

CAVEman: 4D Mapping of Genomic and Medical Information

The CAVEman Project aims to create visual maps of information about diseases that have a genetic component, such as cancer, diabetes, and Alzheimer's. Using an immersive virtual reality environment called the CAVE, the research team will integrate a high-resolution digital atlas of a human body with medical data related to specific diseases. The final result will be a next-generation 4D (space and time) visual system to "see" disease processes and the effects of interventions, such as drugs, on these processes.

About

The CAVEman Project aims to create visual maps of information about diseases that have a genetic component, such as cancer, diabetes, and Alzheimer's. Using an immersive virtual reality environment called the CAVE, the research team will integrate a high-resolution digital atlas of a human body with medical data related to specific diseases. The final result will be a next-generation 4D (space and time) visual system to "see" disease processes and the effects of interventions, such as drugs, on these processes.

From the technical standpoint, the CAVEman software is written in Java and emphasizes complete portability across visualization devices, from simple laptops to sophisticated CAVE installations. Its goal is the development a complete Java 3D-enabled anatomical atlas of the human body, and create a generic data mapping mechanism between the atlas and biomedical patient data.

The CAVEman team collaborates with Kasterstener Publications Inc., a company in Red Deer, Alberta, that specializes in developing anatomical teaching aids. These anatomical models are object-oriented, constructed from multiple information sources including anatomy textbooks and cadaver laboratories, and follow existing anatomical terminology.

CAVEman Demos

(Flash)1. {mgmediabot2}path=http://www.4dbioinformatics.ca/demos/1_Intro.swf|width=508|height=396|popup=Introduction{/mgmediabot2}

These demos are also available on the main demo site <http://www.4dbioinformatics.ca/demos>

2. {mgmediabot2}path=http://www.4dbioinformatics.ca/demos/2_TMEV.swf|width=508|height=396|popup=Gene Expression{/mgmediabot2}3. {mgmediabot2}path=http://www.4dbioinformatics.ca/demos/3_Chemicals.swf|width=508|height=396|popup=Aspirin{/mgmediabot2}

4. {mgmediabot2}path=http://www.4dbioinformatics.ca/demos/4_MedData.swf|width=508|height=396|popup=Medical Imaging{/mgmediabot2} History

The CAVEman project began in April 2005 at the Sun Center of Excellence for Visual Genomics, University of Calgary, Canada. It is funded by the Governments of Canada and Alberta through a Western Economic Partnership Agreement, or WEPA. The project is expected to run until September 2007.

Milestones:

June 2004	Project proposal is submitted for review.
	April 2005
Funding is awarded	(announcement).
September 2005	The development team is fully
staffed.	February 2006
	The system prototype is assembled.
	September 2006
Genomics" opens at the TELUS World of Science.	Our exhibit "4D Inside
	April 2006
	Our 4D exhibit opens at Sun Microsystems headquarters in Palo Alto, CA.
	May 2007
	The release of the CAVEman system is announced.

Data

Currently the CAVEman project supports the following types of data and experiments:

Experiment type	Data representation
Data formats	
Raw imaging data: MRI, fMRI, PET, CT, micro-CT, microscopy, etc.	3D
volumetric images	Any data format supported by ImageJ, such as
TIFF or BMP stacks, GIF, JPEG, or AVI	
Anatomical organ reconstructions	3D surface

models Wavefront OBJ, VRML, J3F (Java 3D) and several other formats
Gene expression microarray
data Numerical data Any data
format supported by TIGR MeV, such as Affymetrix, GenePix or tab-delimited ASCII files
Metabolomic and pharmacokinetic data

Numerical time series
Excel or ASCII tables with proper naming conventions

Publications 2006 / 2007

- Turinsky AL, Fanea E, Trinh Q, Wat S, Hallgrímsson B, Dong X, Shu X, Stromer JN, Hill JW, Edwards C, Grosenick B, Yajima M, Sensen CW (2007) CAVEman: Standardized Anatomical Context for Biomedical Data Mapping. J Anat Sciences Education [accepted for publication in August 2007].

- Shu X, Turinsky AL, Sensen CW, Maurer F (2007) A Case Study of the Implementation of Agile Methods in a Bioinformatics Project. In Concas G.et al. (Eds.): XP 2007, LNCS 4536, Springer, Heidelberg, pp.169-170.

- Cooper DML, Turinsky AL, Sensen CW, Hallgrímsson B (2007) Effect of Voxel Size on 3D Micro-CT Analysis of Cortical Bone Porosity. Calcified Tissue International, 80(3):211-219.

- Cooper DML, Thomas CDL, Clement JG, Turinsky AL, Sensen CW, Hallgrímsson B(2007) Age-Dependent Change in the 3D Structure of Cortical Porosity at the Human Femoral Midshaft. Bone, 40(4):957-965.

- Turinsky AL, Sensen CW (2006) On the Way to Building an Integrated Computational Environment for the Study of Developmental Patterns and Genetic Diseases. Int J of Nanomedicine, 1(1):89-96. (online).

Contact The Lead Researcher at the Sun Center of Excellence for Visual Genomics