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## Education

### Stony Brook University

*Ph.D. (Major: Mechanical, Minor: Computer Science)*

Stony Brook, NY

*Aug. 2015 – Present*

- **Relevant Coursework** : Computer Vision, Machine Learning, Analysis of Algorithms, Computational Geometry, Advanced Control Systems, Robotics, Geometric Modelling for CAD, Product Design Optimization
- Developing a framework for data-driven mechanism design, under guidance of Dr. Purwar; funded by \$450K NSF grant.

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## Experience

### Stony Brook University

*Research Assistant, Teaching Assistant*

Stony Brook, NY

*May 2016 – Present, Aug 2015 – May 2016*

#### Machine Learning

- Achieved 45:1 loss-less data compression for mechanism trajectory database; used autoencoder nets for dimensionality reduction.
- Resulted in quick and efficient motion queries for nearest neighbor in compact feature space.
- Autoencoders trained in greedy layer-wise fashion; Tensorflow, GCP based implementation; Publication in progress.

#### Optimization

- Developed an Lagrange Optimization routine for four-bar linkage synthesis; Reduces constrained optimization into polynomial system. Solved the system by gröebner basis method; implemented using GIAC npm package on node.js server.
- Led to 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 functions 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 node package cluster.

#### Teaching Assistant - MEC101 (Mechanical Design Innovation), MEC 262 Engineering Dynamics

- Involved in creating assignment, exams and conducting recitation sessions for 200+ students in each course.
- Developed modular robotic kits for MEC101 students; Conducted Hands-On tutorials on Arduino programming.

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## Skills

- **Languages** : Proficient in Python, Javascript, MATLAB. Familiar with C++, HTML, CSS
- **Tools & Technologies** : Tensorflow, OpenCV, Git, Numpy, Scikit-learn, Unix/Linux, Boost, STL, Apache Cordova

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## Relevant Projects

### Visual Odometry with Deep Learning

*Python, Tensorflow, OpenCV*

CSE527 Computer Vision, Prof. Roy Shilkrot

*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.

### Central Trajectory Problem

*CGAL, OpenGL, Boost, C++*

CSE555 Computational Geometry, Prof. Joseph Mitchell

*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

*MATLAB, GPOPS-II*

MEC560 Advanced Control Systems, Prof. Vivek Yadav

*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

*MATLAB*

MEC529 Robotics, Prof. N. Chakraborty

*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.

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## Selected Publications

- 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. (2016, August). MotionGen: An iOS and Android App for Planar Four-Bar Motion Generation, ASME 2016 IDETC.
- Deshpande, Shrinath, et al. "Wall-climbing robot with mechanically synchronized gait." Industrial Instrumentation and Control (IIC), 2015 International Conference on. IEEE, 2015.

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## 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