LAHAV LIPSON

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EDUCATION

Princeton University: ***Sept. 2019 – Present***
Ph.D. Candidate in Computer Science
Advisor: Jia Deng

Columbia University: **Sept.** ***2015 – May 2019***
B.S. in Computer Science.
GPA: 4.06 / 4.33 (top 5%)

RESEARCH INTERESTS

3D Reconstruction, SLAM, Visual Odometry, Structure from Motion, Multiview Stereo, Object Pose, Camera Localization

AWARDS AND HONORS

Best Student Paper Award – *International Conference on 3D Vision (3DV)* ***Oct. 2021***
- State-of-the-art stereo matching

Summa Cum Laude from Columbia University ***May 2019***
Academic Excellence Award from Columbia, Department of Computer Science ***May 2019***

PUBLICATIONS

Zachary Teed, Lahav Lipson, and Jia Deng. "Deep Patch Visual Odometry." *arXiv preprint arXiv:2208.04726, 2022.*

Lahav Lipson, Zachary Teed, Ankit Goyal, and Jia Deng. "Coupled Iterative Refinement for 6D Multi-Object Pose Estimation." *In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022.*

Lahav Lipson, Zachary Teed, and Jia Deng. "RAFT-Stereo: Multilevel recurrent field transforms for stereo matching." *In 2021 International Conference on 3D Vision (3DV), 2021. (**Best Student Paper Award**)*

EXPERIENCE

Visual Odometry ***Sept. 2019 – Present***
- Published "Deep Patch Visual Odometry" on arXiv.
- We introduced a new deep learning system for monocular Visual Odometry.
- We outperform all prior work (classical or learned) in both accuracy and speed on standard benchmarks.
- Our method is accurate and robust while running at 2x-5x real-time speeds on a single RTX-3090 GPU using only 4GB of memory.

6D Object Pose ***Sept. 2019 – Present***
- Published "Coupled Iterative Refinement for 6D Multi-Object Pose Estimation" at CVPR 2022.
- We proposed an end-to-end pipeline for estimating 6-DOF object pose from a single image.
- We introduced a differentiable solver layer which jointly optimizes both pose and correspondence, enabling us to dynamically remove outliers to improve accuracy.

- Our method works with-or-without depth input, using one of two variants of our introduced solver layer.
- We achieved state-of-the-art results among published methods on standard benchmarks.

Stereo Matching ***Sept. 2019 – Present***

- Published "RAFT-Stereo: Multilevel Recurrent Field Transforms for Stereo Matching" at 3DV 2021.
- We introduced a new deep architecture for rectified stereo from image pairs.
- Our method uses multi-level recurrent updates to refine a high-resolution disparity-field between images.
- Our method is extremely memory efficient, and a version runs in real-time.
- We achieved state-of-the-art results across multiple real-world datasets.

Signal Processing ***Sept. 2018 – May 2019***

Undergraduate Research under Professor. Changxi Zheng's supervision

- I developed a method to remove audible watermarks from music to evaluate the strength of a popular copyright protection.
- I used known frequency priors and convolutional neural networks to separate sounds by their source.

"Shadows from Shading" ***Jan. 2019 – May 2019***

Coursework Project advised by Prof. Carl Vondrick. Project Poster

- I developed a method for inferring the missing shadows in an image of a 3D model rendered with only Lambertian shading.
- Shadows in images are important because they help convey the relative position of objects, however, they are slow to render. Rendering shadows slows down quadratically with the number of objects, while our approach runs in constant time for a fixed image size.
- I used a convolutional auto-encoder to generate convincing and plausible shadows.

Natural Language ***Sept. 2017 – Dec. 2017***

Undergraduate Research under Professor. Daniel Bauer's supervision

- I developed a method to construct a graph-representation of the semantic meaning of English sentences.
- I assigned fitness scores to sentence fragments using syntactic constraints and context-based semantic predictions from neural networks. These local fitness scores are used to add vertices and edges to the graph.

ADDITIONAL INDEPENDENT PROJECTS

"SimpleGL" ***Jan. 2019 – May 2019***

Project Page

- I designed and developed a library which enables users to create complex interactive 3D scenes in C++ using only a few lines of code. Our library includes Blinn-Phong shading, debugging tools, and interactive fly-through navigation.
- The library supports real-time rendering of large scenes by sharing geometry between objects whenever possible. The project was supervised by Bjarne Stroustrup, who created C++.

3D Printed Walking Robot ***Jan. 2019 – May 2019***

Project Page

- I designed a robot in CAD, 3D printed the chassis and assembled the components.
- I programmed the robot to walk using an onboard Raspberry Pi. The robot has three static legs to support itself and two dynamic arms to pull itself forward.

Evolutionary Learning of Walking Robots ***July 2018 – Oct. 2018***

Project Page

- I developed an evolution-based method to design and optimize spring-mass systems that can walk.
- I used age and fitness as simultaneous objective functions to avoid getting stuck in local minima. The system learns morphologies of robot designs, as well as a multilayer perceptron actuation function which changes the spring parameters at each timestep.

Website for choosing courses at Columbia ***Dec. 2016 – Feb. 2017***

Lionscores.com

- The site enables Columbia students to access statistics aggregated from course evaluations, such as responses to *"Did you enjoy the class?", "How was the workload?"*, and *"Would you recommend it?"*
- The site was accessed **100,000+** times by the Columbia community as of Dec 1st, 2021.

WORK EXPERIENCE

Amazon Intern ***June 2018 – Aug. 2018***

Software Developer Engineer

- Designed and developed an AI-based product recommendation system as part of the Amazon Stores Team.

Teaching Assistant ***2018, 2020 – 2021***

Computer Vision (Princeton), Algorithms and Data Structures (Princeton), Computer Science Theory (Columbia)

- Wrote and/or graded assignments, held office hours and led precepts and discussions.

VOLUNTEERING

Co-lead Bronx High School of Science Coding Club ***Sept. 2018 – Feb. 2019***

Instructor at Bronx Science Hackers Club. Weekly meetings.

- I curated lectures/workshops about programming, and how to use novel technologies. I also assisted students with assigned and independent programming projects.