700, Health Sciences Drive,
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# Shrinath Deshpande

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## Education

**Stony Brook University** — Stony Brook, NY
*Ph.D. (Major: Mechanical, Minor: Computer Science), GPA 3.88* — *Aug. 2015 – Present*

- **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 an ML-based framework for Mechanical Design, under the guidance of Dr. Purwar; funded by $450K NSF grant.

## Experience

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

**Machine Learning**

- Interactive ML Agent for Assisted Mechanism Design; Human Machine Collaboration; ML for conceptual machine design.
- Developing Generative Models (VAE's and Conditional GAN's) for computational creativity and managing uncertainty.
- Working on deep RL model for Mechanical Design; Developed an OpenAI-gym Environment for Mechanism Design Task.
- VAE's for representation learning of Mechanism Motions in 2D and 3D; Trained classifiers for Mechanism Type-Synthesis

**Optimization**

- Developed Lagrange Optimization routine for four-bar linkage synthesis; Reduces constrained optimization into a polynomial system. Solved the system by gröebner basis method; implemented using GIAC npm package on node.js server.
- Lead Author of an award winning publication for solving practical synthesis problems (doi: 10.1115/1.4037801)

**MotionGen: Web, iOS and Android App for Linkage Synthesis**

- Developed smart-synthesis, motion interpolation functionalities for the cross platform app based on MVC architecture; url: http://cadcam.eng.sunysb.edu/. Used Apache Cordova framework for iOS and Android implementations.
- Implemented multi-core computations for synthesis using *Cluster* node package.

## Skills

- **Languages :** Proficient in Python, Javascript, MATLAB, Mathematica. Competent with C++, HTML5, CSS
- **Tools & Technologies :** Tensorflow, OpenCV, Simulink, ROS, Vim, Scikit-learn, OpenGL, Canvas, Three.js, ReactJS

## 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.

**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.
- Algorithm builds a weighted DAG on input; designed heuristics for assigning weights. Output is dijkstra's shortest path on DAG.

**Optimal Control of a Drifting Car** — MEC560 Advanced Control Systems, Prof. Vivek Yadav
*MATLAB, GPOPS-II* — *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.

**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.

## Selected Publications

- Deshpande S, Purwar A. **A Machine Learning Approach to Kinematic Synthesis of Defect-Free Planar Four-Bar Linkages**, ASME IDETC Aug 2018. (Accepted for ASME J. Computing and Information Science in Engineering)
- 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.

## Awards

**A.T. Yang Award in Theoretical Kinematics** — Aug 2017

- Awarded $1000 for the Best Paper at ASME Mechanisms and Robotics Conference, Cleveland, OH, August, 2017