SHUYUAN YANG

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EDUCATION

Case Western Reserve University (CWRU), *Cleveland, OH* Aug. 2022 - Present

MS in Computer Science, GPA: 3.33/4.0

University of West Florida (UWF), *Pensacola, FL* Aug. 2019 - Jul. 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

BE in Software Engineering, GPA: 3.11/4.0

Honor: Individual Scholarship of TYUT in 2017

PUBLICATIONS

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
- Took advantage of DeepLabCut to identify key features in images from the stereo video
- Formulated the pose estimation problem as a visual keypoint alignment problem to be solved by a reinforcement learning agent

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

Vision-based Force Estimation for Telesurgical Robotics May. 2023 - Present

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

SELECTED PROJECTS

Machine Learning Project: Multiple Instance Learning Aug. 2022 - Dec. 2022

Instructor: Prof. Soumya Ray (CWRU)

- Implemented two Multi-Instance Learning algorithms, miBoosting and miFV, using Python
- Utilized Numpy objects and methods to significantly optimize the program's runtime
- Proposed an improvement method and hyperparameter optimization instance that greatly enhanced the accuracy of cross-validation

Capstone Project: Single Page Web Application Development Jan. 2020 - Apr. 2020

Instructor: Dr. Steven P Bitner (UWF)

- Developed a course schedule planner system to help students manage and preview their course selection
- Utilized Git for coordinating group development activities, including module development and bug fixing
- Hosted the system on the cloud, collected data using MongoDB Atlas, and regularly deployed the server and the project on the AWS domain

INTERNSHIP

China Telecom Group System Integration Co., Ltd, Taiyuan Branch Aug. 2021 - Sep. 2021

Intern of the Network Operation Section

- Provided maintenance and solutions for the local network operators
- Helped users to appropriately allocate IPv6 in fiber optic modems and routers, and add Dynamic DNS
- Undertook telecom wireless network coverage test, analyzed and summarized the test data in matplotlib

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 movement and developed fighting strategies 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

Utility Tools: SolidWorks, Linux Server, PyTorch