

# XIAXIN SHEN

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## EDUCATION

- **B.S. Computer Information Technology, Purdue University**

GPA: 3.98 / 4.0

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West Lafayette, IN 47906

## RESEARCH INTERESTS

My research interests include robotics, computer vision, deep learning, machine learning, reinforcement learning, and security

## PUBLICATIONS

### In Preparation (Draft Available)

- **Xiaxin Shen**, Yeji Gong, Haeun Ko, Taeuk Gwak, Jihyeon Noh, Minji Lee, and Eric T. Matson. Uav ground scanning system: Human detection from infrared imagery with deep learning

### Under Review

- Upinder Kaur, Arunashish Datta, Haozhe Zhou, **Xiaxin Shen**, Shreyas Sen, Byung-Cheol Min, and Richard M. Voyles. Rpaag: A reference architecture and testbed for closed-loop precision animal agriculture. In *International National Conference on Cyber-Physical Systems (ICCPS)*. ACM/IEEE, 2022

### Refereed Journal Publication

- David J. Richter, Lance Natonski, **Xiaxin Shen**, and Ricardo A. Calix. Attitude control for fixed-wing aircraft using q-learning. In *International Conference on Intelligent Human Computer Interaction (IHCI)*. Springer, 2021

### Refereed Conference Publication

- Upinder Kaur, Haozhe Zhou, **Xiaxin Shen**, Byung-Cheol Min, and Richard M. Voyles. Robomal: Malware detection for robot network systems. In *2021 IEEE International Conference on Robotic Computing (IRC)*. IEEE, 2021

## AWARDS

- World-wide: 3rd place in the SAE Mobility Forward Challenge: AI Mini-Challenge Competition 2021
- University-wide: Award for Best Visualization in Purdue's 7th Annual ASA DataFest Competition 2021
- Undergraduate Research Grant: X-plane Automatic Flying with Reinforcement Learning 2020
- National-wide: Top 40 and Finalist in the ITA Tech Challenge Programming Competition 2019
- National-wide: Chinese Scholarship Council (CSC) Scholarship 2018

## RESEARCH EXPERIENCE

### UAV Ground Scanning System: Human Detection with Deep Learning

Advisor: Eric T Matson

Team Leader in the IITP Technology Entrepreneurship Program

Jan 2021 - present

- Created LIAEHU dataset comprising low-altitude infrared aerial images for human detection
- Presented an UAV ground scanning system developed with an infrared camera mounted on the UAV to detect human both in the daytime and at night
- Built a warning system for sending real-time notifications with GPS information if the result from the ground scanning system triggers the warning
- Compared and analyzed the performance of several deep learning state-of-the-art models with the LIAEHU dataset including YOLOv3, YOLOv4, YOLOv5, YOLO X, MobileNetSSDv2, and EfficientDet with TensorFlow and Pytorch

### PAAG: Closed-Loop Precision Animal Agriculture

Advisors: Richard M. Voyles & Byung-Cheol Min

Undergraduate Research Assistant

Mar 2021 - Nov 2021

- Proposed a CPS reference architecture for closed-loop precision animal agriculture to deliver individualized care to animals
- Leveraged the uniqueness of animal agriculture in security mechanisms, communication (in-body to out-of-body), and real-time data-driven control
- Augmented low-cost hardware for high-performance in deployment, testing, and validation
- Built long range (LoRa) communication between the smart collar node and the sensor edge node (inset) with the animal body tissues as the medium for data transmission
- Implemented cloud storage and computing by utilizing ThingsBoard to build the dashboard to show sensor value plots temperature, gas, relative humidity, and pressure, based on MQTT protocol

### **Deleted File Persistence Tracking**

**Advisor: Tahir M. Khan**

*Undergraduate Research Assistant*

*Jun 2021 - Oct 2021*

- Recorded 7 sequential images from a single system over time which include operations of deleting files and other activities
- Created DFXML files to represent specific digital forensics artifacts which contain information on all file differences between the two images including deleted, new, and modified files
- Developed a tool to parse DFXML files with Python library lxml and saved results to CSV files
- Analyzed the raw persistence data in terms of byte run, length, image offset, file offset, inode, and hashes

### **RoboMal: Malware Detection for Robot Network Systems**

**Advisors: Richard M. Voyles & Byung-Cheol Min**

*Undergraduate Research Assistant*

*Mar 2021 - Aug 2021*

- Developed the RoboMal dataset using the controller files of the publicly available autonomous car with Gazebo-based simulation for both robotic systems and simpler embedded actuator-based Cyber Physical Systems (CPS)
- Created a total of 450 binary executable and linkable format (ELF) files with 232 malware files and 218 good software files by modifying gains and scalars and manipulating the proportional-derivative (PD) control structure
- Built a bidirectional Long Short-Term Memory (LSTM) based model with embedding for identifying the maliciousness of the code with an accuracy of 85% and precision of 87% which outperforms than other methods like CNN, GRU, and ANN

### **Flow Simulation for Airfoil Images with Autoencoder and CNN**

**Advisor: Tae-Hoon Kim**

*Undergraduate Research Assistant*

*Aug 2020 - Dec 2020*

- Proposed a deep learning-based solution for flow simulation for airfoil images
- Cleaned data with Python for geometry images, data of pressure, velocity, coordinates of X and Y and constructed CSV files with those data
- Built multiple autoencoder models with geometry images and extracted features with different settings of neurons
- Implemented multiple CNN structures and trained models for getting a competitive prediction accuracy for Airfoil pressure and velocity with Python, TensorFlow, Google Colab, and Purdue's Scholar and Gilbreth computing resources

### **Attitude Control for Fixed-Wing Aircraft using Q-Learning**

**Advisor: Ricardo A. Calix**

*Undergraduate Research Assistant*

*Jan 2020 - Nov 2020*

- Proposed a promising automated stabilization model for airplane flight based on Reinforcement Learning (RL)
- Applied algorithms Q-Learning to high dimensional, non-linear and complex tasks with a simulated aircraft Cessna 172 in JSBSim and X-Plane
- Defined a Q-table with the size (states(168), actions(4)) by creating an encoding system by converting discrete action values to continuous values
- Implemented sparse reward function and delta reward function which are trained separately and provides rewards respectively for certain states and all states

## **PROJECT EXPERIENCE**

### **RLEAM Reader: Read, Learn, and Memorize**

*Oct 2021 - Dec 2021*

- Developing RLEAM Reader, which can help users read ebook/documents with a convenient way to lookup dictionary explanations of words and review as well as memorize complex vocabularies with flashcards and forgetting curve
- Implementing the function of querying the meaning of words very conveniently by simple tapping in the read view
- Implementing the function of personalizing favorites lists from the text the user read
- Realizing the association of favorites lists with dates, and helping users review and memorize with flashcards based on the forgetting curve

### **Twitter Scraper**

*Jan 2021 - May 2021*

- Built a web scraping tool to obtain Twitter information by accessing and recording data from the Twitter website with Python library selenium
- Scraped information including user, handle, post dates, tweet texts as well as counts of reply, retweet and like
- Cleaned the data and saved the data to CSV files
- Analyzed and visualized the data with Python libraires: pandas and matplotlib

### **Visualising the Digital Twin Using Augmented Reality Based on Web**

*Jan 2020 - May 2020*

- Presented an application where an Augmented Reality system access the Twin Model data and display real-time information to the user
- Utilized WebAR technology for showing network status, device information and GPS location with the browser of the mobile phone when scanning images through the phone's camera

- Applied three.js, jsartoolkit, and ar.js to the application and utilized jQuery for the ease use of JavaScript

## **E-Commerce Website**

*Team Leader*

*Aug 2019 - Dec 2019*

- Collaborated with 6 students to design and implemented front-end and back-end of the e-commerce website using HTML, JavaScript, CSS, PHP, MySQL
- Utilized distributed application architecture and deployed the database at the Oracle server
- Identified user requirements, drew ER, EER diagram, and created relational schema to build the database

## **Pathway IVY Tech-Purdue Project**

*Student Worker*

*Oct 2018 - May 2019*

- Maintained and improved the Java-based system using the technique of Mybatis, Maven, Spring MVC, Bootstrap, JQuery in order to build a seamless pathway for transfer students
- Implemented a comprehensive framework to evaluate and analyze two programs based on course curriculum, CAE Knowledge Units (KUs), major topics, and NCWF KSAs (Knowledge, Skills, and Abilities)
- Fixed bugs for SQL and data presentation problems in front-end

## **SKILLS**

- **Python:** Implemented data scraping, XML files parsing, data cleaning, data analytics and model building with TensorFlow and PyTorch
- **C/C++:** Implemented data structure and algorithms by finishing about 150 problems at online judge system
- **Java:** Maintained a Java-based system using the technique of Mybatis, Maven, Spring MVC for knowledge mapping. Implemented parallel programming for operating system. Developed Android App: RLEAM Reader
- **Dynamic website development:** Implemented an e-commerce site with HTML, CSS, JavaScript, JQuery, PHP, MySQL
- **Latex:** Edited paper with IEEE/ ACM/ Springer formats
- **Git:** Version control especially for group projects
- **Hadoop & Spark:** Set up a distributed, multi-node Apache Hadoop cluster backed by the Hadoop Distributed File System (HDFS), running on Ubuntu Linux. Ran MapReduce jobs with Hadoop. Deployed Spark and ran NLP tasks with Spark
- **Tableau:** Visualized and analyzed data for illicit drugs in US in Purdue's 7th Annual ASA DataFest Competition

## **REFERENCES**

**Eric T. Matson**

*Professor, Department of Computer and Information Technology, Purdue University*

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**Richard M. Voyles**

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