Visual Data-mining and Tele-immersive Communication System for Seismic Wave Analysis (Part 1 of 2)

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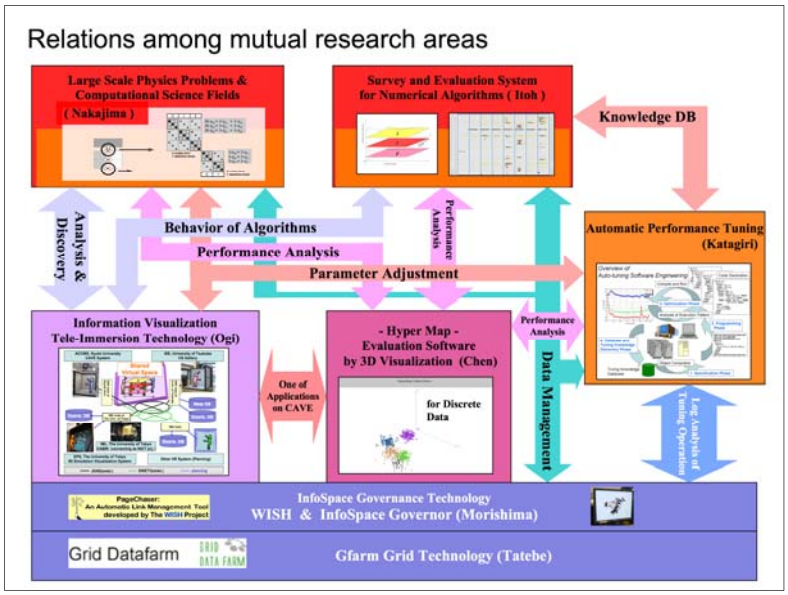
Objective

Visual data-mining is an emerging research topic in large-scale scientific computing. Size of data sets through simulations and observations is huge, and they may be stored in distributed manner. We focus on development of visual data mining system under distributed environments, and discuss on future directions of individual technology and interdisciplinary collaborations.

Especially, in this research, we challenge applying Automatic Performance Tuning technology to data analyses that arise from large scale numerical simulation. Most of numerical simulation has a lot of tunable parameters having effects of simulation's accuracy or performance. As one of ideas, their parameters are automatically tuned to desirable condition to behaviors of actual data. This theme is also studied by Katagiri as new aspects of Automatic Parameter Tuning.

Conceptual Diagram of ViNDAM



In this project, Katagiri and Nakajima consider applying AT technology to a variety of element technologies which are latent in numerical simulations and data analyses.

Our system is composed of seven elemental technologies for visual data analysis.

- Automatic Performance Tuning (AT) by Katagiri

In this research, AT technology is used as one of strategies for noise reduction or data adjustment in numerical simulations or data analyses.

- CAVE System by Ogi

CAVE realizes 3D visualization and shared virtual space among some remote research collaborators.

- HyperMap by Chen

HyperMap realizes 3D data-mining by Principal Component Analysis for discrete data.

- InfoSpace Governor by Morishima

InfoSpace Governor is a technology to make data management easyby introducing a control to maintain and distribute data in theinformation space created by people working together.

- Gfarm: Grid Datafarm by Tatebe

Gfarm is global dependable virtual file system based on Grid environment.

- New Strategy for AT in Large Scale Numerical Simulations by Nakajima

He is developing a framework based on idea of AT for optimum selection of parameters of preconditioned parallel iterative solvers for real-world scientific and engineering applications with finite-element method [paper in iWAPT by Nakajima]. He tries to apply this framework to the system of immersive visual data-mining.

- Survey and Evaluation System for Numerical Algorithms by Itoh

This system aims at systematical evaluation for numer. algo. by visual data-mining, etc. and also aims to help to select numerical algorithms.

Sessions related to us

Intelligent Domain Partitioner for Parallel Finite-Element Applications
Kengo Nakajima PP0

Auto-tuning on Numerical Libraries and Advanced Computer Systems
Organizer: Takahiro Katagiri, Toshiyuki Imamura
MS1(1/2): Wed. Mar. 12 10:00 AM-; MS25(2/2): Thu. Mar. 13 1:30 PM-

Multi-Physics Frameworks and Applications
Organizer: Leroy A. Drummond, Kengo Nakajima, Keiko Takahashi
MS28(1/3): Mar. 13 1:30PM-, MS35(2/3): Mar. 13 4:00PM-, MS43(3/3): Fri. Mar. 14 10:00AM-

Towards Visual Data-mining of Ultra Scale Data-se... Distributed Environments
Organizer: Shoji Itoh, Tetsuro Ogi
MS55: Fri. Mar. 14 3:30PM

Introduction session of ViNDAM

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Visual Data-mining and Tele-immersive Communication System for Seismic Wave Analysis (Part 2 of 2)

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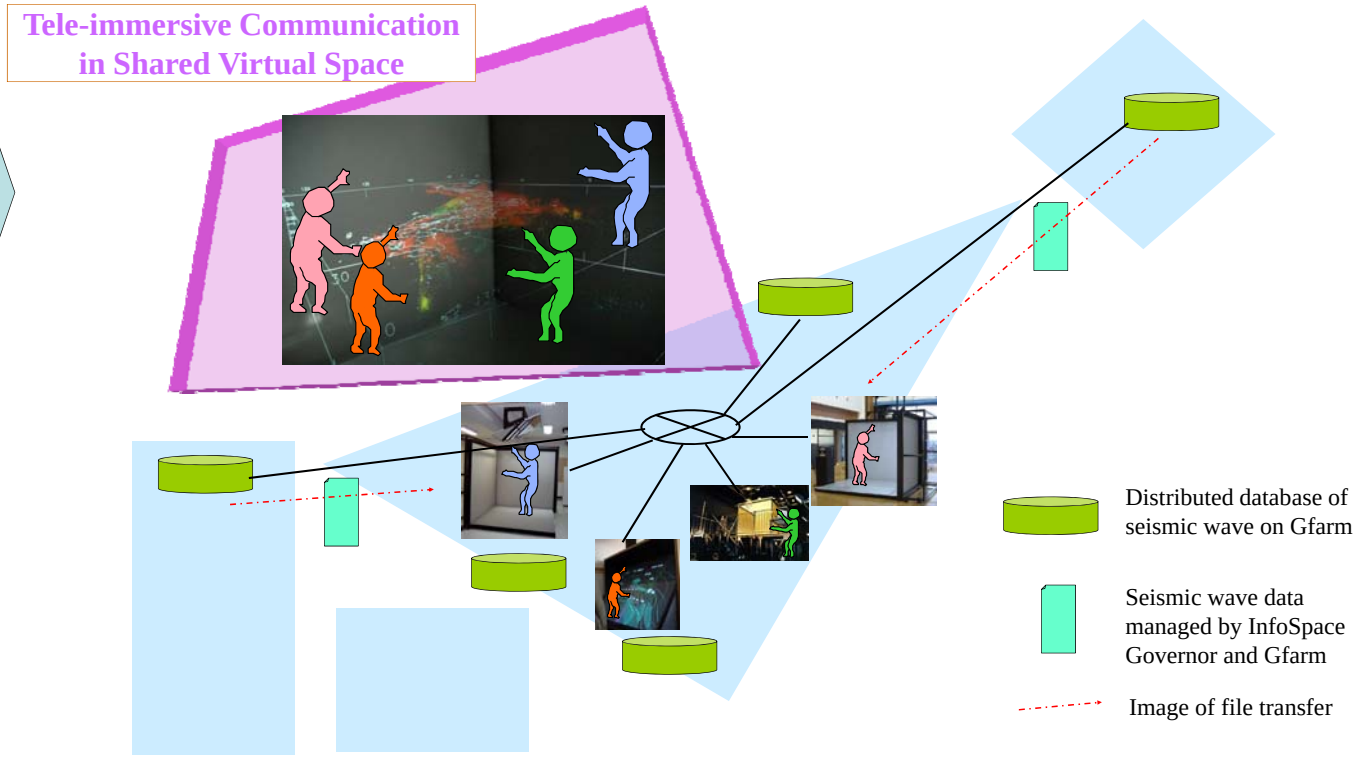
An Assumption Diagram



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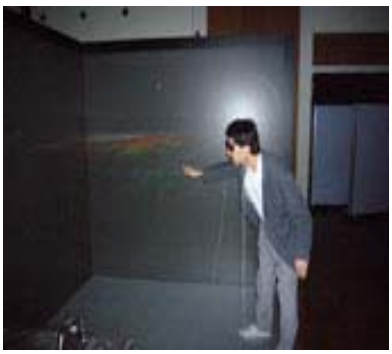
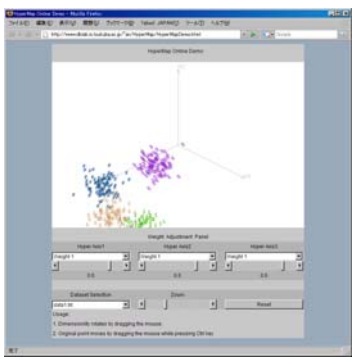
Current Status



Researcher can be immersed in data of seismic data on one CAVE.



Hyper Map has been a web application for 3D data-mining conventionally.

Now, Hyper Map is porting in order to display on CAVE.

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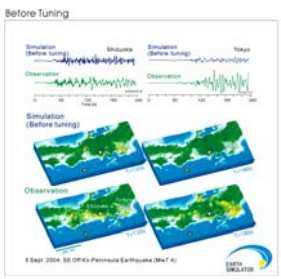
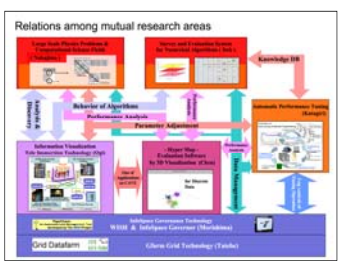
Automatic Tuning for Analyzing of Seismic Wave

At present, core application planning to use this system is “Analysis of Seismic Wave and Its Knowledge Discovery by Large Scale Data Sets by Furumura”.

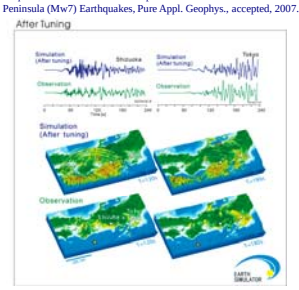


Input



Output

Under the present status of affairs, these graphs (right) are obtained by hand-tuning !



Furumura, T. Hayakawa, M. Nakamura, K. Koketsu, and T. Baba, Development of long-period ground motions from the Nankai Trough, Japan, earthquakes: Observations and computer simulation of the 1944 Tonankai (Mw8.1) and the 2004 SE Off-Kii Peninsula (Mw7) Earthquakes, Pure Appl. Geophys., accepted, 2007.