Roni Sengupta

Assistant Professor
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RESEARCH OVERVIEW

My research lies at the intersection of Computer Vision and Computer Graphics, mainly centered around 3D Vision and Computational Photography. I am particularly interested in solving Inverse Graphics problems where the goal is to decompose images into its' intrinsic components (e.g. geometry, material reflectance, lighting, alpha matte etc.). My research on Inverse Graphics focuses on applications in video communication, AR/VR, robotics, and healthcare.

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 Bababdi, 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 $\triangle_p$ SMS-EMOA for 3-D Benchmark Functions
Mentors: Günter Rudolpho

PUBLICATIONS

Pre-prints/ArXiv/In Submission

[P7] "Continual Learning of Personalized Generative Face Models with Experience Replay"
Annie Wang, Luchao Qi, **Roni Sengupta**
In Submission.

[P6] "MyTimeMachine: Personalized Facial Age Transformation"
Luchao Qi, Jiaye Wu, Annie Wang, David Jacobs, **Roni Sengupta**
In Submission.

[P5] "Leveraging Near-Field Lighting for Monocular Depth Estimation from Endoscopy Videos"
Akshay Paruchuri, Samuel Ehrenstein, Shuxian Wang, Inbar Fried, Stephen M. Pizer, Marc Niethammer,
Roni Sengupta
ArXiv 2024.

[P4] "GaNI: Global and Near Field Illumination Aware Neural Inverse Rendering"
Jiaye Wu, Saeed Hadadan, Geng Lin, Matthias Zwicker, David Jacobs, **Roni Sengupta**
ArXiv 2024.

[P3] "Personalized Video Relighting With a Casual Light Stagel"
Jun-Myeong Choi, Max Christman, Shengze Wang, **Roni Sengupta**
ArXiv 2023.

[P2] "My3DGen: Building Lightweight Personalized 3D Generative Model"
Luchao Qi, Jiaye Wu, Shengze Wang, **Roni Sengupta**
ArXiv 2023.

[P1] "NePhi: Neural Deformation Fields for Approximately Diffeomorphic Medical Image Registration"
Lin Tian, **Roni Sengupta**, Hastings Greer, Raúl San José Estépar, Marc Niethammer
ArXiv 2023.

Conference Publications

[C22] "Universal Guidance for Diffusion Models"
Arpit Bansal, Hong-Min Chu, Avi Schwarzschild, **Roni Sengupta**, Micah Goldblum, Jonas Geiping,
Tom Goldstein
IEEE International Conference on Learning Representations (ICLR), May 2024.

[C21] "Joint Depth Prediction and Semantic Segmentation with Multi-View SAM"
Mykhailo Shvets, Dongxu Zhao, Marc Niethammer, **Roni Sengupta**, Alexander C. Berg
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**
*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
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 Intrinsics 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

[J6] "Bringing Telepresence to Every Desk"
Shengze Wang, Ziheng Wang, Ryan Schmelzle, Liujie Zheng, YoungJoong Kwon, **Roni Sengupta**, Henry Fuchs
to appear *Transactions on Visualization and Computer Graphics (TVCG), 2024.*

[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.

PATENTS

[PA1] "Inverse rendering of a scene from a single image", US Patent 11,295,514
  Jinwei Gu, Kihwan Kim, Jan Kautz, Guilin Liu, Roni Sengupta.

CONTRACTS and GRANTS

[G1] NIH R21 Trailblazer   2024-2027
  Principal Investigator.

  "Next-gen 3D Modeling of Endoscopy Videos.".
  Award amount: $580,000

[G2] UNC Junior Faculty Development Award   2024
  Principal Investigator.

  "Neural Graphics for 3D Modeling of Endoscopy Videos.".
  Award amount: $10,000

[G3] 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)

INVITED TALKS

[T16] University of Maryland, College Park, USA.   Feb 2024
  Building Personalized and Efficient 3D Models
  Host: Jia-bin Huang

[T15] University of North Carolina, Charlotte, USA.   Sept 2023
  Solving Inverse Graphics to Democratize High-quality Video and 3D Processing
  Host: Srijan Das

[T14] Olympus Corporation, Japan.   May 2023
  Solving Inverse Graphics to Democratize High-quality Video and 3D Processing
  Host: Zhen Li

[T13] Amazon, USA.   April 2022
  Democratizing Light Stage
  Host: Walterio Mayol-Cuevas

[T12] Indian Institute of Technology, Kharagpur, India.   April 2022
  Inverse Graphics for Next-Gen Video Communication
  Host: Jiaul Paik

[T11] University of Illinois Urbana-Champaign, USA.   April 2022
  Inverse Graphics for Next-Gen Video Communication
  Host: David Forsyth

[T10] Aalto University, Finland.   Dec 2021
  NextGen Video Conferencing
  Host: Jaakko Lehtinen

[T9] Carnegie Mellon University, Pittsburgh, USA.   Dec 2021
  NextGen Video Conferencing
  Host: Fernando De la Torre

[T8] Samsung AI Research Center, Toronto, Canada   Nov 2021

NextGen Video Conferencing
Host: Konstantinos Derpanis

[T7] Cornell University, New York, USA   May 2021
Advancing Video Communication with Computational Photography
Host: Jin Sun

[T6] University of California, Berkeley, USA   April 2021
Advancing Video Communication with Computational Photography
Host: Angjoo Kanazawa

[T5] University of Maryland, College Park, USA   March 2021
Advancing Video Communication with Computational Photography
Host: David Jacobs

[T4] University of California, San Diego, USA   September 2018
Constraints and Priors for Inverse Rendering
Host: Manmohan Chandraker, Ravi Ramamoorthi

[T3] Cornell University, New York, USA   September 2018
Constraints and Priors for Inverse Rendering
Host: Noah Snavely

[T2] NVIDIA Research, Santa Clara, USA   August 2018
Constraints and Priors for Inverse Rendering
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 Junior Faculty Development Award Award   2024

2. UNC CS Student Association Excellence in Teaching Award   2023

3. Best Student Paper Honorable Mentions, CVPR   2021
   Top 7 out of 7000+ submissions

4. University of Washington Postdoc Travel Grant   2019

5. 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. DEI Chair (Organizing Committee), CVPR   2024

2. Area Chair, IEEE WACV   2023, 2024

3. Jury Member, SIGGRAPH Posters   2023

4. Mentor, UNC-Intel Summer REU Program   2023, 2024

5. Graduate Admissions Committee, UNC, UW, UMD   2018-

6. Tenure-track Faculty Hiring Committee, UNC   2023

7. PhD Thesis Committee
   11 students at UNC Chapel Hill
   2 students at UMD & Uni. of Zargoza.

8. 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

9. Mentor, CV/ML Grad Reality Workshop, University of Washington   April 2021
     Mentored five students from underrepresented communities over two days

10. Conference Reviews: CVPR, ICCV, ECCV, SIGGRAPH, SIGGRAPH Asia, AAAI, BMVC, WACV

11. 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
     CSE 790: 3D Generative Models   Spring 2024

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

Doctoral Students

1. Daniel Lichy (co-advise with David Jacobs at UMD)   2018-2024
2. Jiaye Wu ((co-advise with David Jacobs at UMD)   2019-current
3. Dongxu Zhao (co-advise with Jan-Michael Frahm)   2022-current
4. Akshay Paruchuri   2022-current
5. Jun Myeong Choi   2022-current
6. Luchao Qi   2023-current

Masters Students

1. Andrey Ryabstev (University of Washington), now at Google   2019-2021
2. Peter Lin (University of Washington), now at ByteDance   2020-2021
3. Peter Michael (University of Washington), now PhD at Cornell University   2021-2022
4. Jackson Stokes (University of Washington), now at Google   2021-2022
5. Annie Wang (UNC MS Merit Fellowship)   2023-current
6. Andrea Dunn Beltran   2024-current
7. Noah Frahm   2024-current

Undergraduate Students

1. Wasif Sikder (University of Maryland)   2014
2. Aaron Chan (University of Maryland)   2014-2015
3. Daniel Lichy (University of Maryland)   2017-2018

4. Alex Kim (University of Washington)   2019-2020
5. Thevina Dokka (University of Washington)   2019-2020
6. Xiao Liang (University of Washington)   2020-2021
7. Yulu Pan   2022-2023
8. Bang Gong   2022-2023
9. Peifeng He   2022-2023