

JIZTOM KAVALAKKATT FRANCIS PH.D RESEARCH SCHOLAR

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📍 Dept. of Electrical and
Computer Engineering
Dept. of Agricultural &
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Engineering
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Skills

SCRIPTS & PROGRAMMING LANGUAGE

Python

C / C++

MATLAB

PyTorch

Java

OpenCV

C#

APPLICATION SOFTWARE

LabVIEW

Blender 3D

Unity

CANoe

Qt

EBGuide

CVAT

OPERATING SYSTEMS

Windows API

Linux Distros

Contiki

ROS

Kali Linux

HARDWARE PLATFORM

Arduino

Raspberry Pi

ARM Cortex

Embedded CAN module

Nvidia Jetson

PROTOCOLS

ISO 15118

CAN Bus 11898

802.1x

Bluetooth

Education

Iowa State University, Ames, IA, USA

Ph.D Computer Engineering

Master of Science Computer Engineering 2019

Ph.D Research focus : Data Insights using Machine Vision and Deep Neural Networks. GPA - 3.93/4.0

Fall 2017 to Spring 2024

Loyola ICAM College of Engineering and Technology, Anna University, Chennai, India

Bachelors of Engineering Electronics and Communication Engineering 2017

Final Project : ISO 15118 Car charging station protocol. GPA - 7.6/10

June 2013 to May 2017

Employment

3M - Corporate Research Systems Laboratory

Data Science and Engineering Intern

St. Paul, MN, USA

May 2023 to Aug. 2023

- **WandaVision Platform:** Developed a new sensor testing and debugging platform, WandaVision, enabling real-time data visualization and analysis for sensor data.
- **Dewey Duct Project:** Designed a mini wind tunnel using Solidworks to facilitate air flow sensor testing. Achieved a 15% improvement in integration with the WandaVision platform.
- **Data Platform:** Contributed to the development of a data pipeline for camera vision-based modeling of wound imagery, utilizing U-Net for improved accuracy and efficiency.
- Collaborated across diverse teams to conduct iterative testing and deployment of various technologies. Engaged in brainstorming sessions to devise innovative solutions for a range of challenges.

Iowa State University - Agricultural Bio-systems Engineering

Digital Ag Graduate Research Assistant - Machine Vision/ Machine Learning

Ames, IA, USA

Jan. 2021 to Apr. 2023, Aug. 2023 to Current

- **Project:** Multivariable regression using Deep Learning, Seed Object Detection, Insect Classification using sound, SQL Pipeline maintenance.
- **Research:** Impact of additional data layers to images to improve open-world detection of objects and patterns.
- **Paper:** Pattern-Based Multivariable Regression using Deep Learning (PBMR-DL), Deep Learning, and Pattern-based Methodology for Multivariable Sensor Data Regression
- Funded Innovation project to classify insect sounds based on their sound characteristics.
- Automate Data extraction for furrow vision project and create machine learning models for predicting Residue based on Images.
- Written custom automation and pipeline for data loaders and data pre-processing to SQL Servers.
- Actively working on researching Image segmentation and object detection techniques.

Engineer Designer II / Engineer I - Digital Ag

Ames, IA, USA

Jan. 2020 to Dec. 2020

- **Projects:** CAN-based GPS Tagger, CAN-based Third-party Implement integrator, Satellite-Based Farming Prediction, Code first SQL Data Integration, Camera Image Acquisition App
- Programming and Implementing MRS Embedded Modules for Off-road vehicular CAN-based controller for specialized research products.
- Scripting custom process automation code for Data analytics and SQL Uploads with Backup protocols.
- Setting up and providing in-house support for VM-based products and file transfers with ext4 file format support.
- Designed a custom Android App for more efficient documentation in image capture for Project records.
- Embedded solutions to improve data collection capability in the research of the Agricultural Bio-systems Domain.
- MATLAB-based automation for visualizing and processing Satellite Imagery data to predict crop production and growth loss using NDVI.

Graduate Research Assistant - Digital Ag

Ames, IA, USA

Jan. 2019 to Dec. 2019

- **Projects:** Sensing Objects in Multiple Terrain, Advanced Machinery Data logger Units
- Implementing vision systems and mapping tools to achieve the required goals for the research group using tools such as MATLAB and LabVIEW.
- Sort out the Technological Challenges the Agricultural segment face and find ways to solve and improve overall efficiency.
- Working on supporting Linux-based data logging systems at the hardware level.
- Program Embedded products to suit the required client and internal needs of the research group.

GE Appliances

Fall 2018 AME Co-Op

Lafayette, GA, USA

Aug. 2018 to Dec. 2018

- **Projects:** In-Line Camera Test System, Embedded Inventory control label system.
- Controls and Test Co-op Engineer in the Advanced Manufacture Engineering group.
- Prototype new test modules or procedures to improve manufacturing efficiency using python and proprietary software codes.
- Maintain and rectify the test sequence for new builds.
- Create a custom part tracker for the electronics flashing stations to backtrack uploaded software and inventory.

Iowa State University - Dept of Electrical and Computer Engineering

Graduate Research Assistant - IoT

Ames, Iowa, USA

May 2018 to Aug. 2018, Jan. 2019 to Dec. 2019

- **Project:** Long Range Irrigation Monitoring System
- **Research:** Long Range Low Power IoT devices data collection and power analysis.
- Research Assistant on the Internet of Things (IoT) Research Group developing a Wireless Sensor Network for Precision Agricultural Domain. (Smart Farming)
- Design custom data logger with wireless capability at a generic level. Using Python at the high-level post-processing and C++ at the firmware level.
- Enable future technologies to include temporary storage and additional sensor option for the specific farming application.

Projects

Fall 2021 to Spring 2022

Deep Learning and Pattern-based Methodology for Multivariable Sensor Data Regression

- **Requirement:** Prove a faster approach to solving regression using lower computation requirements while increasing the accuracy of sensor fusion.
- Using historic crop data to predict future crop yield based on data about the weather during the entire season.
- Proved that 2D numerical data can be used with large-scale unique data for pattern detection.
- Proposed multiple applications to simplify regression using advanced pattern detection techniques.

Spring 2022 to Current

Residue Prediction - Machine Learning Modelling

- **Requirement:** Isolate residue and compute residue percentage based on imagery.
- Automate data extraction to generate images to produce an in-house dataset.
- Isolate images to which ground truth for labeling. Use labeled data to create machine learning models for predicting residue.
- Verify new techniques of data processing and see if additional vehicular data can improve prediction results.

Jan. 2019 to Feb. 2020

Stubble Height Detection for Sugar Cane - Sensor Automation

- **Requirement:** Design and develop a tool to measure and adjust the cutting blade for sugar cane harvester.
- Custom algorithm to get the required live stubble height based on LIDAR line scan data.
- Provide feedback to the system to get the blades adjusted to obtain the maximum yield.
- Procured data and provide proof of concept to the client by field testing.

Jan. 2020 to Current

Data Pipeline - SQL uploader - Automation

- **Requirement:** Process incoming client data over FTP and upload it into the SQL Server at set intervals with customized solutions
- Using C# with Entity framework for Code First Database model to upload filtered data into SQL Server.
- Combined multi-code platforms to utilize string manipulation capability with SQL integration capability of C# to improve multithreaded performance.
- Process and prevent duplicate of incoming client Flat Files uploads and provide efficient archive directory architecture for easier SQL query data.

Fall 2021 to Summer 2022

Y drop Estimation - Machine Vision - Automation

- **Requirement:** Design a custom Machine Vision software to isolate prongs for distance detection
- Isolate color bands using HSV Spectrum to detect prongs on running sprayers. Isolating effects of sunlight and moving vibrations
- Populate the detected prong distance based on calibrated data to on-site field-testing.

Publications

Cloud-based multi-sensor remote data acquisition system for precision agriculture (CSR-DAQ) - Master's Thesis

Spring 2018 to Fall 2019

- **Requirement:** Design a cost-effective and accurate data logger for IoT-based information gathering and prediction for the horticulture department.
- Developed the prototype Data logger at stage 4 with a power management cycle perfected to run an entire crop season.
- The end product allows a layman to visualize and measure data of the field as a part of Smart Farming.

Pattern Based Multivariable Regression using deep Learning (PBMRL) - CVPR 2022 - <https://arxiv.org/abs/2202.13541>

Fall 2021 to Mar. 2022

Extended Abstract on current research into using Data as images for pattern recognition using normalized values from sensor. Published in CVPR as extended abstract under the LatinX in AI workshop.

Deep Learning and Pattern Based Methodology for Multivariable Sensor Data Regression - ICMLA 2022

Fall 2021 to Apr. 2022

We propose a deep learning methodology for multivariate regression that is based on pattern recognition that triggers fast learning over sensor data. We used a conversion of sensors-to-image, which enables us to take advantage of Computer Vision architectures and training processes. In addition to this data preparation methodology, we explore the use of state-of-the-art architectures to generate regression outputs to predict agricultural crop continuous yield information. Finally, we compare with some top models reported in MLCAS2021. We found that using a straightforward training process, we were able to accomplish an MAE of 4.394, RMSE of 5.945, and R^2 of 0.861.

Hackathons

HackISU Fall 17 - MLH Hackathon
Ames, Iowa, USA

Fall 2017

- **Problem:** Use machine vision tools provided to solve real-world problems.
- **Prize:** First place in innovation using Image-based self-adjusting machine automation
- A 36 hour no sleep hackathon to learn, explore, and develop new ideas based on challenges presented by the sponsor companies.
- Completed the Image perception and detection challenge and won a desktop 3D printer as the challenge prize.
- Created a video-based self-stabilizing hardware system based on QR codes and video input streams. This can be used to replace wire-based sensors for testing hardware.

HackISU Spring 18 - MLH Hackathon
Ames, Iowa, USA

Spring 2018

- **Problem:** Solve Augmented Reality Project.
- A self-learning challenge to solve an unknown problem using the skills learned during the event.
- Using Real Engine and VR tools to project Augmented reality applications on everyday objects.
- Learn new programming languages and tools to apply solutions to see how it works.
- Created an application to show physical objects with reactive buttons and gravity to teach actions and automation via Augmented Reality.