Artificial Intelligence
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KiSs:An Information Visualization System That Makes Thinking Fun

Interviewer: Katsuaki Tanaka, Research Assistant

——Professor Akaishi, I wonder if you could tell us what you're currently most interested in. I heard that the "Interdisciplinary Memory Research Meetings" have all been quite interesting.

Generally speaking, these days I'm interested in highlighting the relationships that exist between all sorts of things. It's possible to look at a single thing in a variety of ways, and relationships change according to one's perspective. To begin with, I'm trying to bring to light the structures within written texts. For example, if you look at a historical chronology using KiSs, the tool that I created, I can show you a new way of looking at it as something other than a simple chart. When I showed this to Professor Mikuriya at one of our campus-wide, "Interdisciplinary Memory Research Meetings", he came up with one idea after another about how someone writing a historical novel could use it to incorporate different episodes into their story. This is all to say that, by using a computer to freely change perspectives and show things from various angles, I think that it should be possible to draw out the knowledge that lies dormant within someone's mind. Normally, when we speak of information retrieval, it's mainly a question of how best to extract necessary information from a computer, but I think that by interacting with computers, it should be possible to draw out various knowledge and relationships from humans as well. Doesn't it seem that we should be able to give shape to and clarify the implicit knowledge that an individual is not directly aware of, and based on that, go on to think of one thing after another, causing a kind of chain reaction? In this way, in the field of human memory, I'm hoping that the KiSs system can be used as a trigger to help people recall the memories that they had forgotten. For example, it occurred to me that Professor Mikuriya might be able to use it as a support system while he is interviewing politicians.

——Your system doesn't extract "points," does it? In information retrieval, it's usually "points" that are generated, don't you think?

I started out by paying attention to "points," but currently I'm looking at how "points" are tied together. At first, I began researching information searching in databases, and I proposed two methods: "content designation search" and "context designation search." The former is a method where you extract information by specifying a piece of what you're looking for as the search conditions. For example, if you're looking for books written by Goethe, you put "author is Goethe" as a search condition, you can find the books. On the other hand, "context designation search" is where the search conditions are taken from the peripheral information. In other words, it's a method where you look for a piece of information using the conditions and relationships in which it's placed as clues. For example, let's say that you lost your day planner yesterday. If you have contextual information?such as, the last time you took your planner out was when you confirmed the schedule at the end of your meeting, and you did that in such-and-such a place?it may be possible to find the target object, in this case the planner that you left at your meeting yesterday. So you see, it's possible to retrieve the planner, even if you don't have any information about the item itself, based on the information surrounding it. In other words, the connecting relationship between two "points" is frequently significant.

——It's possible to bring out such relationships in subjects other than texts, isn't it?

Currently, for starters, I'm focusing on extracting the

relationships between words that appear in texts. From there, once I've developed a method for extracting general structures, I want to study a wider variety of subjects and apply my research to other problems. For example, if we think of the people, places, and things that appear in scenes from everyday life as a gathering of objects and make a model, then using the same method, I believe that it will be possible to analyze the dynamic changes those objects undergo and the relationships between them.

——Is it better to keep as much information as possible in order to be able to conduct subsequent analysis from various points of view?

Rather than concerning about the amount of information, I think it's really more a question of what kinds of stories and relationships you want to retrieve. The storage capacity of recording media has increased, and it's possible to store lots of information in computers. But the amount of stored information and what you get from them are quite different matters. After all, if you can't retrieve the information that meets your goals from a massive pool of information, then it's not really useful.

Interacting with Computers: Extracting Information from Humans and Retrieving Information from Computers

——Is it possible, in addition to retrieving information from previous data stores, to come up with something like a policy for what types of data should be stored in the future?

I'm not sure about a policy. Really, the only choice we have is to record the things that we think are necessary.

With things like knowledge and culture, new things pile up on the foundation of prior investigations and works in the past. You look at something from a certain point of view, and in response to that you make your own edits, or you accumulate new work that incorporate your own thoughts. When new elements are added, you will be able to adopt new perspectives, and that knowledge itself develops and accumulates. Take math, for example?modern math didn't just suddenly appear, it resulted from the gradual piling up of achievements. Lots of things were rejected as well. What to keep and what to discard, that's a really big problem.

——You don't seem to set a limit to the main fields that the tool can be applied, do you?

There's no single "main field. " What it boils down to is that we want to discover interesting relationships. If there were a technique for highlighting the various relationships surrounding a certain object, we could take the things that people are interested in and show them, "This is the story behind that, this is the background knowledge", then that would bring out new interests and lead to a chain reaction where people could obtain even deeper understanding.

When I visited a museum on Crete in Greece a while ago, the chairs for guards just happened to catch my eye. The backs of the chairs were decorated with carvings of an ox and an axe, but they looked like chairs that the local people used in their daily lives. I was wondering, "I'm seeing oxen and axes all over the place, but what do they mean?" Since the chairs weren't part of an exhibit, however, there wasn't any information about them. When I asked, it turned out that they were actually symbols of Minoan religion, and I was struck by the way that the traces of Minoan civilization were still a part of people's lives there. What occurred to me at the time was that, since the information that museum visitors are looking for varies from person to person, museums are not always providing all the information that people want. If there were a technique, like the one I just mentioned, for extracting relationships, then by showing people the information and stories that lie behind the things they're interested in, at the same time that they would obtain understanding, they would gain new interests. That's the kind of thing I want to achieve.

——When we look at different aspects of a certain thing or view it in a different context, its structure changes, doesn't it?

That's exactly what context is. Take a school-teacher, for example. He might be called "teacher" while he's at school, "Dad" at home, and "Mister" on the street, but in each of those situations, the information related to that person changes. It changes depending on the circumstances, and it's also a question of who's observing. I want to deal well with all these different aspects.

——Even individual units might change depending on our perspective.

If we think of our schoolteacher as an object, then at a given time the unit might be "person," but at another time we might be talking at the level of bodily organs.

——I wonder what would happen if we were to input the text of this interview into your system. Unlike a written text, more than one person is talking, right? Could the computer still identify a structure?well, it might not be a single structure, maybe a multiplex structure?out of the whole?

Yes, as long as we speak using a well-developed structure.

——Would it be consistent with what we intended?

I think there would be both consistencies and inconsistencies. Out of all the words, the system identifies relationships according to certain rules, so naturally it will show them in a state where some of the information in the original text is missing. Some parts, a person could understand it and say, "Ah, yes yes, that's right," and I think that other parts would come out where that wouldn't happen. But when you see these results, if you're able to realize "Oh, there's such-and-

such a relationship there!" then I think that might provide an opportunity to lead to new ideas.

Information Search Designed to Inspire New Ideas: Transitioning from Tools for Searching toward Tools for Thinking

——You joined RCAST in spring 2004. What kind of research were you doing before when you were at Hokkaido University? You gave a talk about how, in the past, the price of rice would go up whenever a feudal lord's procession would pass by, didn't you?

That was a research on data visualization. Various types of historical materials, such as chronologies, ukiyo-e prints, and the price of rice were stored up in a database. In order to use differently structured data in a unified way, I made it possible to input historical materials into, and then get output from, the database as "meme media" that Professor Yuzuru Tanaka at Hokkaido University has been advocating. As for the visualization system, I mapped the attributes of the data on a two-dimensional axis and made the chronological changes in those attribute values visible. This made them possible to change dynamically as movement of media objects. Specifically, when we altered the time, the coordinates of a troop's location changed, so we could see the troop's movement on a map of Japan. Superimposed over that, we showed the price of rice and the numbers of laborers, horses, and amulets in each region. As a result, it became patently clear that in each region that the troops passed through, following their movements, the price of rice went up, the number of conscripted laborers and horses suddenly rose, and after the troops passed by, a mysterious phenomenon called ofuda-kudari occurred, where amulets fell from the sky. I did this research when I was at Shizuoka University. I was collaborating with a professor of history. Apparently, historians had previously conjectured from historical materials and documents and put forward a number of doctrines. But by presenting how, based on the data, some other information would change in related ways, they could very clearly support their theories. Even if the original data was the same that the historians had been using, through a different way of presenting the data, I thought I might be able to support them in verifying their theories and coming up with new hypotheses.

——If I had to put what you do into a word or two, I would say that you're involved in information visualization, but you deal with things with somewhat complex structures, don't you?

As a framework for using differently structured data in a unified way, I'm using "meme media." Using media editing tools like "IntelligentBox*1," and "IntelligentPad*2", we can use lots of different kinds of data in a standardized way, and rapidly accumulate both tools and data. So in the previous example, there were things that couldn't be seen when the system for showing rice prices was separate from the system for showing data related to laborers, but as soon as we unified the two systems, the relationships between the two things became apparent. Actually, at that time my goal was not to show relationships, but rather I was doing research in order to suggest a system framework and software that could be widely used.

——What do you find most interesting about the work you're doing now?

The setup behind the system that I currently use to pick out the relationships between words is extremely simple, but it seems possible to use this simple thing in more areas than I previously imagined. Even though it's simple, it is widely applicable?I find that very interesting. From an engineering standpoint, I'm interested in how widely it can be used, whether it is simple, or what its essential qualities are. At the same time, I'm also interested in what it can be applied to.

——Up until now, we've mainly been talking about extracting information, but your system can probably be used to create structures as well.

This is related to what I was saying earlier about what we retrieve from stored information, but when it comes down to what is and what's not interesting, of course it's up to individual judgment, but I think the key is whether or not there's a story involved. I'm also interested in how to define things like narrativity or the nature of a "story. " I think that if it's possible to use my current technique to create stories or structures, then extremely simple and well-designed new structures will be produced.

——It's been about eight months since you joined RCAST. Has anything about your research mission changed?

When I was at Hokkaido University, I was working on proposals for software architecture and frameworks, suggesting how they could be used for the widest range of purposes. Since I came here, I reevaluated my work from the perspective of Professor Hori's concept of "Liquidization and Crystallization of Knowledge," and I became aware of a variety of advances and potentials for this technology. Then, by rethinking the material that I'd been researching until then, I came up with lots of new things to think about. In the artificial intelligence lab, each member has certain research topics to work on for each theme, and I'm trying to approach them to find out if there is an all-purpose, generic way to solve them.

——What is the research that you've been doing with Professor Nicolas Spyratos about?

That is also research about how to deal with context. Based on the context model that Professor Spyratos has proposed, we store information and then do research on techniques for searching information based on context. For example, a certain person has a number of different names, depending on context. He's called Mr. X, but he also has some

nicknames, and so on. In other words, different names are given to the same object, depending on context. Also, there is information about what kind of names the other objects have in the same context. Using that information, we're doing research on methods for identifying relationships that aren't clearly visible. For example, when we search for a relationship between Takeshi Kitano and Akira Kurosawa, we soon realize that they're related because they're both movie directors. But what we try to discover through our system is like the fact that the person in charge of costume design for Takeshi Kitano's movie Zatoichi was Akira Kurosawa's eldest daughter, Kazuko Kurosawa?a relationship that is dependent on context surrounding the two objects.

——When you say that you "discover" this, is that because all of the information is heavily annotated?

Both a "name" and "reference information" are attached to each object. We search for relationships by following up on names and reference information. Of course, relationships that everyone knows appear, as well as relationships that people aren't aware of.

We thought it might be possible to apply this technique to museum information, so we were introduced to the people working in the Greek research center, FORTH. Zeus, for example, who appears in Greek myths, turns into a white bull and golden rain, transforms himself into a variety of things, and does all sorts of other things. We proposed them a framework that visualizes the data automatically that was inputted in the database based on context modeling. But with this method, only the relationships in the database could be visualized, so I was a little dissatisfied. Essentially, relationships that everyone knows well were identified, but unknown or hidden relationships that are hard to see were not expressed. That made me think that I'd like to focus a little more on this thing called a "relationship" in my research, and that led to what I'm working on now.

Crossing Disciplinary Borders, Synthesizing Humanities and Sciences: A Research Environment that Stimulates the Cycle of Converging and Diverging Ideas

——How do you find the research environment at RCAST?

The first thing that I found interesting after I came to RCAST was that there are scholars from so many different fields here. Lots of new ideas actually occur to me on a daily basis by having discussions with people who think differently. Sometimes I ask Professor Hori or Professor Nakakoji, "Do you have a second?" and I get them to listen to some idea, give me comments or discuss it with me. Occasionally there are questions that I can't answer or times when I can't put my own thoughts together, but by thinking about those things later, I come up with answers in my own way. To have scholars who are active in a wide range of fields around me, that in itself is a rich environment.

——The "Interdisciplinary Memory Research Meeting" that we were talking about in the beginning also has scholars from lots of different fields participating. When I think about how you all manage to stay on the same wavelength, even though your fields are different, I find it hard to believe!

Since everyone speaks about the same topics from their own perspective, it's actually extremely stimulating. Personally, during the time that I've been participating in this group, I've found a variety of new themes. I believe meetings like this will play a role in opening up new fields of research.

——Well, even if everyone is satisfied during the meetings, saying "Ah, yes, that's right.", isn't it also the case that sometimes what they're actually thinking is totally different from person to person?

I'm sure they're different. But I think it's better that way. Well, this is my first year at RCAST, and this has been such an enjoyable time for me. I mean, it's fun to talk with different scholars, and I enjoy having discussions with the students and other people as well. From now on, I want to try lots of new things, without being constrained by common sense. And not just in my research.

——It must be fun to be able to hold your lab's weekly study meetings in a variety of places too.

While I was at Hokkaido University, I collaborated worked with Professor Sunaga at Tama Art University. At Hokkaido, we tended to hole ourselves up in the lab, staring at our computers, but the team from Tama considered experience as an important part of the process when working on information design. As a result, they placed great emphasis on using their bodies and being active. So in order to think about what it means to design information, they actually made sketches on the Hokkaido University campus and gathered the information that would be expressed on the computers by themselves. Regardless of whether they were art students or students from Hokkaido University, everyone gathered information from their own perspective. After that, we broke up into groups, had discussions, and experienced what it's like to design a system. As a result, I came to believe that, even though it's important to make our ideas converge through thorough investigation, on the other hand, it's also important to let our thoughts diverge using some element of play. You can find pleasure in thinking both ways, of course. The systems that I create are not supposed to rob human beings of the pleasures of thinking, but rather, I think that they will make thinking more enjoyable for people.

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Recent publications

Journal Articles

Mina Akaishi, Nicolas Spyratos, Makoto Ohigashi, Yuzuru Tanaka: A system for Tracing Implicit Relationships in a Web of Contexts, 14th European-Japanese Conference on Information Modelling and Knowledge Bases (EJC2004), Vol.1 pp.64-74, Skovde, Sweden June1-4, 2004

Mina Akaishi and Yoshihiro Okada: Time-Tunnel: Visual Analysis Tool for Time-Series Numerical Data and its Aspects as Multimedia Presentation Tool, 8th International Conference on Information Visualization (IV04), pp.456-464, London, England, 14-16 July 2004

Mina Akaishi, Ken Satoh and Yuzuru Tanaka: An Associative Information Retrieval based on the Dependency of Term Co-occurrence, 7th International Conference, DS2004, pp.195-206, Padova, Italy, October 2-5, 2004

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