Yinwei Zhang

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About Me

I am self-motivated, persevering and curious to the unknown knowledge. I was a intern of robotics research group in ABB and the main task is to implement deep learning algorithms in robot systems for performing tasks such as grasping in 3D space. My research with my advisor Dr.Jian Liu in University of Arizona is related with spatial and temporal data analysis.

Education

University of Arizona, United States

Ph.D. Candidate in Systems and Industrial Engineering 2018-Present
M.Sc. in Statistics&Data Science 2020-Present
M.Sc. in Engineering Management 2016-2018

Jingchu University of Technology, China

B.S. in Process Equipment and Control Engineering 2012 - 2016

Internship

Research Intern in Robotics, ABB, Raleigh, NC Jan, 2020 - Aug, 2021

- Reviewed a number of literature, and selected neural networks that are possible to improve the performance of robots in **industrial applications** and **manufacturing processes**;
- **Collaborated** with international groups to collect the data, and proposed a novel **data collection** mechanism that is efficient and effective;
- Trained and tested the networks **parallelly** for **regression** and/or **classification** tasks in a Linux based multi-GPU server based on **Tensorflow** and **PyTorch**;
- Developed the pipeline for serving the trained neural networks by using **TensorFlow Serving** in Docker;
- Developed the **3D image augmentation** algorithm in Python, and integrated it into the training pipeline, which significantly improves the **robustness** of the neural network;
- Developed a mask-based method to evaluate the sensitivity of the NN to the image features, improving the **interpretability** of the cases where the NN failed to predict accurately;
- Created the synthetic industrial environments in **blender** to evaluate the performances of the NN under various conditions;
- Cooperated with project managers to generate **intellectual properties** and write scientific reports.

On-campus Experience

President, INFORMS Student Chapter, University of Arizona Sep, 2021 - Present

- Lead the chapter members to collaborate with the department for organizing social events;
- Analyze students' demands and initiate a new series of workshop that is helpful to students.

Teaching Assistant, Quality Engineering, University of Arizona Jan, 2021 - May,2021

- Unsupervised anomaly detection based on statistical modeling;
- Supervised model selection/training for efficient anomaly detection with historical well-labeled data;
- Model evaluation based on true positive, true negative, false positive and false negative;

Teaching Assistant, Fundamentals of Data Science for Engineers, University of Arizona Aug, 2021 - Dec,2021

- Principles of data pre-processing, e.g., data correcting, data completing, data creating, and data converting;
- Algorithms for supervise/unsupervise learning, e.g., SVM, classification/regression tree, K-means, and etc.;
- Evaluation mechanisms, e.g., Precision, Recall, and F1-score;
- Python and libraries, e.g., Sklearn, Numpy, and Pandas.

PROJECT

Reliability Quantification of the Autonomous Vehicle, University of Arizona 2021

- **Sponsor**: Institute of Automated Mobility (IAM) and Intel
- **Procedures**: I developed a physics-based simulation pipeline for studying safety of the autonomous vehicle. CARLA integrated with Autoware was adopted to realize the simulation pipeline. Different errors were injected into the perception system of the vehicle, e.g., severe weathers and noisy images, in the simulated environment. These errors will be propagated across the whole stages in the perception system and cause accidents. A mathematical model is developed to estimate and predict the possible error occurrence in the object detection stage by considering the injected errors.
- **Methodological Strength**: Physics-based Simulation, Error Injection, CARLA-Autoware

Anomaly Detection via Statistical Learning, University of Arizona 2019

- **Sponsor**: National Science Foundation
- **Procedures**: I developed a modified elastic-net based model with a fast-iterative algorithm to reduce the dimensions of high-volume spatio-temporal sensor data, with a reduction rate higher than 90%. Sparse learning algorithms were also invented to accurately and precisely estimate true model coefficients. Parameters tuning were conducted based on statistical learning strategies. The proposed methodology has been applied in online burst detection in water distribution systems and high-speed video monitoring system for 3D-printing, reducing false-alarm rate from over 70% to sub 1%, and ensure detection rate at over 99%.
- **Methodological Strength**: Statistical Learning, Data Fusion, Dimension Reduction, Large Scale Optimization

Moving Targets Detection and Tracking with Moving Camera, University of Arizona 2018

- **Sponsor**: Air Force Office of Scientific Research
- **Highlights**: Collaborative Surveillance System with UAVs and UGVs
  - **For UGVs**: I trained a deep learning neural network model by TensorFlow and ran it in a Linux platform installed on UGVs to detect moving targets from video streams efficiently and effectively recording with a moving camera.
  - **For UAVs**: I developed an optical flow and perspective transformation based algorithm by OpenCV to detect and track moving targets in videos captured by UAVs. Pyramidal Lucas-Kanade algorithm was used to estimate the speeds and directions of features in the video, improving the processing speed by more than 80%. Morphological operations and connected components analysis were used to enhance the performance by 33%.
- **Methodological Strength**: Computer Vision, Image Processing, Data Fusion.

PRESENTATION

- Xia, S., **Zhang, Y.**, Liu, J. (2020). Investigation of Curing Process Heterogeneity from Raman Spectrum via CP Decomposition. *INFORMS Annual Meeting*.
- **Zhang, Y.** (2019). Tutorial: Applications of Spatial-Temporal Data Analytics in Industry. *Grand Lab Slam Workshop*, University of Arizona, Tucson.
- **Zhang, Y.**, Liu, J., Lansey, K. (2019). Functional Data Analytics for Detecting Bursts in Water Distribution Systems. *INFORMS Annual Meeting*, Seattle.
- **Zhang, Y.**, Liu, J., Son, Y. (2018). Effective and Efficient Moving Object Detection by a Moving Camera, *INFORMS Annual Meeting*, Phoenix.

PUBLICATION

- Pan, F., **Zhang, Y.**, Liu, J., Head, L., Elli, M., & Alvarez, I. (2022). Quantifying error propagation in multi-stage perception system of autonomous vehicles via physics-based Simulation. *Winter Simulation Conference*, Singapore.
- **Zhang, Y.**, Zhang, T., Liu, J., Kang, W., Liang, R., & Potter, B. (2022). Profile extraction for optical lens curing process with Image-based Regularized Tensor Decomposition. *Proceedings of the 2022 International Symposium on Flexible Automation*, Japan.
- Zhang, T., **Zhang, Y.**, & Liu, J., Smooth-sparse decomposition in the image based on alternative smooth direction Model, (on-going).
- Nikravesh, Y., **Zhang, Y.**, Liu, J., & Frantziskonis, G.N (2022). A partition and microstructure-based method for large-scale topology optimization. *Mechanics of Materials*, Volume 166.
- Peterson, R. L., Shea, K. D., Liu, J., Luque, K., Powell, J., **Zhang, Y**., Williams, D. K., Martin-Plank, L., Heasley, B. J., Phillips, L. R., & Crist, J. D. (2021). Family caregiving context: a pilot study. *The Arizona Nurse*, April.

- **Zhang, Y.**, Lansey, K., & Liu, J. (2020). Detecting bursts in water distribution system via penalized functional decomposition. IEEM Conference (honorable mention award).
- Lee, S., Jain, S., **Zhang, Y.**, Liu, J., & Son, Y. (2020). A multi-paradigm simulation for the implementation of digital twins in surveillance application. IISE Conference.
- Lee, S., Jain, S., Yuan, Y., **Zhang, Y.**, Yang, H., Liu, J., & Son, Y. (2019). Design and development of a DDDAMS-based border surveillance system via UVs and hybrid simulations. *Expert Systems With Applications*, 109-123.

Patent

- System and method to generate augmented training data for neural network, No. PCT/US21/37798
- Robotic systems and methods used with installation of component parts
- Robotic systems and methods used to update training of a neural network based upon neural networks outputs

Others

- Programming Skills: Python, C++, R, Matlab, SAS
- Software&Libraries: TensorFlow/PyTorch, OpenCV, Blender, ROS, CARLA, Autoware
- Coursework: Statistical Machine Learning, Fundamentals of Data Science for Engineers, Engineering Statistics, Fundamentals of Optimization, Large Scale Optimization, Theory of Statistics, Statistical Consulting