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1. Messages of Welcome

Message from General Chairs

Welcome to the Ninth International Workshop on Frontiers in Handwriting Recognition, held at Hitachi Central Research Laboratory, located in Kokubunji, Tokyo, Japan.

On behalf of the organizing committee, we are very happy to announce that we have received 120 submissions of high-quality papers representing the work of authors from 38 institutions and 24 countries. There will be 100 oral and poster presentations during this 3.5-day workshop. These presentations will cover classification techniques, shape analysis, gesture recognition, signature verification, writer identification, word and text recognition, and document applications. In addition, we will have the following key speakers.

First, we are honored to have an invited speaker, Prof. S. N. Srihari, State University of New York at Buffalo (USA), who will lecture on "Machine Learning in Questioned Handwriting Examination." Forensic applications have been evolving, and scientific and technological researches have begun sometime ago. Prof. Srihari will present a state-of-the-art forensic handwriting examination.

Second, we welcome distinguished guests - Edward J. Kuebert, US Postal Service (USA); Gerhard Stöner, Deutsche Post World Net (Germany); Joseph Ulvr, Canada Post Corporation (Canada); Dave Evans, Royal Mail (UK); and Hideo Uchida, Japan Post (Japan). They will join our panel discussion on "The Present and Future of the Postal Automation System: In Quest of More Advanced Recognition Technology." The postal application area has long benefited from the technology that has enabled the reading and interpretation of machine and handwritten postal addresses. The technological application in the next decade will be discussed from both the user's and provider's perspectives.

The Program Committee chaired by Professors F. Kimura, J. -H. Kim, A. Downton, and R. Sabourin has invited many authors who contributed high-quality papers and performed 360 reviews. The executive committee has made arrangements for the technical tours sponsored by Fujitsu Laboratories, Hitachi, NEC, and Toshiba, as well as other social

programs. Microsoft sponsored the TabletPC tutorial, another feature of this workshop. IBM's sponsorship has made it possible for us to provide student discounts. We also thank Hiroyuki Mori of Hitachi for developing a Web-based paper review management system.

We hope you all enjoy the exchange of technical and scientific ideas in our beautiful environs, especially during Japan's most colorful season.

Hiromichi Fujisawa
Guy Lorette
General Chairs

Message from Honorary Chair

Welcome to Tokyo. I am very delighted that this important workshop is now being held in Tokyo, Japan, after ICDAR in Tsukuba, 1993, and DAS in Nagano, 1998.

Pattern recognition applied to handwriting recognition and document analysis has been so successful since the commercial OCRs were produced in 1960s. Handwriting recognition will be an important scientific and technological field as long as humans write things by hand.

I convince that this workshop will be a great success in terms of science, technology, and friendship. My best wishes for a productive and enjoyable workshop. If time permits, please take the opportunity to explore and learn more about Japan.

Kazuhiko Yamamoto
Honorary Chair

Message from HCRL

On behalf of the Hitachi Central Research Laboratory (HCRL), it gives me great pleasure to welcome the Ninth International Workshop on Frontiers in Handwriting Recognition to the laboratory. The HCRL, nestled within the natural flora of the Musashino district, was established in 1942 with the mission of "Confronting today's developmental challenges, as well as pursuing research for 10 to 20 years ahead." Our research is currently focused on solution LSIs, communication devices, life science, and information technology, including handwriting recognition.

I hope you will have some time to appreciate autumn in Musashino, as well as having an exciting and stimulating time at the workshop.

Toshikazu Nishino
General Manager, HCRL

2. Committees

Organizing Committee

General Chairs

H. Fujisawa, *Hitachi, Japan*
G. Lorette, *University of Rennes, France*

Honorary Chair

K. Yamamoto, *Gifu University, Japan*

Program Co-Chairs

F. Kimura, *Mie University, Japan*
J.-H. Kim, *KAIST, Korea*
A. Downton, *University of Essex, UK*
R. Sabourin, *Ecole de Technologie Superieure, Canada*

Executive Committee

H. Sako (Chair), *Hitachi, Japan*
M. Nakagawa (Chair), *Tokyo University of Agriculture & Technology, Japan*
Y. Ishitani, *Toshiba, Japan*
M. Koga, *Hitachi, Japan*
S. Senda, *NEC, Japan*
H. Tanaka, *Fujitsu Laboratories, Japan*

Demonstration Arrangements

H. Ikeda, *Hitachi, Japan*

Advisors:

C. Y. Suen, *Concordia University, Canada*
S. Srihari, *State University of New York at Buffalo, USA*

Program Committee

A. Amin, *University of New South Wales, Australia*
E. Anquetil, *INSA/IRISA, France*
A. Biem, *IBM, USA*
A. de Souza Britto Jr, *PUCPR, Brazil*
H. Bunke, *University of Bern, Switzerland*
M. Cheriet, *Ecole de Technologie Superieure, Canada*
X. Ding, *Tsinghua University, China*
M. Fairhurst, *University of Kent, UK*
V. Govindaraju, *SUNY at Buffalo, USA*
L. Heutte, *University of Rouen, France*
S. Impedovo, *University of Bari, Italy*
B. Irie, *Toshiba, Japan*
S. Jaeger, *Maryland University, USA*
Y. B. Kwon, *Chung-Ang University, Korea*
L. Lam, *The Hong Kong Institute of Education, Hong Kong*
G. Leedham, *Nanyang Technological University, Singapore*

S.-W. Lee, *Korea University, Korea*
C.-L. Liu, *Hitachi, Japan*
S. Naoi, *Fujitsu Laboratories, Japan*
D. Nishiwaki, *NEC, Japan*
M. Okada, *Waseda University, Japan*
S. Omachi, *Tohoku University, Japan*
U. Pal, *Indian Statistical Institute, India*
M. Perrone, *IBM, USA*
G. Pirlo, *University of Bari, Italy*
G. Ratzlaff, *IBM, USA*
G. Rigoll, *Munich University of Technology, Germany*
N. Sherkat, *Nottingham Trent University, UK*
H. Shimodaira, *JAIST, Japan*
M. Shridhar, *University of Michigan-Dearborn, USA*
J. Snowdon, *IBM, USA*
S. Srihari, *State University of New York at Buffalo, USA*
C.Y. Suen, *Concordia University, Canada*
S. Tsuruoka, *Mie University, Japan*
S. Uchida, *Kyushu University, Japan*
C. Viard-Gaudin, *University of Nantes, France*
N. Vincent, *University of Tours, France*
L. Vuurpijl, *University of Nijmegen, Netherlands*
T. Wakabayashi, *Mie University, Japan*
T. Wakahara, *Hosei University, Japan*

Reviewers

E. Anquetil, A. Biem, D. L. Borges, A. de Souza Britto Jr., M. Cheriet, A. Downton, C. O. A. Freitas, H. Fujisawa, V. Govindaraju, L. Heutte, G. Houle, J. Hu, B. Irie, K. Ishigaki, Y. Ishitani, S. Jaeger, A. Kawamura, F. Kimura, A. L. Koerich, M. Koga, Y. B. Kwon, L. Lam, G. Leedham, C.-L. Liu, G. Lorette, H. Mizutani, M. Nakagawa, M. Nakai, S. Naoi, D. Nishiwaki, M. Okada, L. E. S. de Oliveira, S. Omachi, T. Pal, U. Pal, T. Paquet, M. Perrone, G. Pirlo, G. Ratzlaff, G. Rigoll, R. Sabourin, H. Sako, S. Senda, H. Shimodaira, M. Shridhar, J. Snowdon, F. Sun, S. Tsuruoka, S. Uchida, C. Viard-Gaudin, N. Vincent, L. Vuurpijl, T. Wakabayashi, T. Wakahara

3. Workshop Information

Venue

The Hitachi Central Research Laboratory (HCRL) is on a 20,000 m² campus that includes a Japanese garden. The picturesque environment retains the splendor of the landscape that formerly covered much of the Musashino plain, furnishing an ideal setting for research activity where distinct seasonal changes take place in the course of each year. The HCRL has about 700 researchers and staff. Several international conferences have been held at the HCRL in the past, including the IAPR Workshop on Machine Vision Applications.

Registration

The registration fee covers

- admission to all technical sessions;
- one registration kit (one workshop bag, one stationary set, and documentation);
- one printed copy and one CD of the proceedings;
- luncheon on October 26, 27 and 28, morning refreshments, and coffee breaks;
- the welcoming reception; and
- the workshop banquet.

Documentation includes

- a stamped receipt for payment;
- a certificate of attendance;
- name badge(s)*;
- banquet ticket(s);
- tutorial tickets (if you have registered);
- excursion ticket(s) (if you have registered);
- a map of the poster presentations; and
- conveyance of messages from the registration and help desk.

*Your name badge must be worn at all times during the workshop and Social Program.

Registration and Help Desk

The registration and help desk will be open over the periods and at the locations listed below.

Mon. Oct. 25	18:00–20:00	Welcoming Reception*
Tue. Oct. 26	08:20–18:00	Entrance Hall**
Wed Oct. 27	08:20–18:00	Entrance Hall
Thu. Oct. 28	08:20–18:00	Entrance Hall
Fri. Oct. 29	08:20–12:00	Entrance Hall

*Outside the *Tempyo Guest Room* (8th fl.) of the Kichijoji Dai-ichi Hotel.

**On the 1st floor of the *Odaira Memorial Building* at HCRL, site of the workshop.

Refreshment Spots, Internet Access, and Message Boards

All facilities on the workshop floor, i.e. the 6th floor, of the *Odaira Memorial Building* will be available through the hours of opening for the registration and help desk. See under ‘Workshop Floor Plan’ on page 15.

Luncheon

Luncheon will be from 12:00 to 13:00 at a company cafeteria named *Keyaki*, which is on the campus of the Central Research Laboratory. See under ‘The Hitachi Central Laboratory Campus’ on page 14. Attendants will be available to guide you to *Keyaki* from the workshop site at 12 o’clock. If you don’t want to be hungry, don’t miss the lunch.

Demos

Demos will be presented in an annex to the auditorium during the technical sessions. See under ‘Workshop Floor Plan’ on page 15.

Transportation from/to hotels

On the mornings of October 26, 27, 28, and 29, free buses for workshop participants will depart from both the Kichijoji Tokyu Inn and Dai-ichi Hotel for the HCRL at **7:30**. Participants who wish to catch these buses should be at the gathering point before 7:20. See their locations under ‘Ground Transportation’ on page 13. At **18:15** on the evenings of October 26, 27, and 28, and at **12:15** on the afternoon of October 29, buses will depart from the parking bay at the front of the *Odaira Memorial Building* for the Kichijoji Tokyu Inn and Dai-ichi Hotel. Participants wishing to catch these buses should be in the parking bay before departure times. See its location under ‘The Hitachi Central Laboratory Campus’ on page 14. While we intend to ensure sufficient seats, seating is on a first-come-first-served basis.

Participants staying in other accommodation will need to find other transportation, such as trains, to get to and from the HCRL. See under ‘Ground Transportation’ on page 13

Useful Telephone Numbers

General

- International code in Japan: 001 010
- Country code for Japan: 81

- Area codes: 042 (Kokubunji),
0422 (Kichijoji and Musashisakai)
- Police: 110
- Ambulance and fire: 119
- Urgent calls to the workshop**
- From inside Japan: 042-327-7771
- From outside Japan: +81-42-327-7771

4. Social Program

Technical Tours

Monday, October 25, Afternoon

Participants registered in advance

Independent technical tour will be organized by Fujitsu Laboratories, Hitachi, NEC, and Toshiba, respectively.

- *Fujitsu Ltd. & Fujitsu Laboratories Ltd., Kawasaki:* Fujitsu Laboratories
- *Toshima Post Office, Tokyo:* Hitachi
- *NEC Showroom at Shinagawa East One Tower, Tokyo:* NEC
- *Toshiba Science Institute, Kawasaki:* Toshiba

Welcoming Reception

Monday, October 25, 19:00-21:00

Participants and Accompanying Guests

All participants and their guests are invited to the IWFHR-9 Welcoming Reception, in the *Tempyo Guest Room* (8th fl.) of the Kichijoji Dai-ichi Hotel from 19:00 on Monday 25, October.

Workshop Banquet

Wednesday, October 27, 19:30-22:00

Participants and Accompanying Guests

The IWFHR-9 Workshop Banquet featuring *Japanese traditional performance* will be held in the *Tempyo Guest Room* (8th fl.) of the Kichijoji Dai-ichi Hotel. Three buses will pick up participants from the parking bay in front of the *Odaira Memorial Building*. The buses will depart for the hotel at **18:15**. Try not to miss your bus; if you do, you have a 7-minute-walk to Kokubunji Station, a 15-minute-ride on a train to Kichijoji Station, and a 4-minute-walk to the Kichijoji Dai-ichi Hotel from Kichijoji Station.

A limited number of remaining tickets are available from the registration desk for ¥10,000.

Spouse Program

Tuesday, October 26 to Thursday, October 28

Companions of Participants

Several volunteers will accompany companions of participants to the sightseeing spots including Tokyo National Museum, Tonogaya Park to enjoy a tea ceremony, and Asakusa in old downtown Tokyo. The tour details will be available at the registration desk and on the message boards. The guests wishing to join a tour are kindly requested to meet at the given time and place.

Excursion

Friday, October 29, 12:30-22:00

Participants registered in advance

A half-day excursion by coach to the Mt. Fuji area has been organized. The registered participants will be able to enjoy views of Mt. Fuji, the highest and most beautiful mountain in Japan, and visit several sightseeing spots in the afternoon. In the evening, they will have a dinner together in a hotel restaurant, and then return to your hotels in Kichijoji at around 22:00.

The participants in the excursion should meet at the parking bay at 12:15 on Friday, October 29. Do not get on a wrong bus because there are two other buses that return to the hotels.

A limited number of remaining tickets are available from the registration desk at ¥12,000 per ticket.

5. Technical Program

About the Presentations

Invited Talk and Panel Discussion

The invited talk and panel discussion will take place in the auditorium at the beginning of the afternoon sessions on Wednesday and Thursday, respectively.

Oral Sessions

All oral presentations are in a single track. Presenters are requested to observe the points given below.

- Each oral presenter is given 25 minutes for his/her presentation, including
 - 2 minutes for preparation,
 - 20 minutes for presentation, and
 - 3 minutes for questions and answers.
- The organizer will provide a PC projector as presentation equipment. An over-head projector (OHP) will also be available, although PC presentations are preferred. If

you require other equipment, please contact the registration desk well in advance.

- Presenters should go to the auditorium 15 minutes before the start of their session, introduce themselves to the session chair, and check that their presentation works with the provided equipment.

Poster Session

The poster session will be held over 120 minutes on the morning of Wednesday, October 27. The first 60 minutes will be for the odd-numbered papers, with the following 60 minutes devoted to the even-numbered papers. To find the paper number corresponding to a poster, see the list of poster presentations in 'Technical Sessions.' Presenters are encouraged to spend most of the time at their poster during their 60-minute-session. Presenters are requested to observe the following points.

- Every poster presenter will be given an A0 size (840-mm × 1190-mm) board for his/her poster. The board will be hung from the ceiling, by chains, in portrait alignment. We will provide thumbtacks (drawing pins) for tacking the poster(s) to the board, along with chains and pointers.
- So that participants can view your work more closely during the workshop, we request that the poster presenters prepare their posters on the morning of Tuesday, October 26, and leave them in place until the morning of

Friday, October 29; at that time, please be sure to remove them.

- A map of the poster presentations, which indicates the location of each poster presentation, will be in the registration kit.

Tutorial

Tuesday, October 26, 19:30-21:00

Participants registered in advance.

A tutorial session will be held as a night session on Tuesday, October 26 in the *Kasuga Guest Room* (7th fl.) of the Kichijoji Dai-ichi Hotel. A light meal will be served to participants from 19:00. This tutorial, sponsored by Microsoft Corporation, covers the development of handwriting recognizers for the 2005 edition of the Windows XP Tablet PC.

A limited number of remaining free tickets are available from the registration desk. The tickets will be given out on a first-come first-served basis.

Award Presentation

Friday, October 29, 11:35

Auditorium

The Program Committee will recognize a best paper, a best presentation, and a best student paper, and will send awards to the respective authors.

6. Technical Sessions

Monday, October 25

13:00-18:00	Technical Tours (<i>Optional</i>)	<i>Kawasaki and Tokyo</i>
19:00-21:00	Welcoming Reception	<i>Kichijoji Dai-ichi Hotel</i>

Tuesday, October 26

08:20-08:40	<i>Morning Refreshments</i>	<i>Annex and Room C</i>
08:40-09:00	Greetings	<i>Auditorium</i>
09:00-10:15	Handwriting Recognition and Shape Analysis I	<i>Auditorium</i>
10:15-10:45	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
10:45-12:00	Handwriting Recognition and Shape Analysis II	<i>Auditorium</i>
12:00-13:00	<i>Lunch Break</i>	<i>Keyaki</i>
13:00-14:40	Classification Techniques I	<i>Auditorium</i>
14:40-15:05	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
15:05-16:20	Handwriting Analysis and Gesture Recognition I	<i>Auditorium</i>
16:20-16:45	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
16:45-18:00	Recognition of Word and Text I	<i>Auditorium</i>
19:30-21:00	Microsoft Tutorial	<i>Kichijoji Dai-ichi Hotel</i>

Wednesday, October 27

08:20-08:40	<i>Morning Refreshments</i>	<i>Annex and Room C</i>
08:40-09:55	Classification Techniques II	<i>Auditorium</i>
10:00-11:00	Poster Session I	<i>Rooms 2, 3 and Annex</i>
11:00-12:00	Poster Session II	<i>Rooms 2, 3 and Annex</i>
12:00-13:00	<i>Lunch Break</i>	<i>Keyaki</i>
13:00-13:50	Invited Talk	<i>Auditorium</i>
13:50-14:40	Signature Verification and Writer Identification I	<i>Auditorium</i>
14:40-15:05	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
15:05-16:45	Handwriting Analysis and Gesture Recognition II	<i>Auditorium</i>
16:45-17:10	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
17:10-18:00	Document Analysis and Applications I	<i>Auditorium</i>
19:30-22:00	Workshop Banquet	<i>Kichijoji Dai-ichi Hotel</i>

Thursday, October 28

08:20-08:40	<i>Morning Refreshments</i>	<i>Annex and Room C</i>
08:40-10:20	Signature Verification and Writer Identification II	<i>Auditorium</i>
10:20-10:45	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
10:45-12:00	Handwriting Analysis and Gesture Recognition III	<i>Auditorium</i>
12:00-13:00	<i>Lunch Break</i>	<i>Keyaki</i>
13:00-14:30	Panel Discussion	<i>Auditorium</i>
14:30-14:55	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
14:55-16:10	Recognition of Word and Text II	<i>Auditorium</i>
16:10-16:35	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
16:35-17:50	Document Analysis and Applications II	<i>Auditorium</i>

Friday, October 29

08:20-08:40	<i>Morning Refreshments</i>	<i>Annex and Room C</i>
08:40-09:55	Classification Techniques III	<i>Auditorium</i>
09:55-10:20	<i>Coffee Break</i>	<i>Rooms 2, 3 and Annex</i>
10:20-11:35	Document Analysis and Applications III	<i>Auditorium</i>
11:35-12:00	Award Presentation and Farewell	<i>Auditorium</i>
12:15	Excursion (<i>Optional</i>)	<i>Parking Bay</i>

Tuesday, October 26

8:20-8:40 Morning Refreshments

8:40-9:00 Greetings

9:00-10:15 Handwriting Recognition and Shape Analysis I *Chair: M. Fairhurst*

Online Character Recognition Using Eigen-Deformations

H. Mitoma, S. Uchida, and H. Sakoe

Self-Supervised Adaptation for On-Line Text Recognition

L. Oudot, L. Prevost, and A. Moises

Handling Spatial Information in On-Line Handwriting Recognition

S. Marukatat and T. Artières

10:15-10:45 Coffee Break

10:45-12:00 Handwriting Recognition and Shape Analysis II *Chair: L. Vuurpijl*

Generative Models and Bayesian Model Comparison for Shape Recognition

B. Krishnapuram, C. M. Bishop, and M. Szummer

Modulating Population Granularity for Improved Diagnosis of Developmental Dyspraxia from Dynamic Drawing Analysis

S. Hoque, M. C. Fairhurst, and M. A. Razian

Contextual Recognition of Hand-Drawn Diagrams with Conditional Random Fields

M. Szummer and Y. Qi

12:00-13:00 Lunch

13:00-14:40 Classification Techniques I *Chair: C.-L. Liu*

Support Vector Machines for Handwritten Numerical String Recognition

L. S. Oliveira and R. Sabourin

A Classifier Based on Distance between Test Samples and Average Patterns of Categorical Nearest Neighbors

S. Hotta, S. Kiyasu, and S. Miyahara

Classification of Time-Series Data Using a Generative/Discriminative Hybrid

K. T. Abou-Moustafa, M. Cheriet, and C. Y. Suen

Speeding Up the Decision Making of Support Vector Classifiers

J. Milgram, M. Cheriet, and R. Sabourin

14:40-15:05 Coffee Break

15:05-16:20 Handwriting Analysis and Gesture Recognition I *Chair: U. Pal*

Model Structure Selection and Training Algorithms for an HMM Gesture Recognition System

N. Liu, B. C. Lovell, P. J. Kootsookos, and R. I. A. Davis

Magic Wand: A Hand-Drawn Gesture Input Device in 3-D Space with Inertial Sensors

S.-J. Cho, J. K. Oh, W.-C. Bang, W. Chang, E. Choi, J. Yang, J. Cho, and D. Y. Kim

Inertial Sensor Based Recognition of 3-D Character Gestures with an Ensemble of Classifiers

J. K. Oh, S.-J. Cho, W.-C. Bang, W. Chang, E. Choi, J. Yang, J. Cho, and D. Y. Kim

16:20-16:45 Coffee Break

16:45-18:00 Recognition of Word and Text I *Chair: N. Sherkat*

N-Gram Language Models for Offline Handwritten Text Recognition

M. Zimmermann and H. Bunke

Handwritten Brazilian Month Recognition: An Analysis of Two NN Architectures and a Rejection Mechanism

M. N. Kapp, C. O. De A. Freitas, and R. Sabourin

A New View of the Output from Word Recognition

M.-P. Schambach

19:30-21:00 Microsoft Tutorial (at Kichijoji Dai-ichi Hotel) *Chair: H. Sako*

Handwriting Recognition on WindowsXP Tablet PC

P. Haluptzok, Microsoft Corporation (USA)

Wednesday, October 27

8:20-8:40 Morning Refreshments

8:40-9:55 Classification Techniques II

Chair: M. Cheriet

Combination of Three Classifiers with Different Architectures for Handwritten Word Recognition
S. Günter and H. Bunke

Normalization Ensemble for Handwritten Character Recognition

C.-L. Liu and K. Marukawa

Boosting Driven by Error Free Regions

R. Lindwurm and J. Rottland

10:00-11:00 Poster Session I

Chair: M. Nakagawa

Odd-numbered presentations

11:00-12:00 Poster Session II

Even-numbered presentations

12:00-13:00 Lunch

13:00-13:50 Invited Talk

Chair: F. Kimura

Machine Learning in Questioned Handwriting Examination

S. N. Srihari, State University of New York at Buffalo (USA)

13:50-14:40 Signature Verification and Writer Identification I

Chair: M. Shridhar

Using HMM Based Recognizers for Writer Identification and Verification

A. Schlapbach and H. Bunke

Ink-Deposition Model: The Relation of Writing and Ink Deposition Processes

K. Franke and S. Rose

14:40-15:05 Coffee Break

15:05-16:45 Handwriting Analysis and Gesture Recognition II

Chair: V. Govindaraju

Recovering Dynamic Information from Static Handwritten Images

Y. Qiao and M. Yasuhara

A Saliency-Based Multiscale Method for On-Line Cursive Handwriting Shape Description

C. De Stefano, M. Garruto, and A. Marcelli

Writer Dependent Online Handwriting Generation with Bayesian Network

H. Choi, S. J. Cho, and J. H. Kim

Representation and Annotation of Online Handwritten Data

A. S. Bhaskarabhatla, S. Madhvanath, M. N. S. S. K. Pavan Kumar, A. Balasubramanian, and C. V. Jawahar

16:45-17:10 Coffee Break

17:10-18:00 Document Analysis and Applications I

Chair: C. Y. Suen

Decompose-Threshold Approach to Handwriting Extraction in Degraded Historical Document Images

Y. Chen and G. Leedham

Text Line Segmentation in Handwritten Document Using a Production System

S. Nicolas, T. Paquet, and L. Heutte

19:30-21:30 Banquet at Kichijoji Dai-ichi Hotel

Thursday, October 28

8:20-8:40 Morning Refreshments

8:40-10:20 Signature Verification and Writer Identification II *Chair: S. Jaeger*

Recent Advancements in Automatic Signature Verification

G. Dimauro, S. Impedovo, M. G. Lucchese, R. Modugno, and G. Pirlo

Automatic Writer Identification Using Fragmented Connected-Component Contours

L. Schomaker, M. Bulacu, and K. Franke

ER^2 : An Intuitive Similarity Measure for On-Line Signature Verification

H. Lei, S. Palla, and V. Govindaraju

Handwriting Analysis for Writer Verification

A. Bensefia, T. Paquet, and L. Heutte

10:20-10:45 Coffee Break

10:45-12:00 Handwriting Analysis and Gesture Recognition III *Chair: G. Leedham*

Distinguishing Text from Graphics in On-Line Handwritten Ink

C. M. Bishop, M. Svensén, and G. E. Hinton

On-Line Handwritten Documents Segmentation

J. Blanchard and T. Artières

Learning to Parse Hierarchical Lists and Outlines Using Conditional Random Fields

M. Ye and P. Viola

12:00-13:00 Lunch

13:00-14:30 Panel Discussion

Moderator: G. Lorette

The Present and Future of the Postal Automation System: In Quest of More Advanced Recognition Technology

Panelists: *E. J. Kuebert, US Postal Service (USA)*

G. Stönnner, Deutsche Post World Net (Germany)

J. Ulvr, Canada Post Corporation (Canada)

D. Evans, Royal Mail (UK)

H. Uchida, Japan Post (Japan)

V. Govindaraju, State University of New York at Buffalo (USA)

H. Fujisawa, Hitachi (Japan)

14:30-14:55 Coffee Break

14:55-16:10 Recognition of Word and Text II

Chair: R. Sabourin

Comparing Natural and Synthetic Training Data for Off-Line Cursive Handwriting Recognition

T. Varga and H. Bunke

Handwritten CAPTCHA: Using the Difference in the Abilities of Humans and Machines in Reading Handwritten Words

A. Rusu and V. Govindaraju

Fast Two-Level HMM Decoding Algorithm for Large Vocabulary Handwriting Recognition

A. L. Koerich, R. Sabourin, and C. Y. Suen

16:10-16:35 Coffee Break

16:35-17:50 Document Analysis and Applications II

Chair: J.-H. Kim

Improving the Structuring Search Space Method for Accelerating Large Set Character Recognition

Y. Yang and M. Nakagawa

An Empirical Study of Statistical Language Models for Contextual Post-Processing of Chinese Script Recognition

Y.-X. Li and C. L. Tan

Spiral Recognition Methodology and Its Application for Recognition of Chinese Bank Checks

H. Tang, E. Augustin, C. Y. Suen, O. Baret, and M. Cheriet

Friday, October 29

8:20-8:40 Morning Refreshments

8:40-9:55 Classification Techniques III

Chair: N. Vincent

Unsupervised Feature Selection for Ensemble of Classifiers

M. Morita, L. S. Oliveira, and R. Sabourin

Using Informational Confidence Values for Classifier Combination: An Experiment with Combined On-Line/Off-Line Japanese Character Recognition

S. Jaeger

A Syntax-Directed Method for Numerical Field Extraction Using Classifier Combination

C. Chatelain, L. Heutte, and T. Paquet

09:55-10:20 Coffee Break

10:20-11:35 Document Analysis and Applications III

Chair: H. Bunke

D-Pen: A Digital Pen System for Public and Business Enterprises

N. Furukawa, H. Ikeda, Y. Kato, and H. Sako

Effect of Recognition Errors on Information Retrieval Performance

A. Vinciarelli

Document Retrieval System Tolerant of Segmentation Errors of Document Images

T. Nagasaki, T. Takahashi, and K. Marukawa

11:35-12:00 Award Presentation and Farewell

12:15 Departure on the Excursion (Optional)

Wednesday, October 27, 10:00-12:00 / Poster Session

History and Future Prospects

P1: History of the International Workshops on Frontiers in Handwriting Recognition

S. Impedovo

Segmentation and Preprocessing

P2: A Recognition Based System for Segmentation of Touching Handwritten Numeral Strings

Y. Lei, C. S. Liu, X. Q. Ding, and Q. Fu

P3: Global Shape Normalization for Handwritten Chinese Character Recognition: A New Method

C.-L. Liu and K. Marukawa

P4: Handwriting Segmentation of Unconstrained Oriya Text

N. Tripathy and U. Pal

P5: Machine-Printed from Handwritten Text Discrimination

E. Kavallieratou, S. Stamatatos, and H. Antonopoulou

P6: Automatic Segmentation of Unconstrained Handwritten Numeral Strings

J. Sadri, C. Y. Suen, and T. D. Bui

P7: Multi-window Binarization of Camera Image for Document Recognition

I.-J. Kim

P8: Local Slant Estimation for Handwritten English Words

Y. Ding, W. Ohyama, F. Kimura, and M. Shridhar

P9: Segmentation of Handwritten Numerals by Graph Representation

M. Suwa and S. Naoi

Feature Extraction and Feature Selection

P10: Character Image Reconstruction from a Feature Space Using Shape Morphing and Genetic Algorithms

C. Iga and T. Wakahara

P11: Extraction of Hybrid Complex Wavelet Features for the Verification of Handwritten Numerals

P. Zhang, T. D. Bui, and C. Y. Suen

- P12: Experimental Analysis of the Modified Direction Feature for Cursive Character Recognition
X. Y. Liu and M. Blumenstein
- P13: Evaluation of Feature Sets in the Post Processing of Handwritten Pitman's Shorthand
S. M. Htwe, C. Higgins, G. Leedham, and M. Yang
- P14: An Optimized Hill Climbing Algorithm for Feature Subset Selection: Evaluation on Handwritten Character Recognition
C. M. Nunes, A. de S. Britto Jr., C. A. A. Kaestner, and R. Sabourin
- P15: Foreground and Background Information in an HMM-Based Method for Recognition of Isolated Characters and Numeral Strings
A. de S. Britto Jr., R. Sabourin, F. Bortolozzi, and C. Y. Suen
- P16: A New Series of Rotation Invariant Moments Derived by Lie Transformation Group Theory
T. Sakata, R. Nishii, T. S. Chin, and R. Sawae

Character Recognition

- P17: The Reduction of Memory and the Improvement of Recognition Rate for HMM On-Line Handwriting Recognition
D. Funada, D. Muramatsu, and T. Matsumoto
- P18: Pattern Recognition by Distributed Coding: Test and Analysis of the Power Space Similarity Method
T. Kobayashi and M. Nakagawa
- P19: Application of Fuzzy Logic to Online Recognition of Handwritten Symbols
J. A. Fitzgerald, F. Geiselbrechtinger, and T. Kechadi
- P20: A Generic Approach for On-Line Handwriting Recognition
S. Marukatat, T. Artières, and P. Gallinari
- P21: Learning HMM Structure for On-line Handwriting Modelization
H. Binsztok and T. Artières
- P22: Diversity-Performance Relationship in a Handwriting Recognition System Based on Bit-Plane Decomposition
S. Chindaro, K. Sirlantzis, M. C. Fairhurst, and S. Hoque
- P23: On the Choice of Training Set, Architecture and Combination Rule of Multiple MLP Classifiers for Multiresolution Recognition of Handwritten Characters
U. Bhattacharya, S. Vajda, A. Mallick, B. B. Chaudhuri, and A. Belaid

Asian Character Recognition

- P24: A Method to Accelerate Writer Adaptation for On-Line Handwriting Recognition of a Large Character Set
A. Nakamura
- P25: An Off-Line Recognition Method of Handwritten Primitive Manchu Characters Based on Strokes
G. Zhang, J. Li, R. He, and A. Wang
- P26: Online Handwriting Recognition for Tamil
K. H. Aparna, V. Subramanian, M. Kasirajan, G. Vijay Prakash, V. S. Chakravarthy, and S. Madhvanath
- P27: Comparison of Elastic Matching Algorithms for Online Tamil Handwritten Character Recognition
N. Joshi, G. Sita, A. G. Ramakrishnan, and S. Madhvanath
- P28: The Clustering Technique for Thai Handwritten Recognition
I. Methasate and S. Sae-tang

Word Recognition and Linguistic Approaches

- P29: Stability Measure of Entropy Estimate and Its Application to Language Model Evaluation
J. Kim, S. Ryu, and J. H. Kim
- P30: Lexicon Organization and String Edit Distance Learning for Lexical Post-Processing in Handwriting Recognition
S. Carbonnel and E. Anquetil
- P31: Combination of Contextual Information for Handwritten Word Recognition
G. Koch, T. Paquet, and L. Heutte

- P32: Signature and Lexicon Pruning Techniques
S. Palla, H. Lei, and V. Govindaraju
- P33: Rejection Strategies for Handwritten Word Recognition
A. L. Koerich
- P34: An Activation-Verification Model for On-Line Texts Recognition
L. Oudot, L. Prevost, and M. Milgram

Signature Verification and Writer Identification

- P35: The Repeatability of Signatures
R. M. Guest
- P36: An Off-Line Signature Verification Method Based on the Questioned Document Expert's Approach and a Neural Network Classifier
C. Santos, E. J. R. Justino, F. Bortolozzi, and R. Sabourin
- P37: Selection of Points for On-Line Signature Comparison
M. Wirotius, J.-Y. Ramel, and N. Vincent
- P38: An Effective Writer Verification Algorithm Using Negative Samples
X. Wang and X. Ding

Applications

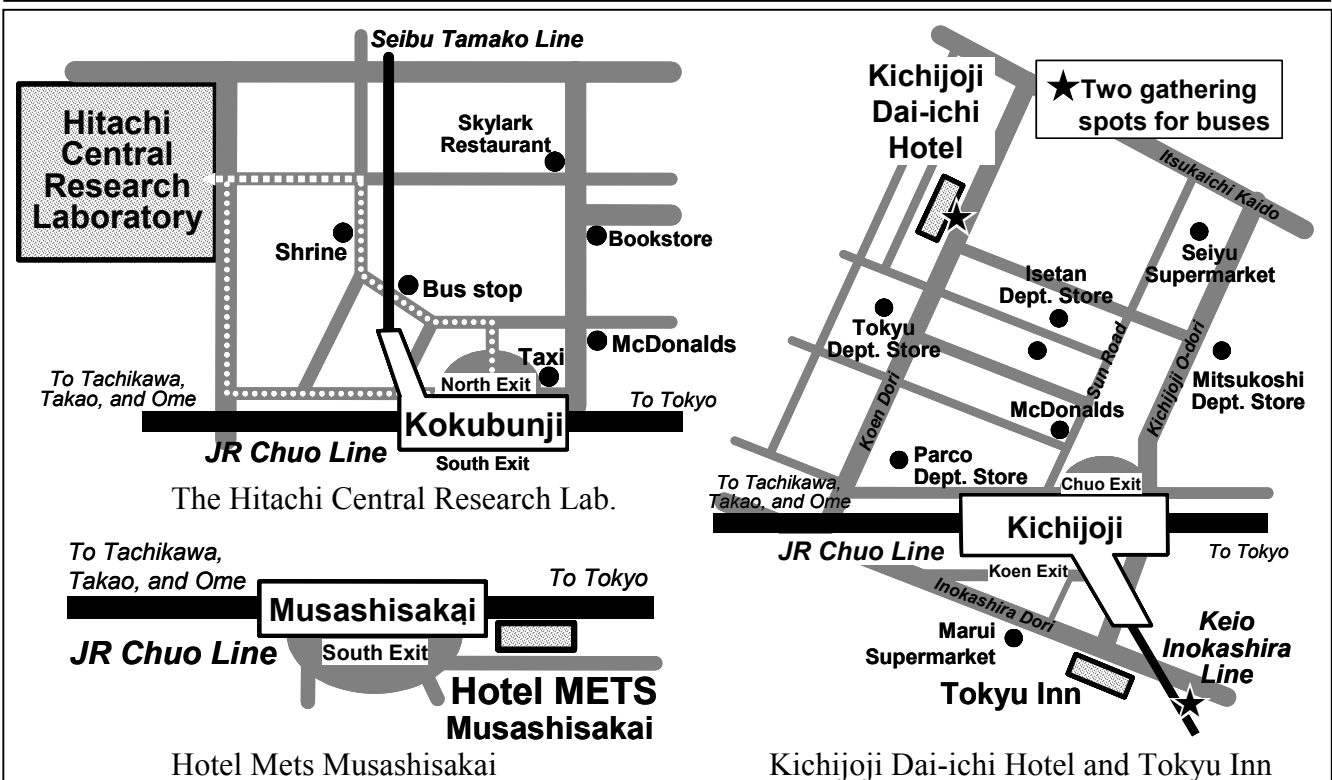
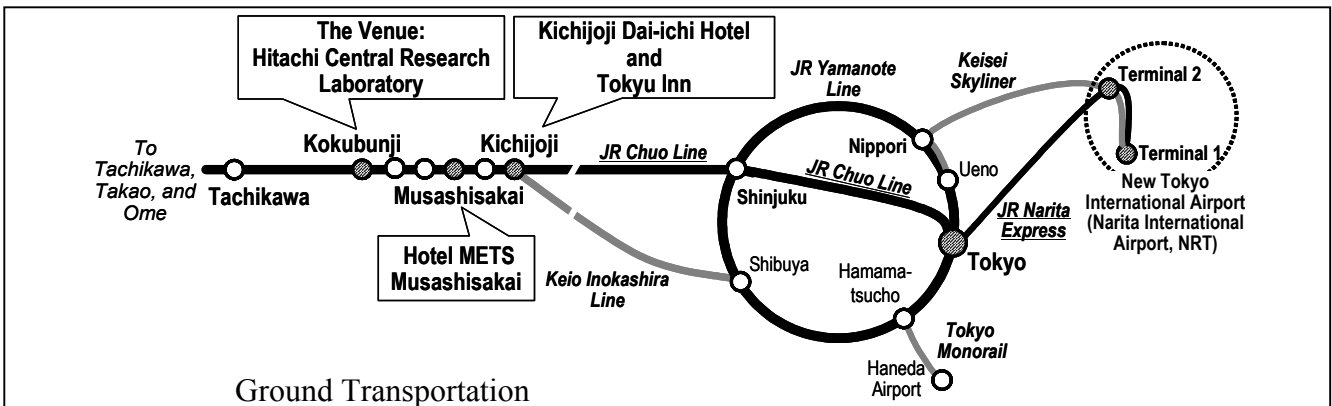
- P39: Generation and Analysis of Handwriting Script with the Beta-Elliptic Model
H. Bezine, A. M. Alimi, and N. Sherkat
- P40: A Fast HMM Algorithm Based on Stroke Lengths for On-Line Recognition of Handwritten Music Scores
Y. Mitobe, H. Miyao, and M. Maruyama
- P41: Handwritten Address Interpretation System Allowing for Non-use of Postal Codes and Omission of Address Elements
T. Akiyama, D. Nishiwaki, E. Ishidera, K. Kondoh, M. Hayashi, and T. Yamauchi
- P42: Handwriting-Based Learning Materials on a Tablet PC: A Prototype and Its Practical Studies in an Elementary School
N. Iwayama, K. Akiyama, H. Tanaka, H. Tamura, and K. Ishigaki
- P43: Handwritten Chinese Address Recognition
C. Wang, Y. Hotta, M. Suwa, and S. Naoi
- P44: A Search Method for On-Line Handwritten Text Employing Writing-Box-Free Handwriting Recognition
H. Oda, A. Kitadai, M. Onuma, and M. Nakagawa
- P45: Base Color Recognition by Tetragonal Regression for Overlapped Watercolors
T. Terai, S. Mizuno, and M. Okada
- P46: PATRAM—A Handwritten Word Processor for Indian Languages
K. Madduri, K. H. Aparna, and V. S. Chakravarthy
- P47: The WANDAML Markup Language for Digital Document Annotation
K. Franke, I. Guyon, L. Schomaker, and L. Vuurpijl
- P48: Recognition and Grouping of Handwritten Text in Diagrams and Equations
M. Shilman, P. Viola, and K. Chellapilla
- P49: Use of Chatroom Abbreviations and Shorthand Symbols in Pen Computing
W. B. Huber, S.-H. Cha, C. C. Tappert, and V. L. Hanson
- P50: A System towards Indian Postal Automation
K. Roy, S. Vajda, U. Pal, and B. B. Chaudhuri
- P51: Verifying the UNIPEN Devset
L. Vuurpijl, R. Niels, M. van Erp, L. Schomaker, and E. Ratzlaff
- P52: A Study on Decision Rule for Japanese Dictation Test
M. Shi, W. Ohyama, T. Wakabayashi, and F. Kimura
- P53: Mode Detection and Incremental Recognition
S. Rossignol, D. Willems, A. Neumann, and L. Vuurpijl

Ground Transportation

1) Transportation between New Tokyo International Airport and the official hotels

To get to the hotels in Kichijoji from New Tokyo International Airport, you can take a Narita Express train operated by JR (Japan Rail) from the airport to Tokyo Station, and then change to a Chuo Line train *kaisoku* for Kichijoji, with the respective legs taking about 70 and 40 minutes. The hotel in Musashisakai is located near JR Musashisakai Station. Musashisakai is on the same Chuo Line as Kichijoji and only two stops further from Tokyo.

JR trains are “color-coded,” i.e. the bodies are generally coded with specific colors. The color for the Chuo Line is orange (almost red).



Useful information

- Hitachi Central Research Laboratory: 1-280, Higashi-Koigakubo, Kokubunji, Tokyo 185-8601
Tel: +81-42-323-1111, Fax: +81-42-327-7695, 7-min-walk from Kokubunji Station
- Kichijoji Dai-ichi Hotel: 2-4-14, Kichijoji-honcho, Musashino, Tokyo 180-0004
Tel: +81-422-21-4411, Fax: +81-422-21-8269, 4-min-walk from Kichijoji Station
- Kichijoji Tokyu Inn: 1-6-3, Kichijoji-minamicho, Musashino, Tokyo 180-0003
Tel: +81-422-47-0109, Fax: +81-422-43-1811, Close to Kichijoji Station (Koen Exit)
- Hotel METS Musashisakai: 2-1-8, Kyonan-cho, Musashino, Tokyo 180-0023
Tel: +81-422-32-5111, Fax: +81-422-32-5100, Close to Musashisakai Station

Calling the hotels: For example, to call the Kichijoji Dai-ichi Hotel from inside Japan, dial 0422-21-4411; from outside Japan, dial +81-422-21-4411.

2) Transportation between the hotels and the workshop venue

The workshop organizer provides the free bus service to the venue from the official hotels and from the venue to the hotels; this service is only available before and after the workshop, at the Kichijoji Dai-ichi and the Tokyu Inn. Hotel METS in Musashisakai is closer to the venue than Kichijoji, and participants staying at this hotel will find it easier to use the train. Kokubunji is only three stops from Musashisakai (a roughly ten-minute ride). The venue is a roughly seven-minute walk from Kokubunji station. See the map of ‘The Hitachi Central Research Lab’ on the previous page. For the banquet, all participants will go the main hotel, Kichijoji Dai-ichi Hotel, by chartered bus from the workshop venue. After the banquet, those staying at the Tokyu Inn may walk back to their hotel, and those staying at Hotel METS in Musashisakai will again probably find it easier to use the train. The ride is only two stops.

3) Timetable of JR Chuo Line between Kichijoji and Kokubunji (as of September 28, 2004)

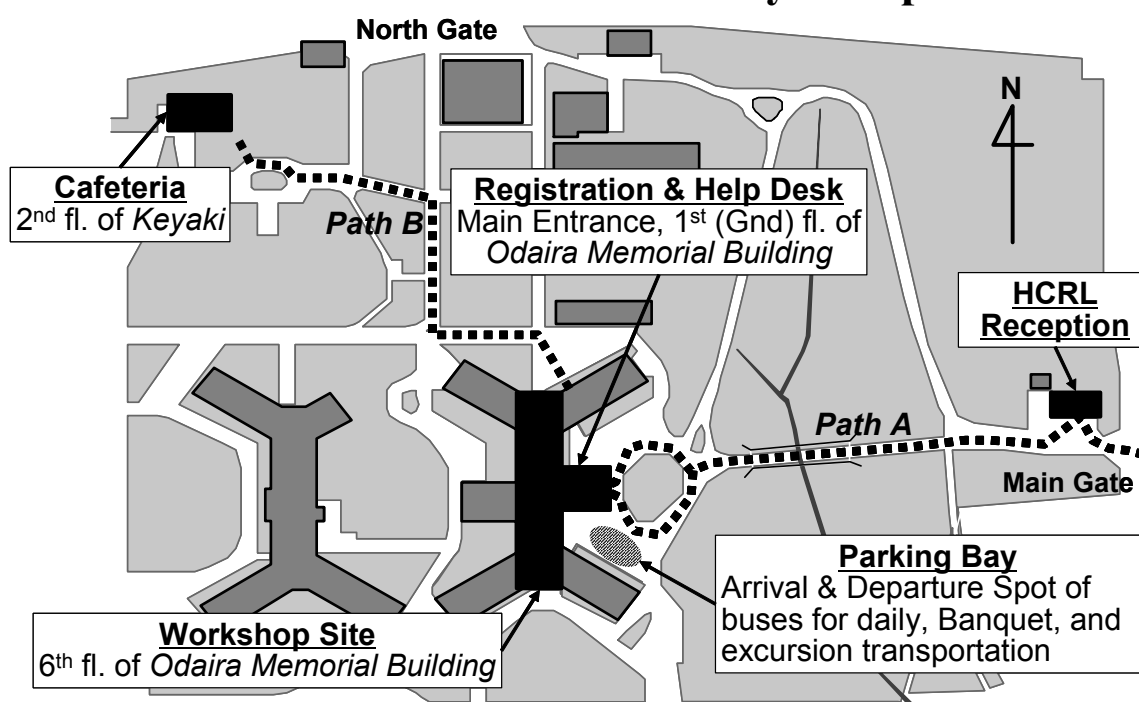
Station name	Trains towards Kokubunji (West bound)*									
Kichijoji	07:31	07:40	07:46	07:49	07:54	07:57	08:00	08:07	08:11	
Musashisakai	07:40	07:48	07:51	07:54	07:59	08:02	08:05	08:12	08:18	
Kokubunji	07:51	07:55	07:59	08:03	08:07	08:10	08:16	08:25	08:27	
Station name	Trains towards Kichijoji (East bound)*									
Kokubunji	18:16	18:19	18:28	18:31	18:35	18:39	18:46	18:52	18:55	18:58
Musashisakai	18:23	18:27	18:36	18:38	18:43	18:46	18:54	19:00	19:02	19:05
Kichijoji	18:30	18:32	18:41	18:44	18:49	18:51	19:02	19:05	19:08	19:11

*Some of the trains which stop at Kokubunji don't stop at Musashisakai neither Kichijoji. The above table only includes times for the *Kaisoku* trains that stop at all three stations. Take the train labeled *Kaisoku*, which means rapid train, and don't take the train labeled *Tokkai*, which means special rapid train.

Useful information

- Kichijoji to Kokubunji (JR Chuo Line): Fifteen minutes by a *Kaisoku* train. Fare ¥160.
- Musashisakai to Kokubunji (JR Chuo Line): Ten minutes by a *Kaisoku* train. Fare ¥150.

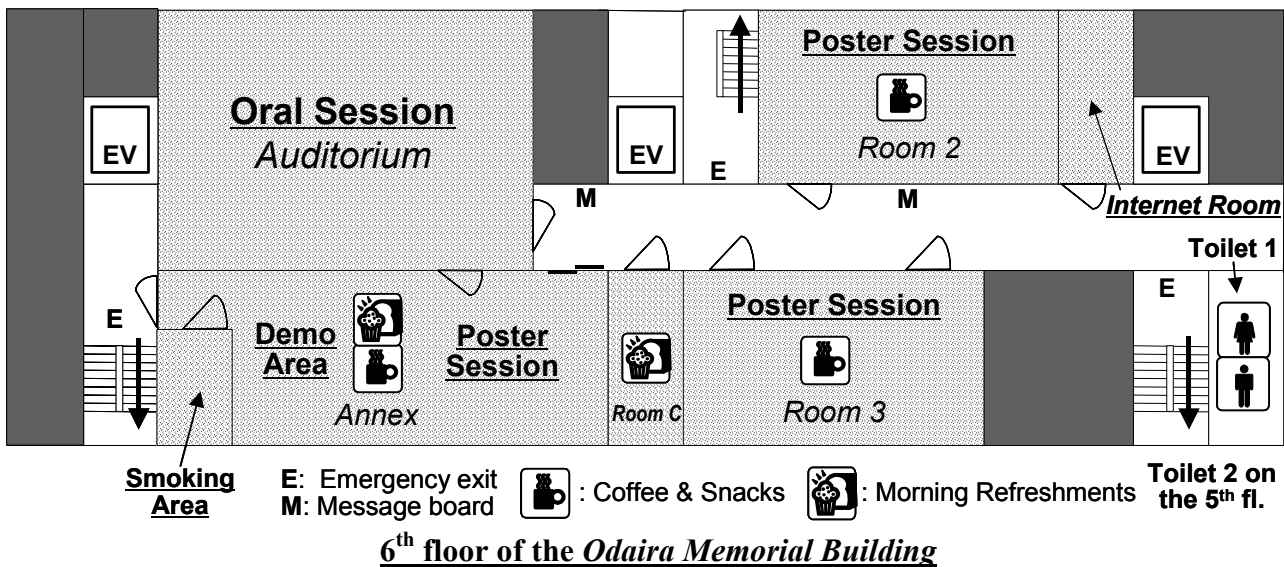
The Hitachi Central Research Laboratory Campus



Requests and Guidance

- Participants arriving at the HCRL **on foot** are kindly requested to inform HCRL Reception that they are the participants in IWFHR-9 (by showing their name badges after they have been issued).
- Path A in the map takes participants to the *Odaira Memorial Building* (1st fl.: Registration and Help Desk, 6th fl.: Workshop Site).
- Path B takes participants to the cafeteria, *Keyaki*, where luncheon will be served.
- Except for the IWFHR-9-related premises shown in the above map, participants are forbidden to enter other parts of the HCRL premises without permission.
- **No photography** in any part of the campus except the 6th floor of *Odaira Memorial Building*.
- **No smoking** in any part of the campus other than the designated smoking area on the 6th floor of *Odaira Memorial Building*, i.e. at the IWFHR-9 site.

Workshop Floor Plan



Requests and Guidance

- Participants must wear their **name badges** at all times during the workshop and social program. The name badge designates the participant as an important guest of the HCRL.
- **No smoking** other than in the smoking area on the 6th floor of the *Odaira Memorial Building*, i.e. at the IWFHR-9 site.
- There are three elevators that the participants can take from the 1st to the 6th floor, and vice versa. The participants are kindly requested **not to go to other floors**.
- There are **three emergency exits** on the floor. If a fire or an earthquake should occur, follow the workshop staffs. Do not use the elevators.
- **Internet connection** via wireless LAN is provided at the workshop site. Participants may also connect using their PCs to the internet using the 100 Base-T cables provided in the Internet Room. In addition, four PCs are provided there for participants who require access but have not brought their own PCs. The participants are not allowed to use wireless LAN inside HCRL, except for the 6th floor of the *Odaira Memorial Building*.

Settings to access the internet are given below.

Internet Setting

IP Address: Auto Configuration
 DNS: Auto Configuration
 Proxy: None

Wireless Connection Setting

IP Address: Auto Configuration
 SSID: IWFHR
 MacFiltering: None

- Two **message boards** are provided to aid efficient communication among the participants.
- There are two toilets. One is on the 6th floor; the other is on the 5th floor.

