Yi Liu

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Education

University of Delaware — Newark, DE
Ph.D. in Computer Science (GPA 4.0/4.0) — Sept. 2017 – May 2022
Research Area: Computer Vision, Image Processing, Deep Learning, Image Segmentation

University of Maryland — College Park, MD
Master of Engineering in Civil Engineering (GPA 3.9/4.0) — Jan. 2016 – Aug. 2017

Hunan University — Changsha, China
Bachelor of Engineering in Civil Engineering — Sept. 2011 – June 2015

Experience

Research Assistant — Dec. 2017 – Present
University of Delaware, Video/Image Modeling and Synthesis Lab — Newark, DE

- Collaborated with Delaware Biotechnology Institute and explored methods such as active contour, deep learning based approaches and etc. for automated quantification analysis of filamentous structures in microscopic images
- Proposed an orientation aware neural network and a terminus pairing algorithm based on geometric properties to segment filaments at instance level, which outperforms other existing methods and is deployed for domain experts
- Developed methods to extract fragments in actin filaments network with a human keypoint detection neural network using Pytorch and a fast-marching algorithm, which reduced average analyzing time from 2 hours to minutes

Computer Vision Research Intern — May 2019 – Sept. 2019
Malong Technologies — Shenzhen, China

- Explored methods to detect cloth fibers in microscopic images and observed that existing anchor-based object detection frameworks, such as R-CNN, are not suitable for this task after experiments
- Reconstructed the problem by modeling fibers as sequences of points; implemented methods to convert COCO format binary mask to sequence data and avoided extra expenses on annotation
- Proposed a neural network based on human pose estimation methods to predict the skeleton of fibers, which addresses the heavily overlapping issue and outperformed other existing object detection frameworks for this task

Publications

- Liu, Y., et al., *Quantifying Actin Filaments in Microscopic Images using Keypoint Detection Techniques and A Fast Marching Algorithm*, ICIP, 2020.
- Liu, Y., et al., *Intersection To Overpass: Instance Segmentation on Filamentous Structures with An Orientation-Aware Neural Network and Terminus Pairing Algorithm*, CVPR Bioimaging Workshop, 2019.
- Liu, Y., et al., *Densely Connected Stacked U-Network for Filament Segmentation in Microscopy Images*, ECCV Workshops, 2018.

Projects

Tracing Curve with Recurrent Neural Network | *Python, OpenCV, Pytorch* — Aug. 2020 – Present

- Created synesthetic curve dataset where multiple curves intersecting and overlapping in images
- Modeled curves as sequences of data points, and adopted a keypoint detection framework to predict endpoints
- Proposed a recurrent neural network taking encoded images and endpoint locations as input to predict the sequence of control points

Uncertainty Estimation Using Bayesian Neural Network | *Python, Pytorch* — Mar. 2020 – May 2020

- Explored methods such as Bayesian Neural Network, Random Network distillation and Ensembling Models for uncertainty estimation and novelty detection
- Applied Bayesian Neural Network for filaments segmentation to evaluate unseen patterns of filamentous structures

Tracking Spherical Objects' Response to Water Waves in Flumes | *Matlab* — May 2018 – Dec. 2018

- Collaborated with Ocean Engineering Lab at the University of Delaware and developed methods for automated quantification analysis of munition mobility experiments in a wave flume based on videos of a bird view camera
- Applied threshold-based methods and morphological operations to detect multiple spherical objects and adopted Kalman-filter to track the objects and successfully obtained their trajectories when objects are occluded

Technical Skills

- **Languages**: Python, Matlab, Java, C++, SQL
- **Frameworks**: Pytorch, Keras, Tensorflow
- **Tools and MISC**: NumPy, OpenCV, OpenGL, MySQL Cplex; Linux, Git, Latex
- **Related Courses**: Computer Vision, Deep Learning, Machine Learning, Intro. to NLP, Computer Graphics