Visiome Platform:

A Test-bed for Neuroinformatics database system

http://platform.visiome.org/
NRV Project Japan
Isao YAMAGUCHI[1], Shiro USUI[2], Hidetoshi IKENO[3], Keisuke TAKEBE[4],
Yasuo FUJII[5], Yoshihiro OKUMURA[2], Izumi OHZAWA[6] and Shigeki NAKAUCHI[7]

1. Corporate Research Laboratory, Fuji Xerox Co., Ltd., Japan
2. RIKEN Brain Science Institute, Japan
3. Himeji Institute of Technology, Japan
4. Nagaoka National College of Technology, Japan
5. DSP Technology Co., Ltd., Japan
6. Grad School of Frontier Bioscience, Osaka Univ., Japan
7. Department of Information and Computer Sciences, Toyohashi University of Technology, Faculty of Engineering, Japan

1. Introduction

In order to understand the brain function, it is required integration of diverse information from the level of molecule to the level of neuronal networks. However, the huge amount of information is making it almost impossible for any individual researcher to construct an integrated view of the brain. To solve this problem, it is required useful neuroinformatics database for preserving, maintaining and sharing the research accomplishments and resources. In the NRV (Neuroinformatics Research in Vision) project in Japan, it has been developed a test bed for neuroinformatics portal named “Visiome (Vision + ome) Platform” that provides reusable programs/scripts of mathematical model, experimental data, analysis tools and their related information described basically in published journal papers. Downloading and executing model programs or scripts registered in the platform allow researchers to see how the models work or compare their own results with other experimental data. It must be useful to improve or integrate related models, and formulate their own hypothesis into a new model. Conversely, they can register their own models, data, and tools to the platform for sharing with colleagues.

2. Features of the Visiome Platform

The Visiome Platform was basically designed as a research resource archive on the Internet, thus it provides functions for searching/browsing its contents and contributing to it via web interface (Fig. 1). Types of contents available in the Visiome Platform are shown in Table 1. Since kinds of softwares for simulation or data acquisition/analysis diverse largely, it is difficult to specify formats for model scripts or data that the system deal with. In order to solve this problem, the Visiome Platform was designed to accept archive files (in zip, lzh or other

compression formats) including any formats of scripts or data with files of readme, license terms, figures and so on. Thus the Visiome Platform is a software archive "platform" in which researchers can share their research resources by downloading and uploading them.

Fig. 1 Top page of the Visiome Platform

Table 1 Item types available in the Visiome Platform

Item Type	Description
Model	•Model Programs/Scripts
Data	•Result Data in Numerical text/Image/Movie Formats
Tool	•Programs/Scripts for Data Analysis
Stimulus	•Stimulus Data in Numerical text/Image/Movie Formats
Simulator	•Simulator programs
Presentation	•Electrical Presentation files
Reference	•Historic/Review Papers' information
Book	•Historic Books' information
URL	•URL of internet resources

In order to make the Visiome Platform more useful to researchers, we added four features to it. First, a novel tree-structure index system (Visiome Index) in the field of visual neuroscience was constructed to provide an overview of the research field. Second, we designed the data structure as a "follow-up system" to facilitate the diversity of the contents. Third, users can bind any kinds of items in the database into virtual binders (Visiome Binder). Fourth, the Platform allows users to manage their PDF reprint collections (MyPDF).

2.1. Visiome Index

The contents in the Visiome Platform are provided along the novel tree-structure index system, the Visiome Index, in the field of visual neuroscience. This index system is based on neuronal and cognitive functions that are important targets in the vision science. It will provide useful information to students and beginners to understand an overview of the field. Top categories of the Visiome Index are shown in Table 2.

Table 2 Top categories of the Visiome Index

Top Category	Field of view
Visual System	•visual pathway from eye to central visual system •psychological or higher order functions
Basic Neuroscience	•physical substance from molecule to cell levels •physiological functions
Model & Theory	•modeling and theoretical methodology
Tool & Technique	•experimental and analytical methods
Application	•technical applications of vision research •bio-inspired device

2.2. Follow-up System

We employed a tree structure named “follow-up system" as the data structure of the Visiome Platform so that the users can add their works to existing items (Fig. 2). That is, any item can be a follow-up of others and vice versa. For example, an experimental data and derived model can be added as follow-ups to a related reference. This system allows free-style and heterogeneous binding of items and adds more values to them.

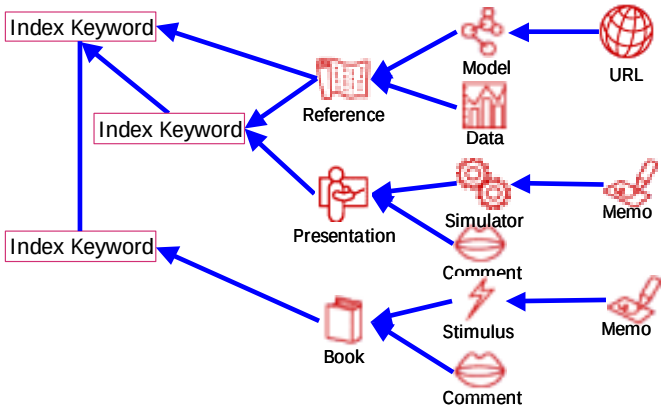
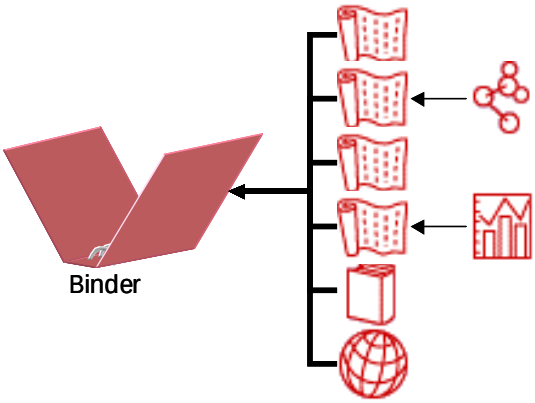


Fig. 2 Data structure of the Visiome Platform

2.3. Visiome Binder

Visiome Binder is a virtual binder derived from the follow-up system that allows users to make collections of items according to specified themes or interests (Fig. 3). We considered such situations that a list of suggestive readings for

students, a collection of models and data for writing a text book or using in a lecture and so on. Besides these educational aspects, this system can be used as a kind of rating system. Number of binders to which an item registered is counted and shown in the search results or item information pages. The Visiome Binder is expected to provide unique categorization of the research field according to perspectives of individual researchers in the front line.



•Contents collection for specified themes or interests

•Suggestive readings, Reference list for lectures/books etc.…

Fig. 3 The Visiome Binder

2.4. MyPDF

MyPDF is one of the most characteristic features of the Visiome Platform that enables users to manage their electronic reprint collections (Fig. 4). Since nearly almost of journal articles are now downloadable as PDF (Portable Document Format) files, large amount of PDF reprint files are accumulating in researchers' local computers. This makes it difficult to search and locate a specific reprint file without an appropriate management tool. MyPDF function provides a solution to this problem by linking the Visiome Platform's reference database to users' personal reprint collections.

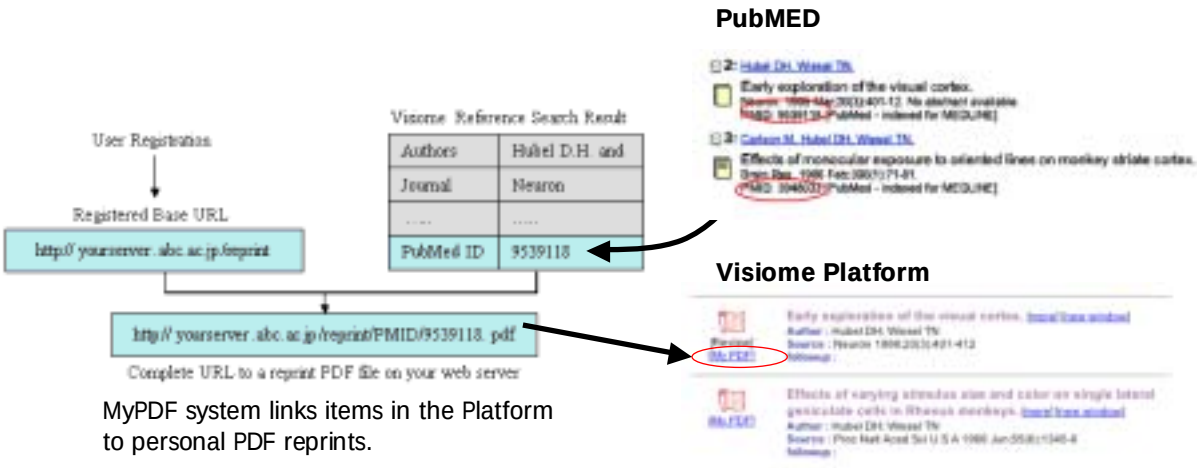


Fig. 4 MyPDF system

2.5. Basic Operations

Figure 5 shows the basic operation scheme for the Visiome Platform. Users can search contents or browse through the Visiome Index, access to their personal reprint collections, see description of individual items, download and upload items. Icons of all item types that the users can contribute are shown at the bottom of windows so that the users can contribute their works as items to any place such as under an Index Keyword in the Visiome Index or to their own or others' items.

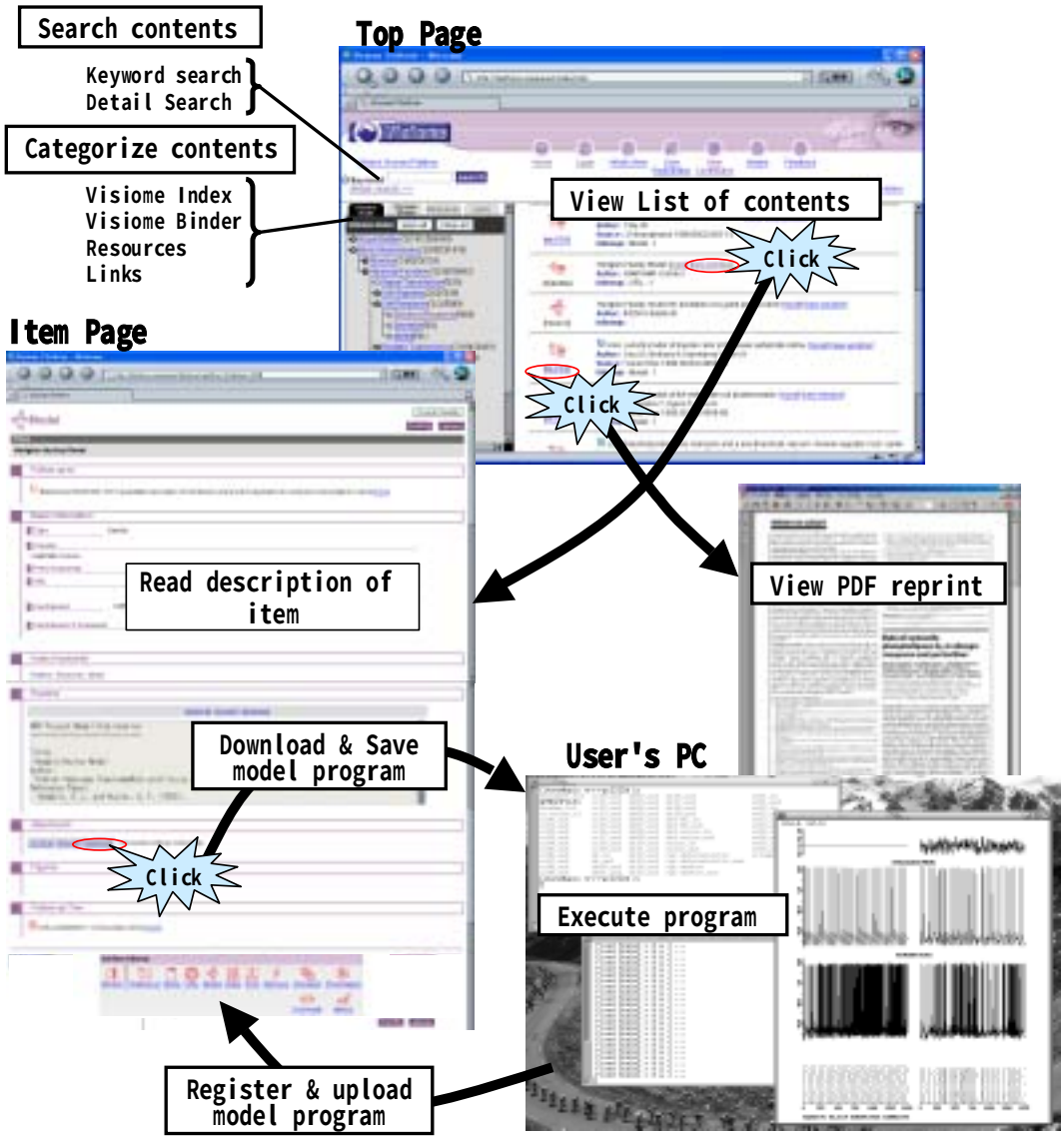


Fig. 5 Basic operation scheme with the Visiome Platform

3. Visiome Environment

The Visiome Platform is not only a portal to visual neuroscience but is the central component of the Visiome Environment, a research support system the NRV project has been developing (Fig. 6). The Visiome Environment is consisted of two server side systems, the Visiome Platform and the Visiome Simulation Server, and two user support tools, Personal Visiome and SATELLITE.

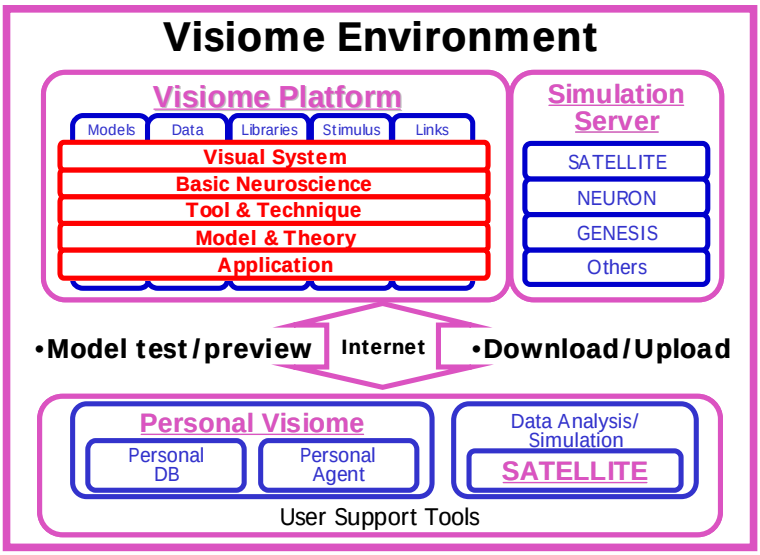


Fig. 6 The Visiome Environment

The Visiome Simulation Server (VSS) provides easy ways of testing models and viewing data registered in the Visiome Platform for researchers. Executable models in the Visiome Platform are made their links to the VSS, and then accessed through the web browsers. VSS also provides visualization functions for registered experimental data by additional registration of the SATELLITE script for data plotting.

The Personal Visiome is a personal edition of the Visiome Platform, thus sharing most of its functions with the Platform. Characteristic functions of the Personal Visiome are user management system, customizable Index system, and an agent system that automatically collects information in the Internet based on registered keywords. The Personal Visiome effectively works with the Visiome Platform for collaboration of contributing, searching and updating the contents.

SATELLITE (System Analysis Total Environment for Laboratory - Language and InTeractive Execution) is a powerful tool combined function for experimental data analysis and simulation of mathematical models. Wide ranges of functions for data acquisition, filtering, frequency analysis, parameter estimation and visualization are integrated in SATELLITE. This tool is also utilized for the online simulation and data visualization engines in the Simulation Server.

4. Future Works

Although the Visiome Platform was designed carefully to meet various needs of neuroscientists, there exist several issues to be solved.

The most important point for such a system like an archive site on the Internet is to keep the quality of its contents. At this point, we started with contents basically described in published journal papers. However, it is still possible that items of low quality will be contributed. In order to overcome this difficult problem,

we employed a “introduce a friend system" to invite new users to the system. A researcher who wants to get an account of the Platform needs to be introduced by existing valid users. This system is expected to guarantee the reference of the new comer. Unfortunately, we do not believe that this will be the final solution to keep the quality of contents. More effective way should be developed to solve the problem.

The copyright and license problems are also serious to solve. Researchers who are critical of data sharing argue that they need guarantee of fair use of the data they contributed. They feel misgivings about that other one will publish a derivative work of theirs without any notice or acknowledgment. So far, researchers have to protect their rights by themselves claiming license conditions to use their works. The Visiome Platform prepares a field for contributors to write their own license conditions. However, to prevent unfair use of shared resources, it is required to involve jurists, informatics researchers and software engineers for further discussion.

How to motivate researchers to contribute is also one of important matters we have to consider. Researchers need incentive to contribute their works to the Visiome Platform. We are planning to implement a system to rate items in the Visiome Platform to encourage researchers. The Visiome Binder is one of the solutions for rating, and other measures such as number of downloads, visitors to the item page and follow-ups by other contributors are possible candidates. We continue to improve and expand the functions of the Visiome Platform to make it a place where researchers spontaneously contribute and share their works.

In conclusion, the Visiome Environment in which the Visiome Platform plays a central role will realize a virtual environment for global electronic collaborations of researchers, especially for young scientists. User support tools are also useful for data analysis, simulation and arrangement of the results and research resources. We hope that the Visiome Environment to be a virtual plaza where neuroscientists get together for collaborating internationally and to be compiled most of important works in the future.

Acknowledgement

This study has been fully supported by “Target Oriented Research and Development for Brain Science”, the Special Coordination Funds for Promoting Science and Technology of Ministry of Education, Culture, Sports, Science and Technology of the Japanese Government.