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Dilip Mathew Thomas

Research Interests

Topological methods for data analysis, scientific data visualization, computational topology, computational geometry.

Education

2009 - 2014 (Thesis submitted)	Ph.D. (Computer Science and Engineering) **Indian Institute of Science, Bangalore** Thesis: Symmetry in Scalar Fields Advisor: Dr. Vijay Natarajan CGPA: 7.0 / 8.0
2007 - 2009	Master of Engineering (Computer Science and Engineering) **Indian Institute of Science, Bangalore** Thesis: Topology Preserving Simplification of Meshes with Embedded Structures Advisor: Dr. Vijay Natarajan CGPA: 7.1 / 8.0
1998 - 2002	Bachelor of Technology (Computer Science and Engineering) **Regional Engineering College, (Now, NIT), Calicut** Aggregate: 74%

Employment History

Aug 2014 - *present*	Research Associate, Indian Institute of Science
Jan 2006 - Jul 2007	Member, Technical Staff, NetApp India Pvt Ltd, Bangalore • Designed and implemented data de-duplication module for virtual tape library • Developed proof of concept to show effectiveness of data de-duplication • Patented an algorithm for efficiently hashing data
Nov 2002 - Jan 2006	Senior Software Engineer, Philips Software Centre, Bangalore • Designed and implemented enhancements for workflow management of a cardiovascular intervention software • Developed a memory management module for efficient image retrieval • Onsite system integration and testing at Philips Medical Systems, Netherlands

Achievements

- Best Presentation Award, Electrical Sciences Divisional Symposium, IISc, 2014
- Honorable Mention Award, Shell India Computational Talent Prize 2013
- Third Best Poster Award, Microsoft TechVista 2011
- Patent on “System and Method for Implementing an Efficient Rolling Hash”, with Roger Stager, Network Appliance Inc. (Appl no. 938/DEL/2007 A)

Publications

1. Dilip Mathew Thomas and Vijay Natarajan.
   "Multiscale symmetry detection in scalar fields by clustering contours."
   IEEE Transactions on Visualization and Computer Graphics (IEEE SciVis 2014), accepted.

2. Dilip Mathew Thomas and Vijay Natarajan.
   "Detecting symmetry in scalar fields using augmented extremum graphs."
   IEEE Transactions on Visualization and Computer Graphics (IEEE SciVis 2013), 19 (12), 2013, 2663-2672.

3. Talha Bin Masood, Dilip Mathew Thomas, and Vijay Natarajan.
   "Scalar field visualization via extraction of symmetric structures."
   The Visual Computer (CGI 2013), 29 (6-8), 2013, 761-771.

4. Dilip Mathew Thomas, Phaneendra K. Yalavarthy, Deepak Karkala, and Vijay Natarajan.
   "Mesh simplification based on edge collapsing could improve computational efficiency in near infrared optical tomographic imaging."
   IEEE Journal of Selected Topics in Quantum Electronics (issue on biophotonics), 18(4) , 2012, 1493-1501.

5. Dilip Mathew Thomas and Vijay Natarajan.
   "Symmetry in scalar field topology."
   IEEE Transactions on Visualization and Computer Graphics (IEEE Vis 2011), 17(12), 2011, 2035-2044.

6. Dilip Mathew Thomas, Vijay Natarajan, and Georges-Pierre Bonneau.
   "Link conditions for simplifying meshes with embedded structures."
   IEEE Transactions on Visualization and Computer Graphics, 17(7), 2011, 1007-1019.

Doctoral Thesis: Symmetry in Scalar Fields

Scalar fields are used to represent physical quantities measured over a domain of interest. Scientists are often interested in studying symmetric or repeating patterns in scalar fields to gain insights about the underlying phenomena.

The thesis proposes three methods to detect symmetry in scalar fields. The first method models symmetry detection as a subtree matching problem in the contour tree, which is a topological graph abstraction of the scalar field. The contour tree induces a hierarchical segmentation of features at different scales and hence this method can detect symmetry at different scales. The second method identifies symmetry by comparing distances between extrema from each symmetric region. The distance is computed robustly using a topological abstraction called the extremum graph. Hence this method can detect symmetry even in the presence of significant noise. The above methods compare pairs of regions to identify symmetry instead of grouping the entire set of symmetric regions as a cluster. This motivates the third method which uses a clustering analysis for symmetry detection. In this method, the contours of a scalar field are mapped to points in a high-dimensional descriptor space such that points corresponding to similar contours lie in close proximity to each other. Symmetry is identified by clustering the points in the descriptor space.

We show through experiments on real world datasets that these methods are robust in the presence of noise and can detect symmetry under different types of transformations. Extraction of symmetry information helps users in visualization and data analysis. We design novel applications that use symmetry information to enhance visualization of scalar field data and to facilitate their exploration.

Personal Details

Nationality	Indian
Date of Birth	November 5, 1980
Marital Status	Married
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