

SHUYUAN YANG

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EDUCATION

- Case Western Reserve University (CWRU), Cleveland, OH** Aug. 2022 - Present
M.S. in Computer Science, GPA: 3.33/4.0
- University of West Florida (UWF), Pensacola, FL** Aug. 2019 - May. 2020
International Exchange Program, GPA: 3.7/4.0
Honor: Dean's List for Fall 2019 & Spring 2020
- Taiyuan University of Technology (TYUT), Taiyuan, China** Sep. 2016 - Jul. 2020
B.Eng. in Software Engineering, GPA: 3.11/4.0
Honor: Individual Scholarship of TYUT in 2017

PUBLICATIONS

- S. Yang, M. H. Le, K. R. Golobish, J. C Beaver, and Z. Chua**, "Vision-based force estimation for minimally invasive telesurgery through contact detection and local stiffness models", *Journal of Medical Robotics Research*, 2024.
- M. H. Le, S. Yang, K. R. Golobish, J. C Beaver, and Z. Chua**, "Vision-based force estimation for minimally invasive telesurgery through contact detection and local stiffness models", poster presented at Debate: Data vs. Model in Medical Robotics Workshop at the IEEE/RSJ International Conference for Intelligent Robots and Systems, Detroit, USA, Oct. 5–7, 2023. (Awarded 3rd Place for Best Poster Competition)

THESIS

- Reconstructing Telesurgical Manipulator Pose via Reinforcement Learning** Aug. 2023 - Present
Supervisor: Prof. Zonghe Chua (CWRU)

A potential approach for estimating a surgical robot's manipulator position is to use reinforcement learning with stereo video data. By achieving alignment between the actual robot and the reinforcement learning agent, the 6 Degrees of Freedom values of the manipulator can be accurately determined.

- Created a video dataset and prepared the environment for reinforcement learning in a PyBullet simulator
- Formulated the pose estimation problem as a visual keypoints alignment problem to be solved by a reinforcement learning agent
- Wrapped the environment with the gymnasium of OpenAI, and benchmarked with Stable Baselines3

- Application of Microblog Data Mining Based on K-means Algorithm** Oct. 2019 - May. 2020
Supervisor: Prof. Fan Liu (TYUT)

To mine the real-world data, a web crawler was used to collect microblog data. Natural language processing techniques were employed for embedding the raw data for k-means clustering. To enhance the clustering performance, a user feature model was constructed using principal component analysis.

- Conducted a literature review of the k-means algorithm and its application to microblog data mining
- Implemented a microblog web crawler to create a custom microblog data set for Sina Weibo
- Converted text data into a sparse matrix using natural language processing methods
- Applied k-means clustering on principal component analysis-embedded features to classify users

RESEARCH EXPERIENCE

- Predictive Modeling of Harmful Algal Blooms in U.S. Lakes Using Machine Learning and Multivariate Environmental Data** Jan. 2024 - Present
Supervisor: Prof. Huichun (Judy) Zhang (CWRU)

Utilizing a rich dataset of satellite-monitored HAB occurrences, for the first time, we have integrated a wide range of environmental variables including wind speed, precipitation, solar irradiation, temperature,

watershed nutrient levels, and human activities to develop a robust machine learning model for predicting HABs.

- Gathered and built a huge dataset (over a million items) from multiple open-source databases
- Implemented data cleaning and pre-processing on HPC with vectorize operations using Pandas and NumPy
- Applied classic machine learning algorithms, including random forest and LSTM network

Vision-based Force Estimation for Telesurgical Robotics

May. 2023 - Nov. 2023

Supervisor: Prof. Zonghe Chua (CWRU)

In scenarios where access to robot kinematic and camera parameters data is not available, I developed a graph neural network approach to estimating a normalized 3D end-effector position from video data based on extracted keypoints from DeepLabCut. This is combined with a contact detector to create a contact-conditional visual force estimation algorithm for in-the-wild telesurgical data.

- Designed and trained a graph neural network model on a stereo video dataset to estimate the 3D position of the telesurgical end-effector
- Assisted with the training and hyperparameter optimization of a visual contact detection module based on the EfficientNetB3 architecture
- Tested the generalization of graph neural network position estimator and contact-conditional force estimator from an artificial tissue dataset to a real tissue dataset

Chinese Semantic Automatic Grading System

Oct. 2018 - Jan. 2019

Supervisor: Prof. Zehua Chen (TYUT)

Compared to automatic grading of multiple choice, I focused on employing natural language processing techniques grading of short answer questions. This was achieved through the development of a system capable of analyzing text similarity in Chinese, significantly enhancing the efficiency of educational assessments.

- Segmented Chinese sentences according to part of speech and extracted keywords from them
- Researched a pre-trained word embedding model to calculate the similarity between any two keywords
- Developed a GUI based on Tkinter and implemented a paragraph similarity comparison system

TA EXPERIENCE

TA for CSDS 446 Machine Learning on Graph

Jan. 2024 - Present

- Tutored 26 students during the office hour and graded both assignments and exams

EXTRACURRICULAR INVOLVEMENT

TYUT Robot Team Fighting Robot Project, Team Leader

Dec. 2017 - Aug. 2018

- Designed Robot with SolidWorks, manufactured and assembled the wheel type robot
- Programmed motion planning on STM32 series single-chip microcomputers using C, resulting in the creation of two distinct styles of fighting robots
- Learned MCU programming, employed digital filtering algorithms to address sensor numerical fluctuations, and utilized timer output for high-frequency PWM square wave motor control
- Won the **First Prize** in the 2018 World Robot Contest Fighting Robot Competition (5%)

3D Innovative Design Project, Team Leader

Sep. 2017 - Dec. 2017

- Performed various advanced model pre-processing tasks such as model slicing and support material optimization, for 3D printing and scanning
- Won the **Second Prize** in the National 3D Innovative Design Competition

SKILLS

Programming Languages: Python, Shell Script, C/C++, JavaScript/TypeScript, LaTeX

Utility Tools: SolidWorks, Linux Server, PyTorch/Torchvision, KiCad, OpenWrt, Affinity Designer

Hands-on Practices: Laser Cutting, Stratasys FDM 3D Printer, Soldering Iron