Dule Shu

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EDUCATION

Carnegie Mellon University   Pittsburgh, PA
Doctor of Philosophy in Mechanical Engineering   2023.5
GPA: 3.92/4.00   (anticipated graduation)

Pennsylvania State University   University Park, PA
Master of Science in Electrical Engineering   2018.5
GPA: 3.62/4.00
Selected Coursework: Real Analysis, Convex Optimization, Stochastic Optimization, Math Logic, Applied Stochastic Processes, Pattern Recognition, Linear Control Systems

Harbin Institute of Technology   Harbin, China
Bachelor of Engineering in Automation   2007.7
GPA: 83/100
Undergraduate Thesis: Linear Matrix Inequalities for Robust Controller Design

SKILLS

Python, PyTorch, MATLAB

PhD RESEARCH

Carnegie Mellon University   Pittsburgh, PA
Deep Learning for Reduced Computational Complexity in Simulating   2022.5 − 2024.5
Partial Differential Equations (PDEs)

- Developed a super-resolution neural network model for fluid flow data using a denoising diffusion probabilistic model for robustness on out-of-distribution low-res input.
- Developed a deep learning model for spatial reconstruction of incomplete fluid flow data using a vector-quantized generative adversarial network for improved numerical stability and accuracy.
- Collaborated with labmates to develop a Transformer-based neural PDE solver which implements axial factorized kernel integral to reduce the computational complexity.
- Collaborated with labmates to develop a deep learning surrogate model simulating PDE in a learned latent space for a reduced computational cost.

ADDITIONAL RESEARCH EXPERIENCE

Carnegie Mellon University   Pittsburgh, PA
Deep Generative Models   2019.8 − 2022.4

- Developed a deep generative model to synthesize 3D mesh objects for evaluating a design cycle consisting of synthesis and physics-based validation.
- Developed a generative adversarial network to evaluate the threat of synthesized attacks against network intrusion detection systems with minimal use of training data by active learning.
- Conducted a pilot study which investigates STEM learners' ability to decipher AI-generated video created by a face-swapping generative model.
- Developed a generative adversarial network for multi-modal data encryption to demonstrate the viability of deep generative methods in steganography.

Pennsylvania State University   University Park, PA
Research assistant in the DARPA FUN Design program   2018.8 − 2019.5

- Collaborated with labmates to develop computational tools for the generation and evaluation of 3D designs.

Graduate student advisor for Penn State Advanced Vehicle Team in EcoCAR3   2015.8 − 2018.5

- Developed a method for road-anomaly detection using contours of sum-of-square polynomials.
- Developed a switch control algorithm for vehicle path planning modeled as a finite-transition system using linear temporal logic.

ACADEMIC PROJECTS

Carnegie Mellon University   Pittsburgh, PA
Course project for Learning Based Image Synthesis Final (16726)   2022.1 – 2022.5
 • A Study of Deep Learning-based 3D Point Clouds Reconstruction.
 (project webpage: https://www.andrew.cmu.edu/course/16-726-sp22/projects/dules/project/)

PUBLICATIONS

Li, Z., Patil, S., Shu, D., & Farimani, A. B. (2023, October). Latent Neural PDE Solver for Time-dependent Systems. In NeurIPS 2023 AI for Science Workshop.

Doss, C., Mondschein, J., Shu, D., Wolfson, T., Kopecky, D., Fitton-Kane, V. A., ... & Tucker, C. (2023). Deepfakes and scientific knowledge dissemination. Scientific Reports, 13(1), 13429.

Li, Z., Shu, D., & Farimani, A. B. (2023). Scalable Transformer for PDE Surrogate Modeling. NeurIPS 2023.

Shu, D., Li, Z., & Farimani, A. B. (2023). A physics-informed diffusion model for high-fidelity flow field reconstruction. Journal of Computational Physics, 478, 111972.

Shu, D., Doss, C., Mondschein, J., Kopecky, D., Fitton-Kane, V., Bush, L., & Tucker, C. (2021, July). A Pilot Study Investigating STEM Learners' Ability to Decipher AI-generated Video. In 2021 ASEE Virtual Annual Conference.

Shu, D., Leslie, N. O., Kamhoua, C. A., & Tucker, C. S. (2020, July). Generative adversarial attacks against intrusion detection systems using active learning. In Proceedings of the 2nd ACM workshop on wireless security and machine learning (pp. 1-6).

Shu, D., Cong, W., Chai, J., & Tucker, C. S. (2020, July). Encrypted rich-data steganography using generative adversarial networks. In Proceedings of the 2nd ACM Workshop on Wireless Security and Machine Learning (pp. 55-60).

Shu, D., Cunningham, J., Stump, G., Miller, S. W., Yukish, M. A., Simpson, T. W., & Tucker, C. S. (2020). 3d design using generative adversarial networks and physics-based validation. Journal of Mechanical Design, 142(7), 071701.

Cunningham, J. D., Shu, D., Simpson, T. W., & Tucker, C. S. (2020). A sparsity preserving genetic algorithm for extracting diverse functional 3D designs from deep generative neural networks. Design Science, 6, e11.

Shu, D., Lagoa, C., & Cleary, T. (2017, October). A sum-of-squares polynomial approach for road anomaly detection using vehicle sensor measurements. In Dynamic Systems and Control Conference (Vol. 58288, p. V002T17A004). American Society of Mechanical Engineers.

Shu, D., & Lagoa, C. M. (2017, February). A linear temporal logic-based approach for vehicle motion planning. In 2017 IEEE International Conference on Mechatronics (ICM) (pp. 25-30). IEEE.

TEACHING ASSISTANT EXPERIENCE

Carnegie Mellon University   Pittsburgh, PA
Teaching assistant   2022.9 – 2022.12
 • Taught weekly recitation for Dynamic Systems and Control (24352).
Pennsylvania State University   Pittsburgh, PA
Lab assistant   2017.8 – 2018.5

 • Taught the lab session of Electronic Circuit Design I (EE 310) to help undergraduate students on designing and building electronic circuits.