Advanced scientific visualization with VisNow

Organizers and presenters:

- Krzysztof Nowiński (ICM, University of Warsaw)
- Bartosz Borucki (ICM, University of Warsaw)
- Kerstin Kantiem (ICM, University of Warsaw)
- Szymon Jaranowski (ICM, University of Warsaw)

Tutorial description:

Visual analysis is one of the most powerful tools for data exploration and interpretation. It takes advantage of visualization techniques and allows scientists to work with their research data in interactive and intuitive way. In today's HPC environment and Big Data era, data analysis techniques, together with visualization, gain on importance. However, the amounts of data and the sizes of single datasets impose the need for adequate software tools. We will address this problem by providing participants with strong tool for data processing, visualization and visual analysis – VisNow.

Within this tutorial we will introduce the audience to the solutions for Scientific Visualization and Visual Data Analysis. The tutorial will cover both the introduction to the state-of-the-art within the topic and the in depth hands-on path through our software platform - VisNow.
VisNow is the open source generic visualization and data processing platform based on data flow paradigm. We've put a major effort not only to overcome the drawbacks of other software tools, but to provide an easy to use and legible system with Large Data (datasets exceeding 10^10 data points) processing capabilities. In this tutorial we will introduce the general concepts of Scientific Visualization and Visual Analysis, especially in HPC environments. VisNow platform will be described, including the philosophy beneath, generic data structures and data flow network. User interfaces will be introduced and several case studies presented in hands-on sessions, to familiarize participants with VisNow interface, most common visualization schemes and data I/O. After completion of this tutorial the participants will have the overview and the basic knowledge on data visualization and visual analysis, with proper awareness of the major problems. The audience should be also able to properly address the visualization tasks and problems, understand data structures and find proper visualization techniques to cover their own research. Participants will gain knowledge on VisNow open source software platform capabilities, will be familiarized with its environment and able to solve 2D, 3D, scalar and vector data visualization tasks with preprocessing and publishable results creation (images, graphs, movies, etc.).

Schedule:

1. Introduction to Scientific Visualization and Visual Analysis
2. Visualization systems and paradigms
3. Generic data structures
4. Introduction to VisNow
    a. Installation
    b. User Interface
5. Hands-on Session #1 – 2D data visualization

    a. 2 dimensional regular grids
    b. Introduction to viewers
    c. 2D and 3D scene manipulation
    d. Data presentation layer – colormapping and display properties
    e. Image creation
6. Hands-on Session #2 – 3D data visualization
    a. 3 dimensional regular grids
    b. 3D data representation
    c. Field slicing
    d. Volume presentation
7. VisNow data I/O
    a. Read/write modules
    b. VisNow field data format
8. Hands-on Session #3 – Vector data visualization
    a. Vector data concept and representation
    b. Glyph and streamline visualization
    c. Flow animation
    d. Movie rendering
9. Hands-on Session #4 – Unstructured data visualization
    a. Irregular field concept
    b. Mesh representation
    c. Grid remapping
    d. Examples
10. Hands-on Session #5 – Data computations
    a. Component- and field-based calculations
    b. Multidimensional histograms and density fields

Additional material:

- VisNow web page http://visnow.icm.edu.pl
- Sample images generated with VisNow: http://visnow.icm.edu.pl/templates/visnow_template/gallery/gallery.html
- Sample video: http://visnow.icm.edu.pl/download/movies/porousMedium.mpg
- Example publication: K.S.Nowiński, B.Borucki, "VisNow - a Modular, Extensible Visual Analysis Platform", Proc. of 22nd Int. Conf. in Central Europe on Computer Graphics, Visualization and Computer Vision WSCG2014, pp 73-76, http://wscg.zcu.cz/WSCG2014/!!_2014-Posters-Proceedings.pdf

Requirements for attendees:

- Basic knowledge on scientific data structures and formats.
- Computer with 64-bit OS: Linux, Windows or Mac OS X and installed Java Runtime Environment (JRE) version 1.7 or newer. Participants are encouraged to use their own laptop computers. Internet access is recommended.