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Building an Integrated Database Management System of Information on Disaster Hazard, Risk, and Recovery Process

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Synopsis

Sharing of various information and data on forecast, prevention, communication of information, history, revival process, etc. of disaster, is indispensable to the suitable total risk management about a disaster. However, in the present condition that disaster prevention study is not matured as an interdisciplinary field, there is almost no cooperation of many fields relevant to disaster prevention, and the system that can be shared does not exist. Then, in this research, the integrated database system about the disaster prevention to which immediate construction is expected is built.

Keywords: database; disaster; integration; Cross-Media Database; metadata, research support information infrastructure

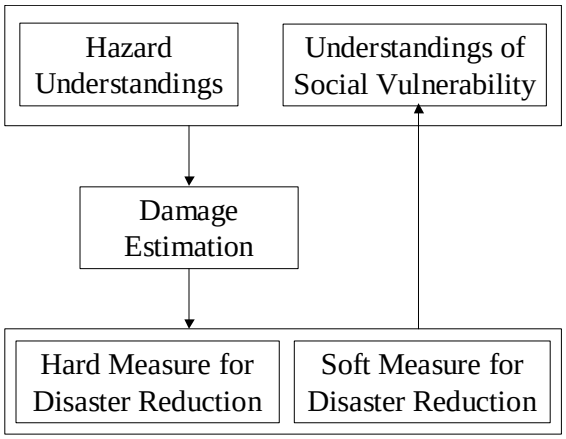
1. Introduction

Disaster reduction science is an interdisciplinary field composed of lots of special subjects of study, such as civil engineering, architecture, earth science, social science. If two identical natural phenomena occurred, disasters and damages would appear in a variety of forms for the different site or the different time. Also, if two different natural phenomena occurred at the same site at the same time, disasters and damages would appear in a variety of forms. That is, the disaster and damage is controlled by combination of various factors, such as regional features, social foundation, geographical and geophysical features, and the physical mechanism of the causal natural phenomena. Fig. 1 shows the outline of disaster reduction science. Therefore, in order to establish disaster reduction science as an interdisciplinary field and to perform the suitable total risk management about a calamity, sharing of various information, data, and research results of a disaster science, such as a forecast, prevention, a calamity history, a communication-of-information system, and restoration and revival process, is indispensable, as well as disaster prevention scholars' human communication. However, a researcher is often difficult to use data and research results of other field than his specialty, and is difficulty to understand them. If suitable explanations for them cannot be obtained, organic cooperation is barred and misapprehension of meaning of data tends to lead the wrong results. Then, a new integrated database system, one of a research support information infrastructures, is needed that has a user interface friendly for the researcher of various disaster science fields, and can store the data of various disaster science fields saved on various formats/media. In this project, we are trying to construct a new integrated database system (Cross-Media Database) that can respond to the needs of the various field of disaster prevention study. This paper explains the outline of the specification of this database system obtained by

probing the problem of the conventional database. The details about the system design and construction, and the application studies using this system are described by Kugai et al. (2004) and Urakawa et al. (2004), respectively.

Fig. 1. The outline of correlation between the specified studies for disaster reduction systems.

2. Conventional Database



In the disaster science field, there are lots of database systems for various data. The natural disaster related bibliography information database "SAIGAI" (http://maple.dpri.kyoto-u.ac.jp/saigai/) has been employed at the Disaster Prevention Research Institute, Kyoto University. One can search natural disaster related articles using this web site with full-text type search. The database system for DPRI annuals (http://www.dpri.kyoto-u.ac.jp/web_j/index_annuals.html) has also been employed at the Disaster Prevention Research Institute, Kyoto University (Matsuura et al., 2004). One can search and see articles in DPRI annuals using this web site with full-text type search or category search, such as authors' name, published year, title of article. This database system can provide the category search since the data themselves are recorded in a defined manner. The strong-motion seismograms database, "Kyoshin Net (K-NET)", has been employed at National Research Institute for Earth Science and Disaster Prevention (http://www.k-net.bosai.go.jp/k-net/). This database system has text catalogues of earthquakes, seismic stations, and so on, since it has the data other than character data. Then, one can obtain seismograms he wants using the catalogues. As above examples, most of conventional database systems have been developed for digital data recorded on a couple of original formats. Hence, the number of required databases will be almost the same as that of the data formats, and the cooperation between different types of databases will be hard to be constructed. Then, even if an article of DPRI annual that describes the analysis using seismograms from K-net is recorded on SAIGAI, it is hard to describe a relationship among the three databases. This may require a complicated procedure for both an administrator and a user as a result, in this interdisciplinary field where there exist various data types on various formats.

On the other hand, the ring server that some research organizations are developing is mentioned as a system that can store various type of digital data (ftp://aist.ring.gr.jp/pub/). This kind of system is also holding the problem since each data does not have its metadata (data for data), instead of few restrictions for data types. If a user does not have information for the data a priori, he cannot know what the data is until he opens it.

Google image search (http://www.google.co.jp/imghp?tab=wi&q=&ie=UTF-8&oe=UTF-8&hl=ja&lr=) is another type of database system for digital images. One can find the images he wants through thumbnails. However, it is hard to find thumbnails, since there are no search keywords other than their file names for digital images on the web.

In disaster science field, as well as most of other research fields, there are no research support information infrastructures that can provide user-friendly interface for efficiently searching lots of types of data. U.S. Redlands Institute proposed the simple and user-friendly database system, which stores the metadata to each data on a unified format that has data for the data, and also stored the relationships between metadata. This has been developed for storing all data produced in a project. As for disaster science, a number of databases designed for some specified types of data, such as above-mentioned K-net, have already been developed. In MEXT 21st Century COE Program for DPRI, Kyoto University, we are developing a specified database for the video archives of lecture series, which is described in the next section. Then, a database that can work in cooperation with other specified databases is required. In this project, the Cross-Media Database System as research support information infrastructure is developed under a technical support of U.S. Redlands Institute.

3. Database System for Video Archives of DPRI Forum in 21st Century COE Program

In MEXT 21st Century COE Program, DPRI provides the lecture series "DPRI-KU Forum" at Kyoto satellite office (four times a week) and Tokyo satellite office (twice a month) (Hashimoto et al., 2003). Anyone can request to attend all lectures through the Internet website. However, ones living far away from the satellite offices and ones that are on duty during the lecture period are hard to attend the lectures. Then, all lectures are recorded with digital video cameras to make video archives of lecture series, and we have a plan to construct an on-demand streaming distribution system of these

lectures. The digital videos are encoded to windows media video (wmv) format, and the indexes of them are added to divide a lecture into several chapters of some minutes. The distribution system is designed so that one can choose and watch some chapters of a lecture he wants. This system is one of the specified databases that the Cross-Media Database should work in cooperation with each other. We place this system as a pilot project of Cross-Media Database's partner. We prepare the same metadata elements for all wmv files of forum lectures as those for video data in Cross-Media Database, whose details are described in the next section and Kugai et al. (2004).

4. Cross-Media Database

Cross-Media Database is designed so that 12 types of data (audio, video, document, image, person, organization, study, model, data, event, Internet, and geospatial) can be stored in (Kugai et al., 2004). These various data usually have derivative correlation with one another. Figure 2 shows an example of such correlation. In order to provide an efficient search engine and display the search results and their related data in a unified format, the appropriate description of metadata, relationship, and controlled vocabularies are essential.

Metadata describe what the data are. Metadata elements are classified into common elements that are independent of data type, and attributes that depend on data type. Attributes of each data type are described in Kugai et al. (2004). Common elements compose of Resource ID Number, Media Type, Format Type, Content Type, Language Type, Public Metadata, Public Abstract, Public Resource, Abstract, Name, Usage Constraint, Relationship Type, Keyword, Date, Foot Print, Contact.

Relationship describes the correlation between two or more data as shown in Fig. 2. For example, when a person *D* writes an article *A* and gives a lecture *I*, his name may be found both in an author field and an lecturer field on some conventional databases owing to lack of the definition of relationship. In the Cross-Media Database, a person *D* is a datum itself, and relationships are defined between a person *D* and data such as an article *A*, a lecture *I*, his affiliation, and so on. Hence, one can run a derivative search and find related data using clickable links that are built using the relationships.

Controlled vocabulary is useful to avoid the ambiguity of notation and improve the search efficiency. It is also important to make a thesaurus for disaster science using the controlled vocabularies, which enables us to construct a user-friendlier database system. This is one of our ongoing tasks, and requires cooperation of a number of specialists in fields of interdisciplinary disaster science.

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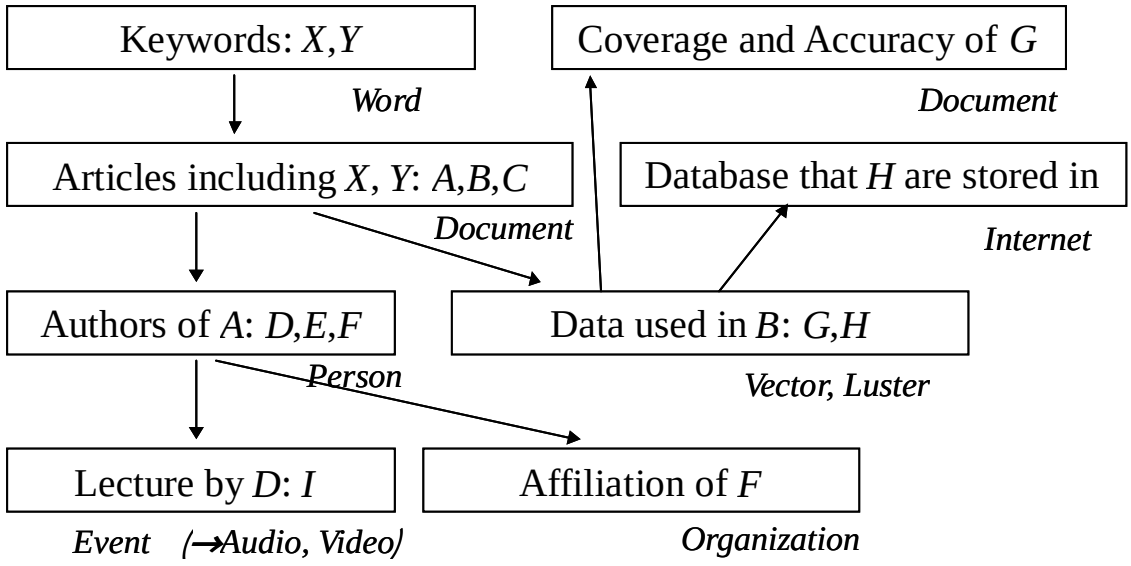

Fig. 2. An example of derivative correlation with various types of data from some keywords.

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要　旨

災害に関する適切なトータルリスクマネージメントには，災害の予知・予防・情報伝達・災害履歴・災害復興過程などの様々な情報，データの共有が不可欠である．しかしながら，防災学が学際分野として未整備な現状において，こうした防災に関連する諸分野の連携はほとんどなく，共有できるようなシステムは存在しない．そこで，本研究では早急な構築が期待される防災に関する統合型データベース・システムの構築をおこなっている．

キーワード：データベース，防災，統合，クロスメディア・データベース，メタデータ，研究支援情報基盤