DONGPING QI

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EDUCATION

Cornell University *08/2017 - Present*
Ph.D. in Applied Mathematics
Adviser: Alexander Vladimirsky

Shanghai Jiao Tong University *09/2013 - 06/2017*
B.S. in Mathematics (Zhiyuan Honor Program)
Adviser: Lei Zhang

RESEARCH INTERESTS

- Numerical analysis; Computational mathematics; Scientific machine learning;
- Optimal control; Path Planning; Reinforcement learning.

SKILLS

Programming Languages	C++, Python, TensorFlow, Matlab, Julia
Software & Tools	LaTeX, GitHub

COURSEWORK

Real & Functional Analysis	Linear Programming
Convex Optimization	Matrix & Sparse Matrix Computation
Dynamical Systems	Partial Differential Equations
Probability & Stochastic Processes	Parallel Computing
Machine Learning for Intelligent System	Numerical Data Science

RESEARCH EXPERIENCES

High-performance Deep Learning Algorithms Using Dynamical Systems
Lawrence Livermore National Laboratory (virtual), NSF MSGI *06/2020 - 08/2020*

Research about interpretable deep neural networks and connections between deep learning and continuous dynamical systems.

Together with my mentors, I implemented a new type of neural network which uses B-Spline basis functions to parameterize the layer weights and biases. The performance and robustness of this neural network has been tested on various supervised learning problems.

The network is constructed in Julia based on Flux.jl and Zygote.jl.

Optimal Control Under Uncertainty
Cornell University, REU research assistant *06/2018 - 08/2018*

Research about suitable model and efficient algorithms for path planning problems under uncertainty. Guided and cooperated with undergraduate students on two projects:

- Path planning when information of target or environment is not known initially while can be revealed at a later time: We came up with a suitable model using Hamilton-Jacobi-Bellman equations. Furthermore, we compared and contrasted different robust methods (risk-sensitive,

chance-constrained optimality, distributionally robustness and so on) for uncertainty quantification.

- Finding optimal strategies for vehicles encountering traffic lights with randomly switching time: We came up with several reasonable models and finished some numerical experiments.

Dynamic Factoring in Eikonal Equation
Cornell University, research intern *08/2016 - 12/2016*

Research about numerical methods for dealing with rarefaction fans caused by non-smooth boundaries, discontinuous PDE coefficients and boundary values.

Together with Prof. Vladimirsky, I developed a dynamic factoring algorithm which helps recover first-order convergence. In particular, the algorithm prevents numerical artifacts around rectangular obstacles when computing the solution for path planning.

The computation is implemented in C++ and visualized in Matlab.

PUBLICATION

1. S. Günther, W. Pazner, D. Qi, "Spline parameterization of neural network controls for deep learning," *submitted to Machine Learning, Springer.*
2. D. Qi, A. Dhillon, A. Vladimirsky, "Optimality and robustness in path-planning under initial uncertainty," *submitted to Applied Mathematics and Optimization.*
3. D. Qi, A. Vladimirsky, "Corner cases, singularities, and dynamic factoring," Journal of Scientific Computing 79/3: 14561476 (2019).

TALKS & POSTERS

SpliNet: Modeling Neural Network Using B-Splines, 08/27/2020
NSF MSGI Virtual Presentation

Path Planning Under Initial Uncertainty, 12/09/2019
Scientific Computing and Numerics (SCAN) seminar, Cornell University

Path Planning Under Initial Uncertainty, 10/22/2019
Algorithms for Threat Detection Workshop (poster session), George Washington University

Rarefaction Fans and Dynamic Factoring in Eikonal Equation, 07/17/2019
International Congress on Industrial and Applied Mathematics (ICIAM), Valencia, Spain

AWARDS

SIAM Student Travel Award 2019
ICIAM 2019

Cornell Graduate School Fellowship 2017
Cornell University, Center for Applied Mathematics

Zhiyuan Outstanding Student Scholarship 2017
SJTU, Zhiyuan College