# SHASHANK **TRIPATHI**

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## EDUCATION

**Max Planck Institute for Intelligent Systems, Tübingen** — Germany
Ph.D., Computer Science — Feb 2021 – present
Advisor: Prof. Michael Black

**Carnegie Mellon University, School of Computer Science** — Pittsburgh, USA
Master of Science in Computer Vision (MSCV) — Dec 2018
GPA: 4.15/4.33, Advised by Prof. Kris Kitani

**Birla Institute of Technology and Science (BITS), Pilani** — Hyderabad, India
Bachelor of Engineering with Honors in Electronics and Communication Engineering, Minor in Finance — July 2016
GPA: 9.16/10 (top 2% among 1500 students, Merit scholarship recipient)

## PUBLICATIONS

· ***3D Human Pose Estimation via Intuitive Physics***
S Tripathi, L Muller, P C Huang, D Tzionas, M J Black. (ongoing)

· ***Occluded Human Mesh Recovery***
R Khirodkar, S Tripathi, K Kitani. CVPR 2022 — https://cvml.page.link/ochmr

· ***AGORA: Avatars in Geography Optimized for Regression Analysis***
P Patel, P C Huang, J Tesch, D T Hoffman, S Tripathi, M J Black. CVPR 2021 — https://cvml.page.link/agora

· ***PoseNet3D: Unsupervised 3D Human Shape and Pose Estimation***
S Tripathi, S Ranade, A Tyagi, A Agarwal. *3DV 2020 (oral)* — https://cvml.page.link/pose

· ***Learning to Generate Synthetic Data via Compositing***
S Tripathi, S Chandra, A Agarwal, A Tyagi, J Rehg, V. Chari. *CVPR 2019* — https://cvml.page.link/learn

· ***C2F: Coarse-to-fine Vision Control System for Automated Microassembly***
S Tripathi, D Jain, H Sharma. *Nanotechnology and Nanoscience Asia, 2018* — https://cvml.page.link/c2f

· ***Sub-cortical morphology and voxel based features for Alzheimer's disease classification***
S Tripathi, SH Nozadi, M Shakeri, S Kadoury. *ISBI 2017* — https://cvml.page.link/shape

· ***Deep spectral-based shape features for Alzheimer's Disease classification***
M Shakeri, H Lombaert, S Tripathi, S Kadoury. *MICCAI-SESAMI, 2016* — https://cvml.page.link/spec

## PATENTS

· ***Learning Temporally Consistent 3D Human Pose via Knowledge Distillation.***
**S Tripathi**, S Ranade, A Tyagi, A Agarwal. *US Patent 16/814,526*

· ***VBC: Task aware synthetic data generation by inserting 3D avatars in real world images and videos.***
**S Tripathi**, S Chandra, A Agarwal, A Tyagi, J Rehg, V. Chari. *US Patent 16/450,499*

· ***Reconstruct-Embellish-Misclassify: Synthetic data generation to fill gaps in data distribution***
**S Tripathi**, S Chandra, A Agarwal, A Tyagi, J Rehg, V. Chari. *US Patent 16/192,433*

## RESEARCH EXPERIENCE

**3D Human Pose Estimation via Intuitive Physics** — Dec 2021 – present
*Advisor: Prof. Dimitrios Tzionas, Prof. Michael Black* — MPI-IS, Tubingen

· Proposed novel biomechanically-inspired intuitive physics terms that are simple, differentiable and compatible with parametric body models such as SMPL/SMPLX
· Demonstrated that incorporating differentiable physics in 3D human pose estimation pipelines results in physically-plausible meshes
· Collected Mocap data with extreme poses to demonstrate the effectiveness of our approach in challenging scenarios

**Occluded Human Mesh Recovery** — Aug 2021 – Dec 2021
*Advisor: Prof. Kris Kitani* — *CMU*

· Proposed a novel top-down mesh recovery architecture capable of leveraging image spatial context for handling multi-person occlusion and crowding

**AGORA: Avatars in Geography Optimized for Regression Analysis** — Aug 2020 – Dec 2020
*Advisor: Prof. Michael Black* — MPI-IS, Tubingen

· Developed a 3D human shape and pose estimation model trained on synthetic data that generalizes to real scenes using various 2D and 3D losses
· Added robustness to occluded scenes and support for the SMIL child model
· Evaluated our model on several 2D and 3D datasets and ran ablation studies

**PoseNet3D: Unsupervised 3D Human Shape and Pose Estimation** — Feb 2019 – Nov 2019
*Collaborators: Dr. Amit Agarwal, Dr. Ambrish Tyagi* — *Amazon Lab126*

· Proposed self-consistency and adversarial losses to train a novel unsupervised teacher model to estimate

3D human pose from RGB videos
· Weak supervision from the teacher was used to train a student model for estimating SMPL body mesh
· Solved issues such as occlusion, domain-gap and temporal jitter leading to realistic and smooth 3D sequence reconstructions on multiple in-the-wild video datasets

**Learning to Generate Synthetic Data via Compositing** May 2018 – Nov 2018
*Advisors: Prof. James Rehg, Dr. Amit Agrawal, Dr. Ambrish Tyagi* *Amazon Lab126*
· Proposed a network for generating novel composite images that retain scene context and realism
· Developed algorithms for efficient training of object detection and image classification models on synthetic composite data, using an online hard-positive mining approach
· Improved baseline Faster-RCNN mAP by 3.5% and baseline SSD mAP by 2.7% on various datasets.

**ClassPaths: Weakly supervised class-specific subnets for faster-inference** Dec 2017 – Dec 2018
*Advisors: Prof. Kris Kitani, Dr. Ambrish Tyagi, Dr. Varsha Hedau* *CMU*
· Exploited class-wise parameter redundancy and activation map sparsity for finding class-specific subnets (ClassPaths) for faster inference
· Proposed an auxiliary supervisor network trained on a multi-loss formulation to jointly optimize accuracy, sparsity, pair-wise selectivity and quantization on the learned class-specific subnets
· Deep-networks employing ClassPaths achieved similar performance as a full capacity network, with 40%-60% FLOPS reduction during inference

**Deep Spectral-based Shape Features for Alzheimer's Disease Classification** Feb 2016 – Jul 2016
*Undergraduate Thesis, Advisor: Dr. Samuel Kadoury* *Univ. of Montreal*
· Developed an unsupervised framework for classification of Alzheimer's disease patients using noisy T1-weighted MRI brain images
· Proposed a combination of grey-matter voxel-based intensity variations and 3D structural (shape) features parameterized with a spherical-harmonics representation
· Results presented near state-of-the-art accuracies (>89%) – outperformed conventional MRI shape-based strategies by 22%-27%

**C2F: Coarse-to-Fine Vision Control System for Automated Microassembly** May 2014 – Dec 2014
Advisor: Dr. H D Sharma *Central Electronics Engineering Research Institute, Pilani*
· Developed a completely automated, visual-servoing based closed loop system to perform 3D micromanipulation and microassembly tasks
· Solved challenges around object recognition/tracking, scene understanding, path planning and obstacle avoidance
· Results led to a ~75% reduction in setup and run time as compared to manual operation, while mitigating any risk of collision during grasp-and-drop experiments

## SCHOLARSHIPS AND AWARDS

- Best business model and best pitch, Cyber Valley Startup Incubation Program 2022, Germany for our startup "YOGI – a virtual yoga classroom" 2022
- IISc Bangalore Summer Research Fellowship – top 20 across India 2015
- *Best Technical Association Award,* BITS-Pilani 2014
- Tournament Winner, Cricket, Arena'13 National Sports Festival 2013
- Undergraduate MERIT scholarship, BITS Pilani – top 2% students 2012
- Founder President's Scholarship, Amity International – top student for 6 years 2011
- Junior Science Talent Search Examination (JSTSE) Scholarship – Ranked 22 in 20,000 applicants 2008

## ACADEMIC DUTIES

Reviewer – CVPR 2022, BMVC 2022
Reviewer – ICCV 2021, CVPR 2021
Reviewer – ECCV 2020 (*Outstanding reviewer award*)
Reviewer – CVPR 2020

## TEACHING EXPERIENCE

Teaching Assistant – 16-720: Computer Vision, Prof. Kris Kitani Fall 2018, CMU
Head Teaching Assistant – 16-385: Computer Vision, Prof. Ioannis Gkioulekas Summer 2018, CMU

## PROFESSIONAL EXPERIENCE

**Amazon** Sunnyvale, USA
Applied Scientist II (AS-II) (*promoted from AS-I in Sep 2020*) Feb 2019 – Feb 2021
Improved 3D human activity reconstruction from 2D videos for enhancing action recognition/detection. Supported Computer Vision algorithm development for the new Echo Show. Worked on virtual try-on and body measurement estimation from images.

**Amazon Lab126** Cupertino, USA
Applied Scientist Intern May 2018 – Aug 2018
Worked on task-aware generation of synthetic image composites for training deep networks

**Franklin Templeton Investments** Hyderabad, India
Summer Intern | Project: Financial Modelling for Tactical Asset Allocation May 2015 – Aug 2015
Built machine-learning models for capturing statistical associations like lead-lag correlation and one directional causality which achieved a 12% improvement in hit-rate for forecasting yield-spreads (US-OAS)

## TECHNICAL SKILLS

*Programming Languages* Python, C++/C, MATLAB
*Tools and Frameworks* Pytorch, Tensorflow, Blender

## RELEVANT COURSES

16-826 Visual Learning and Recognition, CMU
16-822 Geometry Based Methods in Vision, CMU
16-720 Computer Vision, CMU
10-601 Introduction to Machine Learning, CMU
16-811 Mathematical Fundamentals for Robotics, CMU

## ACADEMIC PROJECTS

**Learning Scene Saliency Maps Using Superpixel-augmented Convolutional Neural Networks** Aug 2017 – Dec 2017

- Extracted SLIC superpixel segmentations in input images and defined a range and color separation vector as input to a Siamese Convolutional Neural Network (CNN)
- Trained the network on the ECSSD saliency dataset. Superpixels allow for significant speedup (4x) in training while capturing a larger spatial context, leading to more precise saliency maps

**Towards Integrating Model Dynamics for Sample Efficient Reinforcement Learning** Jan 2017 – May 2017

- Developed a principled approach for solving sample inefficiency issues while deploying model-free reinforcement learning in real environments
- Learned a dynamics model of the world by assuming domain-specific priors on real-world episodes. Used the learned dynamics model to augment real-world episodes as the training progressed
- Established that augmenting real-world data using an approximate world-model tends to be significantly more sample efficient than naïve model-free reinforcement learning

## LEADERSHIP

- Member, External Affairs Committee (Graduate Student Assembly), CMU
- Secretary, Electrical and Electronics Association, BITS Pilani
  Led a team of 37 members. Organised 25 major events, 6 during the technical festival
- Computer Vision Mentor**,** Student Mentorship Program (SMP), BITS Pilani
  Conducted evening classes for teaching 30 junior batch students
- Represented BITS Pilani cricket team in inter-college cricket tournaments and sports festivals
- Organizer of National Seminar on Indian Space Technology (NSIST-2014)

## EXTRA-CURRICULAR

- Teaching volunteer at Nirmaan – BITS Pilani | www.nirmaan.org Mar 2014 – Dec 2015
- Teaching volunteer at LaSalle Boys and Girls Club, Montreal | www.bgclasalle.com Mar 2016 – Jul 2016
- Teaching volunteer at Amitasha – Teaching the girl child | www.amity.edu/amitasha Mar 2009 – Mar 2010