
1 Special Issue on Human Communications

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This special issue, entitled “Human Communications”, summarizes the results of research conducted in the First Middle Term Target Period (from FY 2001 to FY 2005) at the Keihanna Human Info-Communication Research Center, the predecessor of the Knowledge Creating Communication Research Center.

The Keihanna Human Info-Communication Research Center was founded in July 2000 in the Keihanna Area (at the Culture and Science City, located on the site at which the prefectures of Kyoto, Nara, and Osaka meet) as a new establishment to gather and strengthen research and development related to content and interface technologies. The Center set as its goals the creation of basic user-friendly information and communications technologies (including so-called “human communications”) that will enrich the lives of all people, including the old and the impaired, in the course of our transformation to an advanced information society. Further, the Center aims specifically to apply these technologies throughout society with the development of applications for public use. In accordance with these goals, we have aggressively promoted collaboration with third parties, particularly with private research institutions (including the Advanced Telecommunications Research Institute International (ATR) and NTT Communication Science Laboratories in the Keihanna Area), with universities (Kyoto University, Osaka University, Nara Institute of Science and Technology, and others), and with advanced research institutions in other fields.

As part of these collaborative activities,

the Keihanna Info-Communication Open Laboratory was launched in April 2003 within the Keihanna Human Info-Communication Research Center. Taking advantage of this open laboratory, our aims were to establish effective means of collaboration among those in industry, government, and academia; to cultivate human resources incorporating a variety of specialists; and to create new industries relating to information and communications technologies, including advanced network functions, human-centered communications, and network robots. Through these activities we also intended to invigorate the economy in the Kansai Area. To accomplish these aims, in October 2002 we established the Research Promotion Council of Keihanna Info-Communications Open Laboratory (Executive Offices: the National Institute of Information and Communications Technology, the Kansai Economic Federation, the Foundation of the Kansai Research Institute, and the Kinki Bureau of Telecommunications of the Ministry of Internal Affairs and Communications). At the outset the Council was comprised of seventy members. This number subsequently increased, with 110 members taking part as of April 2006. We developed diverse research environments as experimental facilities for the open laboratory, including a so-called “ubiquitous home” and an experimental environment for super-high-definition large-scale images, as well as experimental facilities for GMPLS interconnection verification, distributed virtual network development, and interconnected transmission between OTN-compliant carriers. We also developed the JGN2 (a testbed

network environment for research and development) and performed diverse joint experiments and demonstration experiments with the collaboration of industry, government, and academia.

Within this research environment, the NICT Keihanna Human Info-Communication Research Center organized five Research Groups, each conducting research and development under the research objectives indicated below.

- (1) The Computational Linguistics Group aims to implement environments in support of human cognitive activities. The Group develops technologies for processing and communicating natural language, which forms the basis of human communications, and conducts research and development of systems that process linguistic information in diverse multi-linguistic forms.
- (2) The Interactive Communication Media and Content Group conducts research and development of fundamental software and demonstration systems for creating, accumulating, processing, retrieving, distributing, and personalizing digital content in diverse media in a rapid next-generation Internet environment.
- (3) The Social Interaction Group clarifies the mechanisms that a system equipped with anthropomorphic features will require in order to engage in natural communications with humans. The Group also conducts research and development of communication systems that can interact with human beings in shared situations, systems in fact capable of social relationships with human beings.
- (4) The Human-Computer Intelligent Interaction Group conducts research and development of information and communications technologies required to realize a society in which all people — including the elderly and the impaired — can live comfortably, receiving and sending information free of barriers and limitations.
- (5) The Distributed and Cooperative Media Group conducts research and development

of fundamental technologies to help understand user behavior and the user context, as well as technologies that will facilitate the provision of information and communications services tailored to user needs.

This special issue introduces the results of research activities conducted by these five groups, dividing these introductions into five corresponding chapters.

The chapter on **Natural Language** introduces diverse research activities and specific results, from those relating to fundamental technologies to the results of application technologies concerning natural language processing and language resources. Subjects include a large-scale spontaneous speech corpus (the “Corpus of Spontaneous Japanese”) and its method of construction (an annotation-based method incorporating morphological and dependency structures); diverse information-access technologies for processing natural language information (information retrieval, information extraction or “text mining”, replies to queries, and document classification); technology for automatic construction of a large-scale Japanese-English parallel Corpus and for the assessment of its reliability; a conceptual, systematic, and automatic method for constructing a thesaurus out of a large amount of text (with the relevant retrieval technology as an element of application); construction of a system for automatically indicating the misuse of the Japanese honorific and evaluation of the results of this system; and diverse language resources: a Japanese-Chinese parallel corpus, a Japanese-Chinese translation dictionary, a semantic annotation corpus, and a Japanese English-learner corpus, among others.

The chapter on **Content Fusion Technologies** introduces communications and broadcasting content fusion technologies aimed at integrating web content (“communication content”) and television broadcasting (“broadcasting content”) as well as the digital-content fusion technologies required to incorporate digital content into a real-world environment and the necessary technologies to put

such content to use. The chapter also presents a range of research results, including those relating to complementary television and web reception, a search engine for integrated handling of recorded television programs and web content, diverse media conversion technologies for web content, a technology for the presentation of real-world information based on virtual 3D content, information presentation technology based on existing media metaphors, and technologies for the use of content embedded in a real-world environment.

The chapter on **Social Interaction** addresses research and development of interfaces that will clarify the corporeal functions of daily communications, paving the way for a system enabling shared situations and real interactions with human beings. Specifically, the chapter introduces research and development related to methods of estimating human motor intentionality based on surface electromyography, basic psychological experiments to elucidate the processes of recognition of human body images, the clarification of mechanisms to establish shared attention and information in human communications, and methods of analysis of nonverbal behavior arising during verbal dialogue.

The Chapter on **Universal Terminals** introduces research and development intended to enable the widest range of people, including the old and the impaired, to move about freely and to obtain the information they need. Despite the difficulty of removing barriers from all spaces through which people wish to move, we can respond to most needs through various forms of walking support. This chapter introduces the universal design of a walkway network and a Mobility Support Geographic Information System developed with this end in mind, as well as the Intelligent City Walker (ICW) equipped with various sensors for avoiding obstacles and recognizing the environment, and a user-carried mobile terminal indicating information on navigation routes and the surrounding environment.

The chapter on **Collaborative and Dis-**

tributed Media introduces the research and development of fundamental technologies for customizable home information and communications services based on user behavior and context and on the dynamic linking of the functions of various information devices. The chapter specifically discusses the related UKARI Project, including the “UKARI core” and “UKARI kernel” middleware which coordinates various devices and sensors, and presents a number of proposed systems to help find missing objects in the home.

These research activities were reviewed and reorganized under the “Universal Communications Research Project” established as one of the major research topics in the Second Middle Term Plan that began in FY 2006. These activities are now proceeding under a new organizational structure. The general aims of these activities are summarized below.

As communication systems and device technologies continue to evolve, from optical and wireless communications to IC and RF tags, infrastructures for broadband and ubiquitous information and communications have rapidly expanded; indeed today we have access to information and communications network systems “anywhere, anytime”. Recently, new information and communications systems, notably the so-called “Web 2.0”, are also transforming societal and economic activities.

Nevertheless, when we look at the present situation and ask in fact whether “anyone” can use these information and communications network systems freely and without difficulty, various “barriers” become clear, including the following specific examples.

- (1) Language barriers: We can access information all over the world via the Internet. However, if we can't understand the language in which information is presented, we can't make effective use of such information, however valuable it may be. Smooth communications are similarly frustrated by such language barriers.
- (2) Barriers to quality: The Internet is not limited to information that is correct and valu-

able; it also contains a great deal of erroneous and even intentionally misleading information. We need to be clever in identifying reliable information from an enormous amount of available content so that we may be confident in making knowledgeable use of this information.

- (3) Barriers in capabilities: Advanced and enhanced functions entail a complicated system operation (even the operation of mobile phones and PCs), and a great deal of knowledge and experience are required to make full use of these complex systems. This increased complexity has in turn led to a greater expansion of the digital divide.
- (4) Cyber-Real barriers: With the ever-increasing role of the information and communications community, the inconsistency between information circulated in this community and the facts of the real world can lead to significant problems. Demand is high for the development of technologies and systems that will enable the seamless connection of these communities in real time.

These barriers become even more conspicuous as information and communications network systems develop further. It is perhaps no exaggeration to say that the future development of the information and communications network will depend on overcoming these barriers.

The basic concept of “universal communications” has been proposed as an overall means of overcoming these barriers and establishing a communication environment that is truly user-friendly for all. Accordingly, NICT

organized a Knowledge Creating Communication Research Center and a Universal Media Research Center in April 2006, to enhance and supplement its efforts to promote research and development that will lead to the realization of universal communications.

Specifically, the Knowledge Creating Communication Research Center works to construct communication environments that can overcome differences in languages, knowledge, and capabilities, all built upon an advanced information and communications infrastructure. The Center also conducts research and development of multilingual translation, verbal and non-verbal dialogue, information analysis based on reliability assessment, and user-friendly communication environments. The Universal Media Research Center conducts coherent research and development of super-realistic communication systems — from basic research such as the clarification of sensory mechanisms (visual and auditory as well as the remaining senses) to the construction of super-realistic communication systems based on 3D images and sounds.

This seasonal report thus introduces research concerning human communications under the First Middle Term Plan. The results of this research have now been inherited by the Universal Communications Project, which continues the research and development with the overarching aim of implementing user-friendly communication environments. We look forward to receiving any thoughts and guidance from our readers in the further promotion of our future research activities.



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