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Shrinath Deshpande

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Education

Stony Brook University — Stony Brook, NY
Doctor of Philosophy (Ph.D.) (Major: Mechanical, Minor: Computer Science), GPA 3.88 — *Aug. 2015 – May 2020*

- **Relevent Coursework :** Artificial Intelligence, Computer Vision, Machine Learning, Analysis of Algorithms, Advanced Control Systems, Robotics, Advanced Dynamics, Computational Geometry, Geometric Modeling, Product Design Optimization
- Developing the world's first Machine Learning-driven Mechanism Design computational framework, under the guidance of Dr. Purwar; funded by $450K National Science Foundation grant.

Experience

Autodesk Research — San Francisco, CA
Robotics Research Intern — *May 2019 – Aug 2019*

- Worked on CAD Informed Adaptive Robotic Assembly Project; Developed a CAD-driven Assembly Motion Planner for 3D CAD Assemblies; Implemented in Fusion 360 and an in-house Robotic Environment.
- Integrated a concave-concave mesh collision library (C++) with In-house Robotic Environment; Impacted three research projects
- Identified an opportunity to leverage the data created by the motion planner; Initiated a novel deep learning project on learning the Latent Embeddings for Assembly Motion Plans; Developed a representation schema for Motion Plans; Trained a VAE on a synthetic dataset; Applications include Synthesis, Recognition, and Segmentation of Motion Plans

Stony Brook University — Stony Brook, NY
Research Assistant — *May 2016 – Present*

- Developed an ML-assisted framework for Mechanism Design; Outperforms the state of the art algorithms for mechanism synthesis
- Deep Learning is applied for Probabilistic Inference, Representation Learning, Conditional Generation, Sequence Modeling and Translation, Anomaly Detection, Image Segmentation, Embedding Generation, Similarity Matching, and Clustering
- Deep Learning is augmented with domain-specific synthesis algorithms for Computational Creativity.
- Developing a Machine Learning-Driven Web-Based App for Synthesis of Mechanical Linkages; Deployed on Google Cloud Platform; url: http://motiongenpro.appspot.com/; [Tensorflow, React, Redux, MongoDB, GCP]
- Lead author of an award-winning publication for solving practical synthesis problems (doi: 10.1115/1.4037801)
- Published four first authored journals and

Skills

- **Languages :** Proficient in Python, Javascript, C++, MATLAB, Competent with Mathematica, HTML5, CSS
- **Tools & Technologies :** Tensorflow, OpenCV, Simulink, ROS, Vim, Scikit-learn, OpenGL, Canvas, Three.js, React, Redux, GCP, AWS, Kubernetes, Kubeflow, SageMaker, Firebase, MongoDB, Annoy

Publications

- Deshpande S, Purwar A. **An Image-Based Approach to Variational Path Synthesis of Linkages**, Accepted for ASME International Design Engineering Technical Conferences 2020
- Deshpande S, Purwar A. **Computational Creativity via Assisted Variational Synthesis of Mechanisms using Deep Generative Models**, ASME Journal of Mechanical Design 2019; doi :10.1115/1.4044396
- Loya, A., Deshpande, S., Purwar, A. **Machine Learning Driven Individualized Gait Rehabilitation: Classification, Prediction, and Mechanism Design**, ASME Journal of Engineering in Medical Diagnostics and Therapy, May 2020
- Deshpande S, Purwar A. **A Machine Learning Approach to Kinematic Synthesis of Defect-Free Planar Four-Bar Linkages**, Feb 2019, ASME J. Computing and Information Science in Engineering, doi 10.1115/1.4042325
- Deshpande S, Purwar A. **A Task-Driven Approach to Optimal Synthesis of Planar Four-Bar Linkages for Extended Burmester Problem**, ASME. J. Mechanisms Robotics. 2017;9(6):061005-061005-9. doi:10.1115/1.4037801
- Purwar, A., Deshpande, S., Ge, Q. J. **MotionGen: An iOS and Android App for Planar Four-Bar Motion Generation**, ASME IDETC 2016 August.
- Deshpande, S, et al. **Wall-climbing robot with mechanically synchronized gait.** Industrial Instrumentation and Control (ICIC), 2015 International Conference on. IEEE, 2015.

Relevant Projects

Deep Reinforcement Learning for Continuous Control Tasks CSE 537 AI, Prof. N Balasubramanian
Tensorflow, OpenAI-Gym https://github.com/deshpandeshrinath/deepDGP *Jan 2018 – May 2018*

- Implemented Deep DPG algorithm to learn continuous control policies; Compatible with all OpenAI-Gym environments.
- Implemented Hindsight Experience Replay for learning goal-oriented tasks with sparse binary rewards.

Visual Odometry with Deep Learning CSE527 Computer Vision, Prof. Roy Shilkrot
Python, Tensorflow, OpenCV https://github.com/sladebot/deepvo *Oct 2017 – Dec 2017*

- Built deep Recurrent Convolutional Neural Network for pose estimation of a car; CNN was derived from pretrained FlowNet2.0
- Trained and tested on KITTI visual odometry dataset (grayscale); Supported by Human Interaction Lab, Stony Brook.

Face Tracking in Video CSE527 Computer Vision, Prof. Roy Shilkrot
Python, OpenCV *Oct 2017 – Nov 2017*

- Detected the face in first frame with Viola-Jones Detector; Compared the tracking by CAMShift, PF, KF, Optical Flow tracker algorithms.

Computing Central Trajectory CSE555 Computational Geometry, Prof. Joseph Mitchell
CGAL, OpenGL, Boost, C++ *March 2017 – May 2017*

- Developed an algorithm to find valid representative trajectory among n time-stamped trajectories; works in d dimensional space.
- The algorithm builds a weighted DAG on input; designed heuristics for assigning weights. The output is Dijkstra's shortest path on DAG.

Optimal Control of a Drifting Car MEC560 Advanced Control Systems, Prof. Vivek Yadav
MATLAB, GPOPS-II [Source] *Oct 2016 – Dec 2016*

- Designed Ext. Kalman Filter for Observer; Modeled governing dynamics; Used empirical tire friction model for drift simulations.
- Computed shortest path using Dynamic Programming. Obtained Optimal Control via Direct Collocation; Implemented in MATLAB using optimal control solver GPOPS II.
- Used high gain PID controller to follow optimal control. Results match with empirical drifting techniques used by race drivers.

Motion Planning of Baxter Arm MEC529 Robotics, Prof. N. Chakraborty
MATLAB *March 2016 – May 2016*

- Computed smooth B-Spline motion for pushing. Computed Jacobian matrix; Applied approximate Inverse Position Kinematics
- Obtained joint angles and rates for the task. Performed simulations to validate the results.

Interactive Manipulation of NURBS Surfaces MEC572 Geomtric Modelling, Prof. Anurag Purwar
C++, OpenGL *March 2016 – May 2016*

- QT5, OpenGL based implementation in C++ for interactive manipulation of Non Uniform Rational B-Spline Surfaces.

Wall Climbing Robot Senior Design Project
MATLAB, Simulink, Solidworks *Jan 2015 – May 2015*

- Design of a novel mechanism inspired by Gecko; Fabrication CNC lathe, laser cutter and 3D printing, vacuum for adhesion
- Developed control system for autonomous climbing on flat surfaces; climbing speed of 3 inches/sec

Awards

- Research Intern Culture Catalyst Award, Autodesk, Aug 2019
- Autodesk Intern Blog Contest Winner, Autodesk, Aug 2019
- Award of Research Achievement, Sigma XI Scientific Research Society, May 2019
- Featured in Student Spotlight, Mechanical Engineering, Stony Brook University, Fall 2019
- A.T. Yang Award in Theoretical Kinematics, Aug 2017