Visiome environment: Enterprise Solution for Neuroinformatics in Vision Science

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Understanding brain functions requires integration of information at diverse levels of aggregation, from the molecular to the network. The huge amount of information that is needed makes it almost impossible for any individual researcher to develop an integrated view of the brain. To address this problem in the context of the NRV (Neuroinformatics Research in Vision) project, an integrated computer and network system for vision neuroscience (the “Visiome Environment”) is being developed,, as a test bed of useful neuroinformatics tools. The Visiome Environment is comprised of four components:

1. Visiome Platform (neuroinformatics database system)

The Visiome Platform (http://platform.visiome.org/) is a database system that provides published references with reusable programs/scripts of mathematical model, experimental data, analytical tools, and related information. Especially, by executing model programs, researchers can catch up how the models work, compare their own results with other experimental data, improve or integrate models, and formulate their own hypothesis into a model. They can also register their own models, data, and tools to the database for sharing with colleagues.

The platform also provides a novel tree-structure index system (Visiome Index) of research in vision neuroscience. The indexed database contains not only the extensive relevant literature, but, by virtue of its tree structure, allows the user to access the code of a model described or referenced in any paper as well as any supplementary data, provided the authors have made such material available. It will support researchers in

their quest to understand the visual system from the perspective of visual functions and assist in the construction of models based upon their own hypotheses.

2. Visiome Simulation Server (online simulation server)

Our concept of sharing model programs over the Internet is expected be an effective way to facilitate the testing of proposed models by other investigators. However, at present, such testing is still hampered by incompatibilities between model developer by problems such as software version conflicts and hardware incompatibilities.

The simulation server in the Visiome Platform provides a common site for online simulation. It contains a high-performance simulation engine for analysis, computation and simulation. Users who want to test model scripts can access to the server through a web browser. On the site, they can execute available model scripts, then view and download their results. It is an efficient method for reusing model script to download from the platform and execute on local computer, but it would be demanded to install requisite software for running them. We recognize that this approach may not be suitable for very large-scale models or for very old programs that require special purpose or obsolete computer systems for their execution. The simulation server can not only facilitate utilization of models of current interest, but can also serve as an archival site for older models of historical interest.

3. SATELLITE (System Analysis Total Environment for Laboratory - Language and InTeractive Execution)

A vital aspect of development for neuroinformatics field is the improvement of the research environment for information management, data analysis and model simulation in laboratory. SATELLITE (System Analysis Total Environment for Laboratory - Language and InTeractive Execution) is a collection of powerful tools for experimental data analysis and simulation of mathematical models. A wide range of functions for data acquisition, filtering, frequency analysis, parameter estimation and visualization are available by entering commands through the SATELLITE-shell. The programming capability of SATELLITE provides automatic execution of a command sequence in a script file. Script files (SATELLITE scripts) that are written and used by researchers in experiment and modeling should be considered precious resources of techniques and know-how for many scientists and students. In our project, it is going to provide and exchange scripts over the Visiome platform.

One of unique features in SATELLITE is a real-time simulation function (Real-time simulator). It can be sampled analog data through the A/D converter, calculated mathematical model responses by using real data, and then results are outputted from the D/A converter in real time. This function is able to implement mathematical model into the real biological or neural system.

4. Personal Visiome (neuroinformatics database for laboratories)

As information management software for neuroscience and neuroinformatics researcher, a database system for personal or laboratory use (Personal Visiome) is developing. The system can store and organize all kind of files, such as PDF files of literature, image and ASCII/binary experimental data files. The display of contents in Personal Visiome can be customized by each user or group. In these years, many articles or papers are published day by day, and it is hard to keep tracking research trends and getting variable information for one's research. An agent system in Personal Visiome automatically accesses neuroinformatics, neuroscience and literature database sites, and collects useful information for users (newly published paper, updating of homepage, conference information, and so on). This system, working within the Visiome Platform for collaboration, allows for contents registration, searching and updating.

The Visiome Environment will establish a virtual environment for global electronic collaborations by providing resources, such as useful tools for simulation and data analysis, reusable model programs. We welcome the collaboration of other developing teams, in order to construct sites for integration and inheritance of huge achievements of forerunners.

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