

Dagstuhl Seminar 09302
New Developments in the Visualization and Processing of Tensor Fields
19.07.2009 - 24.07.2009

Organizers:

Bernhard Burgeth (Universität des Saarlandes, DE)
David H. Laidlaw (Brown University - Providence, US)

This Dagstuhl Seminar was concerned with the visualization and processing of tensor fields, like its two predecessors: seminar 04172 organized by Hans Hagen and Joachim Weickert in April 2004, and the follow-up seminar 07022 in January 2007 with David Laidlaw and Joachim Weickert as organizers. Both earlier meetings were successful, resulting in well received books and triggering fruitful scientific interaction and exchange of experience across interdisciplinary boundaries. We believe that the 2009 seminar will prove to have been equally successful.

Our main goal was to bring together researchers from rather different fields, ranging from visualization and image processing to applications in structural mechanics, fluid dynamics, elastography, and numerical mathematics. The scientific output will be collected in a post-proceedings volume currently being produced.

Schedule

The meeting schedule comprised several different types of talks. We started Monday morning with a 2-3 minute appetizer talk from every attendee. The organizers collected slides from everyone Sunday evening into a single presentation, which helped to keep the pace of the presentations high. These introductions helped the attendees learn a little about each other right from the start and fostered interaction earlier than in some other Dagstuhl seminars I have attended. For a meeting like this one that brings together different communities, this was particularly valuable.

There were two attendees who presented hour-long review-level talks. These introduced the community to two topics that were not broadly known. The first topic was solid mechanics and the opportunities in that field for tensor visualization and analysis. The second topic was methods for decomposing 3rd- and higher-order tensors into lower-order ones. While some of the group had heard of these methods, I believe that everyone came away with a better common base of understanding.

The remainder of the sessions but one were structured around 20-25 minute individual talks. The accompanying list of abstracts details the presentation topics. These presentations were organized in groups of four with two talks in each group from each of the two disciplinary populations represented at the meeting. Our goal with this organization was to better mix the populations, to keep both populations within the audience interested, and to bring together potential computation-visualization

collaborations. The organization seemed successful, but our subjective evaluation may be biased.

We tried a new outing for this seminar: a trip to a local coal-mine museum. It was a pleasant place to be in the warm weather, and provided a bonding experience for the group. A photo of the group attired for the mine is below:



Results

The Dagstuhl survey results suggest a success. All respondents said they would come to another seminar. All of the content-related responses were higher than those for the comparison group of seminars. In fact, no responses were lower than the comparison-group mean.

As with the two related seminars preceding this one, we have begun the process of producing a Springer book. This third volume in the series is in early production; the proposed contact authors and chapter titles are:

1. "Anna Vilanova i Bartrol" <A.Vilanova@tue.nl>

A study of classification techniques for HARDI data simplification

2. "Stephan Didas" <stephan.didas@itwm.fraunhofer.de>

Higher Order PDEs for Filtering Tensor-Valued Data

3. "Thomas Schultz" <t.schultz@uchicago.edu>

Towards resolving fiber crossings with higher order tensor inpainting

4. "Luis Pizarro" <pizarro@mia.uni-saarland.de>

Deblurring matrix fields

5. "Song Zhang" <szhang@cse.msstate.edu>
Visualizing DTI Fibers as 2D Points
6. "Cagatay Demiralp" <cad@cs.brown.edu>
Modeling and exploring brain connectivity via two-dimensional maps
7. "Cagatay Demiralp" <cad@cs.brown.edu>
Manifold ways of coloring DTI fiber tracts
8. "eugene zhang" <zhang@eecs.oregonstate.edu>
A Survey on Tensor Field Design for Geometry Processing: Theory, Approaches, and Applications
9. "Carl-Fredrik Westin" <westin@bwh.harvard.edu>
Representation and Estimation of Tensor-pairs
10. "Rodrigo Moreno" <rodrigo.moreno@urv.cat>, Angel Garcia, and Domenec Puig
Adaptation of Tensor Voting to Image Structure Estimation
11. "Liz Marai" <marai@cs.pitt.edu>
Tensor Visualization in Turbulent Combustion Flow Calculations
12. "Xavier Tricoche" <xmt@purdue.edu>
Beyond Topology: A Lagrangian Metaphor to Visualize the Structure of 3D Tensor Fields
13. "Ofer Pasternak" <oferpas@post.tau.ac.il>
The effect of metric selection on tensor interpolations
14. "Hans Knutsson" <knutte@imt.liu.se>
Towards Closure on Structure Tensor Estimation – Introducing Polynomial Quadrature Filter Sets
15. "matt hall" <m.hall@cs.ucl.ac.uk>
Anomalous diffusion tensor imaging
16. "Rodrigo de Luis Garcia" <rodlui@tel.uva.es>
On the choice of a tensor distance for DTI white matter segmentation
17. "Gordon L. Kindlmann" <glk@uchicago.edu>

Characterizing the scale-space structure of diffusion MRI through tensor invariants

18. "bernhard peters" <bernhard.peters@uni.lu>

An Approach to Visualise Tensors from Stress/Strain Analysis

19. "Hans-Christian Hege" <hege@zib.de>

Features in Uncertain Tensor Data

21. "Ingolf Sack" <ingolf.sack@charite.de>

Elastic wave scattering observed by magnetic resonance imaging

22. "Dirk Zeckzer" <zeckzer@informatik.uni-kl.de>

Global and Local Field Analysis

23. "Gerik Scheuermann" <scheuermann@informatik.uni-leipzig.de>

Image Space Tensor Field Visualization using a LIC-like Method

24. "Ingrid Hotz" <hotz@zib.de>

Challenges in tensor visualization in the area of mechanical engineering

25. "Bernhard Burgeth" <burgeth@math.uni-sb.de>

Edge-Enhancing Diffusion for Matrix Fields

Conclusions

This third-in-a-series seminar was a great success. The attendees report high marks, and the expected book is starting off with strong involvement from the authors. We have hopes of proposing another in this series with two new organizers and one continuing one. The field continues to expand and mature, and Dagstuhl seminars continue to help make that process a robust one.