Data utilization and analytics platform

Universal Communication Research Institute

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We are conducting R&D to contribute to increasing convenience for people and building a rich and secure society through human-friendly communication technology and intelligent advanced technology. In particular, we are conducting R&D on technology that uses big data, incorporating the vast amount of knowledge and information circulating in society (social knowledge) as a source of information, and makes specialist knowledge available easily, even to non-specialists. This is done by generating useful questions and automatically providing answers to those questions, and by providing knowledge that helps users in making decisions. We also engage in joint R&D with the Resilient ICT Research Center, on platform technology that will organize the social knowledge on the Internet regarding disasters in real time, integrate it with various types of observation data, and to provide it to users in an easy to understand form. To optimize and increase the efficiency of various social systems, we are also conducting R&D on an image analysis technology providing advanced recognition of circumstances and support for taking action. We aim to create new ICT that will realize human-friendly and society-friendly communication and be useful for the lifestyles and well-being of people.

Application and use of DISAANA/ D-SUMM (Joint development with the Resilient ICT Research Center)

Details regarding DISAANA and D-SUMM will be described in the section on the Resilient ICT Research Center.

Next-generation conversation technology R&D

To use social knowledge effectively, we are promoting development of the WEKDA next-generation dialog system. WEKDA, or WEb-based Knowledge Disseminating dialog Agent, uses the large volume of knowledge on the Web to conduct conversation on a wide range of topics (Fig.1). Rather than conversing based on rules and scenarios, as with other conversation technologies, it uses questions and answers based on the vast information on the Web. There is demand in society for this sort of advanced next generation artificial intelligence technology. Underlying WEKDA is WISDOM X, a system that analyzes the information on some four billion Web pages to present answers to questions. When given an input phrase (e.g.: "iPS cells are amazing, aren't they?"), it uses deep learning to ask a question about what to show the user (e.g.: "What would you like to see about iPS cells?). When WISDOM X is given this question, the system generates a response from the results of searching for an answer (e.g.: "A possible treatment for cardiomyopathy using iPS cells has been found."). An outline of this mechanism was developed in FY2016, and in FY2017, we implemented a deep learning mechanism to rank the results from the answer search and also functionality to generate an appropriate response from the search results, using a deep learning method similar to machine translation. These enabled the system to generate more appropriate responses from the results of the answer search. The architecture of WEKDA is shown in Fig.2. The dialog system was implemented by combining multiple deep-learning modules, including those just mentioned. Questions can be input directly to WISDOM X and the answer will be presented.

Fig.1 : Conversation with the WEKDA next-generation dialog system

Currently, WEKDA is limited to handling "What" questions that can be answered with a noun, such as "What can be done to solve global warming?" and "What if" questions such as "What if global warming continues?" However, WISDOM X can also answer "Why" questions to find reasons for things, such as "Why has Japan fallen into deflation?" The responses to such questions were relatively long; however, and not suitable as answers. In FY2017, we developed a deep learning technology that summarizes such long responses, enabling shorter answers to be given, such as "Because society is continuing to age" for the question above.

As a computing platform supporting this technical development, we have integrated a deep learning framework into the RaSC middleware. RaSC was developed at this center and has been used in the past to run large scale software such as WISDOM X on a large scale cluster in parallel and at high speed. This has enabled us to run WEKDA, which is an amalgamation of deep learning technology, at low cost and high speed. While conducting this research, we also developed a new batch scheduler to improve utilization of GPGPUs, and were able to improve efficiency of GPGPU use in the Institute.

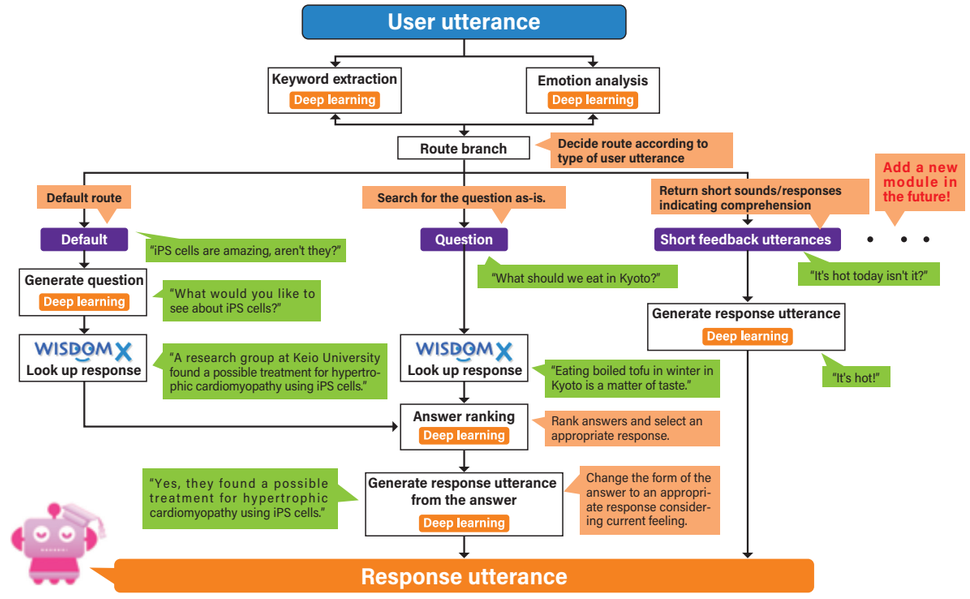

Fig.2 : WEKDA dialog system architecture

Image analysis technology R&D

We have developed a method for clustering large volumes of tourism photographs collected from SNS according to structure, as a technology to automatically build a tourism-support image corpus. The method is implemented by performing clustering on a graph with vertices for each image, connected by comparing local feature points (a match graph)(Fig.3). Earlier clustering methods had the disadvantage of not being able to detect small clusters, so to solve this problem, we developed a new clustering method using a random walk technique. This method was presented at the IEEE International Conference on Image Processing (ICIP) 2017. In the proposed method, the accuracy of clustering would be negatively affected by making too many steps in the random walk, so we also developed a method to prevent taking too many steps, and conducted tests to confirm that it is effective.

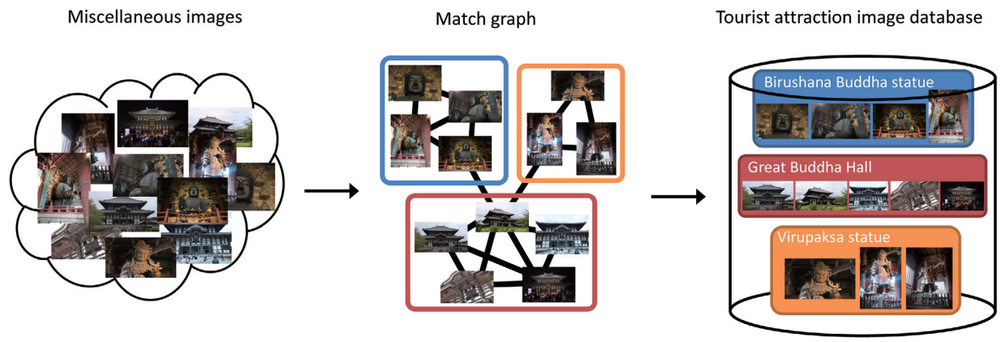

Fig.3 : Technology to build an image corpus to support tourism automatically