

Roni Sengupta

Assistant Professor

Department of Computer Science

University of North Carolina at Chapel Hill

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RESEARCH OVERVIEW

The goal of my research is to create next-generation video communication and content creation by democratizing high-quality video production and editing. To achieve this goal, I develop algorithms at the intersection of Computer Vision, Computer Graphics, and Machine Learning that can edit various components of an image or a video by understanding its intrinsic components (e.g. geometry, material reflectance, lighting, alpha matte etc.). This problem is also known as Inverse Graphics.

EDUCATION

University of Maryland, College Park, USA

Aug 2013 - May 2019

PhD in Electrical & Computer Engineering

Advisor: David W. Jacobs

Committee: David W. Jacobs, Rama Chellappa, Tom Goldstein, Abhinav Shrivastava, Behtash Bababadi, Carlos D. Castillo

Dissertation: Constraints and Priors for Inverse Rendering from Limited Observations.

Jadavpur University, Kolkata, India

July 2009 - May 2013

Bachelor of Engineering with Honors in Electronics and Telecommunication Engineering

Advisors: Ananda Shankar Chowdhury, Swagatam Das

EMPLOYMENT

Assistant Professor: **University of North Carolina at Chapel Hill**

July 2022 -

Postdoctoral Research Associate: **University of Washington**

March 2019 - Jun 2022

Advisor: Brian Curless, Ira Kemelmacher-Shlizerman, Steve Seitz

Graduate Student: **University of Maryland, College Park**

Aug 2013 - Feb 2019

Advisor: David W. Jacobs.

Research Intern: **NVIDIA Research, Santa Clara, CA, USA**

April 2018 - Nov 2018

Neural Inverse Rendering of an indoor scene

Mentors: Jinwei Gu, Kihwan Kim, Guilin Liu, Jan Kautz

Research Intern: **Snapchat Inc., Venice, CA, USA**

April 2017 - Aug 2017

Shape from Shading and Photometric Stereo based reconstruction

Mentors: Linjie Luo, Chen Cao

Research Intern: **Weizmann Institute of Science, Rehovot, Israel**

June 2015 - June 2016

Low rank methods for SfM and Photometric Stereo

Mentor: Ronen Basri

Research Intern: **Technical University Dortmund, Germany**

May 2012 - July 2012

Extension of Δ_p SMS-EMOA for 3-D Benchmark Functions

Mentors: Günter Rudolpho

PUBLICATIONS

Pre-prints/ArXiv

- [P5] “Personalized Video Relighting With an At-Home Light Stage”
Jun-Myeong Choi, Max Christman, Shengze Wang, **Roni Sengupta**
ArXiv 2023.
- [P4] “My3DGen: Building Lightweight Personalized 3D Generative Model”
Luchao Qi, Jiaye Wu, Shengze Wang, **Roni Sengupta**
ArXiv 2023.
- [P3] “NePhi: Neural Deformation Fields for Approximately Diffeomorphic Medical Image Registration”
Lin Tian, **Roni Sengupta**, Hastings Greer, Raúl San José Estépar, Marc Niethammer
ArXiv 2023.
- [P2] “Bringing Telepresence to Every Desk”
Shengze Wang, Ziheng Wang, Ryan Schmelzle, Liujiu Zheng, YoungJoong Kwon, **Roni Sengupta**,
Henry Fuchs
ArXiv 2023.
- [P1] “Universal Guidance for Diffusion Models”
Arpit Bansal, Hong-Min Chu, Avi Schwarzschild, **Roni Sengupta**, Micah Goldblum, Jonas Geiping,
Tom Goldstein
ArXiv 2023.

Conference Publications

- [C21] “Joint Depth Prediction and Semantic Segmentation with Multi-View SAM”
Mykhailo Shvets, Dongxu Zhao, Marc Niethammer, **Roni Sengupta**, Alexander C. Berg
to appear IEEE Winter Conference on Applications of Computer Vision (WACV), January 2024.
- [C20] “Motion Matters: Neural Motion Transfer for Better Camera Physiological Sensing”
Akshay Paruchuri, Xin Liu, Yulu Pan, Shwetak Patel, Daniel McDuff, **Roni Sengupta**
*to appear IEEE Winter Conference on Applications of Computer Vision (WACV) **Oral** (2.5% acceptance rate), January 2024.*
- [C19] “rPPG-Toolbox: Deep Remote PPG Toolbox”
Xin Liu, Akshay Paruchuri, Girish Narayanswamy*, Xiaoyu Zhang, Jiankai Tang, Yuzhe Zhang,
Yunato Wang, **Roni Sengupta**, Shwetak Patel, Daniel McDuff
to appear NeurIPS 2023, Datasets and Benchmarks Track.
- [C18] “MVPSNet: Fast Generalizable Multi-view Photometric Stereo”
Dongxu Zhao, Daniel Lichy, Pierre-Nicolas Perrin, Jan-Michael Frahm, **Roni Sengupta**
IEEE/CVF International Conference on Computer Vision (ICCV), October 2023.
- [C17] “Measured Albedo in the Wild: Filling the Gap in Intrinsic Evaluation”
Jiaye Wu, Sanjoy Chowdhury, Hariharmano Shanmugaraja, David Jacobs, **Roni Sengupta**
International Conference on Computational Photography (ICCP 2023).
- [C16] “A Surface-normal Based Neural Framework for Colonoscopy Reconstruction”
Shuxian Wang, Yubo Zhang, Sarah K McGill, Julian G Rosenman, Jan-Michael Frahm, **Roni Sengupta**, Stephen M Pizer
International Conference on Image Processing and Machine Intelligence (IPMI 2023).

- [C15] “Towards Unified Keyframe Propagation Models”
Patrick Esser, Peter Michael, **Roni Sengupta**
IEEE CVPR Workshop 2022 - AI for Content Creation Workshop.
- [C14] “Real-Time Light-Weight Near-Field Photometric Stereo ”
Daniel Lichy, **Roni Sengupta**, David Jacobs
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), June 2022.
- [C13] “Robust High-Resolution Video Matting with Temporal Guidance”
Shanchuan Lin, Linjie Yang, Imran Saleemi, **Roni Sengupta**
IEEE Winter Conference on Applications of Computer Vision (WACV), January 2022, pages 238-247.
- [C12] “A Light Stage on Every Desk”
Roni Sengupta, Brian Curless, Ira Kemelmacher-Shlizerman, Steve Seitz
IEEE/CVF International Conference on Computer Vision (ICCV), October 2021, pages 2420-2429.
- [C11] “Real-Time High Resolution Background Matting”
S. Lin*, A. Ryabtsev*, **S. Sengupta**, B. Curless, S. Seitz, I. Kemelmacher-Shlizerman
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), June 2021, pages 8762-8771.
Oral (Top 2%), **Best Student Paper Honorable Mentions.** (Top 7 of 7000+ submissions)
- [C10] “Shape and Material Capture at Home”
Daniel Lichy, Jiaye Wu, **Roni Sengupta**, David Jacobs
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), June 2021, pages 6123-6133.
- [C9] “Lifespan Age Transformation Synthesis”
Roy Or-El, **Roni Sengupta**, Ohad Fried, Eli Shechtman, Ira Kemelmacher-Shlizerman
European Conference on Computer Vision (ECCV), October 2020, pages 739-755.
- [C8] “Background Matting: The World is Your Green Screen”
Roni Sengupta, Vivek Jayaram, Brian Curless, Steve Seitz, Ira Kemelmacher-Shlizerman
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), June 2020, pages 2291-2300.
- [C7] “Neural Inverse Rendering of an Indoor Scene from a Single Image”
Roni Sengupta, Jinwei Gu, Kihwan Kim, Guilin Liu, David Jacobs, Jan Kautz
IEEE/CVF International Conference on Computer Vision (ICCV), October 2019, pages 8598-8607.
- [C6] “SfSNet : Learning Shape, Reflectance and Illuminance of Faces in the Wild”
Roni Sengupta, Angjoo Kanazawa, Carlos D. Castillo, David Jacobs
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), June 2018, pages 6296-6305.
Spotlight (Top 10%)
- [C5] “A New Rank Constraint on Multi-view Fundamental Matrices and its Application to Camera Location Recovery”
S. Sengupta, T. Amir, M. Galun, Amit Singer, T. Goldstein, D. Jacobs, R. Basri
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), July 2017, pages 4798-4806.
Spotlight (Top 10%)
- [C4] “Frontal to profile face verification in the wild”
S. Sengupta, JC Chen, C. D. Castillo, V. Patel, R. Chellappa and D. Jacobs
IEEE Winter Conference on Applications of Computer Vision (WACV), January 2016, pages 238-247.

- [C3] “Evenly spaced Pareto front approximations for tricriteria problems based on triangulation”
Günter Rudolph, Heike Trautmann, **Roni Sengupta**, Oliver Schütze
International Conference on Evolutionary Multi-Criterion Optimization (EMO), 2013, pages 443-458.
- [C2] “A frequency domain approach to silhouette based gait recognition”
Roni Sengupta, Udit Halder, Rameshwar Panda, Ananda Shankar Chowdhury
National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG), 2013, pages 1-4.
- [C1] “Configuration of sensors on a 3-D terrain: an approach based on evolutionary multi-objective optimization”
Md Nasir, **Roni Sengupta**, Swagatam Das, Sanjoy Das
Genetic and Evolutionary Computation Conference (GECCO), 2012, pages 1443-1444.

Journal Publications

- [J5] “SfSNet: Learning Shape, Reflectance and Illuminance of Faces in the Wild”
Roni Sengupta, Daniel Lichy, Angjoo Kanazawa, Carlos D. Castillo, David Jacobs
IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), 2020.
- [J4] “Solving Uncalibrated Photometric Stereo Using Fewer Images by Jointly Optimizing Low-rank Matrix Completion and Integrability”
Roni Sengupta, Walter Forkel, Hao Zhou, Ronen Basri, Tom Goldstein, David Jacobs
Journal of Mathematical Imaging and Vision (JMIV), 2017.
- [J3] “Multi-objective node deployment in WSNs: In search of an optimal trade-off among coverage, lifetime, energy consumption, and connectivity”
Roni Sengupta, Swagatam Das, Md Nasir, Bijoy K. Panigrahi
Engineering Applications of Artificial Intelligence (EAAI), 2013.
- [J2] “An evolutionary multiobjective sleep-scheduling scheme for differentiated coverage in wireless sensor networks”
Roni Sengupta, Swagatam Das, Md Nasir, AV Vasilakos, Witold Pedrycz
IEEE Transactions on Systems, Man, and Cybernetics-Part C, 2012.
- [J1] “A dynamic neighborhood learning based particle swarm optimizer for global numerical optimization”
Md Nasir, Swagatam Das, Dipankar Maity, **Roni Sengupta**, Udit Halder, PN Suganthan
Elsevier Information Sciences, 2012.

CONTRACTS and GRANTS

- [G1] NIH R01 2023-2025
Co-Investigator. Joint Collaboration between UNC-Duke-Wake Forest.
“Advancing Communication strategies to support future HIV vaccine use among African Americans in the South.”.
Award amount: \$140,882 (I-Portion)
- [G2] NIH U01 2022-2024
Co-Investigator. Joint Collaboration between UNC-Duke-Wake Forest.
“Leveraging artificial intelligence and social innovation to reduce disparities in COVID-19 testing among African Americans.”.
Award amount: \$123,764 (I-Portion)
- [G3] NSF Robust Intelligence Small 2019-2022

Co-authored as a PhD student with David Jacobs (PI) and Ronen Basri (co-PI)

“NSF-BSF Small: Reconstructing Shape, Lighting and Reflectance Properties of Indoor Scenes from Video”.

Award amount: \$493,297.00

INVITED TALKS

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| [T15] | University of North Carolina, Charlotte, USA.
Solving Inverse Graphics to Democratize High-quality Video and 3D Processing
Host: Srijan Das | Sept 2023 |
| [T14] | Olympus Corporation, Japan.
Solving Inverse Graphics to Democratize High-quality Video and 3D Processing
Host: Zhen Li | May 2023 |
| [T13] | Amazon, USA.
Democratizing Light Stage
Host: Walterio Mayol-Cuevas | April 2022 |
| [T12] | Indian Institute of Technology, Kharagpur, India.
Inverse Graphics for Next-Gen Video Communication
Host: Jiaul Paik | April 2022 |
| [T11] | University of Illinois Urbana-Champaign, USA.
Inverse Graphics for Next-Gen Video Communication
Host: David Forsyth | April 2022 |
| [T10] | Aalto University, Finland.
NextGen Video Conferencing
Host: Jaakko Lehtinen | Dec 2021 |
| [T9] | Carnegie Mellon University, Pittsburgh, USA.
NextGen Video Conferencing
Host: Fernando De la Torre | Dec 2021 |
| [T8] | Samsung AI Research Center, Toronto, Canada
NextGen Video Conferencing
Host: Konstantinos Derpanis | Nov 2021 |
| [T7] | Cornell University, New York, USA
Advancing Video Communication with Computational Photography
Host: Jin Sun | May 2021 |
| [T6] | University of California, Berkeley, USA
Advancing Video Communication with Computational Photography
Host: Angjoo Kanazawa | April 2021 |
| [T5] | University of Maryland, College Park, USA
Advancing Video Communication with Computational Photography
Host: David Jacobs | March 2021 |
| [T4] | University of California, San Diego, USA
Constraints and Priors for Inverse Rendering
Host: Manmohan Chandraker, Ravi Ramamoorthi | September 2018 |
| [T3] | Cornell University, New York, USA
Constraints and Priors for Inverse Rendering
Host: Noah Snavely | September 2018 |
| [T2] | NVIDIA Research, Santa Clara, USA
Constraints and Priors for Inverse Rendering | August 2018 |

Host: Jinwei Gu, Kihwan Kim

- [T1] University of Washington, Seattle, USA August 2018
Constraints and Priors for Inverse Rendering
Host: Ira Kemelmacher-Shlizerman, Steve Seitz

AWARDS AND HONORS

1. UNC CS Student Association Excellence in Teaching Award 2023
2. Best Student Paper Honorable Mentions, CVPR 2021
Top 7 out of 7000+ submissions
3. University of Washington Postdoc Travel Grant 2019
4. German Academic Exchange Service (DAAD) Scholarship 2012
3 month paid summer internship at TU Dortmund, Germany.
Awarded to roughly 100 seniors per year from India.

SERVICES AND PROFESSIONAL ACTIVITIES

1. Area Chair, IEEE WACV 2022,2023
2. Mentor, UNC-Intel Summer REU Program 2023-
3. Graduate Admissions, UNC, UW, UMD 2018-
4. Co-organizer & Mentor, CV/ML Workshop, University of Washington October 2021
Introducing CV/ML concepts to young UW CSE undergrads
Two hours introductory lecture and half-day mentoring of five students
5. Mentor, CV/ML Grad Reality Workshop, University of Washington April 2021
Mentored five students from underrepresented communities over two days
6. Conference Reviews: CVPR, ICCV, ECCV, SIGGRAPH, SIGGRAPH Asia, AAAI, BMVC, WACV
7. Journal Reviews: TPAMI, IEEE TIP, JMIV, CGF

TEACHING

1. Instructor, University of North Carolina at Chapel Hill
CSE 590&790: Neural Rendering Fall 2022
CSE 590&776: Computer Vision in 3D World Spring 2023, Fall 2023
2. Co-Instructor, University of Washington Fall 2019
CSE 590V Computer Vision Seminars
3. Graduate Teaching Assistant, University of Maryland Fall 2013
ENEE 420 Communication Systems
4. Graduate Teaching Assistant, University of Maryland Spring 2014
ENEE 222 Elements of Discrete Signal Analysis

MENTORSHIP AND ADVISING

*Mentees who co-authored above listed publications are indicated with **

At UMD & UW

1. Wasif Sikder (University of Maryland) Undergraduate, 2014
2. Aaron Chan (University of Maryland) Undergraduate, 2014-2015

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| 3. Daniel Lichy* (University of Maryland) | Undergraduate, 2017-2018 |
| 4. Alex Kim (University of Washington) | Undergraduate, 2019-2020 |
| 5. Thevina Dokka (University of Washington) | Undergraduate, 2019-2020 |
| 6. Xiao Liang (University of Washington) | Undergraduate, 2020-2021 |
| 7. Andrey Ryabstev* (University of Washington), now at Google | MS, 2019-2021 |
| 8. Peter Lin* (University of Washington), now at Microsoft | MS, 2020-2021 |
| 9. Peter Michael (University of Washington), now PhD at Cornell University | MS, 2021-2022 |
| 10. Jackson Stokes (University of Washington), now at Google | MS, 2021-2022 |
| 11. Daniel Lichy* (University of Maryland) | PhD student, 2018-2022 |
| 12. Jiaye Wu* (University of Maryland) | PhD student, 2019-current |
| 13. Vivek Jayaram* (University of Washington) | PhD student, 2019 |
| 14. Roy Or-El* (University of Washington) | PhD student, 2019-2020 |
| 15. Dalton Hildreth (University of Washington) | PhD student, 2020 |
| 16. Alice Gao (University of Washington) | PhD student, 2021-2022 |
| 17. Mengyi Shan (University of Washington) | PhD student, 2021-2022 |

At UNC

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|---|---------------------------|
| 1. Yulu Pan* | UG student, 2022-2023 |
| 2. Xiaolong Huang | UG student, 2022-2023 |
| 3. Pierre-Nicolas Perrin* (with Junier Oliva) | MS student, 2022-2023 |
| 4. Dongxu Zhao* (with Jan-Michael Frahm) | PhD student, 2022-current |
| 5. Akshay Paruchuri* | PhD student, 2022-current |
| 6. Jun Myeong Choi | PhD student, 2022-current |
| 7. Luchao Qi* | PhD student, 2023-current |
| 8. Annie Wang (UNC MS Merit Fellowship) | MS student, 2023-current |
| 9. Yu Fang (with Marc Niethammer) | PhD student, 2023-current |