

PRESS RELEASE**KEIO TECHNO-MALL 2011****"Let's get started." December 9th (Fri) -Introduction to the Latest Research-**

The Keio Leading-edge Laboratory of Science and Technology (KLL; Yokohama City) will hold KEIO TECHNO-MALL 2011, "Let's get started," on December 9th (Fri) at the Tokyo International Forum (Marunouchi, Chiyoda Ward, Tokyo).

KEIO TECHNO-MALL 2011 offers roughly 80 demonstrations, showcases and panel displays which convey to the public the various findings and technologies produced by Keio University's Faculty of Science and Technology and Graduate School of Science and Technology.

An overview of the event can also be found in the press release dated November 17th, but the purpose of this release is to introduce the "Key Topics" of this year's event, focusing in particular on four of this year's presenters. Also of interest are the "Current Interest Topics" which have been in the media of late.

We encourage representatives from the media to come and hear firsthand about what Keio University researchers and graduate students working on the cutting edge of science and technology have achieved so that their projects and results can then be communicated to a wider audience.

Key Topics (*Further details on the following four topics are given on subsequent pages.)

- (1) VIDELICET: A Visualization Provenance Management System (Exhibition Booth 40)
Professor FUJISHIRO, Issei (Department of Information and Computer Science / Center for Computer Science)
- (2) Facial Action Mimicking Avatar System (Exhibition Booths 49, 50, 68, 69)
Associate Professor MITSUKURA, Yasue (Department of System Design Engineering / Center for System Integration Engineering)
- (3) Situation-Aware User Support (Exhibition Booths 56, 57, 58)
Assistant Professor IJIMA, Tadashi (Department of Administration Engineering / Center for Open Systems Management)
- (4) Simulating Optimal Trading and Hedging Strategy in the Financial Markets (Exhibition Booth 61)
Associate Professor IMAI, Junichi (Department of Administration Engineering / Center for Open Systems Management)

Current Interest Topics

Professor YAMAZAKI, Nobutoshi: "Seats That Never Make You Tired" (October 19, Nikkan Jidosha Shimbun) (Exhibition Booth 1)

Professor AOYAMA, Tojiro / Associate Professor KAKINUMA, Yasuhiro: "Electro-adhesive Fixing for Fabricated Materials" (October 10, Nikkan Kogyo Shimbun) (Exhibition Booth 22)

Professor OHNISHI, Kouhei: "Recreation of Human Fingertip Movement: Keio University Develops Two-fingered Robot" (September 29, Nikkei Sangyo Shimbun) (Exhibition Booths 18, 19)

Professor TERASAKA, Koichi: "Academy Yoshizumi - Amazing, Life Changing Bubbles! What Are 'Microbubbles?'" (September 26, TV Asahi: Morning Bird!) (Exhibition Booth 33)

*For more information about displays, seminars, etc., please visit the KEIO TECHNO-MALL 2011 website: <http://www.kll.keio.ac.jp/ktm/en/>

*If you would like to cover this event, please inform us in advance at the contact details below.

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[Research Topic (1)] VIDELICET: A Visualization Provenance Management System (Exhibition Booth 40)

Professor Issei Fujishiro has presented a cooperative visualization environment known as "VIDELICET," which serves as a data visualization support system capable of recommending visualization methods and tools optimized to a user's objectives. By employing this system, individual users, project teams and others can compile and publicly release their successful past visualization projects as well as receive support for current visual analysis. This system is garnering attention for its ability to help even the novice user to sort through the diversity of visualization tools currently available and select those which will optimize his or her workflow.

“Invisible Visualization” of Unnecessary Data

Simulation and modeling are now being incorporated into all fields, and massive volumes of data are being generated for use in research and business. In order to ascertain the state and significance represented in these massive data volumes, it is useful to convert them into appropriate graphs or conceptual diagrams, thereby producing a “compression” effect that facilitates an understanding of the target phenomena. This “visualization” of data has been made much easier through the use of increasingly sophisticated computers to the point where, as things stand now, computer-assisted visualization is an accessible approach that anyone can utilize. However, at the same time that this approach is gaining wider acceptance, there are many ineffective examples of visualization resulting from unfamiliarity with highly sophisticated visualization tools or the visualization of unnecessary data, leading to unintended results. In response to this situation, Professor Fujishiro has developed a system called VIDELICET (Visualization Design Life Cycle management), which is based on the concept of “invisible visualization” whereby users are not presented with worthless visual information thanks to the system sorting through the numerous visualization methods and tools to recommend those that are optimized to the user's objectives.

Optimized Workflows Tailored to Users' Visualization Objectives

The technical essence of visualization lies in converting numbers and values into visual representations. The process for achieving this can be roughly divided into three phases: 1) conceptual design via the selection of objectives and guidelines for achieving said objectives, 2) articulation design via the selection of specific visualization methods and tools, and 3) parameter tweaking leading to results which are easy to understand visually. The “invisible visualization” offered by VIDELICET takes on all of these functions to offer robust support for “first person perspective” visualization which is directed towards that which the user wants to know. Specifically, the user provides VIDELICET with a visualization objective, i.e., the user tells VIDELICET what he or she wants to know from the target data. VIDELICET then provides the user with a priority ranking of design guidelines, visualization methods and tools that will result in effective visualization. By executing workflows tailored to the objectives, the users can obtain suitable initial results while at the same time suppressing valueless results. Another merit to use VIDELICET is that it can awaken a user's experience and intuition.

Only Tools Successful in the Past Are Recommended

VIDELICET performs “invisible visualization” workflow recommendations based on its "repository" which compiles successful past examples. This repository is built up from projects which the user and VIDELICET have collaborated on in the past. VIDELICET recommends tools with a good track record to users and then collects and compiles examples of success by the users utilizing the tools which it recommended, thereby augmenting the repository. By repeating this cycle of user support, followed by successful example collection and compilation, a certain level of quality can be guaranteed from the objective-tailored visualization workflow which VIDELICET recommends.

In addition, the successful examples compiled in the repository can be referenced according to the detailed provenance data for each, including not only methods and tools employed but even adjusted parameter values, setting sequence and user comments. By re-utilizing this provenance information, users are allowed to expeditiously perform additional testing on previous research or to perform validation of related research.

Highly Versatile and Applicable Regardless of Field

On the day of the demonstration, actual datasets acquired from a wind tunnel will be used with the VIDELICET prototype to analyze a Karman vortex street. Visitors will be able to experience firsthand the open, cooperative work environment which provides a sense of ease in selecting visualization methods and tools recommended based on successful past examples and which collects and compiles its own results as successful examples for future reference.

The repository with which the VIDELICET is equipped is highly versatile and not specific to any one category of research. For the future, work is being done to make the VIDELICET compatible with not only fluid dynamics but also structural dynamics, medicine, biology and every other field.

[Research Topic (2)] Facial Action Mimicking Avatar System (Exhibition Booths 49, 50, 68, 69)

Associate Professor Yasue Mitsukura engages in research aimed at eliciting the meaning and intent contained within biosignals and image signals, and she has presented a system which utilizes brainwaves, as one type of biosignal, to objectively evaluate human feelings and preferences. In addition, Mitsukura has presented a technical application of image signal analysis in the form of a system capable of reading the emotions and bearing of a person using image signals who is observed through a Web camera and then mimicking these emotions using an avatar. It is expected that this research will continue to be developed as a support tool for emotional communication.

Practical Application of Biosignal Semantic Analysis Technology

There has been an abundance of research in recent years into reading the feelings and emotions contained in biosignals, something which is essential for human communication. Associate Professor Mitsukura has further advanced the state of this research by not only improving the accuracy of semantic analysis but also by putting it to practical use, such as through the development of a compact, high-speed device for compiling and analyzing biosignals as well as the development of an easy-to-use interface. The "Facial Action Mimicking Avatar System" and "Simple EEG-based Objective Evaluator," which will be on display at the booths, represent extremely practical applications of basic research up to this point, and they are attracting the interest of industry.

Quantifying Human Feelings and Preferences Based on Brainwave Measurements Using a Simple Measuring Device

Because objective evaluation of human feelings and preferences depends so much on subjective factors, these feelings and preferences are difficult to quantify. This is particularly true for questionnaires, where people can often be confused by the wording of questions, making quantification of feeling and preference extremely difficult. Thus, in order to inject objectivity into the evaluation of feelings and preferences, Associate Professor Mitsukura has presented a system capable of reproducing, in real-time, objective evaluations of drowsiness, concentration, stress, etc., based on analyses of brainwaves.

At the exhibition booth, a simple EEG (requiring only ten seconds to put on and without the need for gel) is utilized to analyze brainwaves; this then allows the state (drowsiness, concentration, stress) of the wearer to be observed in real-time. The brainwaves measured represent one PF1 location (using the international ten-twenty system), and they can be analyzed using a mobile PC or smartphone.

Specific, anticipated uses of this system include using it to objectively evaluate interest in books or magazines, the effectiveness of advertising and the taste of food; it is also attracting attention as a communication interface for use with people who have lost the ability to communicate, such as a result of total paralysis. Also, because the evaluator is light and unobtrusive when worn, it can be used to easily record changing feelings and preferences over time, thus being used as a bio life-log or for bio-feedback.

An Avatar which Mimics Your Expressions

In a scene from a movie about the near future, the main character wears pajamas as he talks into a videophone; on the screen on the other end of the line, he appears neatly dressed in a suit. When the sleepy-faced man frowns or smiles, his well-dressed self also frowns or smiles. Now, like the technology in this scene, Associate Professor Mitsukura has presented a system which can mimic users through an avatar. A person frowning or smiling in front of a Web camera will see their avatar also frowning or smiling. When the user approaches the Web camera, the avatar also gets closer; when the user moves back, so too does the avatar. The avatar mimics the user's expressions in almost perfect real-time; if the user turns to the Web camera to give a kiss, the avatar makes a kissing face at the same time. The smooth, natural movements are enough to make users think they are dealing with a real person.

The system detects changes in a person's eyes, mouth, etc., from image signals, determines whether they are smiling or frowning, and then mimics this with the avatar. It also recognizes and mimics changing expressions, detecting the moment by moment transitions, such as from a smile to a frown. The processing of image signals occurs almost instantaneously, and the resulting image output is produced at 30fps (frames / second) to mimic expressions smoothly and naturally.

In addition to being used for avatar-driven Skype or videophone sessions, it could also be used as a stand-in for the actual person, such as an e-learning instructor. Also, regardless of what the speaker thinks or feels inside, the avatar only mimics a speaker's expressions, making it suitable for call centers and receptionists.

[Research Topic (3)] Situation-Aware User Support (Exhibition Booths 56, 57, 58)

Assistant Professor Tadashi Iijima works to build environments containing unobtrusive systems and services which provide users with appropriate functions. This year Iijima will present three research results which utilize technology in sensing, simulation and security.

Unobtrusive Support Systems and Services

Assistant Professor Tadashi Iijima and his teams work to construct systems capable of inferring/detecting users' objectives and intentions for a given system or service and then providing them with optimally timed, appropriate functions and information. This year, Iijima will present (1) a system which uses sensing technology to estimate human actions and then provides support for those actions, (2) a cross-cutting, information sharing electronic health records system driven by security and cloud computing technology, and (3) a simulation technology-driven support system for disaster evacuation planning which takes into consideration the condition and behavior characteristics of individual people.

Constructing a Sensor-based Human Behavior Recognition and Work Support Environment

The system being presented is capable of observing a human's actions, inferring what their next action will be and then proactively providing services required by the person. On the day of the presentation, a work support environment will be demonstrated which can assist a person assembling blocks.

Using cameras, infrared sensors and floor pressure sensors, this system extracts information about the person's actions, such as where they are standing and how their hands are moving, and then compiles data about the relationship of the actions, the work being performed and the results. By analyzing this data, the system is able to predict the person's next action and then support them by indicating where the part or tool they will need for their next action is located.

This system can be utilized not only in factory assembly lines but even in household kitchens. For example, when someone in the process of cooking stops their hands in hesitation, the system (which has observed their hand movements thus far) will casually inform the person about what step comes next. The aim is to provide support only when a user is detected to be in need of help, such as in the kitchen example, or in danger.

Producing Electronic Documents that Provide Both Fine-grained Security Management and User Convenience

The popularization of electronic publishing has created the need for restricting users' ability to change content and for changing the scope of viewable content according to a user's access qualifications. Associate Professor Iijima and his team are working on addressing these issues of fine-grained access control without sacrificing user convenience in the process.

The security system that will be presented this year is aimed at electronic health records and allows for detailed viewing and writing restriction settings to be put in place for multiple roles, e.g., doctors, nurses and pharmacists. This protects patient privacy as well as prevents mistakes and falsifications from making their way into health records. Also, data is contained in a computer cloud in order to better protect it from being lost as well as to make it more accessible, such as by allowing test data to be shared between multiple medical institutions. Currently there is discussion on enabling paramedics out on emergency calls to have mobile access to some of a patient's electronic health records if permission is granted by a doctor.

Geo-Simulation of Human Behavior to Contribute to Emergency Evacuation Planning

This presentation will discuss work on creating simulations of how people living and working in a given area will behave in the event of a disaster so that this information can be used to help create and deploy actual disaster evacuation plans.

The project that will be introduced uses a portion of the map for Kamakura City as the basis for a virtual space in which the behavior of residents, possessing gender, age, etc., characteristics assigned in accordance with statistical data, is simulated during a disaster. This simulation can assist in the creation of actual wide-area evacuation planning that takes into account specific behavioral considerations, such as what paths people will take when heading towards an evacuation shelter, whether people will go by car or on foot, and how fast they will be moving.

Currently, work is progressing on the construction of a system which performs rapid simulations using synchronous/asynchronous assimilation of data being continually received from a disaster area in order to help in the creation of response measures that reflect the changing situation in the affected area. This project utilizes building design data in place of geographic data in order to apply disaster prevention measures not only to the regional level but also to the interior of individual public facilities and commercial buildings as well.

[Research Topic (4)] Simulating Optimal Trading and Hedging Strategy in the Financial Markets (Exhibition Booth 61)

Associate Professor Junichi Imai has built a system which can simulate future trajectories of underlying stocks, derivatives and other financial products. He has developed a systematic way of simulating up-to-date financial models. This system can visually compare the effects of traditional trading strategies and some new trading strategies which reflect crucial empirical facts observed in the real financial market. It is anticipated that this system will help senior risk managers find better hedging strategies by visualizing possible future outcomes of their trading strategies.

Logical Support for Trading Strategies Generated by Computational Finance

Computational finance provides us practical and efficient methods for calculating fair prices of financial products, creating new financial instruments for risk management, measuring risk exposures, and developing optimal investment strategies. Using the knowledge and technology developed in the field of computational finance, we can seek more objective decision-making, those that are not too dependent on trader's intuition and personal past experiences. It will be a core competency of financial institutions, especially in the current highly uncertain environment.

Contributing to Financial Product Price Assessment and Risk Hedging

Associate Professor Imai has developed a simulation system, based on the innovation developed in computational finance, which allows us to assess hedging strategies for options, a type of derivatives.

A European option is a contract giving its owner the right to buy (or sell) a fixed number of shares of a specified common stock at a fixed price (exercise price) at a predetermined date (expiration date). It is a unique type of financial contract, because it gives the buyer the exclusive right, but not the obligation to exercise at the expiration date.

A "call" option is an option which gives the owner the right to buy the underlying asset. One can get a call option by paying some option premium. For example, suppose that the market price of the underlying asset is higher than the exercise price at the expiration date. Then, the owner of the call option can exercise the right to purchase the asset at the exercise price, instead of the market price, with the difference representing a profit. But what if the market price is lower than the exercise price? Then, the owner can simply relinquish his or her right and buy the asset at the market price.

On the other hand, the option writer gets the option premium in selling the call option. If the market price of the underlying asset at the expiration date is lower than the exercise price, he or she can make the option premium as a profit. When the market price is higher than the exercise price, the writer has the obligation to reply the exercise of the option, selling the underlying asset at the exercise price. Thus, the writer is exposed to a potential loss from the option contract. Because financial institutions often play the writers' roles, they need to decide an appropriate premium to prevent them from unpredictable loss.

The system presented by Associate Professor Imai is based on the option pricing theory that can simulate future trajectories of underlying stocks, options and hedging strategies under a more sophisticated financial model, called the Lévy process. This system helps senior risk managers evaluate the risk exposure of financial assets and find better hedging strategies by visualizing possible future outcomes of their trading strategies.

Simulations Are Adaptable to Different Trading Strategies

Option pricing theory was first proposed in 1973 by Fischer Black, Myron Scholes and Robert Merton. Since then, the theory has been extended in a number of important directions. However, many studies have reported empirical findings that contradict a fundamental assumption that "stock return follows a normal distribution". The actual financial data indicate that the asset returns typically exhibit semi-heavy tails and large discontinuous movements. These facts are also supported by a history of financial disasters; Black Monday in 1987, the bankruptcy of Long-Term Capital Management (LTCM) in 1998 and the Lehman Brothers bankruptcy in 2008. Thus, a quest for new financial modeling has been begun in order to take these empirical findings into account.

The simulation system presented by Associate Professor Imai is adaptable to these issues. It can simulate various financial models and visually compare them in order to verify the effectiveness and risk.

Expected Use as Real Options

This system is demonstrated from the point of view of financial institutions. It is worth mentioning that options are fundamentally based on the concept of flexibility under uncertainty of future environment. Thus, this system can be extended to make strategic investment decisions for non-financial institutions. Managers can make flexible decisions; to defer, expand, subtract, or abandon the investment that depend on unfolding events. They are known as real options, and they are where future applications of this system are expected to be found.