

SUJAL BISTA, PH.D.

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PROFESSIONAL SUMMARY

Graphics research scientist and software engineer with 15+ years of experience building real-time rendering, extended reality experiences, and GPU-accelerated systems for interactive 3D applications, games, healthcare, and national security. Proven track record of architecting high-performance graphics platforms and immersive applications, leading multimillion-dollar research initiatives, and delivering award-winning work at the intersection of computation, AI-driven graphics, and design. Brings deep expertise in modern graphics APIs, shader programming, and scientific visualization, along with strong cross-functional leadership to translate complex ideas into scalable, production-ready systems.

TECHNICAL EXPERTISE

- **3D Graphics & Visualization:** Neural rendering | GenAI | Real-time rendering | CPU/GPU-based optimization | Saliency & perception | Distributed ray tracing | Scientific & medical visualization | Physics-based rendering | Spatial datasets
- **Immersive Technologies:** XR medical training modules | Cybersickness research | Depth perception | Volumetric capture systems
- **Machine Learning:** Medical segmentation & classification | Application of Generative AI | Dimensionality reduction
- **Project & Team Leadership:** Cross-functional research | Grant development | Hiring & mentoring | Executive-level coordination
- **Languages & APIs:** C/C++ | DirectX | OpenGL | WebGL | OpenXR | HLSL | GLSL | CUDA | CG | Python | C# | Java
- **Tools & Platforms:** 3ds Max | MotionBuilder | Mudbox | MATLAB | Unity | Unreal
- **Other:** Game development | Physics engine programming | Spatial audio development | Socket programming

PROFESSIONAL EXPERIENCE

Director of Immersive Visualization Research Center

Aug 2024 – Present

Institute for Health Computing, University of Maryland, College Park, MD

- Lead research in graphics and immersive visualization, including cybersickness, neural rendering, and scientific visualization - advancing the performance and usability of interactive systems.
- Architect XR rendering applications for medical and scientific use, supporting platforms from head-mounted displays to glasses-free 3D systems using Unreal Engine, Unity, and low-level graphics APIs.
- Spearhead development of scalable XR training modules using advanced techniques such as NeRF and Gaussian Splatting, enabling efficient creation and deployment of training scenarios for medical professionals.

Interim Co-Executive Director (Founding)

Jan 2023 – Aug 2024

Institute for Health Computing, University of Maryland, College Park, MD

- Co-led the founding of a new computational health institute, managing site selection, grant development, and academic/industry partnerships across multiple locations and disciplines.
- Recruited researchers and engineers across XR, AI, and bioinformatics domains; established three core research programs and directed team operations.
- Developed visualization applications and GenAI-based interfaces to support 3D exploration, data analysis, and medical training scenarios tailored for healthcare professionals and industry partners.
- Secured early-stage funding and coordinated with federal and state agencies to establish research infrastructure prioritizing science and economic development.

Founder and Game/Graphics Engineer

Jan 2016 – Present

Extra Fluffy Studios, Rockville, MD

- Built a fully playable stylized 3D platformer leveraging C++, DirectX 12, HLSL, and OpenXR, implementing custom rendering, physics, AI, and audio systems.
- Implemented a wide range of rendering components such as physically based rendering, subsurface scattering, atmospheric scattering, dynamic deformation, procedural snow systems, visualization effects (rain, clouds, smoke, fire, snow, fur, etc.), fluid rendering (using shaders, FFT, and simulation), level of detail optimizations, and dynamic shadows (using ray tracing and shadow maps).
- Created original 3D models, character animations, and audio assets using 3ds Max, Mudbox, MotionBuilder, and Audacity, building unique assets and a complete soundscape.

Research Scientist

May 2014 – Jan 2016

UM Institute for Advanced Computer Studies, University of Maryland, College Park, MD

- Developed a modular testbed for virtual and augmented reality applications, compatible with multiple devices, including curved hemispherical displays and modern head-mounted displays, to support visualization and cybersickness research.
- Created tools for visualizing and classifying EEG datasets to analyze the impact of nicotine and e-cigarettes.
- Implemented volume rendering and machine learning techniques to visualize and segment MRI data, advancing the study of traumatic brain injury.

Graduate Research Assistant

Sep 2008 – May 2014

Graphics and Visual Informatics Lab, University of Maryland, College Park, MD

- Built multi-view rendering systems and applied GPU-based optimizations using OpenGL, CG, and CUDA to support distributed immersive visualization, simulation, and real-time rendering of complex medical and scientific datasets.
- Developed and evaluated machine learning tools for segmentation and classification using techniques such as Laplacian eigenmaps, contributing to six publications and award-winning research recognized by IEEE SciVis and ASME CIE.

Lead Graphics Programmer

Jul 2004 – Jul 2008

Center for Advanced Transportation Technology Laboratory, University of Maryland, College Park, MD

- Built a real-time transportation visualization and simulation system used by **FEMA** during the **2008 Presidential Inauguration**, optimized rendering of massive satellite data, and implemented dynamic visual effects using C++, OpenGL, and GLSL.

Software Engineer

Jun 2002 – Sep 2004

Atomic Engineering Corporation, Gaithersburg, MD

- Developed spectral analysis tools using C++ to identify molecular compositions, analyzed raw lab data, and converted them into structured formats, improving analysis speed and usability.

Computer Lab Assistant

Sep 2000 – Jun 2002

Montgomery College, Rockville, MD

- Provided programming support for students, maintained hardware/software in academic labs, and performed OS/network troubleshooting for over 200 systems.

EDUCATION

Ph.D. in Computer Science

University of Maryland, College Park, MD | GPA: 3.90

May 2014

M.S. in Computer Science

University of Maryland, College Park, MD | GPA: 3.90

May 2010

B.S. in Computer Science

University of Maryland, College Park, MD

May 2005

AWARDS

- **Larry S. Davis Doctoral Dissertation Award**, Best Dissertation in Computer Science 2014
- **IEEE SciVis Best Paper Award** 2014
- **ASME CIE Best Paper Award** 2012
- **Charley V. Wootan Award**, Best Paper in Transportation Policy 2007
- **NSF Computer Science, Engineering, and Mathematics Scholarship** 2001 – 2002, 2003 – 2004

SELECTED PUBLICATIONS

- **Performance of a Deep Neural Network Trained on Professionally Generated Gaussian Splat Imagery for Autonomous Aerial Refueling**
Ryan Lowe, Violet Mwaffo, Matthew Johnson, Sujal Bista, Jon Heagerty, Olivia Mercurio, Barbara Brawn, Amitabh Varshney, Donald H. Costello
AI/AA SCITECH 2026 Forum, pp. 0309 Jan 2026
- **HoloCamera: Advanced Volumetric Capture for Cinematic-Quality VR Applications**
Jonathan Heagerty, Sida Li, Eric Lee, Shuvra Bhattacharyya, Sujal Bista, Barbara Brawn, Brandon Y Feng, Susmija Jabbireddy, Joseph Jaja, Hernisa Kacorri, David Li, Derek Yarnell, Matthias Zwicker, Amitabh Varshney
IEEE Transactions on Visualization and Computer Graphics, 30(5), pp. 2767–2775 ([Paper](#)) Apr 2024
- **Kinetic Depth Images: Flexible Generation of Depth Perception**
Sujal Bista, Ícaro Lins Leitão da Cunha, Amitabh Varshney
The Visual Computer, 33(10), pp. 1357–1369 ([Paper](#))([Video](#)) Oct 2017
- **Tracking Fluctuation Hotspots on the Yeast Ribosome Through the Elongation Cycle**
Suna P. Gulay, Sujal Bista, Amitabh Varshney, Serdal Kirmizialtin, Karissa Y. Sanbonmatsu, and Jonathan D. Dinman.
Nucleic Acids Research, 45(8), pp. 4958–4971 ([Paper](#)) Feb 2017
- **Video Fields: Fusing Multiple Surveillance Videos into a Dynamic Virtual Environment**
Ruofei Du, Sujal Bista, Amitabh Varshney
Proc. 21st Int'l Conference on Web3D Technology ([Paper](#))([Video](#)) Jul 2016

- Visual Knowledge Discovery for Diffusion Kurtosis Datasets of the Human Brain**
 Sujal Bista, Jiachen Zhuo, Rao P. Gullapalli, Amitabh Varshney
 In *Visualization and Processing of Higher Order Descriptors for Multi-Valued Data*, Springer, pp. 213–234 (Paper) Jul 2015
- Visualization of Brain Microstructure Through Spherical Harmonics Illumination of Spatio-Angular Fields**
 Sujal Bista, Jiachen Zhuo, Rao P. Gullapalli, Amitabh Varshney
IEEE Transactions on Visualization and Computer Graphics, 20(12), pp. 2516–2525 [Best Paper Award] (Paper) (Video). Dec 2014
- Using GPUs for Realtime Prediction of Optical Forces on Microsphere Ensembles**
 Sujal Bista, Sagar Chowdhury, Satyandra K. Gupta, Amitabh Varshney
ASME Journal of Computing and Information Science in Engineering, 13(3), pp. 031002. (Paper) (Video) Apr 2013
- Using GPUs for Realtime Prediction of Optical Forces on Microsphere Ensembles**
 Sujal Bista, Sagar Chowdhury, Satyandra K. Gupta, Amitabh Varshney
Proc. ASME IDETC/CIE [Best Paper Award] (Paper) (Video) Aug 2012
- Speeding Up Particle Trajectory Simulations Under Moving Force Fields Using GPUs**
 Rob Patro, John P. Dickerson, Sujal Bista, Satyandra K. Gupta, Amitabh Varshney
ASME Journal of Computing and Information Science in Engineering (Paper) Jun 2012
- MDMap: A System for Data-Driven Layout and Exploration of Molecular Dynamics Simulations**
 Robert Patro, Cheuk Yiu Ip, Sujal Bista, Samuel Cho, Dave Thirumalai, Amitabh Varshney
IEEE Symposium on Biological Data Visualization (Paper) (Video) Oct 2011
- Social Snapshot: A System for Temporally Coupled Social Photograph**
 Robert Patro, Cheuk Yiu Ip, Sujal Bista, Amitabh Varshney
IEEE Computer Graphics and Applications, 31(1), pp. 74–84 (Paper) (Video) Feb 2011
- Global Contours**
 Sujal Bista, Amitabh Varshney
 UMLACS Technical Report, CS-TR-4957 (Paper) May 2010
- Real-Time Massive Data Simulation Visualization**
 Sujal Bista, Michael L. Pack
 2008 IEEE Conference on Technologies for Homeland Security, pp. 543–548 May 2008
- Wide-Area, Four-Dimensional, Real-Time, Interactive Transportation System Visualization**
 Michael L. Pack, Phillip Weisberg, Sujal Bista
Transportation Research Record, pp. 97–108 [Best Paper Award] (Paper) (Video) Dec 2007
- Four-Dimensional Interactive Visualization System for Transportation Management and Traveler Information**
 Michael L. Pack, Phillip Weisberg, Sujal Bista
Human Performance, Simulation and Visualization: Journal of the Transportation Research Board, pp. 152–158 (Paper) Jan 2005

SELECTED PRESENTATIONS

- Evaluation Methods for Markerless Registration**
 Sujal Bista, Jonathan Heagerty, Sida Li, Arya Palan, Sarah B. Murthi, Barbara Brawn, Amitabh Varshney
 Presented at *Powering MedXR: Technology Driving Immersive Care*,
 MDIC Medical Extended Reality (MedXR) Summit, College Park, MD Nov 2025
- Power of Computing**
 Sujal Bista
Precision Medicine for Learning Health Systems, Baltimore, MD May 2023
- Visualization of Brain Microstructure through Spherical Harmonics Illumination of Spatio-Angular Fields**
 Sujal Bista, Jiachen Zhuo, Rao P. Gullapalli, Amitabh Varshney
 Presented at *IEEE TVCG Special Session on Visualization*, ACM SIGGRAPH, Los Angeles, CA Aug 2015
- Visualization of Brain Microstructure through Spherical Harmonics Illumination of Spatio-Angular Fields**
 Sujal Bista, Jiachen Zhuo, Rao P. Gullapalli, Amitabh Varshney
 Presented at *IEEE Scientific Visualization (SciVis) Conference*, Paris, France Nov 2014
- Using GPUs for Realtime Prediction of Optical Forces on Microsphere Ensembles**
 Sujal Bista, Sagar Chowdhury, Satyandra K. Gupta, Amitabh Varshney
 Presented at *ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC/CIE)*, Chicago, IL Aug 2012

ACTIVITIES

Weightlifting

- Volunteer Coach, Mach 10 Weightlifting 2015 – Present
- 5th Place, 56kg Men, US National Weightlifting Championships 2012
- 1st Place, 56kg Men, Maryland State Championships 2011

Martial Arts

- 2nd in Intermediate Changquan and Staff in USA Wushu Kungfu Federation National Championships 2005
- 2nd in Intermediate Changquan, Mantis, and Staff in 8th International Wushu-Kungfu Festival & Championships 2004
- 3rd in Intermediate Changquan in 8th Annual Collegiate Wushu Championship 2004
- President, Terp Wushu Club, University of Maryland 2004
- Vice-President, Terp Wushu Club, University of Maryland Fall 2003
- Developer & Manager, Wushu Judging Software for collegiate competitions and national team trials 2005 – 2016