Manasi Datar

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Research Interests

Statistical Shape Analysis and Visualization
non-parametric models, correspondence models, shape regression, longitudinal shape analysis, ensemble statistics, hypothesis testing

Image Processing and Machine Learning
multi-modality registration, image segmentation, unsupervised clustering, information fusion, hierarchical self-organizing maps (HSOM)

Computational Anatomy
characterization of morphological changes due to natural development or disease progression, visualization of early brain growth, longitudinal analysis of sub-cortical structures

Education

University of Utah — **Ph.D., Scientific Computing**
Advisor: Dr. Ross Whitaker — Aug 2008 - Oct 2013
Thesis: Statistical Analysis of Ensembles of Nonregular Shapes

Utah State University — **M.S., Computer Science**
Advisor: Dr. Heng-Da Cheng — Aug 2002 - May 2005
Thesis: Natural Scene Segmentation using Information Fusion and HSOMs

University of Mumbai — **B.E., Computer Engineering**
Jun 1998 - Dec 2002

Research Experience

Siemens Healthineers AG — **Research Scientist**
Erlangen, Germany — Jul 2014 - present

1000shapes GmbH — **Software Developer**
Berlin, Germany — Jan 2014 - Jun 2014
Research and Development for Image and Geometry Processing
- Technical design and implementation of the requirements imposed on the software
- Development and implementation of test plans, planning and design of user interface

Scientific Computing and Imaging Institute (SCI) — **Research Assistant**
Salt Lake City, UT, USA — Aug 2008 - Oct 2013
Robust Correspondences for Nonregular Surfaces
- Isotropy invariant correspondences via Geodesic-distance-to-landmark features
- Geodesic distance for correct inter-particle interactions
- Entropy based on surface normals to model highly curved features
- Intersection with a set of geometric primitives as constraints for open surfaces

Correspondences for Shape Change Over Time
- Regression models (linear regression, Gompertz growth model) for cross-sectional shape analysis
- High-dimensional linear mixed-effects model for longitudinal shape analysis

Statistical Shape Analysis for Orthopedics
- CAM-FAI study: comparison of complex 3D morphology to quantify morphologic differences
- MO in mouse models: study 'steal phenomenon' via localized correlation measures

GE Global Research (GRC) **Research Scientist**
Bangalore, India Jun 2005 - Jul 2008

Molecular Pathology Image Segmentation
- Application: tissue quantification and staging for prostate cancer detection
- Adapted HSOM segmentation algorithm to segment molecular pathology images

Multi-modality Image Registration
- Goal: Provide registration solutions spanning use-cases and applications
- Novel method to use anatomical cues for driving registration

Modeling Material Properties for Non-Rigid Registration
- Strategy to vary spatial deformation based on rigidity constraints
- Modified flow-based algorithms to incorporate varying degrees-of-freedom deformation

Visualization of Image Fusion
- Novel paradigm to visualize 3D motion fields derived from the fusion process
- Leveraged existing s/w architecture to facilitate visual debugging

Utah State University **Graduate Student**
Logan, UT, USA Aug 2002 - May 2005

Segmentation of Natural Scenes using Information Fusion and HSOM
- Novel strategy based on region inhomogeneity, to select training samples
- Unsupervised paradigm requiring no *a priori* knowledge of the image domain
- Combination of color and texture features for perceptually consistent segmentation

Automatic Image Orientation Detection
- Image representation based on sub-region color moments
- Reduced feature set using features only from peripheral blocks of an image
- Supervised SOM used to identify and correct image orientation

Full Papers

R Mollro, H Delingette, **M Datar**, T Heimann, et al., " Longitudinal Analysis using Personalised 3D Cardiac Models with Population-Based Priors: Application to Paediatric Cardiomyopathies," in Proc. MICCAI, 2017, pp. 350-358

MM Roh, **M Datar**, T Heimann, M Sermesant, et al., "SVF-Net: Learning Deformable Image Registration Using Shape Matching," in Proc. MICCAI, 2017, pp. 266-274

R Mollro, JA Hauser, X Pennec, **M Datar**, et al., "Longitudinal Parameter Estimation in 3D Electromechanical Models: Application to Cardiovascular Changes in Digestion," in Proc. FIMH, 2017, pp.432-440

I Oguz, J Cates, **M Datar**, B Paniagua, et al., "Entropy-based particle correspondence for shape populations," Int J CARS, 2016 11: 1221. doi:10.1007/s11548-015-1319-6

C Nita, I Stroia, LM Itu, C Suciu, V Mihalef, **M Datar**, et al., "GPU accelerated, robust method for voxelization of solid objects," HPEC, 2016, pp. 1-5

R Mollro, D Neumann, M-M Roh, **M Datar**, et al., "Propagation of Myocardial Fibre Architecture Uncertainty on Electromechanical Model Parameter Estimation: A Case Study," in Proc. FIMH, 2015, pp.448-456

N Amenta, **M Datar**, A Dirksen, M de Bruijne, et al., "Quantification and visualization of variation in anatomical trees," in Proc. Research in Shape Modeling AWMS, 2015

MD Harris, **M Datar**, RT Whitaker, E Jurrus, et al., "Statistical Shape Modeling of Cam Femoroacetabular Impingement," J Orthop Res., 2013 doi 10.1002/jor.22389

KB Jones, **M Datar**, S Ravichandran, H Jin, et al., "Toward an understanding of the short bone phenotype associated with multiple osteochondromas," J Orthop Res. 2013 Apr;31(4):651-7. doi: 10.1002/jor.22280

M Datar, I Lyu, SH Kim, J Cates, et al., "Geodesic distances to landmarks for dense correspondence on ensembles of complex shapes," in Proc. MICCAI (2), 2013, pp.19-26

M Datar, P Muralidharan, A Kumar, S Gouttard, et al., "Mixed-Effects Shape Models for Estimating Longitudinal Changes in Anatomy," in Proc. STIA, 2012, pp.76-87

MD Harris, **M Datar**, E Jurrus, CL Peters, et al., "Statistical Shape Modeling of CAM-type Femoroacetabular Impingement," in Proc. CMBBE, 2012

B Paniagua, L Bompard, J Cates, RT Whitaker, **M Datar**, et al., "Combined SPHARM-PDM and Entropy-based Particle Systems Shape Analysis Framework," Proceedings of SPIE , Volume 8317 (1), 2012

M Datar, Y Gur, B Paniagua, MA Styner, RT Whitaker, "Geometric Correspondence for Ensembles of Nonregular Shapes," in Proc. MICCAI (2), 2011, pp.368-375

M Datar, J Cates, PT Fletcher, S Gouttard, et al., "Particle Based Shape Regression of Open Surfaces with Applications to Developmental Neuroimaging," in Proc. MICCAI (1), 2009, pp.167-174

JV Miller, G Gopalakrishnan, **M Datar**, PRS Mendonça, R Mullick, "Deformable Registration with Spatially Varying Degrees of Freedom Constraints," in Proc. ISBI, 2008, pp.1163-1166

M Datar, D Padfield, H Cline, "Color and Texture Based Segmentation of Molecular Pathology Images using HSOMs," in Proc. ISBI, 2008, pp.292-295

M Datar, D Padfield, H Cline, "Color and Texture Based Segmentation of Molecular Pathology Images using HSOMs," in Proc. MIAAB, 2007, url: http://www.miaab.org/miaab-2007-papers.html

M Datar, X Qi, "Automatic Image Orientation Detection Using the Supervised Self-Organizing Map," in Proc. SIP'06, 2006

HD Cheng, **M Datar**, W Ju, "Natural Scene Segmentation Based on Information Fusion and Homogeneity Property," in Proc. CVPRIP, 2006

Talks/ Posters

MD Harris, **M Datar**, E Jurrus, CL Peters, RT Whitaker, AE Anderson, "Statistical Shape Modeling of Cam Femoroacetabular Impingement," ORS Annual Meeting, 2013

M Datar, "Shape Analysis in Orthopedics," Graduate Recruiment Visit 2013, SCIx 2012

M Datar, "Statistical Shape Analysis with Biomedical Applications," Engineering Scholars Program, 2012

M Datar, Elizabeth Jurrus, "ShapeWorks: Case study, demo and tutorial," EMBC Workshop, 2012, url: http://www.sci.utah.edu/cibcwksp2012-agenda.html

B Peterson, **M Datar**, M Hall, RT Whitaker, "GPU Accelerated Particle System for Triangulated Surface Meshes," SAAHPC, 2010

M Datar, J Chang, E Han, Y Mallya, et al., "Correlating Perfusion/Diffusion to Anatomy: A Clinical Study Assessing Automated Image Registration," ASNR, 2007

M Datar, G Gopalakrishnan, S Ranjan, R Mullick, "Anatomically Guided Registration for Multimodal Images," in Proc. IEEE AIPR, 2006

DP Stormont, A Arora, M Chandrasekharan, **M Datar**, U Dave, C Gharpure, J Jorge, A Kutiyanawala, V Patel, B Ramaswamy, L Sackett, and Z Song, "Blue Swarm 3: Integrating Capabilities for an Autonomous Rescue Robot Swarm," Thirteenth AAAI Robot Competition and Exhibition (AAAI 2004)

Patents

D Padfield, **M Datar**, H Cline, "Segmentation of Tissue Images using Color and Texture." U.S. Patent 7,949,181

R Mullick, G Gopalakrishnan, **M Datar**, "System and Method for Geometry Driven Registration." U.S. Patent Application 20070280556

SOFTWARE

ShapeWorks https://github.com/SCIInstitute/shapeworks 2009 - 2013
method for constructing compact, non-parametric point-based models of shape ensembles

ShapeWorks Remote Client http://www.sci.utah.edu/software/shapeworks.html 2011
provides a UI and allows ShapeWorks computation to be performed in a Client/Server setting

PROGRAMMING

C, C++, Python, R, Matlab, ITK, VTK, FLTK, OpenGL, QT, CUDA