
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 the guidance of Dr. Purwar; funded by \$450K [NSF grant](#).

Experience

Stony Brook University

Research Assistant, Teaching Assistant

Stony Brook, NY

May 2016 – Present, Aug 2015 – May 2016

Machine Learning

- Used autoencoder nets for dimensionality reduction; Achieved 45:1 data compression for mechanism trajectory database
- Implemented fast and efficient motion queries for nearest neighbors in compact feature space; Implemented using Scikit-learn.
- Autoencoders trained in greedy layer-wise fashion; Tensorflow, GCP based implementation; Publication in progress.

Optimization

- Developed 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 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 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 *Cluster* node package.

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.

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

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.

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.

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