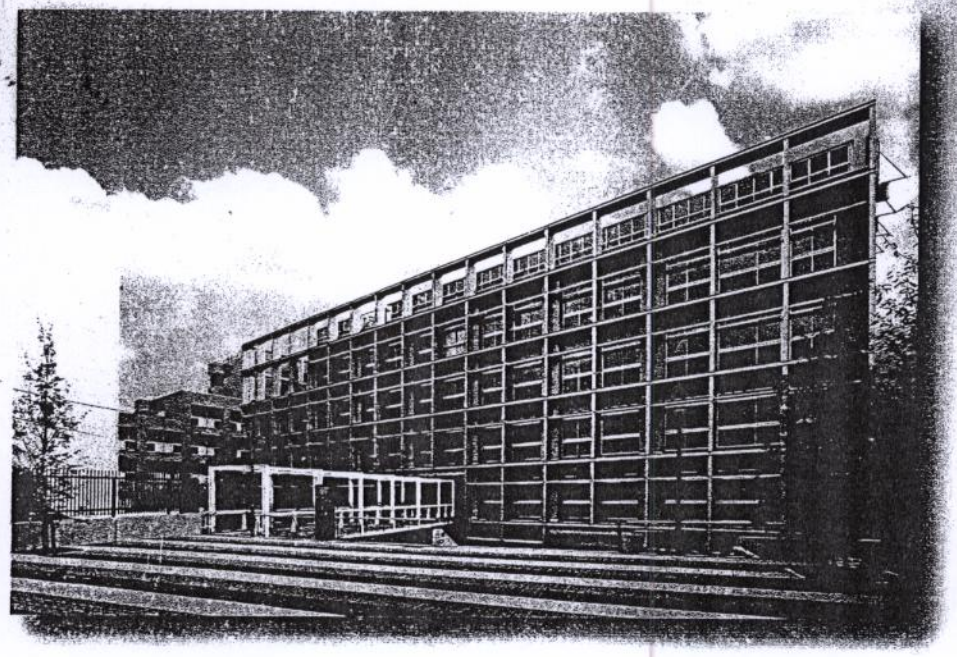
30th JSST Annual Conference (JSST 2011)
International Conference on Modeling and Simulation Technology

Final Program and Abstracts

October 22-23, 2011
Tokai University Takanawa Campus,
2-3-23, Takanawa, Minato-ku, Tokyo, 108-8619, JAPAN

JSST 2011



Organized by
Japan Society for Simulation Technology (JSST)
Supported by
Tokai University Takanawa Campus

30th JSST Annual Conference (JSST 2011)
International Conference on Modeling and Simulation Technology

October 22-23, 2011,
Takanawa Campus of Tokai University, Tokyo, Japan

Ginza, Tokyo :

Call For Papers

ABOUT JSST 2011:

International Conference JSST 2011, which is sponsored by Japan Society for Simulation Technology (JSST) will be held to explore challenges in methodologies for modeling, control and computation in simulation and their applications in various fields including social, economic and financial as well as already established scientific and engineering solutions. For more details, visit the homepage of JSST: http://www.jsst.jp/e/JSST2011.

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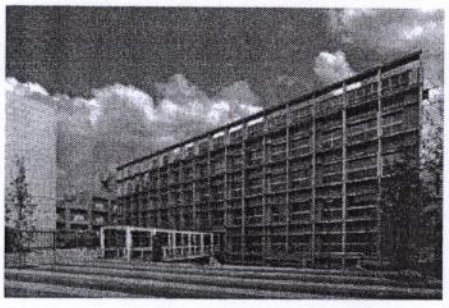
Steering Committee:
Administrative board members of JSST

CONFERENCE VENUE:

The Conference will take place in Tokyo at the Takanawa Campus of Tokai University:
http://www.u-tokai.ac.jp/international/campus/takanawa.html

Takanawa Campus of Tokai University:



TOPICS:

Artificial Intelligence, Brain Science, Computational Engineering, Evolutionary Computation, Financial Engineering, Fluidics, Fuzzy Control, Genetic Algorithms, Innovative Computations, Management Simulation, Micro Machines, Mobile Vehicle, Monte Carlo Simulation, Neural Networks, Neurocomputers, Numerical Simulation, Risk Handling, Robotics, Virtual Reality, Visualization, Other Related Fields.

PROCEEDINGS:

Electronic proceedings (CD-ROM) are delivered during the conference. For selected papers, the conference makes official recommendation to be re-submitted to one of the following journals:

- International Journal of Simulation Technology (IJST)
- Transaction of the Japan Society for Simulation Technology (in Japanese).

IMPORTANT DATES:

March 15, 2011	Submission of proposals for organized sessions
May 15, 2011	Submission of an extended abstract (within 2 pages, PDF format)
July 10, 2011	Notification of acceptance
August 20, 2011	Submission of the full text of the paper (within 8 pages, PDF format)

CONTACT ADDRESS:

Noriyuki Komine (Tokai University) E-mail: jsst2011@ml.tokai-u.jp

(CFP Version 2010/11/02)

30th JSST Annual Conference (JSST 2011)
International Conference on Modeling and Simulation Technology

Program Overview

October 22, 2011 (Saturday)

8:40-9:40	Registration at Student Hall (Building 2, 1F)
9:40-10:00	Opening Ceremony (Bldg.2, B1, 2B101) ▪ Prof. Dr. Koji Koyamada, President of JSST ▪ Prof. Dr. Hirohisa Uchida, Member of Board of Trustees, Tokai University Educational System (TES)
10:00-11:00	Plenary Talk by Prof. Dr. Mitsunori Matsumae from Tokai University (Building 2, B1, 2B101)
11:10-12:10	Plenary Talk by Prof. Dr. Kazuyuki Aihara from the University of Tokyo (Building 2, B1, 2B101)
12:10-13:10	Lunch
13:10-15:10	Sessions (Room 1, Room 2, Room 3, Room 4, Room 5, Room 6 and Room 7)
15:10-15:30	Coffee Break
15:30-17:30	Sessions (Room 1, Room 2, Room 3, Room 4, Room 5, Room 6 and Room 7)
18:00-20:00	Banquet (Comedor Lounge, Building 4, B1)

October 23, 2011 (Sunday)

8:40-9:40	Registration at Student Hall (Building 2, 1F)
09:00-10:40	Sessions (Room 1, Room 2, Room 3, Room 4, Room 5 and Room 7)
11:00-12:00	Plenary Talk by Prof. Dr. Genki Yagawa from the University of Tokyo (Building 2, B1, 2B101)
12:10-13:00	Luncheon Session (Building 2, B1, 2B101) Panel Discussion on "A perspective on Simulation Technology"
13:10-15:10	Sessions (Room 1, Room 2, Room 3, Room 4, Room 5 and Room 7)
15:10-15:30	Coffee Break
15:30-17:30	Sessions (Room 1, Room 2 and Room 7)

30th JSST Annual Conference (JSST 2011)

International Conference on Modeling and Simulation Technology

October 22-23, 2011
Tokai University, Tokyo, Japan

Conference Program

Saturday, October 22

8:40-9:40 Registration, Building 1 (1F: Student Hall)

Building 2, Room 2B101

9:40-10:00 Opening Ceremony
Prof. Dr. Koji Koyamada, President of JSST
Prof. Dr. Hirohisa Uchida, Tokai University

10:00-11:00 Plenary Talk
"Intraoperative Imaging and Surgical Technique in the Field of Neurosurgery,"
Prof. Dr. Mitsunori Matsumae, Tokai University

11:10-12:10 Plenary Talk
"Hybrid Dynamical Systems Modelling and Simulation on Hormone Therapy of Prostate Cancer,"
Prof. Dr. Kazuyuki Aihara, The University of Tokyo

Room 1 (1201)

13:10-15:10 OS6-1: Numerical Simulation and Visualization of Nonlinear Problems (1)

(20min/talk)
Chair: Soichiro Ikuno (Tokyo University of Technology)
Co-Chair: Ayumu Saito (University of Hyogo)

20 Time-Domain FEM Analysis of Shielding Current Density in High-Temperature Superconducting Film with Crack: Application to Permanent Magnet Method,
Takayama Teruou* (Yamagata University), Ayumu Saitoh (University of Hyogo), Atsushi Kamitani (Yamagata University)

69 Nonlinear Magnetohydrodynamic Simulation of Flux Amplification and Sustainment of Spherical Torus Plasmas by Multi-pulsed Coaxial Helicity Injection,
Takashi Kanki* (Japan Coast Guard Academy), Masayoshi Nagata (University of Hyogo) Yasuhiro Kagei (RIST)

81 Multi-Objective Topology Optimization Based on Immune Algorithm for Electromagnetic Devices,
Takahiro Sato* (Hokkaido University), Kota Watanabe (Hokkaido University), Hajime Igarashi (Hokkaido University)

135 The Comparative Study of Spam Mail Classification by Rule - Based , K-Nearest Neighbor, Naive Bays and Decision Tree,
AEKKARAT LORPHICHIAN* (RMUTT)

Room 5 (4203)

13:10-15:10 R-CO-1: Control and Optimization (1)
(20min/talk)
Chair: Taworn Benjanarasuth (KMITL)

17 Real-time Model Predictive Control of Torsional Vibration System,
SUNGWAN BOKSUWAN* (KMITL), Taworn Benjanaraauth, Jumrus Rattanayukol,

31 Optimal H2 Integral Servo Controller with Derivative State Constrains for Suppressing under Damping of Oscillatory System,
Wahei Ichiyama* (Tokai University), Noriyuki Komine (Tokai University), Masahiro Yoshida, Taworn Benjanarasuth (KMITL)

43 Simulation All-Pass Filter using OTA-URC,
Atichaya Klungtong* (RMUTT), Wanchalerm Chanwattanapong (Rajamangala University of Technology Thanyaburi), Virote Pirajnanchai (Rajamangala University of Technology Thanyaburi) Paitoon Rakluea (RMUTT)

51 Design of Current Gain Controlled CFTA,
Kritsada Bunruang (KMITL), Tattaya Pukkalanun (KMITL), Worapong Tangsrirat* (KMITL)

52 Single DVCC-Based Current-Mode Universal Filter Using Grounded Passive Components,
Orapin Channumsin (KMITL), Sumalee Unhavanich (King Mongkut's University of Technology North-Bangkok), Worapong Tangsrirat* (KMITL)*

53 Current-mode Quadrature Oscillator Employing ZC-CFTA Based First-Order Allpass Sections,
Pratya Mongkolwai (KMITL), Teerasilapa Dumawipata (King Mongkut's University of Technology North-Bangkok), Worapong Tangsrirat* (KMITL)

15:30-17:30 R-CO-2: Control and Optimization (2)
(20min/talk)
Chair: Sutheera Puntheeranurak (KMITL)

93 An Automated Method for Angle-Closure Glaucoma Screening in Slit-lamp Images,
Kanokwan Rakjaeng* (SIIT,Thammasat University), Waree Kongprawechnon, Toshiaki Kondo (Thammasat University), kanokvate Tungpimolrut (National Electronic and Computer T), Nobuhiko Sugino (Tokyo Institute of Technology), Anita Manassakorn (King Chulalongkorn Memorial Hospital)

103 Electronically Tunable Phase-Lead Compensator Using OTAs,
Jeerasit Kongkauropthom (KMITL), Thepjit Cheypoca (KMITL),
Wandee Petchmaneelumka* (KMITL), Amata Luangpol (KMITL),
Vanchai Riewruja (KMITL)

Abstract—This paper proposes the chaotic modem system using nonlinear map and simultaneous Volterra filters for cipher and secure communications. By using the proposed structure, the sensitivity of the parameter mismatching between the transceiver and receiver sides improved, and the randomness of the generated chaotic signal is obtained in various parameters combination.

Paper ID: 72
Feature-based Gradient Orientation Structure Tensor Method

Pramuk Boonsieng, Toshiaki Kondo, and Waree Kongprawechnon
School of Information, Computer, and Communication, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Abstract— This paper presents a feature-based motion estimation technique based on gradient orientation structure tensor method (GOSTM). The GOSTM employs unit gradient vectors in place of image intensities. In this paper, we have introduced the Harris corner detector to the GOSTM. The proposed method can separate reliable estimated motion vectors from unreliable ones. We also compare the mean and standard deviation error on feature-based and block-based searching area. The proposed method can draw dense motion on reliable feature.

Paper ID: 105
Large-Scale Optimization Methods for Meteorological Data Assimilation

Y. Horibata
Faculty of Engineering, Hosei University, Japan

Abstract—Meteorological data assimilation is formulated as a nonlinear optimization problem with simple bounds on the variables. The problem has tens of thousands of variables, and can be solved efficiently only if the storage and computational costs of the optimization algorithm can be kept at a tolerable level. Two large-scale optimization methods are employed to minimize the objective function, and are compared. Numerical experiments are presented.

Paper ID: 135
The Comparative Study of Spam Mail Classification by Rule - Based, K-Nearest Neighbor, Naive Bays and Decision Tree.

Aekkarat Lorphichian 1 Thanyaporn Boonyoung1 and Niroot Por-Ngam 1
1 Department of Educational Information Technology, Faculty of Technical Education,
Rajamangala University of Technology Thanyaburi, Pratumthani, Thailand

Abstract— This research aims to study the Spam Mail classification by Rule-Based, K-Nearest Neighbor (KNN), Naïve Bays and Decision Tree. Set of reference data from the UCI Machine Learning Repository of Spam Mail Data Set. The results showed that the highest accuracy is Rule-Based 90%, Decision Tree 81.74%, KNN 79.13% and Naive Bays 71.96%. A high dimension dataset suitable of Rule-Based and Decision Tree technique most. Tendency of class are naturally affect to lowest performance accuracy. Selection of attributed, total data per dataset, amount of data in each of training should be similar will effect to performance improve.

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JSST2011 Session Program Schedule, October 22-23, 2011

Saturday, October 22

	Room 1 (1201)	Room 2 (1202)	Room 3 (1203)	Room 4 (1204)	Room 5 (4203)	Room 6 (1B205)	Room 7 (4204) Japanese Sessions
8:40-9:40	Registration at Student Hall (Building 1, 1F)						
9:40-10:00	Opening Ceremony (Building 2, B1, 2B101) Prof. Dr. Koji Koyamada, President of JSST Prof. Dr. Hirohisa Uchida, Tokai University						
10:00-11:00	Plenary Talk (Building 2, B1, 2B101) Intraoperative Imaging and Surgical Technique in the Field of Neurosurgery Prof. Dr. Mitsunori Matsumae, Tokai University						
	Coffee Break						
11:10-12:10	Plenary Talk (Building 2, B1, 2B101) Hybrid Dynamical Systems Modelling and Simulation on Hormone Therapy of Prostate Cancer Prof. Dr. Kazuyuki Aihara, The University of Tokyo						
	Lunch						
13:10-15:10	OS 6-1	OS 3-1	OS 5-1	Computational Engineering	Control and Optimization (1)	OS 7-1	Simulation Method (1)
	Coffee Break						
15:30-17:30	OS 6-2	OS 3-2	OS 5-2	Numerical Simulation	Control and Optimization (2)	OS 7-2	Computation & Simulation
	Conference Banquet (Comedor Lounge, Building 4, B1)						

Sunday, October 23

8:40-9:40	Registration						
9:00-10:40	OS 6-3	OS 10	OS 9	Mobile	Control and Optimization (3)		Signal Processing & Telecommunication Network
	Coffee Break						
11:00-12:00	Plenary Talk (Building 2, B1, 2B101) A Perspective on Simulation Technology Prof. Dr. Genki Yagawa, The University of Tokyo						
12:10-13:00	Luncheon Session (Building 2, B1, 2B101) Panel Discussions on "A Perspective on Simulation Technology "						
	Coffee Break						
13:10-15:10	OS 2-1	OS 1-1	OS 8	Simulation Method	Soft Computing		Structural Analysis & Simulation
	Coffee Break						
15:30-17:30	OS 2-2	OS 1-2					Simulation Method (2)

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30th JSST Annual Conference (JSST 2011)
International Conference on Modeling and Simulation Technology

Welcome to JSST 2011 in Tokyo

On behalf of the Japan Society for Simulation Technology, I am pleased that we successfully hold our annual conference which has been transformed into the international one. I think that this accomplishment is owed to the efforts of our committee members. We sincerely thank those who accept our invitation to invited talks and representatives of our relevant societies who participate in our panel discussion. It is very important to adopt the reviewing system in order to accept high-quality oral presentation papers in our international conference. An electronic reviewing system is indispensable for excellent researchers to efficiently review papers. It is our honor that our committee members have successfully installed the paper reviewing system of which we can make full use although we were running out of time.

Our progress on the internationalization has been attributed to the excellent leadership of successive presidents. Our society had organized five international conferences with success including what our former society did. In AsiaSim2009 which took place in Ritsumeikan University, our society asked for the establishment of Federation of Asian Simulation Societies (FASS) which are composed of Singapore and Thailand in addition to China, Korea and Japan which had organized the AsiaSim conference by turns. The establishment will be completed at AsiaSim2011 which will take place in Seoul University. Our society is also finalizing our publication of a new English journal at 2013 by Springer.

Japan, which suffered from the 2011 off the Pacific coast of Tohoku Earthquake, has been being revived through the warm-hearted aid from many countries including yours. Unfortunately, I was in Shinkansen when the earthquake struck us. I was truly surprised to find that it was so crowded near the Shinagawa station with many people who were at a loss when I arrived in seven hours late. I hope that you find an indication of the revival in the facial expression of people whom you have met around Shinagawa. Although we had suffered from the earthquake followed by Tsunami and nuclear crisis, we truly confirmed a strong bond with the world countries. Especially for our society, we recognized the importance of the simulation technologies with respect to the "look before you leap." The simulation generates tremendous size of datasets. If we fail to take care of them, we might be drowned in the flood of datasets. Currently, we are preparing for educating people about simulation.

I would like all the participants to enjoy this international city, Tokyo and deepen our mutual understanding. Especially I would like to ask many of you to join the invited talk entitled as "A Perspective on Simulation Technology" presented by our former president, Prof. Dr. Genki Yagawa, followed by the panel discussion in the second day of the conference. We expect that the bond between us will be strengthened more tightly through the active discussion.

Koji Koyamada
JSST President
General Chair, JSST 2011

30th JSST Annual Conference (JSST 2011)

International Conference on Modeling and Simulation Technology

Welcome to JSST 2011 in Tokyo

It is our great pleasure to welcome all of you to the 30th JSST Annual Conference (JSST2011) in Tokyo, Japan. The conference is organized in cooperation with the 44 societies and one Union of Scientists and Engineers.

The conference includes three plenary talks, 157 contributed technical presentations, 5 technical exhibits and one panel discussion. The technical program consists of 130 contributed papers in the International Sessions with 27 papers in Japanese Sessions. The papers on Emergency Wired/Wireless Communication Systems on Disaster (OS1), Advanced Computer Simulation for Biomolecules and Nano Materials (OS2), Nano-Embedded Device and System Design (OS3), Simulation Techniques of Electromagnetic Fields Analysis (OS5), Numerical Simulation and Visualization of Nonlinear Problems (OS6), Information Visualization in Immersive Virtual Environment (OS7), Brain Simulation (OS8), Simulation and Control for Vehicles (OS9), Navigation, Guidance, and Control in Aerospace Systems (OS10) will be presented in 9 organized sessions. In addition, 10 regular sessions are also scheduled.

We hope that participants from oversea countries will have an enjoyable historical and scenic site as well as the latest technologies during their stay in Tokyo.

We would like to express our heartfelt thanks to plenary speakers for their prestigious talks, to all participants for their strong support of this annual conference, and to organizing committee members, JSST staff and volunteers for their dedicated efforts to make this conference possible and fruitful.

We are looking forward to seeing you again in JSST 2012.

Noriyuki Komine
Steering Chair, JSST 2011

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JSST 2011 Registration

Registration Hours

Saturday, October 22, 8:40-9:40

Sunday, October 23, 8:40-9:40

Registration desk is located at the first floor of building 1 in Tokai University Takanawa Campus.

On-site Registration Fee

On-site registration is possible at the registration desk during registration hours.

The registration desk doesn't accept credit cards; only cash (Japanese yen).

JSST member: 25,000 JPY

Non-member: 25,000 JPY

Registration fee covers Program book, CD-ROM, Sandwich lunch box and Banquet.

Student Registration

Students are required to present their student ID Cards at the conference registration desk. Name, university and country must be written on the registration sheet.

Student registration not includes Program book, CD-ROM, Sandwich lunch box and Banquet.

Conference Banquet

Saturday, October 22, 18:00-20:00 at the Comedor Lounge in Building 4, B1

Regular (JSST-member, Non-member): 5,000 JPY

Student (JSST-member, Non-member): 5,000 JPY

Banquet's ticket is included in the registration fee.

Facilities of Computer Room

Computer facilities are provided at computer room (1B302) in Building 1, B3.

User ID and Password are required to use the computer facilities. Please contact the secretariat at the registration desk.

30th JSST Annual Conference (JSST 2011)
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Plenary Talk

Saturday, October 22, 10:00-11:00 (Building 2, B1, Conference Hall, 2B101)

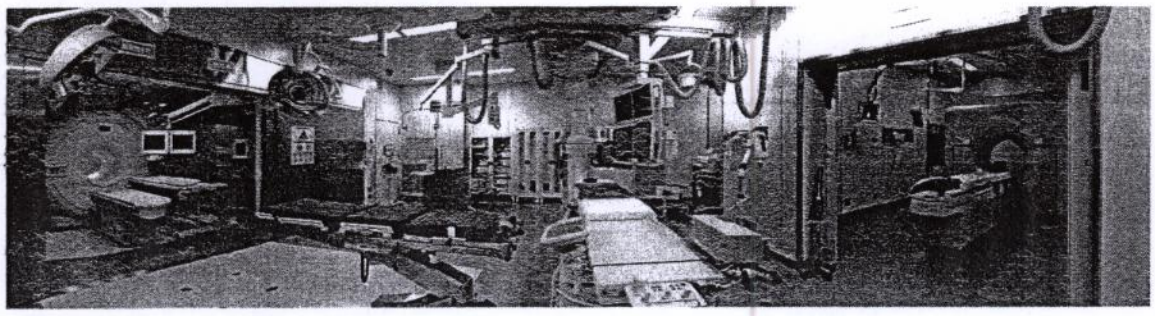
Intraoperative Imaging and Surgical Technique in the Field of Neurosurgery

Mitsunori Matsumae, M.D., D.M.Sc.
Department of Neurosurgery, Tokai University School of Medicime,
143 Shimokasuya, Kanagawa, Japan

Abstract: Magnetic resonance imaging (MRI) provides images with high soft tissue contrast, and can offer physiological information (e.g., temperature and blood and cerebrospinal fluid flow measurements) and chemical information (e.g., magnetic resonance spectroscopic imaging). In addition, MRI is a totally radiation-free imaging technique, unlike computed tomography (CT) and angiography. CT remains an excellent modality for diagnosis of bony structures and hemorrhagic lesions, and also offers a short imaging time, making CT useful for beating and pulsatile organs. CT is a particularly powerful imaging tool in the field of emergency medicine. Angiography is a sophisticated tool for vascular imaging procedures. Angiography is currently the main imaging modality for endovascular interventions, allowing excellent catheter manipulation. In the field of surgery, many optical tracking and magnetic surgical navigation systems are available. In addition, ultrasonographic systems provide the surgeon with high-quality intraoperative images. Moreover, intraoperative CT and MRI have developed dramatically over the past 20 years. In the operating theater, surgeons must identify not only approaching angles, but also lesion remnants during surgical procedures. Complementary combination of these diagnostic modalities is useful to overcome their individual weaknesses, such as imaging speed, soft tissue resolution, radiation exposure, and multi-dimensional projection imaging. Simultaneous use of imaging equipment during surgery also promises favorable outcomes for patients.

In February 2006, Tokai University Hospital in Kanagawa, Japan, was officially opened as a hybrid MRI, CT, angiography, and surgical procedure suite, named the Magnetic Resonance Imaging/X-ray/Operation suite (MRXO). Details of the MRXO and the last 5 years of experience with this suite are presented herein. A combined operation and angiography station is located in the center of the MRXO, and the magnetic resonance and computed tomography stations are each placed in adjoining bays connected to the operation/angiography station by shielded sliding doors. The operating table and tables for each imaging modality are positioned in a straight line. On top of each table is a fully magnetic- and X-ray-compatible mobile patient tabletop. The mobile patient table thus allows quick, safe movement of the patient to each modality. During the day, we use this suite for radiological interventions and surgical procedures. For nights, holidays and weekends, the suite is designated for diagnostic procedures. We have safely performed each of the various interventional procedures since opening. The specially designed operating table for the

MRXO reduces limitations on neurosurgeons that are typical of standard neurosurgical procedures. This hybrid imaging suite provides high-quality intraoperative imaging, ensuring maximum quality of diagnostic and surgical results. This suite combining surgery and imaging equipment marks a significant milestone in the improvement of stroke and brain tumor treatment and other interventional procedures. The streamlined imaging procedure also contributes to the high cost-effectiveness of the MRXO.



Biography: Prof. Mitsunori Matsumae received the M.D. degree and D.M.Sc. degree in Medical Science from Tokai University, Japan in 1982 and 1988 respectively. In 1988, he joined the Department of Neurosurgery, Tokai University School of Medicine as an assistant professor and was later promoted to an associate professor in 1999 and to a full professor in 2005. From 1990 to 1992, he served as a research fellow in Harvard Medical School and Children's Hospital Boston, Massachusetts, USA. Prof. Mitsunori Matsumae has acquired Japanese Professional Medical Physician's License, Professional Board certified in Neurosurgery and Professional Board certified in Cerebral Stroke since 1982, 1990 and 2003, respectively. He has joined the editorial boards of several scientific medical journals including "Neurologia medico-chirurgica", the official journal of the Japan Neurosurgical Society from 2006, "Neurological Surgery" from 2006 and "Neurotraumatology" from 2003. Besides academic activities, Prof. Mitsunori Matsumae is also a Member of "Confrerie des Chevaliers du Tastvin".

30th JSST Annual Conference (JSST 2011)

International Conference on Modeling and Simulation Technology

Plenary Talk

Saturday, October 22, 11:10-12:10 (Building 2, B1, Conference Hall, 2B101)

Hybrid Dynamical Systems Modelling and Simulation on Hormone Therapy of Prostate Cancer

Kazuyuki Aihara, Ph.D., Institute of Industrial Science, University of Tokyo

Abstract: In this talk, I will review our research on hybrid dynamical systems modelling and simulation to personalized hormone therapy of prostate cancer. First, I survey recent progress of hybrid dynamical systems theory and its applications to biological and medical systems. Then, I introduce our application of hybrid dynamical systems modelling and simulation to intermittent hormone therapy of prostate cancer. In particular, I show that we can make a personalized mathematical model for each patient only from observed time series data of serum PSA(Prostate-Specific Antigen) and optimize the schedule of intermittent hormone therapy on the basis of the mathematical modelling.

Reference: Ed. by K.Aihara: A theme issue on theory of hybrid dynamical systems and its applications to biological and medical systems, Philosophical Transactions of the Royal Society A, Vol.368, No.1930 (2010).

Biography: Prof. Aihara received the B.E. degree in electrical engineering in 1977 and the Ph.D. degree in electronic engineering in 1982 from the University of Tokyo, Tokyo, Japan. Currently, he is Professor of Institute of Industrial Science, Director of Collaborative Research Center for Innovative Mathematical Modelling, Graduate School of Information Science and Technology, and Graduate School of Engineering, the University of Tokyo. His research interests include mathematical modeling of biological systems, parallel distributed processing with chaotic neural networks, and time series analysis of complicated data.

30th JSST Annual Conference (JSST 2011)
International Conference on Modeling and Simulation Technology

Plenary Talk

Sunday, October 23, 11:00-12:00 (Building 2, B1, Conference Hall, 2B101)

A Perspective on Simulation Technology

Genki Yagawa, Dr. of Engineering, Emeritus Professor at University of Tokyo, Director and Professor at Center for Computational Mechanics Research of Toyo University and World Class University Professor at SungKyunKwan University

Abstract:

1. Simulation technology as a science
2. Simulation and supercomputing
3. Simulation for safety related problems
4. What we can do by simulation and what we cannot
5. Future issues

Biography: Dr. Yagawa is Emeritus Professor at University of Tokyo, Director and Professor at Center for Computational Mechanics Research of Toyo University, World Class University Professor at SungKyunKwan University, President of Nuclear Safety Research Association, President of International Association for Computational Mechanics, Member of Science Council of Japan, Board Member of Engineering Academy of Japan, Chief Editor of International Journal of Computational Methods(World Scientific) and Associate Editor or Editorial Board Member of 12 international journals. He is a Fellow of American Society of Mechanical Engineers, International Association for Computational Mechanics, Atomic Energy Society of Japan, Japan Society for Industrial and Applied Mathematics and Japan Society for Simulation Technology, Honorary Member of Japan Society of Mechanical Engineers and Japan Association for Computational Mechanics and Honorary Doctor of Iasi Technical University.

30th JSST Annual Conference (JSST 2011)
International Conference on Modeling and Simulation Technology

Luncheon Session

Panel Discussions on "A Perspective on Simulation Technology"

Sunday, October 23, 12:10-13:00,
Building 2, B1, Conference Hall ,2B101

In this panel discussion, representatives of major simulation-related academic societies in Japan discuss future of simulation technology and possible collaboration of researchers.

Chair: Shin'ichi Oishi (Waseda University)

Panelists:

Prof. Dr. Genki Yagawa (Emeritus Professor at University of Tokyo), International Association on Computational Mechanics (IACM)
Prof. Dr. Ichiro Hagiwara (Professor at Tokyo Institute of Technology), The Japan Society for Industrial and Applied Mathematics (JSIAM)
Prof. Dr. Hiroshi Okuda (Tokyo University), The Japan Society for Computational Engineering and Science (JSCES)
Prof. Dr. Koji Okamoto (Tokyo University), The Visualization Society of Japan (VSJ)
Prof. Dr. Koji Koyamada (Kyoto University), Japan Society for Simulation Technology (JSST)

JSST 2011
International Conference on Modeling and Simulation Technology
October 22-23, 2011, Tokai University Takanawa Campus,
Tokyo, JAPAN

The Comparative Study of Spam Mail Classification by Rule - Based, K-Nearest Neighbor, Naive Bays and Decision Tree.

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Rajamangala University of Technology Thanyaburi, Pratumthani, Thailand
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Abstract— This research aims to study the Spam Mail classification by Rule-Based, K-Nearest Neighbor (KNN), Naïve Bays and Decision Tree. Set of reference data from the UCI Machine Learning Repository of Spam Mail Data Set. The results showed that the highest accuracy is Rule-Based 90%, Decision Tree 81.74%, KNN 79.13% and Naive Bays 71.96%. A high dimension dataset suitable of Rule-Based and Decision Tree technique most. Tendency of class are naturally affect to lowest performance accuracy. Selection of attributed, total data per dataset, amount of data in each of training should be similar will effect to performance improve.

Keywords — Spam Mail, Rule-Based, K-Nearest Neighbor (KNN), Naïve Bays ,Decision Tree ,Spam Mail

1 Introduction

Email spam [1], also known as junk email or unsolicited bulk email (UBE), is a subset of spam that involves nearly identical messages sent to numerous recipients by email. Definitions of spam usually include the aspects that email is unsolicited and sent in bulk. One subset of UBE is UCE (unsolicited commercial email). The opposite of "spam," email which one wants, is called "ham," usually when referring to a message's automated analysis (such as Baysian filtering).

Due to the alarming increase of the spam volume and its serious impact, providing vigilantly spam fighters has recently attracted considerable attention. In addition to regulations and legislations, several technical solutions including commercial and open-source products have been proposed and deployed to alleviate this problem [2]. Installing anti-spam filters at the network gateway is among the most commonly used mechanism to block or quarantine

Classification working with categorical data or a mixture of continuous numeric and categorical data. Classification analysis might suit your needs well. This technique is capable of processing a wider variety of data than regression and is growing in popularity. You'll also find output that is much easier to interpret. Instead of the complicated mathematical formula given by the regression technique you'll receive a decision tree that requires a series of binary decisions.

Spam classification can be recast as document classification task where the classes to be predicted are spam and legitimate. In spam mail classification, the Rule-Based , K-Nearest Neighbor, Naive Bays and Decision Tree algorithm are methods for classifying objects based on closest training.

This paper proceeds as follows. Section 2 presents the four classifiers for used in this research. Section 3 describes the research methodology. Section 4 presents four classifiers for comparison and reports on performance evaluation results of those classifiers using accuracy and F measure. Section 5 concludes the findings.

2 Classifiers

2.1 Rule - Based

A rule-based system consists of if-then rules, a bunch of facts, and an interpreter controlling the application of the rules,given the facts. These if-then rule statements are used to formulate the conditional statements that comprise the complete knowledge base. A single if-then rule assumes the form 'if x is A then y is B' and the if-part of the rule 'x is A' is called the antecedent or premise, while the then-part of the rule 'y is B' is called the consequent or conclusion. There are two broad kinds of inference engines used in rule-based systems: forward chaining and backward chaining systems.

In a forward chaining system, the initial facts are processed first, and keep using the rules to draw new conclusions given those facts. In a backward chaining system, the hypothesis (or solution/goal) we are trying to reach is processed first, and keep looking for rules that would allow to conclude that hypothesis. As the processing progresses, new sub-goals are also set for validation. Forward chaining systems are primarily data-driven, while backward chaining systems are goal-driven. For an example with the following set of if-then rules

Rule 1: If A and C then Y
Rule 2: If A and X then Z
Rule 3: If B then X
Rule 4: If Z then D

2.2 K-Nearest Neighbor

The classical KNN algorithm is very simple: the aggregate patterns in a pattern space belong to the same class or at least the classes they bolong to have the same posterior distribution[1,2]. Suppose there are c classes ω_1, ω_2,.. ω_c, k-nearest neighbors, judge the majority of these k-nearest neighbors belong to some class, and then assign X to this class. Suppose k_1, k_2,...,k_c are respective sample numbers that belong to classes $\omega 1$, $\omega 2$, , ωc in k-nearest neighbors [3]. The decision function can be defined as :

$$\mu_i(X)= k_i \text{ , } i=1, 2,\dots , c \qquad (1)$$

According to this formula, the decision rule is : if

$\mu_j(X)= max k_i$, then X $\in \omega_j$.

Given a set X containing m samples, each sample has n attribues: $X_i=(x_{i1} x_{i2} xi_3 ,xi_n) \{i=(1,2, m)\}$.

Assume a sample Y=(y1,y2, ,yn) which is going to be classified, and the following is the process that finds out which class Y belongs to:

Assume K is the number of nearest neighbors.

Calculate the euclidean distances between the sample which is going to be classified and each training sample.

$$D(Y,X_i) = \sqrt{\sum_{j=1}^{n}(y_j - x_{ij})^2} \quad (2)$$

Select k minimum values in the m distance values, and the samples with these k value as the nearest neighbors. Statistics the class of these k nearest neighbors.Set the class which contains most of these k nearest neighbors as the class of new sample.

2.3 Naive Bayes

The Naive Bayes classifier applies to learning tasks where each instance x is described by a conjunction of attribute values and where the target function f *(x)* can take on any value from some finite set V. A set of training examples of the target function is provided, and a new instance is presented, described by the tuple of attribute values $<a_1,a_2,...,a_n>$. The learner is asked to predict the target value, or classification, for this new instance.

The Bayesian approach to classifying the new instance is to assign the most probable target value, v_{MAP}, given the attribute values $<a_1,a_2,...,a_n>$ that describe the instance.

$$v_{MAP} = \arg\max_{v_j \in V} P(v_j \mid a_1,a_2,...,a_n) \quad (3)$$

$$v_{MAP} = \arg\max_{v_j \in V} \frac{P(a_1,a_2,...,a_n,\mid v_j)P(v_j)}{P(a_1,a_2,...,a_n)} \quad (4)$$

$$= \arg\max_{v_j \in V} P(a_1,a_2,...,a_n,\mid v_j)P(v_j)$$

The naive Bayes classifier is based on the simplifying assumption that the attribute values are conditionally independent given the target value. In other words, the assumption is that given the target value of the instance, the probability of observing the conjunction $a_1,a_2,...,a_n$ is just the product of the probabilities for the individual attributes:

$$v_{NB} = \arg\max_{v_j \in V} P(v_j)\prod_i P(a_i \mid v_j) \quad (5)$$

2.4 Decision Tree

Decision tree learning methods search a completely expressive hypothesis space, which can avoid the partial optimization. Given a training set, a general procedure for generating a decision tree can be briefly described as follows.The entire training set is first considered as the root node of the tree. Then the root node is split into two sub-nodes based on some heuristic information. If the instances in a sub-node belong to one class, then the sub-node is regarded as a leaf node, else continue to split the sub-node based on the heuristic information. This process repeats until all leaf nodes are generated.

C4.5 is extended from the basic ID3, and their main ideas of are similar. The difference between them is C4.5 algorithm is more applicable and overcome some drawbacks of traditional ID3 [6]. Both of them generate a single decision tree, and the tree divides the training set into several subsets. Each subset is a leaf node, and each path from the root to leaf node can convert into a rule. The decision tree can be expressed by a set of rules finally. Quinlan's C4.5 works well in managing two class problem, however, when it comes to a dataset with multiclass, it often generates a tree with too many leaf nodes. So the decision tree will become serious complicated, which leads to poor generalization capability.

3 Research Methodology

Implementation of this research was to conduct research on three stages : Data preparation, Experimental Design and Accuracy calculations.

3.1 Data Preparation

In this paper we used data from the UCI Machine Learning Repository Mail (Spam Mail) detail of the data set, as shown in table 1.

Table 1. Details of Spam Mail Data Set.

Data Set	Attributed	Insance	Class
Spam Mail	58	4601	Not Spam = 2788 Spam = 1813

The dataset consists of 4601 instances of legitimate and spam email messages with 39.4% being spam. Each instance is characterized by 57 input attributes and is labeled as spam (represented as 1) or legitimate (represented as 0).The attributes include the frequency of various words (e.g."money"), the frequency of special characters (e.g. dollar sign), and the length of sequences of consecutive capital letters in the message. Attributes 1-48 give the percentage of words in the email message for the respective keyword indicated in the attribute name. Attributes 49-54 give the percentage of characters in the email message for the respective character indicated in the attribute name. Attributes 55 and 56 give the average and maximum lengths, respectively, of uninterrupted sequences of capital letters in the message. Attributes 57 gives the total number of capital letters in the message. The attribute number will be used as the variable number for models described throughout this paper. Attribute number 58 in the dataset is the true class (legitimate = 0, spam = 1).

3.2 Experimental Design

In this study we have three models as :

Model 1 : Select all attributed and separate *equal* class in test set. Model 1 used training set 3,166 instance (1,183 spam and 1,183 non-Spam) test set 460 instances and used all attributes.

Model 2 : Select all attributed and separate *Imbalance* class in test set 3,166 instance (1,050 spam and 2,116 non-Spam) test set 460 instances and used all attributes

Model 3 : Select specifically attributed and separate *Balance* class. Used attributes 1-48 give the percentage of words in the email message and training set 3,166 instance (1,183 spam and 1,183 non-Spam) test set 460 instances.

3.3 Accuracy calculation

In this study to measure the performance of the classification by Precision: P, Recall: R and F1 measure. The Accuracy calculation used WEKA software.

Our experiments adopt two popular performance measures in text classification domain: accuracy and F measure. Accuracy: Accuracy is defined by the ratio of the number of correct predictions and the number of all predictions (both correct and incorrect):

$$Acc = \frac{Ncp}{Np} x\ 100\ \%$$

where *Ncp* is the number of correct predictions and *Np* is thenumber of all predictions (i.e. the number of test samples). For a perfect classification, *Ncp* = *Np* and *Acc* = 100%. So, the Acc ranges from 0 to 100%, with 100% corresponding to the ideal, the higher the accuracy the better.

F measure: *F* measure is defined as

$$F = \frac{2R * P}{R + P}$$

Recall (R) is the percentage of the emails for a given category that are classified correctly. Precision (P) is the percentage of the predicted emails for a given category that are classified correctly. It is a normal practice to combine recall and precision to F measure so that classifiers can be compared in terms of a single rating. *F* ranges from 0 to 1, the higher the *F* measure the better.

Recall: It determines the fraction of correctly classified records actually classified as positive classes. The recall is higher when false negative is less.

$$Recall\ (R) = \frac{\mathrm{TP}}{TP + FN}$$

4 Results

Table 2. shows the accuracy of data classification techniques (Rule - Based , K-Nearest Neighbor, Naive Bays and Decision Tree) from original data set. Rules-Based reaches a maximum of 90 % accuracy and followed by Decision Tree 81.74 % accuracy.

Table 2. Accuracy of Spam Mail Classification from original data set..

Date Set	KNN	Naïve Bays	Decision Tree	Rule- Based
Original Spam mail	79.13	71.96	81.74	90.00

Table 3. shows the rule-based Precission, F1 meausure and Recall from original data set. Rules-Based reaches a maximum of 0.65.

Table 3. Precission, F meausure and Recall of Spam Mail Classification from original data set by Rule-Based classifier.

Date Set	Precision	Recall	F1
Original Spam mail	0.875	0.517	0.65

Table 4. to determine the accuracy of classification technique : KNN. Naieve Bays, Decission Tres and Rule Based. The result shows in table 3. Model 1 and model 2 the highest accuracy is 75.65 % and 72.83 % respectly. Model 3 the highest accuracy is 83.48 % in Rule-Based.

Table 4. Accuracy of Spam Mail Classification.

Model	KNN	Naive Bays	Decision Tree	Rule-Based
1	75.65	70.00	72.61	71.95
2	72.83	67.61	61.96	66.09
3	75.00	70.65	71.74	83.48

5 Conclusion

In this paper, we report our work on a Rule - Based , K-Nearest Neighbor, Naive Bays and Decision Tree . We suggest the precision in all techniques are high precision because the amount of data in a data set with a lot of training. Proper technique for the identification of the most Rule-Based. The accuracy of up to 90%. The Number of data sets in each imbalance class, resulting in lower performance accuracy.

Contributing to the identification of better classification. Is to select the attributes that fit the training data set. Amount of data in a data set should have enough practice to learn. The amount of data in each class of training data set should have a similar amount.

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