Samarth Brahmbhatt

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EDUCATION

Doctor of Philosophy, Robotics (advisor: James Hays)
School of Interactive Computing, Georgia Institute of Technology, GA   May 2020

Master of Science in Engineering, Robotics (advisor: Kostas Daniilidis)
University of Pennsylvania, PA.   May 2014

Bachelor of Technology, Electronics & Communication Engineering
Nirma University, Ahmedabad, India.   May 2012

PUBLICATIONS

1. "PressureVision: Estimating Hand Pressure from a Single RGB Image" - Patrick Grady, Chengcheng Tang, **Samarth Brahmbhatt**, Christopher D. Twigg, Chengde Wan, James Hays, and Charles C. Kemp, *The European Conference on Computer Vision, ECCV 2022)*
2. "Visual Pressure Estimation and Control for Soft Robotic Grippers" - Patrick Grady, Jeremy A. Collins, **Samarth Brahmbhatt**, Christopher D. Twigg, Chengcheng Tang, James Hays, and Charles C. Kemp, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2022*
3. "ContactOpt: Optimizing Contact to Improve Grasps" - Patrick Grady, Chengcheng Tang, Minh Vo, Christopher D. Twigg, **Samarth Brahmbhatt**, and Charles C. Kemp, *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2021 (oral)*
4. "ContactPose: A Dataset of Grasps with Object Contact and Hand Pose" - **Samarth Brahmbhatt**, Chengcheng Tang, Christopher D. Twigg, Charles C. Kemp, James Hays, *The European Conference on Computer Vision, ECCV 2020*
5. "Towards Markerless Grasp Capture" - **Samarth Brahmbhatt**, Charles C. Kemp, and James Hays, *Third Workshop on Computer Vision for AR/VR, CVPR 2019*
6. "ContactGrasp: Functional Multi-finger Grasp Synthesis from Contact" - **Samarth Brahmbhatt**, Ankur Handa, James Hays, and Dieter Fox, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2019*
7. "ContactDB: Analyzing and Predicting Grasp Contact via Thermal Imaging" - **Samarth Brahmbhatt**, Cusuh Ham, Charles C. Kemp, James Hays, *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2019 (oral, **best paper finalist**)*
8. "MapNet: Geometry-Aware Learning of Maps for Camera Localization" - **Samarth Brahmbhatt**, Jinwei Gu, Kihwan Kim, James Hays, Jan Kautz, *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2018 (spotlight)*
9. "DeepNav: Learning to Navigate Large Cities" - **Samarth Brahmbhatt**, James Hays, *IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2017*
10. "StuffNet: Using 'Stuff' to Improve Object Detection" - **Samarth Brahmbhatt**, Henrik Christensen and James Hays, *IEEE Winter Conference on Applications of Computer Vision (WACV) 2017*
11. "Occlusion-Aware Object Localization, Segmentation and Pose Estimation" - **Samarth Brahmbhatt**, Heni Ben Amor and Henrik Christensen, *British Machine Vision Conference (BMVC) 2015*
12. "Single Image 3D Object Detection and Pose Estimation for Grasping" - Menglong Zhu, Kosta Derpanis, Yinfei Yang, **Samarth Brahmbhatt**, Mabel Zhang, Cody Phillips and Kostas Daniilidis, *IEEE International Conference on Robotics and Automation (ICRA) 2014*

13. "RoboCup 2013 Humanoid Kidsize League Winner" - Daniel D. Lee, Seung-Joon Yi, Stephen McGill, Yida Zhang, Larry Vadakedathu, **Samarth Brahmbhatt**, Richa Agrawal and Vibhavari Dasagi, *RoboCup 2013: Robot World Cup XVII, Springer Berlin Heidelberg 2014*
14. "Practical OpenCV" - **Samarth Brahmbhatt**, *book published by Apress Media LLC*

RESEARCH EXPERIENCE

Intel Intelligent Systems Lab   Fall 2020 - present
Postdoctoral Researcher
Projects involving sim-to-real reinforcement learning for robot manipulation, navigation, and locomotion.

Institute for Robotics and Intelligent Machines, Georgia Tech   Fall 2014 - Spring 2020
Graduate Research Assistant
- Understanding functional grasps of household objects, focusing on hand-object contact and hand pose (Pubs. 1 to 7)
- Learning to navigate large cities using Convolutional Neural Networks (CNNs) (Pub. 9)
- Object detection and semantic segmentation using CNNs (Pub. 10)
- Detection and 3D pose estimation of partially occluded objects (Pub. 11)

Facebook Reality Labs, Sausalito, CA   Summer 2019
A novel functional grasping dataset, image-based hand-object contact prediction
Advisors: Chengcheng Tang, Chris Twigg
Creating a large and diverse dataset of paired 3D hand pose, object pose, hand-object contact and multi-view RGB-D images. Deep learning experiments for the novel task of hand-object contact prediction (Pub 4).

NVIDIA Research, Seattle   Summer 2018
Hand pose optimization for human-guided multi-fingered grasping
Advisors: Ankur Handa, Dieter Fox
Synthesizing functional human-like grasps for diverse robotic end-effectors, from human demonstrations of hand-object contact (Pub 6).

NVIDIA Research, Santa Clara   Summer 2017
Deep Learning for Camera Localization
Advisors: Jinwei Gu, Kihwan Kim
Deep learning for image-based camera localization: proposed novel algorithms to use geometric constraints between images and to make use of large amounts of unlabelled data through semi-supervised learning (Pub. 8).

Dextro, Inc. New York City   Summer 2015
Improving CNN-based object localization using local context
- Implemented a Convolutional Neural Network system for object localization and semantic segmentation (Pub. 10)
- Used semantic segmentation as a local context signal to improve object detection
- Implemented CPU and GPU versions of various required layers in Caffe

GRASP Laboratory, University of Pennsylvania   Spring 2014
Detecting Partially Occluded Objects in Images (Masters' Thesis)
- Augmented the DPM object detection algorithm to detect up to 60% occluded objects
- Used HOG features and graph-cuts to segment all pixels inside the bounding box to object/non-object
- Used Structural SVM to train HOG feature and graph edge weights (Pub. 11)

GRASP Laboratory, University of Pennsylvania   Summer 2013
Detection and 6-DOF pose estimation of objects from a single 2D image
Helped develop an algorithm to detect objects using their shape and estimate their 6-DOF pose from a single RGB image by matching the outline with a CAD model (Pub. 12). Works in heavily cluttered scenes.

GRASP Laboratory, University of Pennsylvania Spring 2013
Robocup 2013 Humanoid Kid-size soccer international competition
Our team won the Kid-size international competition. I contributed to the particle-filter based localization system and player location disambiguation based on the goalkeeper ball estimate.

INVITED TALKS

- Contact-Centric Grasping Behavior - Guest lecture at the Robotic Caregivers: From Dreams to Reality Spring 2020 course at Georgia Tech.
- Hand-Object Contact - University of Toronto People, AI, & Robots Research Group, March 2021
- Hand-Object Contact During Grasping: Capture, Analysis, and Applications - CVPR 2020 Doctoral Consortium, June 2020
- A Contact-Centric Understanding of our Functional Grasping Behavior - Guest Lecture in Georgia Tech BMED 8813 course on robotic caregivers, Spring 2020
- "A Contact-Centric Understanding of our Functional Grasping Behavior" - Stanford Vision and Learning Lab, Stanford CA USA 3/23/2020
- "A Contact-Centric Understanding of our Functional Grasping Behavior" - Facebook AI Research, Pittsburgh PA USA 2/28/2020
- "A Contact-Centric Understanding of our Functional Grasping Behavior" - Facebook Reality Labs, Redmond WA USA 2/26/2020
- "A Contact-Centric Understanding of our Functional Grasping Behavior" - Amazon Robotics & AI, Seattle WA USA 2/24/2020

SELECTED COURSEWORK

Learning in Robotics (UPenn ESE 650) Spring 2013
- RGB-D point-cloud registration for 3D mapping (wiki)
- Planar Simultaneous Localization and Mapping using a particle filter (wiki)
- Image panoramas using 3-DOF orientation tracking by an Unscented Kalman Filter (wiki)
- Path planning in aerial photographs using imitation learning (wiki)
- Probabilistic color image segmentation using Gaussian Mixture Models (wiki)

Computer Vision and Computational Photography (UPenn CIS 581) Fall 2013
- Logo replacement using Shape Context feature matching (wiki)
- Panoramas by Corner appearance feature matching (wiki)
- Image Morphing by Thin Plate Splines (wiki)

Machine Perception (UPenn CIS 580) Spring 2013
- Image stitching using vanishing points and matching points (wiki)
- Logo warping using perspective transforms (wiki)

Intro to Parallel Programming (Udacity Online Course) Summer 2014
- Tone mapping using histogram equalization
- Poisson blending of masked images

COMPUTER SKILLS

- *Programming Languages*: C++, Python
- *Libraries and Tools*: PyTorch, TF-Agents, ROS, GTSAM, OpenCV, Vim, Git, LaTeX

SERVICE

- Regularly review for CVPR (outstanding reviewer 2019), RSS, ECCV, ICRA, IROS, BMVC, WACV, T-PAMI, and RA-L.
- RoboGrads: VP Academics (2017), VP PhD Robotics Program (2018)

- Asha for Education: Ran the Atlanta half-marathon thrice to raise funds, coached the running group twice