeongwook Seo¹

(¹Namseoul University, ²IoT Research Department Electronics and Telecommunications Research Institute)

IS-16 : Comparison of Machine Learning Models for Solar Energy Prediction

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Jong-Sung Lee, Min-Ho Jeon, and Chang-Heon Oh(KOREATECH)

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IS-20 : An Effective Method for Generating Color Images Using Genetic Algorithm

Joo Hyoung Cha and Young Woon Woo(Dong-eui University)

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Sangjoon Park and Jongchan Lee(Kunsan National University)
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- MD-8 : A Comparative Study of Teacher's Recognition for Multicultural Gifted: Korea and Russia**
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- NS-7 : A Study on Event Log Validity Analysis for Detecting Threats by Insiders in Control System**
JongMin Kim¹, MinSu Kim¹, and DongHwi Lee²
(¹Kyonggi University, ²DongShin University)

Session MD-C : Multimedia and Digital Convergence

Session DA-B : Database and Internet Application

Session Chair : Seong-Yoon Shin(Kunsan National University)

11:00~11:50 (Crystal Room #2)

- MD-9 : Use of Tesla's Columbus egg for Physics Demonstration & Development of Teaching-Learning Materials**
Hee-Mok Kim¹ and Chan-Soo Jee²(¹KAIST, ²Kangwon National University)
- MD-10 : A Study on specific region detection and recognition based on Transfer-Learning and Data Augmentation**
Kwang-Seong Shin and Dong-Sik Jo(Wonkwang University)
- MD-11 : Usability evaluation on smartphone app of module kit for DIY smart toy**
Hun Choi and Yoo-Jung Choi(Catholic Univ of Pusan)
- MD-12 : Forecast Likelihood of Stock Trading Price Based on Big Data Analysis**
Soo-Tai Nam¹, Chan-Yong Jin¹, and Seong-Yoon Shin²
(¹Wonkwang University, ²Kunsan University)

- MD-13 : A Study on Preference of Mobile Unlocking Methods Using Delphi and AHP (analytic hierarchy process)**
Soo-Tai Nam¹, Seong-Yoon Shin², and Chan-Yong Jin¹
(¹Wonkwang University, ²Kunsan University)
- MD-14 : Image-based Meter Digit Recognition**
Min-Seop Kim and Haechul Choi(Hanbat National University)
- DA-2 : Cloud-based Field-Oriented ERP Development**
Dai-Hyun Jang¹, Ki-Hong Park², Jong-Seok Lee³, and Seong-Yoon Shin²
(¹DaiShin I&C Co, ²Kunsan National University, ³Woosuk University)
- DA-3 : Deep Learning Method for Animal Image Classification**
Abdur Razzaq Fayjie¹, Guangxing Wang², Hyun-Chang Lee³,
and Seong-Yoon Shin⁴(¹Dibrugarh University, ²Jiujiang University,
³Wonkwang University, ⁴Kunsan National University)
- DA-4 : Product Recommendation System**
Doyeun Hwang¹, Hankil Kim², Inshik Kang², and Hoekyung Jung¹
(¹Paichai University, ²Korea University of Media Arts)
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Moon-Sun Shin¹, Seon-Min Hwang¹, and Kyeong-Ja Jeong²
(¹Konkuk University, ²Chung Cheong University)
- DA-6 : Bowwow: Stress Monitoring Platform based on Heart Rate Variability of Dog**
Jeong-Hee Chi, Chae-Eun Lee, Hui-Won Yang, and Moon-Sun Shin
(Konkuk University)
- DA-7 : A Study on Smart Factory Construction Method for Efficient Production Management in Sewing Industry**
Jung-Cheol Kim and Il-Young Moon(KOREATECH)
- DA-8 : Corresponding Design for Wireless Communication Network Failure Suppression for Narrow space**
Na-Ra Jeong, Kam-Yeon Lee, and Hyun-Ju Park(Infoworks Corp)
- DA-9 : Workload Balancing of Hadoop Tasks Based on Availability of Nodes**
Wooseok Ryu(Catholic University of Pusan)

An Immune-Inspired Algorithm for Vehicle Routing Problem

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Abstract

Combinatorial optimization is a problem of finding discrete feasible solutions and its best solution for all feasible solutions. The Travelling Salesman Problem (TSP) and Vehicle Routing Problem (VRP) are the common problems of combinatorial optimization. In VRP, we need to find the optimal set of routes for a vehicle to traverse in order to deliver to a given set of customers. VRP generalises TSP (multi-TSP) and the objective of the VRP is to minimize the total route cost. Many approaches and algorithms proposed by researchers nowadays. In this paper, we propose an Artificial Immune System's algorithm as a promising new VRP algorithm. We use the Clonal Selection Algorithm (CSA) which is an immune-inspired algorithm based on Clonal Selection Principle. This approach is implemented and tested on various dataset of waste transportation In Northern Bandung, West Java, Indonesia. The preliminary results are promising and lead to believe that the Clonal Selection Algorithm is a viable approximation heuristic for the VRP.

Index Terms: Vehicle Routing Problem, VRP, Optimization Problem, Combinatorial Problem, Artificial Immune System, Clonal Selection Algorithm, Immune-Inspired Algorithm, Bio-inspired Algorithms.

I. INTRODUCTION

Vehicle Routing Problem (VRP) is an optimization problem in determining routes with limited vehicle capacity. There is an initial depot and a number of n locations with various demands. A vehicle departs from the initial depot, visits all locations to fulfill requests from each location [1]. The purpose of this problem is to minimize the total distance traveled by the vehicle by arranging the order of places to visit along with when the vehicle will return to fill its capacity again [1].

Basically, VRP can be solved using multi-Traveling Salesperson Problem (mTSP), where a traveling merchant must visit the entire city exactly once, and return to his hometown. At mTSP, there are m traveling traders who each visit a particular city exactly once, and return to the original city [2]. MTSP is a complex problem, namely a difficult problem where there is no solution with a polynomial time to solve it and requires a non-polynomial-time algorithm (NP Problem). In resolving NP problems, the exact approach cannot handle the problem large. The heuristic approach is the choice of solutions, namely a quick approach to get a feasible solution. Artificial Immune System (AIS) [3] is one of bio-inspired computing inspired by the behavior of the immune system that is adaptive and self-organizing. AIS has many roles in the issue of learning, optimization, and

intrusion detection [3]. This paper investigate AIS algorithm to solve VRP with mTSP approach, for Bandung waste transportation. Systematically, this paper contains an introduction, system model and methods, related research, results and conclusions, and acknowledgments.

II. SYSTEM MODEL AND METHODS

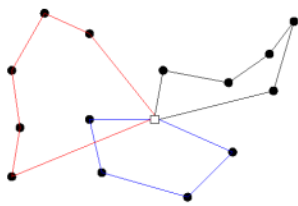


Fig. 1 VRP with 3 vehicles

3.1 VRP and mTSP Solution Approach

VRP is a combinatorial problem which can be seen as an extension of the classic problem Traveling Salesperson Problem (TSP). With the mTSP approach, the solution is obtained by transforming the mTSP into a TSP. The following [Fig. 1] is an overview of VRP problems with 3 vehicles. Basically, the VRP problem is to consider the optimal route while taking into account the capacity loading limits.

3.2 Proposed mTSP solutions with AIS

With the mTSP solution approach, the VRP problem can be seen as a mTSP problem with TSP resolution. For the TSP problem itself, there are several solutions that use the immune system-inspired metaheuristic approach. Especially for Traveling Salesperson Problems, AIS was used for the first time by Castro and Von Zuben [4]. Subsequent research was conducted by M. Bakhouya and J. Gaber [5], where the researchers proposed immune based algorithms and compared them with ant colony approaches from other researchers.

This [Fig. 2] shows the Clonal Selection Algorithm. By using the AIS approach, the first step in solving the problem of combinatorial optimization is to map the problems and elements contained in AIS [4][6]. Based on the TSP approach, CSA is used to solve the mTSP problem. The first thing to do is the representation of the mTSP problem in the form of the mTSP domain like this [Fig. 3] below:

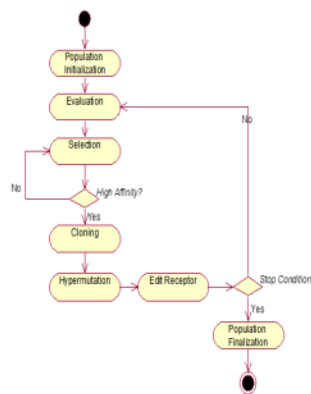


Fig. 2 Clonal Selection Algorithm (CSA)

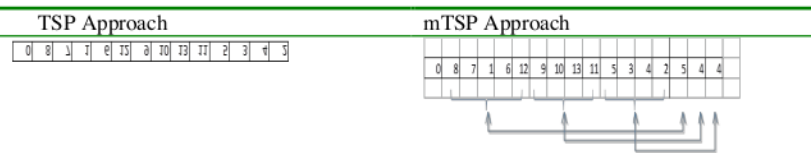


Fig. 3 TSP and mTSP representation of 14 vertices with node 0 as depot [7]

In the case of mTSP this is two-part representation. The first part represents the tour and the second part represents salesmen. This shows that the first salesmen were in charge of visiting 5 cities, while the second and third salesmen were in charge of visiting 4 cities.

III. RESULT

A. Experiment Design

We use Java programming language to implement the algorithm with this experiment design:

Dataset	Waste transportation In Northern Bandung, West Java, Indonesia: Bandung36.vrp and Bandung148.vrp
VRP parameter:	Number of vertices: 36 or 148 Number of salesmen: between 2- 17 and between 2 - 74
CSA parameters	Number of population (N) = 50; Selection size (n) = 10; The value for the cloning factor (β) = 0.1; Value for mutation factor (rho) 2.5; Size for random replacement (d) = 5
Determination of criteria stops	Number of generations (g) = 1000, 10,000, 100,000

B. Experiment Result

This below show the experiment result for dataset Bandung36.vrp.

Table 1 mTSP for North Bandung waste transportation

Number of salesmen	Sub-tour Cost	Total Cost
2	1106 434	1540
3	66 1102 1064	2232
4	865 108 113 1263	2369
5	994 254 222 643 251	2364
6	250 377 42 1260 168 408	2505
7	693 42 106 930 222 40 936	2969
8	72 40 780 206 42 1031 156 222	2540
9	890 66 108 222 168 42 72 40 667	2245
10	42 1043 222 283 108 206 156 543 40 66	2719
11	959 72 40 42 206 147 222 156 66 108 968	2976
12	1007 206 156 42 168 66 222 106 40 146 108 472	2739
13	974 42 423 108 72 40 198 206 156 66 106 476 222	3089
14	206 66 474 156 198 106 685 146 40 222 42 72 108 880	3401
15	601 42 250 803 168 222 106 206 40 198 146 72 156 108 453	3571
16	494 108 168 606 40 66 156 106 222 250 42 146 250 206 72 780	3712
17	222 206 278 40 338 1007 66 106 250 108 198 146 288 168 42 72 156	3741
18	892 206 42 146 108 198 338 66 72 156 250 40 106 290 311 278 222 168 3889	



Fig. 4 Best cost for each salesmen (36 nodes)

Fig. 5 result of mTSP for 148 nodes of Bandung waste points.

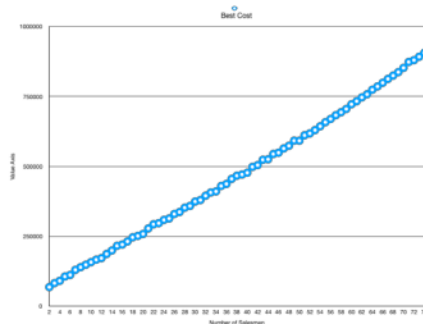


Fig. 5 Best cost for each salesmen (148 nodes)

We can see, the number of salesmen has increased in line with the best costs obtained. The best best cost is obtained for the number of salesmen = 2. This is consistent with the two dataset.

IV. DISCUSSION AND CONCLUSIONS

A. DISCUSSION

In this paper, a clonal selection based algorithm was proposed for solving the VRP with mTSP approach. This algorithm is can show solution for mTSP for Bandung waste transportation dataset. Two dataset in experiments show that the best cost (minimal cost) result from 2 salesmen / driver in VRP. This is because, the cost represent distance between nodes. Actually we need other representation of cost, like capacity of the truck and the time limit as VRP constraint. This is will be future research.

B. CONCLUSION

VRP can be solved by mTSP approach using bio-inspired computation like Clonal Selection Algorithm. This algorithm has been shown the good performance, but has several limitations since the need to define constraint for the VRP constraints.

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REFERENCES

- [1] Yeun, Liong Choong, Ismail, W., Khairuddin, O., & Zirour, M. (2008). Vehicle Routing Problem: Models and Solutions. *Journal of Quality Measurement and Analysis*, 205-218.
- [2] Bektas, T. (2006). The multiple traveling salesman problem: an overview of formulations and solution procedures. *OMEGA: The International Journal of Management Science*, 34(3), 209-219.
- [3] Alsharhan S, J.R. Al-Enezi. Abbod MF, "Artificial Immune Systems – Models , Algorithms and Applications," *International Journal of Research and Reviews in Applied Science (IJRRAS)*, pp. 118-131, May 2010.
- [4] Leandro N. de Castro and Fernando J. Von Zuben, "Learning and Optimization Using the Clonal Selection Principle," *IEEE Transactions On Evolutionary Computation*, vol. 6, no. 3, pp. 239-251, June 2002.
- [5] Gaber J Bakhouya M, "An Immune Inspired-based Optimization Algorithm : Application to the Traveling Salesman Problem," *AMO - Advanced Modeling and Optimization*, vol. 9, no. 1, pp. 105-116., 2007.
- [6] Jason Brownlee, "Clonal Selection Algorithms," Complex Intelligent Systems Laboratory, Centre for Information Technology Research, , Faculty of Information Communication Technology, Swinburne University of Technology, Melbourne, Australia , Technical 2009.
- [7] Purbasari, A., Suwandi, I. S., Santoso, O. S., & Mandala, R. (2014). A New Approach to Solve Multiple Traveling Salesmen Problem by Clonal Selection Algorithm. *International Journal of Applied Engineering Research*, 9 (21).

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