

# JIZTOM KAVALAKKATT FRANCIS PH.D RESEARCH SCHOLAR

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📍 Dept. of Electrical and  
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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 : Machine Vision and Machine Learning on Real World Applications. GPA - 3.93/4.0

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

Fall 2017 to Current

June 2013 to May 2017

## Employment

Iowa State University - Agricultural Bio-systems Engineering

Digital Ag Graduate Research Assistant - Machine Vision/ Machine Learning

Ames, IA, USA

Jan. 2021 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 in 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.

Hochschule Heilbronn (University of Heilbronn), Germany

Senior Design Project Intern

Heilbronn, Baden-Württemberg, Germany

Feb. 2017 to Mar. 2017

- **Research:** ISO15118 Protocols and deployment for car charging stations.
- Developed Display driver for ISO15118-based Car Charging Station written in C case structure.
- Led a three-member team, with a specific focus on back-end drivers for the display unit.

## Projects

Fall 2021 to Spring 2022	<b>Deep Learning and Pattern-based Methodology for Multivariable Sensor Data Regression</b> <ul style="list-style-type: none"><li>• <b>Requirement:</b> Prove a faster approach to solving regression using lower computation requirements while increasing the accuracy of sensor fusion.</li><li>• Using historic crop data to predict future crop yield based on data about the weather during the entire season.</li><li>• Proved that 2D numerical data can be used with large-scale unique data for pattern detection.</li><li>• Proposed multiple applications to simplify regression using advanced pattern detection techniques.</li></ul>
Spring 2022 to Current	<b>Residue Prediction - Machine Learning Modelling</b> <ul style="list-style-type: none"><li>• <b>Requirement:</b> Isolate residue and compute residue percentage based on imagery.</li><li>• Automate data extraction to generate images to produce an in-house dataset.</li><li>• Isolate images to which ground truth for labeling. Use labeled data to create machine learning models for predicting residue.</li><li>• Verify new techniques of data processing and see if additional vehicular data can improve prediction results.</li></ul>
Jan. 2019 to Feb. 2020	<b>Stubble Height Detection for Sugar Cane - Sensor Automation</b> <ul style="list-style-type: none"><li>• <b>Requirement:</b> Design and develop a tool to measure and adjust the cutting blade for sugar cane harvester.</li><li>• Custom algorithm to get the required live stubble height based on LIDAR line scan data.</li><li>• Provide feedback to the system to get the blades adjusted to obtain the maximum yield.</li><li>• Procured data and provide proof of concept to the client by field testing.</li></ul>
Jan. 2020 to Current	<b>Data Pipeline - SQL uploader - Automation</b> <ul style="list-style-type: none"><li>• <b>Requirement:</b> Process incoming client data over FTP and upload it into the SQL Server at set intervals with customized solutions</li><li>• Using C# with Entity framework for Code First Database model to upload filtered data into SQL Server.</li><li>• Combined multi-code platforms to utilize string manipulation capability with SQL integration capability of C# to improve multithreaded performance.</li><li>• Process and prevent duplicate of incoming client Flat Files uploads and provide efficient archive directory architecture for easier SQL query data.</li></ul>
Fall 2021 to Summer 2022	<b>Y drop Estimation - Machine Vision - Automation</b> <ul style="list-style-type: none"><li>• <b>Requirement:</b> Design a custom Machine Vision software to isolate prongs for distance detection</li><li>• Isolate color bands using HSV Spectrum to detect prongs on running sprayers. Isolating effects of sunlight and moving vibrations</li><li>• Populate the detected prong distance based on calibrated data to on-site field testing.</li></ul>

## Publications

Cloud-based multi-sensor remote data acquisition system for precision agriculture (CSR-DAQ) · Master's Thesis	Spring 2018 to Fall 2019
<ul style="list-style-type: none"><li>• <b>Requirement:</b> Design a cost-effective and accurate data logger for IoT-based information gathering and prediction for the horticulture department.</li><li>• Developed the prototype Data logger at stage 4 with a power management cycle perfected to run an entire crop season.</li><li>• The end product allows a layman to visualize and measure data of the field as a part of Smart Farming.</li></ul>	

Pattern Based Multivariable Regression using deep Learning (PBMR-DL) · CVPR 2022 - <a href="https://arxiv.org/abs/2202.13541">https://arxiv.org/abs/2202.13541</a>	Fall 2021 to Current
<p>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 <math>R^2</math> of 0.861.</p>	

## Hackathons

HackISU Fall 17 · MLH Hackathon Ames, Iowa, USA	Fall 2017
<ul style="list-style-type: none"><li>• <b>Problem:</b> Use machine vision tools provided to solve real-world problems.</li><li>• <b>Prize:</b> First place in innovation using Image-based self-adjusting machine automation</li><li>• A 36 hour no sleep hackathon to learn, explore, and develop new ideas based on challenges presented by the sponsor companies.</li><li>• Completed the Image perception and detection challenge and won a desktop 3D printer as the challenge prize.</li><li>• 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.</li></ul>	
HackISU Spring 18 · MLH Hackathon Ames, Iowa, USA	Spring 2018
<ul style="list-style-type: none"><li>• <b>Problem:</b> Solve Augmented Reality Project.</li><li>• A self-learning challenge to solve an unknown problem using the skills learned during the event.</li><li>• Using Real Engine and VR tools to project Augmented reality applications on everyday objects.</li><li>• Learn new programming languages and tools to apply solutions to see how it works.</li><li>• Created an application to show physical objects with reactive buttons and gravity to teach actions and automation via Augmented Reality.</li></ul>	