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National Institute of Informatics

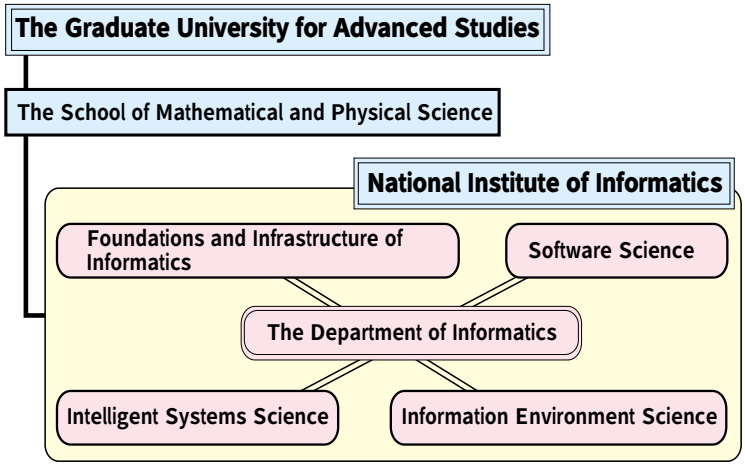
National Institute of Informatics News No.3

Implementation of doctoral course in Informatics -----Embarking on the journey to establish the Department of Informatics in the Graduate University for Advanced Studies (SOKENDAI)-----

Since the time it was known as the National Center for Science Information Systems (NACSIS), the National Institute of Informatics (NII) has been offering various academic support for graduate education in the University of Tokyo and the University of Library and Information Science, based on its achievement on developing databases for research activities and on the research in information infrastructure. Recently awareness of the importance of our contribution to the society by performing graduate education has increased. In addition the demand for highly skilled IT professionals has been growing. Thus in June 2000 we made a request to the Graduate University for Advanced Studies (SOKENDAI) for establishment of the new department, and launched to set up the Department of Informatics at the School of Mathematical and Physical Science in the University. Then *SOKENDAI* has submitted a formal proposal of budget request to the Ministry of Education, Culture, Sports, Science, and Technology (MEXT).

Supported by the fifteen Inter-University Research Institutes, *SOKENDAI* specializes in offering doctoral course in various fields. The consortium boasts a wide range of resources as state-of-the-art research facilities and information library, and it also offers a platform to delve into cutting-edge research. Through substantial use of the consortium resources, which is otherwise difficult for existing graduate school to provide, *SOKENDAI* aims to meet the social demand for highly qualified researchers and specialists

Informatics is a novel research area that deciphers information in its totality on a macro scale by resolving problems associated with information. Based upon the traditional Computer Science and Engineering, it also covers the domain of Human and Social Information Science. Because it is a study of the method to gather, manage, search, analyze, evaluate and utilize the information, as well as which of the information communications technology to perform this process, Informatics plays important role in that it forms the foundation of almost every academic domain, and that its adoption will create new research topics. In addition, Informatics has been making contributions to the progression of industries



and improvement in our lives through its application. Rapid advances and development of Internet and microelectronics will accelerate this process in Informatics.

Advancement in the field of IT today is regarded as national strategy and basis for international cooperation. What it means is that interdisciplinary research, rather than conventional way of study of scientific technology, is vital for the development in Information Technology. Researchers and specialists in Informatics and IT are increasingly required to be equipped with plenty of knowledge and comprehensive ability to solve problems to promote the integrated framework of information and scientific technology, as well as information and society.

Objective of the Department of Informatics is to develop professionals with proficient knowledge of cutting-edge technology, comprehensive perspective, flexibility, and highly specialized skill sets.

Those who meet one of the following qualifications may apply for the Department of Informatics.
Those who have/ are
1. Master's degree in Informatics or IT related discipline
2. Engaged in the information and communications industry or IT institutions as a researcher, and willing to get the academic degree in Informatics
3. University faculty members, and willing to get the academic degree in Informatics
4. Graduate students from abroad

They are expected to gain such career options as follows
1. IT researcher at national/ company institutes
2. Faculties at universities
3. IT venture entrepreneurs
4. IT professionals in the R&D division of the companies

(Research Cooperation Division)

Name of the inter-university research institute:
National Institute of Informatics

Major: Informatics (the doctoral course)

Program: Informatics

Fields areas: Foundations and Infrastructure Science, Software Science, Intelligent Systems Science, Information Environment Science

Degree Offered: Doctorate in Informatics

▶ See next page for detailed explanation of academic and research fields offered.

◆ Major

Informatics

Based upon the traditional Computer Science and Engineering, Informatics also covers the domain of Human and Social Information Science to be a new multi-disciplinary research area. In this program fundamental concept, theory, technologies in Informatics, including various issues on Information Systems Technology and Social Information Technology to realize advanced information infrastructure, software system, intelligent system, and to manage information content are studied comprehensively. This program aims to provide students with practical lessons to become professionals in Informatics and IT. For this purpose courses of every research field contain those with experiment and classes in rotation.

◆ Courses and Experience Offered

Foundations and Infrastructure of Informatics

Research on the theory and technical foundations of advanced information systems is done. Modern information systems are based on Information Mathematics and Information Communication Network Infrastructure. In this research area, both disciplines are treated comprehensively. In Information Mathematics, Mathematical Informatics is the key subject, and research is also done on Logic in Computer Science, Psycholinguistics, and Algorithms.
In Information Communication Network Infrastructure, the key Subjects are Communication Engineering, and Information and Communication Networks, and Multimedia Communications. Research on Communication Protocols, and functionally Advanced Networks are also focused. As a whole, the theoretical and experimental research on comprehensive information infrastructure is done.

Software Science

Software is the key technology of information systems. With the advance of ubiquitous information systems, software is requested to provide more and more sophisticated functions, and revolutionary methods are hoped to develop and maintain large and complex software systems with high quality and reliability. To satisfy these next generation system requirements, this are conduct researches from core/fundamental themes to application-oriented themes: programming languages, distributed software systems and networked multimedia information systems form a fundamental part. Data engineering, human-machine interface, computer graphics and multimedia information processing are application-oriented.

Intelligent Systems Science

In the highly information-oriented society of the 21st century we are required to have the ability to solve various problems by obtaining necessary information through advanced IT. To realize such a society intelligent information systems are indispensable and intelligent system technology would be the key domain. In this field of research we deal with essentially important topics and primary relevant academic areas in intelligent system technology. Providing intelligent systems, reasoning science and information logic as main courses, we promote extensive research on knowledge sharing system, soft computing, machine learning, image data processing, and natural language processing.

Information Environment Science

"Information environment" is a new concept which combines information with its technological infrastructure; its management, distribution and retrieval systems; people who relate with it; and its social infrastructure. Information environment science has come to be recognized as a field of science indispensable for realizing the information society. In this area, the basic course subjects are Digital Documents, Library Informatics and Academic Information Environment Environment. In addition to the above, Digital Publication, Informational Linguistics, Information Retrieval and Information Sociology will be taught systematically, from their basis to application.

The Graduate University for Advanced Studies (SOKENDAI) URL
▶ **http://www.soken.ac.jp/english%20pages/english-front.html**

PIA-Core: Learning to Semantically Annotate Texts from an Ontology and XML Instance Data

Associate Professor, Symbolic Reasoning Research, Foundations of Informatics Research Division

Nigel Henry Collier

Graduated from the Department of Computer Science, Leeds University (UK) in1992. Awarded a MSc. in Machine Translation in 1994 and a Ph.D. in 1996, both from the Department of Language Engineering, UMIST (University of Manchester Institute of Science and Technology).
Toshiba Fellow at Toshiba Central Research Laboratories (Japan) working on research related to knowledge acquisition for machine translation and cross-language information retrieval from 1996 to 1998. JSPS (Japan Society for the Promotion of Science) Fellow working on information extraction from molecular biology texts at the Department of Information Science, University of Tokyo from 1998 to 2000. Associate Professor at NII from 2000.
Research interests cover information extraction, natural language processing and machine learning.

PIA-Core (PIA: Portable Information Access system) aims to develop a domain adaptable information extraction (IE) system based on machine learning technology. In contrast to other Internet and Intranet-based technologies such as information retrieval (IR), used for searching the World Wide Web (Web), which are characterized by strong portability to any document collection, no such system as yet exists for IE, i.e. for extracting specific factual information from inside documents. Information extraction systems extract proto-typical facts from a large collection of texts such as the activation of proteins in cells in biology or the merging and acquisitions of companies in business news.

We consider that the main factors which have prevented IE from becoming a widely used technology are: (1) a reliance on the existence of knowledge sources such as term lists that may or may not exist, and (2) an emphasis on hand-built rules and patterns to customize the IE system to the new domain. The problem we see with this direction is that it promotes the development of rather inflexible IE systems that cannot easily be ported to new domains without substantial efforts to customize the system. Perhaps the greatest problem is that since there is no prior understanding between the IE system developer and the domain knowledge provider about the availability and encoding of the knowledge that will be used by the IE system, there is no guarantee that the type of knowledge that the system needs will be available in the new domain. We believe that the Semantic Web offers an opportunity to solve some of these problems.

PIA-Core: Machine Learning on the Semantic Web

The **Semantic Web** model, now being proposed by the W3C (W3C: World Wide Web Consortium) as the next generation Web, is shown in Figure 1 and raises many exciting possibilities. For example, that we can markup texts in XML (XML: Extensible Markup Language) according to an ontology written in RDF(S) (RDF(S): Resource Description Framework Schema) and then build software applications to reason with this knowledge using Artificial Intelligence-type inferencing engines built on logic. Intelligent applications such as being able to find the answer to a question in a document collection, electronic shopping, making appointments using agents, as well as 'smart' browsing of documents can then become a reality.

The majority of information on the Web, estimated at about 70%, is in the form of free-texts. However, due to the very high cost we cannot expect that instances of the concepts defined in the RDF(S) ontologies, such as technical terms, proper nouns, temporal and quantity expressions and their relations, will be marked up by experts in every text. This is one of the bottlenecks in the extension of Semantic Web applications to the majority of documents that can be viewed on the Web today. What is missing in the current focus on formalization is a consideration about how the actual instantiation of the concepts defined in the ontologies will take place.

Our expectation is that with the advent of standards for the annotation of semantic content on the Web such as XML for document structure, RDF for defining objects and their relations, and RDF(S) for defining basic ontological modeling primitives on top of RDF, that sources of domain knowledge will become widely available in electronic form and that these resources should be used for supervised training of a portable IE system which we call PIA-Core. Crucially these sources of knowledge will be

available in a predictable format allowing PIA-Core to be rapidly deployed in new domains. In this respect the requirement of IE for structured knowledge and of the Semantic Web for instantiation can be viewed as complementary.

The key goal of PIA-Core is to investigate machine learning as a way to reliably replicate the capabilities of experts. We are currently looking at the application of a number of models to this task such as SVMs (SVM: Support Vector Machine) and HMMs (HMM: Hidden Markov Model) that combine the knowledge available in the ontology with linguistically motivated features available from robust natural language processing tools such as morph-syntactic analyser. As shown in Figure 1, the scenario is that experts will develop a domain model (ontology) in RDF(S) and a relatively small set of example marked up texts using an ontology editor. From this knowledge PIA-Core will learn how to automatically annotate new texts in the same domain. By focusing on domain-based learning we hope to make use of the ontology as a valuable knowledge resource. Our current application domains are molecular biology and news; we aim to develop the system initially for both English and Japanese.

If we can achieve this then we hope that PIA-Core can provide a domain portable information extraction system that contributes to the increase of knowledge available to intelligent computer applications and users on the Semantic Web, making intelligent information access a reality for everybody.

PIA is a collaborative project between researchers at NII, Exeter University (UK), Osaka University, Ritsumeikan University and Kasetsart University (Thailand).

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3) A. Lassila and R. Swick (eds.), Resource Description Framework (RDF) Model and Syntax Specification, World Wide Web Consortium Recommendation, **http://www.w3.org/xml/TR/REC-rdf-syntax**, 22nd February, 1999. World Wide Web Consortium.
4) D. Brickley and R. V. Guha (eds.), Resource Description Framework (RDF) Schema Specification 1.0, W3C Candidate Recommendation, **http://www.w3.org/TR/2000/CR-rdf-schema-20000327**, 27th March, 2000. World Wide WebConsortium.
5) T. Berners-Lee, M. Fischetti and M. Dertouzos, Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web, Harper, San Francisco, September, 1999. ISBN: 0062515861.

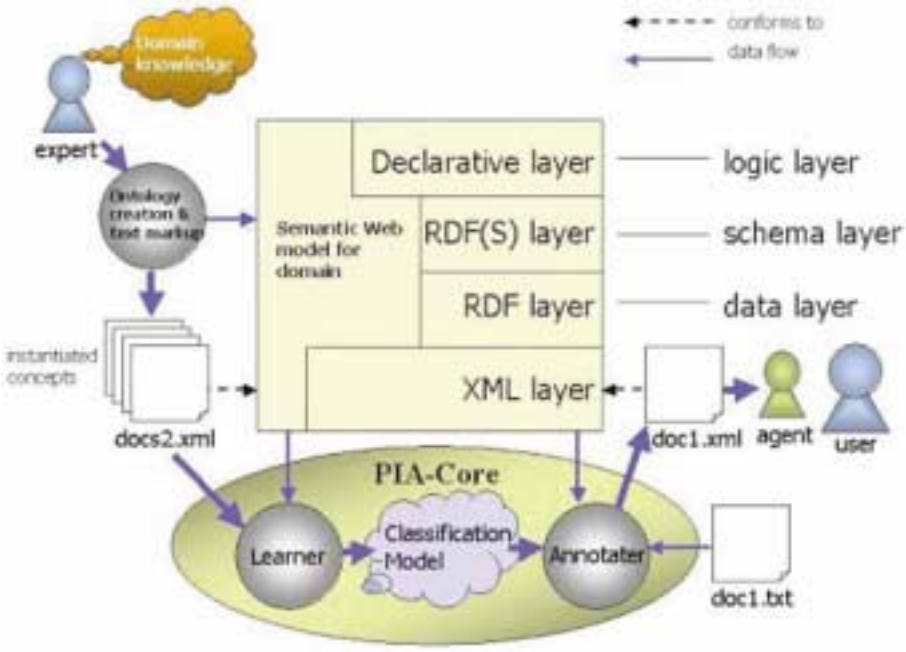


Figure 1. PIA-Core position in the Semantic Web model

9th NII Monthly Seminar ◆ June 20, 2001

Trial of the Paris-Contents Distribution Service (iFrench)

Visiting Professor, High Quality Networking Laboratory, Research Center for Testbeds and Prototyping, NII
Senior research engineer, supervisor in NTT Service Integration Laboratories

Masatoshi KAWARASAKI

He received his BE, ME and Ph.D. degrees of electrical engineering from Kyoto University in 1975, 1977 and 1991, respectively. Joining the Nippon Telegraph and Telephone Corporation (NTT) in 1977, he is currently in NTT Service Integration Laboratories. His study areas are architecture, design and control of telecommunication networks.

Broadband-compatible Web sites and contents are now appearing in medium-to-high-speed Internet access environment, such as ADSL or optical access. In September 2000, NTT Laboratories commenced a video delivery trial of the Paris-Contents Distribution Service (**iFrench**), which streams information about metropolitan Paris to Japan with the cooperation of NTT Europe. The trial, which combines video contents created at NTT's Paris base with a video delivery technologies/ copyright protection/ membership-based charging platform, aims to verify the marketability of video delivery service and the validity of the platform.

iFrench contents are developed by gathering on-site information about Paris in the video format with the cooperation of a French web development company. Composed of video (i-Video) and the latest information (i-News/i-Commerce/i-Web), iFrench is updated weekly and delivered to users in Japan.

Mass Delivery System (MDS) is used to deliver the video contents. This system optimizes the entire access environment by adopting mirroring that suits user access distribution through the use of distributed mirror servers set-up in advance. To protect copyright, a unique ID is allocated to video contents. This ID is embedded into the contents as a digital watermark. Although the embedding of digital watermarks has already been used in still images, this trial is the first time the concept has been extensively applied to video. iFrench is a membership-based service that allows users to be either monthly and zone members. At full-scale service implementation, contents charges will be added to the user's telephone bill using, for example, NTT Communication's "Calle" system. By conducting contents delivery separated and independent of authentication and accounting process, iFrench matches the invoice method with the contents being delivered via mirror servers to provide quick access to contents.

The number of registered members to the iFrench Internet site (**http://ifrench.ntt.fr**) reached 2,500 at the end of March 2001, thereby verifying the validity of the platform.

At the presentation of the NII study meeting, demonstrations of the iFrench video contents and the watermarking characteristics regarding quality and durability were performed.

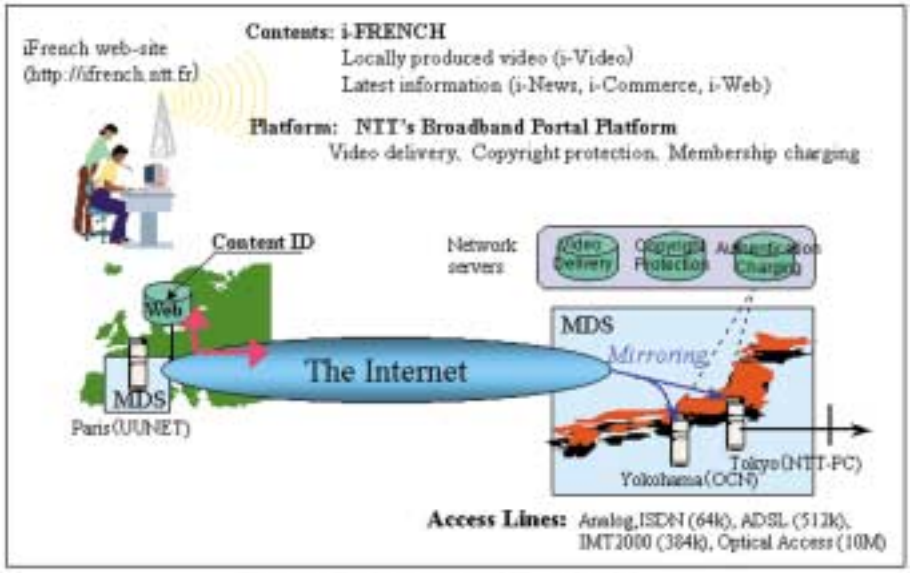


Figure Basic concept of iFrench trial

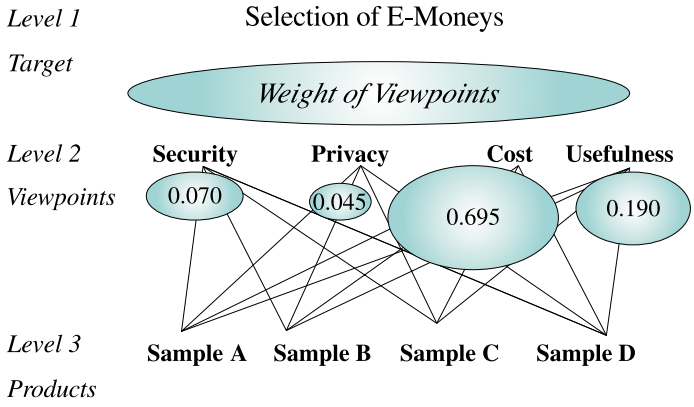
The institutional problem of electronic commerce

Associate Professor, Information Institution Research, Human and Social Information Research Division

Hitoshi Okada

Graduated in 1988 from Dep. of Law, University of Tokyo (Private Law Course), graduated in 1989 from Dep. of Law, University of Tokyo (Public Law Course), completed in 1998 the master course at Osaka School of International Public Policy (OSIPP), Osaka University; Ph.D. of International Public Policy; served as assistant research fellow at Private Finance Service Research Program at OSIPP, Osaka University, took the present office in November 2000; and, serves as secretary for the FACE forum of IEICE.

A next-generation portable telephone and the optical Internet enable the distribution of mass contents.
In order for a consumer to enjoy a movie and music, safe and easy cybermoney is required.
There are two kinds of cybermoney, one records customer information like a credit card, and another has anonymity like a cash currency.
Although customer information makes marketing more precise and prevents exploitation or double use, it also has the risk of privacy disturbance.
The safety intensity required for cybermoney differs according to the moneys scale dealt with, and the demand level to protection of personal information changes with utility functions of consumer each.
In this research, four elements of safety, anonymity, cost, and convenience were compared through the hearing to an expert of a distribution industry, and each significance was evaluated.
Moreover, numerical evaluation of the cybermoney of four types was carried out through the questionnaire to the specialists of finance.
By multiplying element significance and element characterlistics, it becames possible to choose cybermoney optimal type for every introductory scene.
By applying this research technique to development of the online purchase of scientific contents, I am planning to propose an academic online money in the near future.



Hierarchy of evaluating E-Moneys

10th NII Monthly Seminar ◆ July 18, 2001
Network related issues on Shared Virtual Environments with haptic media

Visiting Associate Professor, High Quality Networking Laboratory, Research Center for Testbeds and Prototyping, NII
Associate Professor, Center for Spatial Information Science at the University of Tokyo

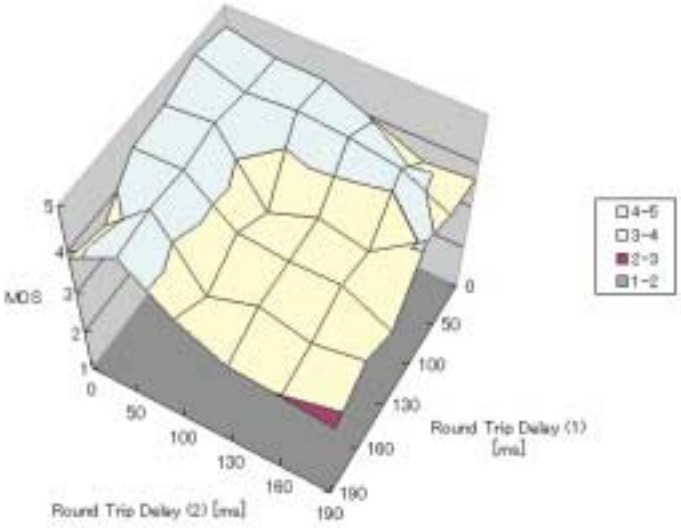
Kaoru Sezaki

He received his B.E., M.E. and Dr. E. Degrees in electrical engineering from the Univ. of Tokyo in 1984, 1986, and 1989, respectively. He joined the Institute of Industrial Science at the Univ. of Tokyo in 1989. Since 2001, he has been an Associate Professor of the Center for Spatial Information Science at the University of Tokyo. From 1994 to 2000, he was a guest associate professor at the National Center for Science Information Systems. His research interests include communication networks, location and context aware network services, haptic media, high-speed switching systems, and image processing.

Recently, haptic information and force feedback have been recognized as emerging and promising media as alternative to voice and image media as well as new type of human interface. Also, many experimental

level applications using haptics have been developed and some of them like surgery training are already commercially successful. However, almost all the existing applications have been developed by researchers of robotics whose interest are developing the hapitc devices themselves. Thus they ignore or almost unaware of the effect of the network impairment and assume ideal broadband minimum latency experimental network. In practical networks, however, there exist the severe bandwidth limitation, rather large latency and the packet loss and countermeasure against them is necessary to maintain the quality of applications.

From this point of view, in our laboratory we focus on such network oriented issues of haptic information and started the measurement of fundamental characteristics of transmission of haptic information over networks. We are developing the shared virtual environment (SVE) with haptic media. Currently, we focus on the issues as coding of haptic stream, media synchronization for the compensation of network latency and the countermeasure against packet loss for SVE type applications. Several interesting results are already found and introduced at the meeting. For example, the figure shows the characteristics of the subjective quality against the network latency in case of the collaborative task of carrying a virtual object using two haptic devices. Surprisingly, it is shown that strict media synchronization may sometimes cause the deterioration of the performance. Such counter-intuitive results can never be seen in case of conventional voice and image media They should be taken care of when construcing network protocols for haptic applications.



De-syntacticizing the theories of reference maintenance from the viewpoint of poetic function of language and gesture: A case of Japanese discourse.

Associate Professor, Cognitive Science Research, Foundations of Informatics Research Division

Nobuhiro Furuyama

Graduated in 1991 from School of Human Science, Waseda University; received his MA degree in human science in 1993 from Graduate School of Human Science, Waseda University and his Ph.D. degree in psychology in 2001 from Department of Psychology, The Division of Social Sciences, The University of Chicago; took the present office in April 2001; covers speciality in psycholinguistics and ecological psychology.

In the 10th NII Monthly Seminar, I presented a piece of work from my dissertation that argues for communicational unity of spoken language and gesture. In particular, I argued that textual structure, in addition to grammar, is the plane on which language and gesture, through the emerging indexical

relationships between and within the two different kinds of signs, together reveal communicational intent.

To demonstrate this argument, I picked up one of the classical problems in linguistics that referential ambiguity arises from the strong tendency to elide the subject/topic noun phrases. I pointed out that morpho-syntactic explanation is inadequate, if not entirely incorrect, to solve the problem. I then introduced a new approach to this issue that focuses on how the discursive textual structure is built up through various indexical relationships between and within the textual and gestural elements. Two analytically different arrangements of the linguistic and gestural signs were illustrated: One is indexical unity between speech and gesture realized by the performativity of speech as well as the tight synchronization tendency between the two signs, and the other is poetic structure realized by the iconic-indexical relationships within each type of the signs. It was emphasized that these two constitute, respectively, the vertical and horizontal threads that interweave one piece of fabric of discursive textual structure.

As an example of such a structure, an excerpt from a cartoon story narration by a Japanese speaker was examined. It was meant to demonstrate the significance of the analytic framework promoted in the present study. It particularly shows that gesturally achieved poetic structure is crucial in disambiguating the referent of the actor/subject noun phrase of a verb phrase '*soko made kuru* (come up to there),' which is ambiguous because of an apparent violation of the morpho-syntactic rule by continuing to elide the subject noun phrase when it is expected to be explicitly mentioned. Communicational intent, it was argued at last, emerges through the indexical relationships, at least in part, between and within the linguistic and gestural signs.

Introduction to Joint Research Project

Information Access based on Association

1. Information Access based on Association

Virtually any documents including Encyclopedia, newspapers, and daily information within industries becomes available in digital form. The effective access to those information is crucial to our intelligent life. We need a swift and reliable method to collect relevant documents from millions of documents. But the currently available methods are mostly based on simple keyword search, which suffers low precision and low recall. To remedy this, several new methods are proposed. Among them, information access based on similarity between documents or words looks promising to offer an intuitive way to overview a large document sets. But the heavy computing cost for evaluating similarity prevents them from being practical for large corpora of million docs.

2. Generic Engine for Association: GETA

GETA (**G**eneric **E**ngine for **T**ransposable **A**ssociation) is the software that provides the efficient generic computation for association, and is expected to bring a breakthrough in information access of next generation. GETA enables the quantitative analysis of various proposed methods based on association, and provides the implementation basis for making them practical. The development of GETA is now in the final stage of a three years project. It is a joint research effort by the group of researchers from Hitachi Central Research Laboratory and NII. It is supported by the Advanced Software Technology project under the auspices of Information Promotion Agency (IPA), Japan. GETA is expected to release as open source software in spring 2002.

The basic features of GETA is as follows:

(i) Efficient and generic computation for association
(ii) It is portable to various UNIX's on PC servers.
(iii) Associative document search for over one million documents can be done within a few seconds.
(iv) The similarity measures among docs or words can be switched dynamically during computation.

3. Document analysis methods using GETA

Various methods for document analysis will be implemented using GETA. A couple of examples are:

(1) Tool for dynamic document clustering
The various methods for dynamic document clustering are implemented using GETA:

(i) It provides an efficient implementation of HBC (Hierarchical Bayesian Clustering) method. It takes 2 seconds for clustering 1000 documents on a PC.
(ii) Representative terms of each cluster are available.
(iii) For comparative studies among different methods, most major existing clustering methods (e.g. Ward method, single-link method) are also available.

(2) Tool for evaluating word representativeness
Representativeness is a new measure for evaluating the power of words to represent some topic. It provides the quantitative criterion for selecting effective words to summarize the content of a given set of documents. We propose a new measure for word representativeness together with an efficient implementation for evaluating them using GETA. It is also possible to apply it for automatic selection of important compound words.

4. Experimental Associative Search Interface

C/Perl interface of GETA is useful to implement experimental systems for comparing various statistical measures of similarities. For demonstrating this flexibility of GETA, we implement an associative search interface for document search (See below). It can be used for quantitative comparison among various measures.

5. Future Plan

We are planning to port GETA on PC clusters. This distributed version of GETA should be able to process tens of millions of documents with same efficiency. It is expected to make new information access based on association be applied to large corpora such as web documents.

(Akihiko Takano, Professor,
Programming Languages Research,
Software Research Division
<aki@nii.jp>)

Associative Search Interface using GETA

TOPICS

NII Technical Reports were launched

NII launched the following technical reports. (NII Technical Report, ISSN 1346-5597)
For details, please visit our web site. ▶ **http://research.nii.ac.jp/TechReports/**

Number	Author and Title	Date of Publication
NII-2001-001E	ICHISE Ryutaro, TAKEDA Hideaki and HON-IDEN Shin-ichi / An Alignment Algorithm between Concept Hierarchies	May 10, 2001
NII-2001-002E	HAYAMI Ken/ On the Behaviour of the Conjugate Residual Method for Singular Systems	July 4, 2001
NII-2001-003J	HAYAMI Ken/ On the Behavior of the Conjugate Residual Method for Singular Systems (in Japanese)	August 3, 2001

Electronic Library Service (NACSIS-ELS)

Since April 1997, NII has provided "NACSIS-ELS," an online information service that enables users to browse pages of Japanese academic journals. Documents are available to be retrieved by using searches by title, author, or keywords of journals from your computer.

Outline of NACSIS-ELS

NACSIS-ELS provides an electronic document delivery of Japanese academic journals to support academic researches: it enables users - wherever they are - to retrieve original texts from journals quickly and easily.

NACSIS-ELS includes data on academic journals provided by Japanese academic societies. Contents are bibliographic data (e.g. title, author, abstracts, and journals) as well as image data created by scanning texts.

Users of NACSIS-ELS can search articles by bibliographic information, also read and output image data for printing in the Internet.

NACSIS-ELS provides data on academic articles for researchers whenever and wherever they need. Researchers can retrieve necessary academic data without constraints of time and distance, staying where they are researching.

Included Data in NACSIS-ELS

Following is the breakdown of data at the end of January 2002.

Number of academic societies: 167
Number of academic journals: 449
Number of academic articles: 1,068,504
Number of pages in image data: 3,619,370

NOTE: Academic societies have a right to establish ① copyright fees, as well as ② the time the latest issue of journals is taken public.

System Requirements

You can use NACSIS-ELS on either your Workstation or personal computer connected to the Internet. Reading and printout of texts are available only with special software for NACSIS-ELS. The software is developed by NII to prevent publications from illegal online uses unauthorized by author: it helps to dissolve fears for piracy in information society including the Internet.

Workstation users can read and print out academic articles in NACSIS-ELS with the special browser: Windows and Mac users can use a WWW browser plug-in. The special browser and plug-in software for NACSIS-ELS are available to be downloaded from the site of NACSIS-ELS.

How to Use

NACSIS-ELS is available to use all day, all year round at **http://www.nii.ac.jp/els-e.html**. Users of NACSIS-ELS are free to search and display bibliographic data, and display table of contents. However, you need registration as follows if you want to read and/or print full-text data.

(1) How to Apply

You need to register to use NACSIS-ELS. Qualifiers are as follows: Researchers (including graduate students) and staff in universities/junior and technical college/inter-university research

institutions/institutions within jurisdiction to Ministry of Education, Culture, Sports, Science and Technology and Agency for Cultural Affairs, as well as full members of academic societies.

Simplification of registration process has been now under study.

(2) Charge

The use of NACSIS-ELS itself is free for the foreseeable future, though royalties are charged on some of data. Whether or not royalty is charged for data depends on the academic society concerned.

For further information on copyright charge, please refer to **http://www.nii.ac.jp/els/copy-e.html.**

NII is planning the automation of wider range of academic journals, to make NACSIS-ELS more capable archives. We will keep our efforts to enlist more academic societies. NII also plans to add new contents such as university bulletins in near future.

For inquiries:
Image Contents Section, Contents Division
Tel: 81-3-4212-2315
Email: els@nii.ac.jp

(Contents Division)

Support for the Computerization of the Library of the Beijing Center for Japanese Studies

With the collaboration of the Japan Foundation, NII has been assisting in the computerization of the catalog records of the Library of the Beijing Center for Japanese Studies since fiscal year 1998.
The original goals, the introduction of the library system's operation and the creation of a database for about 57,500 Japanese books, were achieved within three years since the start of the NII's support to that center in 1998.
Mr. Kitamura, Director of the Dissemination Activities Division of the International and Research Cooperation Department, Mr. Sakurai, Chief of the International Activities Section of the Publicity and Survey Division of the International and Research Cooperation Department, and Mr. Yonezawa, Chief of the Contents Management Section of the Contents Division of Development and Operations Department, visited the Beijing Center for Japanese Studies between June 17 and 29 of 2001. They provided advices and technical support to the staff of that center with regards to matters such as: (I) the entering of about 12,000 of Chinese books into a database; (II) the preparation of ILL within China; and (III) upgrading the operation of center's library functions. These measures were taken for the preparation of the opening a new library in the Beijing Center for Japanese Studies in 2003.
With the cooperation of the Beijing Center for Japanese Studies and of some libraries in China which hold Japanese materials, the above mentioned NII's staff, some professors and librarians from the Beijing Center for Japanese Studies visited Tianjin Foreign Studies University, Tianjin Library and Second Historical Archives of China to survey their practices related to the storing Japanese materials. The purpose of this visit was to support the creation of a union cataloging system for Japanese materials.
In addition to that, NII's staff also visited the libraries of Peking University and China Agricultural University in order to exchange opinions on creating a union cataloging system for Japanese materials in China and to survey the feasibility of cooperation with Chinese library network.

(Publicity and Survey Division)

Library of the Beijing Center for Japanese Studies

Providing advices and technical support to the Center

Document Delivery Service between U.S. and Japan

"Document Delivery Service" is a new term that means service of academic documents by libraries in response to researchers' requests. Interlibrary Loan (ILL) system, the online system which enables member libraries to request photocopy or loan of documents each other, supports this service.

There are many kinds of ILL systems in the world, such as NACSIS-ILL (NII) in Japan, OCLC (Online Computer Library Center) and RLG (Research Libraries Group) in the U.S., and KERIS (Korea Education & Research Information Service) in Korea. In the recent globalization of academic researches, however, there were trends toward international standardization of ILL system, aiming at conjunction with ILL systems and efficient international ILL service.

In "CULCON (U.S.-Japan Conference on Cultural and Educational Interchange)" and other meetings concerned, on the other hand, there were proposals for the improvement of document delivery service between the U.S. and Japan. ILL system providers, in both sides of the two countries, were requested to develop the system based on ISO ILL Protocol.

In response to those requests, NII implemented ISO ILL Protocol to NACSIS-ILL, and then will start an experimental interconnection with OCLC on November 2001. The ILL system linkage between NACSIS-ILL and OCLC will enable NACSIS-ILL member libraries to request photocopy to foreign libraries, as same as domestic ones. Z39.50 Protocol, a international standard for bibliographic and holding information retrieval, was also implemented on June 2001. So, bibliographic database of NII are now available using Z39.50 Protocol.

NII will keep efforts to infrastructure and improvement of NACSIS-ILL, to promote global document delivery service.

(Contents Division)

Super SINET Promotion Conference Meeting and Symposium Held

Mr. D. Yoshida, Chief of Information Section, MEXT

Prof. Y. Suematsu, Director General of NII

Mr. H. Murakami, President of Japan Telecom Co., Ltd.

NII plans to start the operation of Super SINET in January 2002. Super SINET based on 10Gbps optical communications technologies is the world fastest network to connect scientific research organizations, and the network will use optical crossconnects (OXCs) for the first time in the world, and will provide a critical infrastructure for the most advanced scientific research in the fields,

for example, of high energy and fusion science, genome informatics, space and astronomical sciences, super-computer interlocking (GRID) and nanotechnology development, all of which require capabilities for very large-volume data exchange.
In FY 2001, the following 11 universities and research organizations are planned to be connected by Super SINET: Tohoku University, the University of Tokyo, Nagoya University, Kyoto University, Osaka University, the Institute of Space and Astronautical Science (ISAS), National Institute of Genetics (NIG), National Astronomical Observatory, National Institute for Fusion Science, High Energy Accelerator Research Organization (KEK) and NII.
Prior to the commencement of the actual operation of Super SINET, the 1st meeting of the Super SINET Promotion Conference and its symposium on "Structure and Effective Application of Super SINET" were held on 31 August, 2001, at the National Center of Science under the sponsorship of NII.
In the meeting, the Super SINET Promotion Conference, wishing to contribute to the promotion of scientific research in which Super SINET would play a vital role, decided that its activities be pursued by establishing a study group on each frontier research subject.
The meeting was followed by the symposium, where the issues of the advanced research subjects and the structure of Super SINET were discussed. Mr. Yoshida, Chief, Information Section, Research Promotion Bureau, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Prof. Suematsu, Director General, NII, and Mr. Murakami, President, Japan Telecom Co., Ltd. a member of the joint research with NII, made addresses, and the program proceeded to the presentation on the concept of Super SINET and on, by directorate researchers from each research field, some actual applications of Super SINET, attracting enthusiastic interest of the participants.
Being the first occasion of this conference, the meeting together with the symposium was opened to the public, and attracted some 250 participants. In addition, the meeting and the symposium were carried live via Internet to the universities, etc.
e-Japan Priority Policy Program (March 2001 IT Strategy Headquarters' Decision) has stated that the general arrangements of Super SINET be promoted, and therefore the estimate budget for the costs for the new connection with Hokkaido University, Tsukuba University, Tokyo Institute of Technology, Kyushu University, Okazaki National Research Institutes, etc. has been demanded for 2002 fiscal year.

(For details, contact net6@sinet.ad.jp)

(Network Systems Division)

The Super-SINET Promotion Conference Launched

Prof. Shoichiro Asano
Director & Professor,
Infrastructure Systems Research Division:
Representative, Super-SINET Promotion Conference

The Super SINET Promotion Conference was started on August 31, 2001 at the National Center of Science.

As explained in NII News No.3. Super-SINET to connect certain research institutions with 10Gb/s or more bit rates is to be initially operated in January 2002, in order to facilitate their activities for advanced scientific research. Super SINET is

Prof. Mitsutoshi Hatori. Director, Development and Operations Department, is making an address at the Conference's meeting.

Prof. Hiroaki Terada, President, Information Communications Institute, Japan Telecom Co. Ltd., stated the critical values of the photonic network.

expected to significantly promote such activities in the fields of high-energy physics, space and astronomical sciences, genome information processing, nano-technology and computational GRID as well as to materialize photonic Internet for the first time in the world.

The newly-formed Super-SINET Promotion Conference is responsible for the decision of objectives, the development of plans and the exchange of research results of the researches. For this purpose, it is planned that necessary study groups on research subjects are established. The meeting of the Conference was held and publicly broadcast via Internet, where the Charter of the Super-SINET Promotion Conference was adoptd and the Representative of the Conference and the Program Directors of study groups were elected. Further, because it has already been decided that the Super-SINET project and the ITBL project administrated by the Ministry of Education, Culture, Sports, Science and Technology(MEXT) be integrated for the network operation, representatives of the Institute of Physical and Chemical Research, Japan Atomic Energy Research Institute (JAERI) and other ITBL member organizations also attended the meeting. In the future, meetings of the members of the two projects will regularly be held. The meeting was followed by the Symposium on Super-SINET.
Subsequent to the opening address by Prof. Yasuharu Suematsu, Director General, NII, Mr. Haruo Murakami, President & Chief Executive Officer, Japan Telecom Co., Ltd. who is the representative of NII research partners for the Super-SINET project, gave an aspiring speech on the future of the company and then Mr. Daisuke Yoshida as honorable guest, Director, Information Section, Research Promotion Bureau, the Ministry of Education, Culture, Sports, Science and Technology, expressed congratulations and expectations for this project.

The author, Asano, outlined Super-SINET by using video demonstration, and then the program proceeded to the brief introduction of three research subjects. Prof. Yoshiyuki Watase, High Energy Accelerator Research Organization (KEK) referred to the relationship between emerging, challenging and internationally collaborative research topics and Super-SINET, and Prof. Yoshihiro Chikada, National Astronomical Observatory, to the possibility that super high-speed communications would contribute to dramatic progress of space and astronomical observation. Finally, Prof.Yoshiyuki Kawazoe, Metal Materials Research Institute, Tohoku University, introduced details of the forefront development efforts for new materials in an intelligible way, giving the audience a deep impression. In conclusion, Honorary Professor Hiroaki Terada, Osaka University, made a speech on the technological and business implications of photonic network. Honorary Professor Terada is the most prominent figure in the information communications field and, at present, in the position of President, Information Communications Institute, Japan Telecom Co., Ltd. This Symposium attracted some 250 participants from Japan and overseas countries, including those from US companies such as Lucent Technologies, Cisco Systems and Calient Networks. To achieve the smooth operation of Super-SINET and the successful development of its new functions, close cooperation with other research organizations and companies in Japan and overseas has to be strengthened, and it is expected to initiate some joint development projects with the participant entities in the present meeting and Symposium.

On the Behaviour of Iterative Methods for Singular Systems

Professor,
Mathematical Informatics Research,
Foundations of Informatics Research Division

Ken Hayami

1981: Master of Engineering, Graduate School of Engineering, The University of Tokyo. Ph.D., Dr. Eng. 1981: Research Laboratories, NEC Corporation.
1993: Associate Professor, Graduate School of Engineering, The University of Tokyo. From January, 2001: Professor, Mathematical Informatics Research, Foundations of Informatics Research Division, National Institute of Informatics.
Specializes in numerical analysis, especially numerical linear algebra, boundary element method and solution of inverse problems.

Problems in engineering and science often lead to large systems of linear equations. Iterative solvers are indispensable for the solution of such systems, and research have been done on various iterative solvers and their theory. However, the behaviour of iterative solvers on singular systems have not yet been sufficiently clarified.

Hence, we will consider the behaviour of iterative solvers for systems of linear equations whose coefficient matrices are not regular. Such systems arise, for instance, in finite difference approximations of partial differential equations describing the temperature distribution in a totally insulated room. They also arise in stochastic equations arising in the congestion analysis of computer networks.

Consider applying the Conjugate Residual (CR) method, which is a powerful method, to such singular systems. The method iteratively improves the approximate solution so that the residual (the difference between the right and left hand sides of the equation) is minimized. In the process, the method tries to improve the solution in the direction which is, in a sense, orthogonal (conjugate) to the previous direction.

It is clarifying to take a convenient basis when mathematically analyzing whether the CR method successfully gives the true solution. That is, when the range and kernel of the coefficient matrix are mutually orthogonal, the CR method can be decomposed in to the two components. Further, it can be shown that the necessary and sufficient condition for the CR method to successfully converge for arbitrary right-hand-side and initial approximate solution, is that the symmetric part of the coefficient matrix is semi-definite, and its rank is the same as the original matrix.

Further extending this idea, one can derive the necessary and sufficient condition for the CR method to converge when the direct sum of the range and kernel is the whole space, and the right-hand-side of the original equation belongs to the range space of the coefficient matrix, i.e. when the system is consistent.

As an example, for the singular system of linear equations arising in the finite difference approximation of the one-dimensional convection diffusion equation, the case of the periodic boundary condition corresponds to the former case, and the case of the Neumann (insulating) boundary condition corresponds to the latter.

For details, please refer to
NII Technical Reports (NII-2001-002E and 003J).

▶ URL http://research.nii.ac.jp/TechReports/index.html

Toward Knowledge Web Services

Visiting Associate Professor, Full-Text Contents Laboratory (visiting), Research Center for Testbeds and Prototyping, NII
Senior researcher, Tokyo Research Laboratory, IBM Research

Naohiko Uramoto

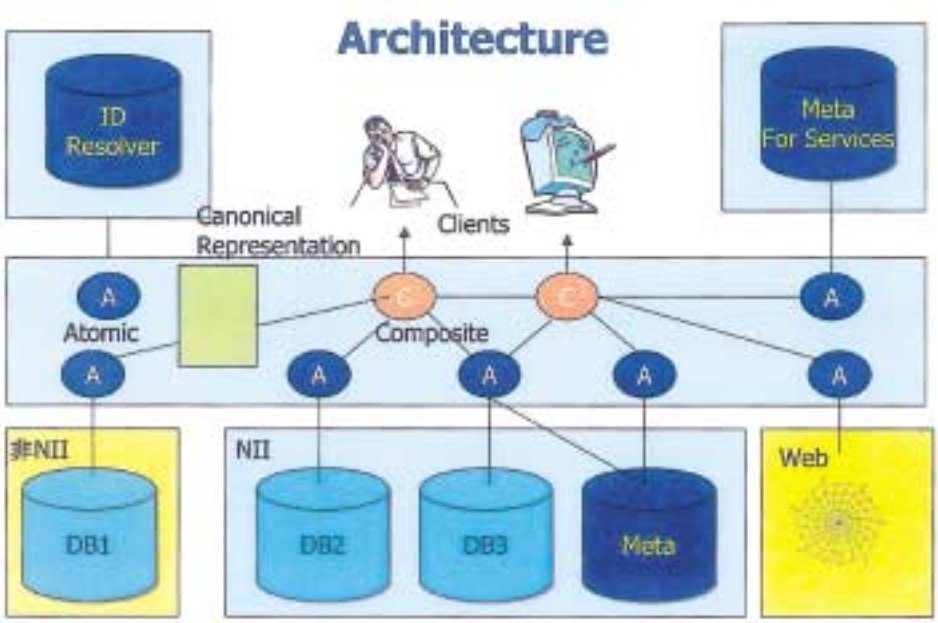
Naohiko Uramoto received the B.E. degree and M.S. degree from Kyushu University in 1988 and 1990, respectively. He joined IBM Research, Tokyo Research Laboratory in 1990, and he has engaged in research of natural language processing, information retrieval, and XML related technologies and their applications. He received Ph.D. from Kyusyu University in 2000, and joined NII in November 2000 as a visiting associate professor, Full-Text Contents Laboratory (visiting), Research Center for Testbeds and Prototyping.

The evolution of the Web does not stop year by year. In business area, XML has been playing a primary role on data representation. And now, the two new models the Web are coming: the Web Services and the Semantic Web. The aim of them is to make the web understandable for computers and accelerate the collaboration between humans and computers.

The Web is a huge knowledge system. There are huge amount of knowledge in the form of HTML files on the Web. XML makes it possible to deal Web resources as the structured data. To change the data to "operational knowledge", we must discuss on how to acquire, represent, and operate the data on the Web. Developing domain dictionaries and ontology are also important.

There have been many knowledge-system applications based on Artificial Intelligence (AI) and Natural Language Processing (NLP) technologies. Search engines and machine translation systems are good examples some of which had great successes, but most of them did not become big waves. One of the reason is the applications are complex and monolithic systems so that they are hard to maintain, enhance, and integrate them.

We are proposing the Knowledge Web Service which is a set of Web Services for existing and new AI/NLP applications. Each service has an XML-in/XML-out interface with a service description. It can be combined to construct larger services. The services can be operational from both human and computer, and it is easy to combine many tools and applications. Currently we are working on developing a set of Web services for existing tools developed at NII.



Introduction to Joint Researches Type Theory for Classical Logic

1. Type Theory

A type theory is a mathematical theory which analyses the notion of types, which are obtained by generalizing the notion of data types (for example, int in the programming language C) in programming languages. Type theories have been studied intensively for ten years. Type theories have not only theoretical deep significance, but also many contributions to design of programming languages. For example, the programming language ML is a practical programming language whose theoretical basis is a type theory. Recently the notion of types became indispensable for design of programming languages, since by using type information a compiler can optimize codes and automatically detect errors of programs written by human. On the other hand, various deep mathematical structures have been found in type theories. In particular, Curry-Howard isomorphism was found and it turned out that a logical system corresponds to a type theory by one-to-one correspondence.

2. Curry-Howard Isomorphism

Curry-Howard Isomorphism is one-to-one correspondence by which each type theory corresponds to a logical system of mathematical logic. A logical system is a theory which analyze inferences of mathematics by analyzing its syntax, while a type theory is a theory which analyze programs and types of data, and they seems very different. However, Curry-Howard isomorphism proved that they are essentially the same. This correspondence enabled knowledge for type theories in the computer science area and knowledge in the mathematical logic area to give new knowledge for each others, and make dramatic progress in both areas. For example, it is famous that a long-standing open problem in the mathematical logic area was solved by using the idea of a type theory. Moreover this correspondence gives us constructive programming, which is a way of programming and by which we can produce a program and its verification proof by writing a constructive proof of its specification formula, instead of writing a program directly and verifying it.

3. Type theories corresponding to classical logic

Curry-Howard isomorphism was known only for the relationship between constructive logics and type theories. Constructive logic is obtained from the usual logic used in mathematics, which is called classical logic, by erasing the law of excluded middle, which states that either "A" or "not A" holds. It is natural to think about extending Curry-Howard isomorphism to classical logic, since it is a common logic.

Our joint research is based on this idea, and we will study an extension of Curry-Howard isomorphism from constructive logic to classical logic. Recently this problem has been studied intensively and many good results have been obtained. However an appropriate answer to the question about what a type theory corresponding to classical logic is has not been found yet. It is conjectured that a type theory corresponding to classical logic is a type theory of continuation, exception handling and concurrent process calculus.

Curry-Howard Isomorphism

logical system	type theory
formula A	type A
and $A \& B$	cartesian product $A \times B$
or $A \vee B$	disjoint sum $A + B$
imply $A \supset B$	function space $A \to B$
for all $\forall x \in A.B$	dependent product $x : A.B$
proof P	program P
P is aproof of A	P is a type of A
proof normalization	program execution
classical logic	? type theory of exception handling, concurrency

Our research will construct a type theory of various features of programming languages which could not be covered by known type theories, such as continuation, exception handling, and concurrent process calculus. Then our research will enable us to use constructive programming to synthesis programs with these features. Moreover our research will contribute to mathematical logic by clarifying computational content of classical logic.

The members of our joint research of this year are Professor *Hirokawa* of *Kyushu* University, Professor *Kameyama* of *Tsukuba* University, Doctor *Nakano* of *Ryukoku* University, Professor *Fujita* of *Shimane* University, Professor *Hasegawa* of University of Tokyo, and I.

(Makoto Tatsuta, Professor,
Foundations of Algorithms Research,
Foundations of Informatics Research Division)

Introduction of NACSIS Projects

New service of image information through NACSIS-IR

The Information Retrieval Services of NII (NACSIS-IR) have accumulated scientific information in all fields of humanities, social sciences and natural sciences, to supply researchers with the necessary information online speedily and accurately.

On the databases of 'Scientific Papers' and 'Clinical Case Reports,' NACSIS-IR has started the service of image information.

The databases have stored up literal information i.e. titles, names of author, extracts and texts of the papers carried in scientific periodicals: full text search and readout have been available. New service supplements with non-literal information such as diagrams, tables, pictures, and formulas through WWW browsers, by accumulating such information as images. This online provision works as an alternative to the former facsimile services of visual information.

For details on how to use the service, please visit the web site of NACSIS-IR.

▶ **URL http://www.nii.ac.jp/ir/ir-e.html**

(Application Division)

Transfer of Authority of NACSIS Career Information Service (NACSIS-CIS)

Since May 20, 1997, NII had exercised jurisdiction over 'NACSIS Career Information Service (NACSIS-CIS),' which encourages the circulation of faculty members, as well as the employment of talented researchers with various backgrounds and careers.

NACSIS-CIS had provided online career information for researchers, displaying the databases on position offers publicized by scientific institutions i.e. universities. Since the online service started,