

## Soumyadip (Roni) Sengupta

(he/him)

Assistant Professor

Department of Computer Science

University of North Carolina at Chapel Hill

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## RESEARCH OVERVIEW

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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

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### 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

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*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  $\Delta_p$  SMS-EMOA for 3-D Benchmark Functions

Mentors: Günter Rudolpho

## PUBLICATIONS

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### *Conference Publications*

- [C15] “Towards Unified Keyframe Propagation Models”  
Patrick Esser, Peter Michael, **Soumyadip Sengupta**  
*IEEE CVPR Workshop 2022 - AI for Content Creation Workshop.*
- [C14] “Real-Time Light-Weight Near-Field Photometric Stereo ”  
Daniel Lichy, **Soumyadip 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, **Soumyadip Sengupta**  
*IEEE Winter Conference on Applications of Computer Vision (WACV), January 2022, pages 238-247.*
- [C12] “A Light Stage on Every Desk”  
**Soumyadip 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, **Soumyadip 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, **Soumyadip 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”  
**Soumyadip 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”  
**Soumyadip 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”  
**Soumyadip 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, **Soumyadip 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”  
**Soumyadip 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, **Soumyadip 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”  
**Soumyadip 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”  
**Soumyadip 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”  
**Soumyadip 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”  
**Soumyadip 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, **Soumyadip Sengupta**, Udit Halder, PN Suganthan  
*Elsevier Information Sciences*, 2012.

### **CONTRACTS and GRANTS**

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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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|-------|---|----------------|
| [T13] | Amazon, USA.<br>Democratizing Light Stage<br>Host: Walterio Mayol-Cuevas  | April 2022     |
| [T12] | Indian Institute of Technology, Kharagpur, India.<br>Inverse Graphics for Next-Gen Video Communication<br>Host: Jiaul Paik              | April 2022     |
| [T11] | University of Illinois Urbana-Champaign, USA.<br>Inverse Graphics for Next-Gen Video Communication<br>Host: David Forsyth               | April 2022     |
| [T10] | Aalto University, Finland.<br>NextGen Video Conferencing<br>Host: Jaakko Lehtinen   | Dec 2021       |
| [T9]  | Carnegie Mellon University, Pittsburgh, USA.<br>NextGen Video Conferencing<br>Host: Fernando De la Torre                                | Dec 2021       |
| [T8]  | Samsung AI Research Center, Toronto, Canada<br>NextGen Video Conferencing<br>Host: Konstantinos Derpanis                                | Nov 2021       |
| [T7]  | Cornell University, New York, USA<br>Advancing Video Communication with Computational Photography<br>Host: Jin Sun                      | May 2021       |
| [T6]  | University of California, Berkeley, USA<br>Advancing Video Communication with Computational Photography<br>Host: Angjoo Kanazawa        | April 2021     |
| [T5]  | University of Maryland, College Park, USA<br>Advancing Video Communication with Computational Photography<br>Host: David Jacobs         | March 2021     |
| [T4]  | University of California, San Diego, USA<br>Constraints and Priors for Inverse Rendering<br>Host: Manmohan Chandraker, Ravi Ramamoorthi | September 2018 |
| [T3]  | Cornell University, New York, USA<br>Constraints and Priors for Inverse Rendering<br>Host: Noah Snavely                                 | September 2018 |
| [T2]  | NVIDIA Research, Santa Clara, USA<br>Constraints and Priors for Inverse Rendering<br>Host: Jinwei Gu, Kihwan Kim                        | August 2018    |
| [T1]  | University of Washington, Seattle, USA<br>Constraints and Priors for Inverse Rendering<br>Host: Ira Kemelmacher-Shlizerman, Steve Seitz | August 2018    |

## AWARDS AND HONORS

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1. Best Student Paper Honorable Mentions, CVPR  
Top 7 out of 7000+ submissions 2021
2. University of Washington Postdoc Travel Grant 2019
3. 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

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1. Graduate Admissions, University of Washington 2020,2021
2. Graduate Admissions, University of Maryland, College Park 2018
3. 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
4. Mentor, CV/ML Grad Reality Workshop, University of Washington April 2021  
Mentored five students from underrepresented communities over two days
5. Conference Reviews: CVPR, ICCV, ECCV, SIGGRAPH, SIGGRAPH Asia, AAAI, BMVC, WACV
6. Journal Reviews: TPAMI, IEEE TIP, JMIV, CGF

## TEACHING

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1. Instructor, University of North Carolina at Chapel Hill Fall 2022  
CSE 590790: Neural Rendering
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

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

1. Wasif Sikder (University of Maryland) Undergraduate, 2014
2. Aaron Chan (University of Maryland) Undergraduate, 2014-2015
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-current
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-current
17. Mengyi Shan (University of Washington) PhD student, 2021-2022
18. Akshay Paruchuri (University of North Carolina at Chapel Hill) PhD student, 2022-current
19. Jun Myeong Choi (University of North Carolina at Chapel Hill) PhD student, 2022-current
20. Qiwei Zhou (University of North Carolina at Chapel Hill) PhD student, 2022-current

## REFERENCES

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**David W. Jacobs (Thesis Advisor)**

Professor, University of Maryland, College Park  
djacobs@cs.umd.edu  
Brendan Iribe Center  
University of Maryland, College Park  
College Park, MD 20742

**Steve Seitz**

Professor, University of Washington and Director at Google  
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Computer Science and Engineering  
University of Washington  
Box 352350  
Seattle, WA 98195-2350

**Ira Kemelmacher-Shlizerman**

Associate Professor, University of Washington  
kemelmi@cs.washington.edu  
Computer Science and Engineering  
University of Washington  
Seattle, WA 98195-2350

**Brian Curless**

Professor, University of Washington  
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Seattle, WA 98195-2350

**Angjoo Kanazawa**

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Berkeley Way West 8014,  
University of California  
Berkeley, CA 94720