

Tushar Athawale

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Research Interest

Data visualization, statistical uncertainty quantification, topological data analysis, visualizations for large-scale/high-dimensional data, in situ computing and analysis, data science

Research and Work Experience

Oak Ridge National Laboratory (ORNL), Oak Ridge, TN **Nov 2021 - Present**
Computer Scientist in the visualization group led by Dr. David Pugmire. Application of statistical uncertainty quantification and visualization in conjunction with high performance computing for analysis of large-scale scientific data.

University of Utah, Salt Lake City, UT **Oct 2016 - Oct 2021**
Post-Doctoral Fellow in the scientific visualization group supervised by Distinguished Prof. Chris R. Johnson at the Scientific Computing and Imaging (SCI) Institute. Research in statistical uncertainty quantification and visualization for scientific data with applications ranging from biomedical imaging to large-scale simulations.
Co-Instructor, teaching CS6635/5635, Scientific Visualization, Spring 2018 and Spring 2019.
Co-Instructor, teaching CS6962, Decomposition-Based Techniques in Data Analysis, Spring 2017.
Seminar Leader, scheduling weekly SCI Institute *visualization research seminars* for two semesters.

MathWorks, Inc., Natick, MA **July 2015 - Oct 2016**
Application Support Engineer, providing solutions to complex technical issues experienced by the customers working with MATLAB. Lead contributor to the design and implementation of the in-built MATLAB function IMROTATE3 introduced in the release of R2017a for rotation of 3D images. Conducting phone and on-site technical interviews to hire new candidates for the Application Support Engineering role.

University of Florida, Gainesville, FL **May 2011 - May 2015**
Research Assistant in the visualization group led by Prof. Alireza Entezari in the Department of Computer and Information Science and Engineering (CISE). Research in uncertainty quantification for isosurface visualizations, where isosurfaces are rendered with the widely used marching cubes algorithm.
Teaching Assistant for the graduate- and undergraduate-level courses on Computer Graphics (CAP 4730/ 5705), Advanced Data Structures (COP 5536), and Programming Fundamentals for CIS Majors 1 (COP 3502).

Nvidia Corporation, Pune, India **Aug 2009 - May 2010**
Software Engineering Intern, the study of the screen space ambient occlusion (SSAO) algorithm and embedding of game-specific SSAO profiles into the Nvidia drivers for video games, such as Gears of War.

Education

Doctor of Philosophy (PhD) in Computer and Information Science and Engineering **May 2010 - May 2015**
University of Florida, Gainesville, FL
Dissertation: Quantification and visualization of spatial uncertainty in isosurfaces for parametric and nonparametric noise models [[link](#)]
Advisor: Prof. Alireza Entezari
Graduated with highest distinction, GPA: 3.75/4.00

Master of Science (MS) in Computer and Information Science and Engineering **May 2010 - May 2014**
University of Florida, Gainesville, FL
Graduated with highest distinction, GPA: 3.75/4.00
Relevant Coursework: Analysis of Algorithms, Advanced Data Structures, Computer Graphics, GPU Architecture and Programming, Machine Learning

Bachelor of Engineering (BE) in Computer Engineering **May 2006 - May 2010**
University of Pune, Pune, India
Graduated with highest distinction, GPA: 8.81/10.00

Teaching

- CS6635/5635 - Visualization for Scientific Data**, University of Utah **2018, 2019**
 Co-instructor with Distinguished Prof. Chris R. Johnson. Graduate-level lectures on visualizations for scalar-field and vector-field data, ParaView software, and uncertainty visualizations. Development and grading of course assignments and projects. Helping students successfully meet their project milestones.
- CS6962 - Decomposition Techniques for Computational Data-Enabled Science and Engineering**, University of Utah **2017**
 Co-instructor with Distinguished Prof. Chris R. Johnson. Graduate-level lectures on data decomposition techniques, such as principal component analysis and singular value decomposition. Development and grading of course assignments and projects. Helping students successfully meet their project milestones.
- CAP 4730, CAP 5705 - Computer Graphics**, University of Florida **2012, 2014**
 Teaching Assistant for Prof. Alireza Entezari. Graduate and undergraduate level. Grading of lab assignments and projects. Helping students in problem solving.
- COP 5536 - Advanced Data Structures**, University of Florida **2011, 2015**
 Teaching Assistant for Distinguished Prof. Sartaj Sahni. Graduate level. Grading of lab assignments and projects. Helping students in problem solving.
- COP 3502 - Programming Fundamentals for CIS Majors 1**, University of Florida **2013**
 Teaching Assistant for Dr. Peter J. Dobbins. Undergraduate level. Conducting student labs on Java programming language and grading lab assignments.

Mentored Students

- Brooke Stanislawski**, Wind, Energy & Turbulence Lab, University of Utah
 A student in my *Visualization for Scientific Data (Spring, 2019)* class. I have mentored Brooke to get her class project published in the *EnergyVis 2021* conference. The project is about developing 3D visualizations for the simulation data modeling interactions between solar photovoltaic farms and atmospheric boundary layer.
- Dennis Njeru**, SCI Institute, University of Utah
 A student in my *Visualization for Scientific Data (Spring, 2019)* class. I have mentored Dennis with Dr. Johnson to help him get his research project published in the *CMBBE* journal. The project is about developing uncertainty visualizations for the simulation data generated in the domain of Electrocardiography Imaging (ECGI).

Peer-Reviewed Journal Publications

- Tushar M. Athawale**, Chris R. Johnson, Sudhanshu Sane, and David Pugmire, Fiber Uncertainty Visualization of Bivariate Data with Parametric and Nonparametric Noise Models. *IEEE Transactions on Visualization and Computer Graphics*, Special Issue on 2022 IEEE VIS Conference, vol. 29, no. 1, pp. 613-623, 2023. [[doi](#)] [[pdf](#)] [**Acceptance rate: 122/460 = 26.5%**]
- Dennis Njeru, **Tushar M. Athawale**, Jessie France, and Chris R. Johnson, Quantifying and Visualizing Uncertainty for Source Localization in Electrocardiographic Imaging, *To appear in Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization*, 2022. [[doi](#)] [[pdf](#)]
- Tushar M. Athawale**, Dan Maljovec, Lin Yan, Chris R. Johnson, Valerio Pascucci, and Bei Wang, Uncertainty Visualization of 2D Morse Complex Ensembles Using Statistical Summary Maps. *IEEE Transactions on Visualization and Computer Graphics*, vol. 28, no. 4, pp. 1955-1966, 2022. [[doi](#)] [[pdf](#)]
- Tushar M. Athawale**, Bo Ma, Elham Sakhaee, Chris R. Johnson, and Alireza Entezari, Direct Volume Rendering with Nonparametric Models of Uncertainty. *IEEE Transactions on Visualization and Computer Graphics*, Special Issue on 2020 IEEE VIS Conference, vol. 27, no. 2, pp. 1797-1807, 2021. [[doi](#)] [[pdf](#)] [**Acceptance rate: 32/125 = 25.6%**]
- Tushar M. Athawale** and Chris R. Johnson, Probabilistic Asymptotic Decider for Topological Ambiguity Resolution in Level-Set Extraction for Uncertain 2D Data. *IEEE Transactions on Visualization and Computer Graphics*, Special Issue on 2018 IEEE VIS Conference, vol. 25, no. 1, pp. 1163-1172, 2019.

[[doi](#)] [[pdf](#)] [[code](#)] [Acceptance rate: 32/128 = 25%]

6. **Tushar M. Athawale**, Kara A. Johnson, Chris R. Butson, and Chris R. Johnson, A Statistical Framework for Quantification and Visualization of Positional Uncertainty in Deep Brain Stimulation Electrodes. *Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization*, vol. 7, no. 4, pp. 438-449, 2019. [[doi](#)] [[pdf](#)] [[code](#)]
7. **Tushar M. Athawale**, Elham Sakhaee, and Alireza Entezari, Isosurface Visualization of Data with Nonparametric Models for Uncertainty. *IEEE Transactions on Visualization and Computer Graphics*, Special Issue on 2015 IEEE VIS Conference, vol. 22, no. 1, pp. 777-786, 2016. [[doi](#)] [[pdf](#)] [[code](#)] [Acceptance rate: 33/134 = 24.60%]
8. **Tushar M. Athawale** and Alireza Entezari, Uncertainty Quantification in Linear Interpolation for Isosurface Extraction. *IEEE Transactions on Visualization and Computer Graphics*, Special Issue on 2013 IEEE VIS Conference, vol. 19, no. 12, pp. 2723-2732, 2013. [[doi](#)] [[pdf](#)] [[code](#)] [Acceptance rate: 34/126 = 27%]

Conference Proceedings/Workshops

1. Mengjiao Han, **Tushar M. Athawale**, David Pugmire, Chris R. Johnson, Accelerated Probabilistic Marching Cubes by Deep Learning for Time-Varying Scalar Ensembles. *In IEEE VIS 2022 Conference: Short Papers, Oklahoma City, OK, USA*, pp. 155-159, 2022. [[doi](#)] [[pdf](#)] [Acceptance rate: 33/104 = 32%]
2. **Tushar M. Athawale**, David Pugmire, Chris R. Johnson, Kenneth Moreland, Dan Lu, Jieyang Chen, James Kress, Scott Klasky, Manish Parashar, Uncertainty-Aware Scientific Data Visualization for Trusted Decision-Making. *In ASCR Workshop on Visualization for Scientific Discovery, Decision-Making, & Communication (Virtual)*, 2022. [[doi](#)] [[pdf](#)]
3. David Pugmire, Kenneth Moreland, James Kress, Jieyang Chen, **Tushar M. Athawale**, Scott Klasky, Hank Childs, Efficient Visualization on Complex Distributed Resources. *In ASCR Workshop on Visualization for Scientific Discovery, Decision-Making, & Communication (Virtual)*, 2022. [[doi](#)] [[pdf](#)]
4. **Tushar M. Athawale**, Sudhanshu Sane, and Chris R. Johnson, Uncertainty Visualization of the Marching Square and Marching Cubes Topology Cases. *In IEEE VIS 2021 Conference, New Orleans, LA, USA (Virtual)*, pp. 106-110, 2021. [[doi](#)] [[pdf](#)] [Acceptance rate: 41/142 = 29%]
5. Sudhanshu Sane, **Tushar M. Athawale**, and Chris R. Johnson, Investigating Multivariate, Vector, and Topological Data Analysis Techniques for Mantle Flow Pattern Visualization. *2021 IEEE SciVis Contest, New Orleans, LA, USA (Virtual)*, 2021. [[pdf](#)] [IEEE VIS 2021 Scientific Visualization Contest Finalist]
6. **Tushar M. Athawale**, Brooke Stanislawski, Sudhanshu Sane, and Chris R. Johnson, Visualizing Interactions Between Solar Photovoltaic Farms and the Atmospheric Boundary Layer. *In e-Energy'21: Proceedings of the Twelfth International Conference on Future Energy Systems, Torino, Italy (Virtual)*. ACM, New York, NY, USA, pp. 377-381, 2021. [[doi](#)] [[pdf](#)] [Acceptance rate: 14/18 = 77.7%]
7. Sudhanshu Sane, **Tushar M. Athawale**, and Chris R. Johnson, Visualization of Uncertain Multivariate Data via Feature Confidence Level-Sets. *In Proceedings of the 23rd Eurographics/IEEE VGTC Conference on Visualization: Short Papers, Eurographics Association, Zurich, Switzerland (Virtual)*, 2021. [[doi](#)] [[pdf](#)] [Acceptance rate: 20/45 = 44%]
8. **Tushar M. Athawale**, Alireza Entezari, Bei Wang, and Chris R. Johnson, Statistical Rendering for Visualization of Red Sea Eddy Simulation Data. *2020 IEEE SciVis Contest, Salt Lake City, USA (Virtual)* Oct 2020. [[arXiv](#)] [[pdf](#)] [IEEE VIS 2020 Scientific Visualization Contest Finalist]
9. **Tushar M. Athawale**, Kara A. Johnson, Chris R. Butson, and Chris R. Johnson, A Statistical Framework for Visualization of Positional Uncertainty in Deep Brain Stimulation Electrodes. *2019 IEEE Workshop on Visual Analytics in Healthcare (VAHC), Vancouver, BC, Canada*, pp. 54-55, Oct 2019. [[doi](#)] [[pdf](#)]

Published Books

1. Debabala Swain, Prasant Kumar Pattnaik, and **Tushar M. Athawale** (Eds.), Machine Learning and Information Processing, Proceedings of ICMLIP 2020. *Advances in Intelligent Systems and Computing 1311*, Springer Singapore, 2021. [[doi](#)]

Tutorials

1. **Tushar M. Athawale**, Kenneth Moreland, David Pugmire, Silvio Rizzi, and Mark Bolstad, VTK-m - A ToolKit for Scientific Visualization on Many-Core Processors, *presented at IEEE VIS 2022 tutorial track*.

Presentations and Seminars

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| Paper presentation at IEEE VIS 2022 , Oklahoma City, OK, USA (Hybrid)
Fiber Uncertainty Visualization for Bivariate Data With Parametric and Nonparametric Noise Models [slides] | Oct 2022 |
| Technical talk at IU PTI-ORNL Joint Symposium , Bloomington, IN, USA
Statistical Analysis for Uncertainty Quantification and Visualization of Scientific Data [slides] | Sept 2022 |
| Technical talk at DOE CGE , Eugene, OR, USA (Virtual)
Statistical Analysis for Uncertainty Quantification and Visualization of Scientific Data [slides] | Aug 2022 |
| Technical talk at Dagstuhl Seminar on Visualization and Decision Making Design Under Uncertainty, Dagstuhl, Germany (Virtual)
Statistical Analysis for Uncertainty Quantification and Visualization of Scientific Data [slides] | Aug 2022 |
| Invited talk at IEEE VIS 2021 Application Spotlights , New Orleans, LA, USA (Virtual)
Statistical Analysis for Uncertainty Quantification and Visualization of Scientific Data [slides] [video] | Oct 2021 |
| Invited talk at University of South Florida (USF) , Tampa, FL, USA (Virtual)
Statistical Analysis for Uncertainty Quantification and Visualization of Ensemble/ Large-Scale Data [slides] | June 2021 |
| Invited talk at ICMLIP 2020 , Hyderabad, India (Virtual)
Applications of Uncertainty Visualization for Analysis of Scientific Data [slides] | Nov 2020 |
| Paper presentation at IEEE VIS 2020 , Salt Lake City, UT (Virtual)
Direct Volume Rendering with Nonparametric Models of Uncertainty [slides] [video] | Oct 2020 |
| Paper presentation at IEEE VIS 2020 , Salt Lake City, UT (Virtual)
Uncertainty Visualization of 2D Morse Complex Ensembles Using Statistical Summary Maps [slides] [video] | Oct 2020 |
| Paper and poster presentations at IEEE SciVis Contest 2020 , Salt Lake City, UT (Virtual)
Statistical Rendering for Visualization of Red Sea Eddy Simulation Data [slides] [video] [poster] | Oct 2020 |
| Keynote speaker at ICMLIP 2019 , Pune, India
Statistical Analysis for Uncertainty Quantification and Visualization of Scientific Data [slides] | Dec 2019 |
| Invited talk at Indian Institute of Science (IISc) , Bengaluru, India
Statistical Analysis for Uncertainty Quantification and Visualization of Scientific Data [slides] | Nov 2019 |

Invited talk on a poster at <u>2019 IEEE Workshop on Visual Analytics in Healthcare (VAHC)</u> , Vancouver, BC, Canada A Statistical Framework for Visualization of Positional Uncertainty in Deep Brain Stimulation Electrodes [poster]	Oct 2019
Invited talk at <u>Oak Ridge National Laboratory (ORNL)</u> , Oak Ridge, TN, USA Statistical Analysis for Uncertainty Quantification and Visualization of Ensemble/ Large-Scale Data [slides]	May 2019
Invited talk at <u>Los Alamos National Laboratory (LANL)</u> , Los Alamos, NM, USA Statistical Analysis for Quantification and Visualization of Spatial Variability in Features of Uncertain Data [slides]	Dec 2018
Paper presentation at <u>IEEE SciVis 2018</u> , Berlin, Germany Probabilistic Asymptotic Decider for Topological Ambiguity Resolution in Level-Set Extraction for Uncertain 2D Data [slides] [video]	Oct 2018
Paper presentation at <u>IEEE SciVis 2015</u> , Chicago, IL, USA Isosurface Visualization of Data with Nonparametric Models for Uncertainty [slides]	Oct 2015
Paper presentation at <u>IEEE SciVis 2013</u> , Atlanta, GA, USA Uncertainty Quantification in Linear Interpolation for Isosurface Extraction [slides]	Oct 2013

Professional Services

- Member of a **program committee** for the IEEE VIS [2020](#), [2021](#), [2022](#) short papers
- Member of a **program committee** for the IEEE [TopoInVis 2022](#) workshop
- **Reviewer** for the IEEE VIS (2017-2022), EuroVis (2017-2019, 2021-2023), PacificVis (2023), and China Visualization (2020) conferences
- **Reviewer for journal papers**: IEEE Transactions on Visualization and Computer Graphics (TVCG), Computer Graphics Forum (CGF), Computers & Graphics (CAG), and Journal of Big Data
- **Poster reviewer** for undergraduate student posters presented at the Undergraduate Research Symposium in 2018 and 2019
- **Student volunteer** at the IEEE VIS 2013