Shivam Duggal

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Research Interest

My research interests lie at the intersection of computer vision, computer graphics & robotics. I am particularly interested in topics such as *scene understanding, 3D perception, 3D reconstruction, 2D/ 3D simulation, physics-based vision & robot learning.*

Education

Carnegie Mellon University — Aug 2021 - Present
Masters of Science in Robotics (MSR) — Pittsburgh, USA
- Advisor: Deepak Pathak
- **CGPA: 4.16/4** (till 2nd semester*)

Delhi Technological University (DTU, formerly DCE) — Aug 2013 - Aug 2017
Bachelor in Technology, Computer Science (B.Tech) — Delhi, India
- Aggregate: 83.7% , **CGPA: 9.12/10**

Research Experience

Carnegie Mellon University — Aug 2021 - Present
Graduate Student Researcher — Pittsburgh, USA
- Advisor: Deepak Pathak

Brown University — May 2021 - Aug 2021
Research Intern — Remote
- Advisor: Srinath Sridhar

Uber Advanced Technology Group — Nov 2019 - Feb 2021
Research Scientist I — Toronto, Canada
- Advisor: Raquel Urtasun

Uber Advanced Technology Group — Aug 2018 - Nov 2019
AI Resident **(3 AI residents selected world-wide)** — Toronto, Canada
- Advisor: Raquel Urtasun

Awards & Honors

[* Denotes All India National rank]

Top 0.2%	**GeoSim nominated as Best Paper Candidate CVPR**	2021
Rank **1**/**70**	Marketplace Hackathon, Amazon	2017
Rank **20**/**7937***	Codechef June Long Challenge	2017
Rank **10**/**1885***	Hackerearth Collegiate Programming Contest	2016
Rank **28***	**ACM ICPC India Finals**	2016
Rank **29**/**2609***	ACM ICPC Amritapuri Regionals	2016
Rank **29**/**867***	ACM ICPC Chennai Preliminary Round	2016
Rank **12**/**5693***	Codechef October Long Challenge	2016
Rank **1**/**130** Interns	Flipkart Hackathon JUGAAD	2016

Rank **6***	IEEEXtreme Programming Competition	2015
Rank **8***	IEEEXtreme Programming Competition	2014

PrePrints & Selected Publications

[* Denotes equal contribution]

[CVPR 2022] ***Shivam Duggal***, *Deepak Pathak. "Topologically-Aware Deformation Fields for Single-View 3D Reconstruction."* [Link]

- Proposed a framework for **learning 3D object shapes & dense 3D object correspondences** from just an unaligned category-specific image collection.
- The 3D shapes are generated implicitly as deformations to a category-specific signed distance field & are **learned in an unsupervised manner solely from image collections & camera poses** w/o any 3D supervision.

[NeurIPS 22] *(under review)* *Trevor Houchens, Cheng-You Lu,* ***Shivam Duggal***, *Rao Fu, Srinath Sridhar. "NeuralODF: Learning Omnidirectional Distance Fields for 3D Shape Representation."* [Link]

- Proposed a 3D reconstruction approach that models object geometry by storing **depth to object's surface from any 3D point in any viewing direction.**
- Introduced mechanisms to transform other geometric representations (meshes, point clouds, voxels) to & from the proposed geometric representation.

[WACV 2022] ***Shivam Duggal****, *Zihao Wang*, Wei-Chiu Ma, Sivabalan Manivasagam, Justin Liang, Shenlong Wang, Raquel Urtasun. "Mending Neural Implicit Modeling for 3D Reconstruction in the Wild."* [Link]

- Recent **neural implicit shape modeling** methods show promising results on synthetic/ dense data but perform poorly on sparse/ noisy real-world data.
- Analysed the root cause behind such behavior & proposed a simple yet effective curriculum learning method, which lead to **much higher fidelity shapes**.

[CVPR 2021] *Yun Chen*, Frieda Rong*,* ***Shivam Duggal****, *Shenlong Wang, Xinchen Yan, Sivabalan Manivasagam, Shangjie Xue, Ersin Yumer, Raquel Urtasun. "GeoSim: Realistic Video Simulation via Geometry-Aware Composition for Self-Driving."* [Link]

- Proposed a **geometry-guided simulation** procedure for generating **photo-realistic renderings** of real-world traffic scenes.
- Our proposed pipeline contains: (1) 3D Mesh Reconstruction, (2) 3D-aware Object Placement, (3) Novel-View Rendering, (4) GAN-based post-processing.
- **Nominated for Best Paper Award!**

[ICCV 2019] ***Shivam Duggal***, *Shenlong Wang, Wei-Chiu Ma, Rui Hu, Raquel Urtasun. "Deeppruner: Learning efficient stereo matching via differentiable patchmatch."* [Link]

- Previous stereo matching methods are based on dense pixel-wise correspondence estimation, which bottlenecks their efficiency.
- Combined the strengths of deep learning & traditional search-space pruning technique, **PatchMatch**, to propose a real-time stereo matching algorithm **(62ms on KITTI)**, which is at par with SOTA methods.

[WACV 2019] *Shamit Lal*, **Shivam Duggal***, Indu Sreedevi. "Online video summarization: Predicting future to better summarize present."* [Link]

- Proposed a **multi-task Conv. LSTM architecture** for generating video summary auto-regressively, which is at par with non auto-regressive methods.
- Augmented our summarization system with a **next frame prediction network** to assist it reason about the next frame's inclusion in the summary.

Industry Experience

Amazon, Hyderabad, India	(Software Eng.)	Aug 2017 - Jul 2018
Flipkart, Bangalore, India	(Software Eng. Intern)	Jun 2016 - Aug 2016
Parallel Dots, Delhi, India	(Machine Learning Intern)	Dec 2015 - Jan 2016

Conference Reviewing

3DV 2022, ECCV 2022, CVPR 2022, WACV 2021, ICRA 2021, IROS 2021, SIGGRAPH Asia 2021

Skills

Languages/ Tools & Frameworks Python, C/C++, LaTeX/ Pytorch, Git, AWS

Other Projects

Non-Exponential Radiative Transfer for Light Transport CMU, Pittsburgh

- Studied the **Radiative Transfer Framework (RTE)** which governs the physics of light transport through a participating medium.
- Classical RTE models light transmittance (as an exponential function) only through spatially-uncorrelated participating mediums. We explored **the affect of spatially-correlated participating mediums on RTE**, by modeling light transmittance as non-exponential functions.

Poisson Solver for Depth Completion Uber ATG, Toronto

- Casted the problem of monocular depth completion using single camera image and sparse Lidar points, **to a boundary value problem.**
- Instead of directly predicting depth value per pixel, we developed an approach to first predict relative-depth estimates per pixel and then integrate them to predict the final depth value.

Emotion Recognition on speech signals DTU, India

- Implemented ensemble approaches and compared various algorithms for emotion recognition in speech signals using MFCC and energy as features.
- Publication: Emotion recognition on speech signals using machine learning, **ICBDACI (2017)** [Link]