

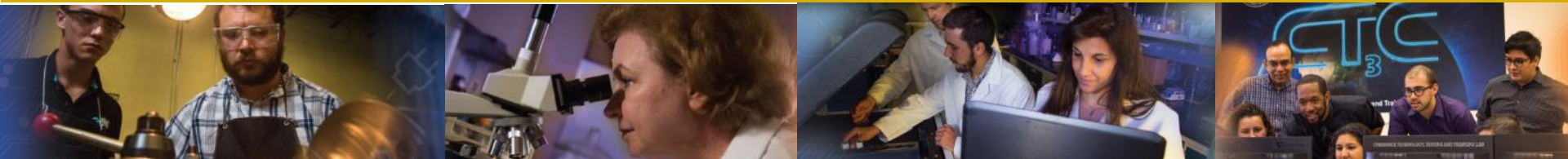


FIU Project 3 – Waste and D&D Engineering and Technology Development

Presented: August 7, 2019

Dr. Himanshu Upadhyay

FLORIDA INTERNATIONAL UNIVERSITY





Project Tasks and Scope

Task 1 Waste Information Management System (WIMS)

- Manage complex-wide waste forecast information for planned treatment/disposal
- Provide web-based system to receive, organize, and report DOE waste forecast streams via a common application

Task 3 Knowledge Management Information Tool (KM-IT)

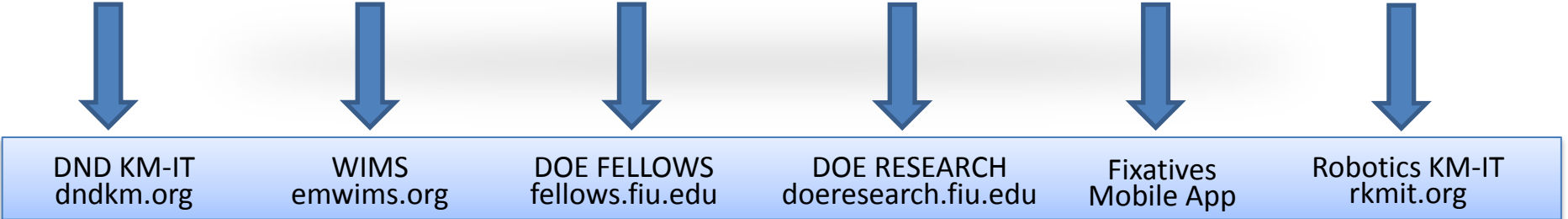
- Maintain and preserve D&D knowledge by enhancing communication, information sharing, and distribution to assist future D&D projects and workforce

Task 6 Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies

- Develop a pilot-scale infrastructure using machine learning/deep learning and big data technologies for structural health monitoring of facilities using investigate a imaging technologies deployed at FIU mock up facilities



Knowledge Base for Environmental Management



DND KM-IT
dndkm.org

WIMS
emwims.org

DOE FELLOWS
fellows.fiu.edu

DOE RESEARCH
doersearch.fiu.edu

Fixatives
Mobile App

Robotics KM-IT
rkmit.org





Knowledge Base for Environmental Management



Knowledge Base for Environmental Management

D&D KM-IT
Deactivation & Decommissioning Knowledge Management Information Tool

Modules: *Powered by the Global D&D Community*

License/Contract	Best Practices	Phone/Voice Library	Document Library
Specialized Database	Inspection	Collaboration Tools	Training

D&D Knowledge Management Information Tool

D&D KM-IT is a web-based knowledge management information tool custom-built for the deactivation and decommissioning

Waste Information Management System

Waste Disposition GIS Map

Waste Information Management System

Robotics KM-IT
Knowledge Management Information Tool

Robotics Knowledge Management Information Tool

Mobile, Lessons Learned, PDRon Video Library, Document Library, Collaboration Tools, Training

The technology module provides comprehensive

D&D KM-IT Mobile

GET IT ON Google Play

Download on the App Store

Fixative Native App

Deactivation and Decommissioning Mobile Platform

FIU Applied Research Center DOE Research

DOE / FIU Cooperative Agreement

DOE / FIU Cooperative Agreement Research

Student Connection Zone

DOE / FIU Science & Technology WorkForce Development Initiative

About KBEM

The KBEM provides a common interface for all IT applications for DOE EM developed and maintained by the Applied Research Center at Florida International University. The Knowledge Base for Environmental Management (KBEM) provides a unified system of knowledge management (community of knowledge) for the Department of Energy Office of Environmental Management (DOE EM) and includes the following major areas: Deactivation and Decommissioning (D&D), Soil and Groundwater (S&GW), Waste Processing, and International Knowledge



<https://kbem.org/>



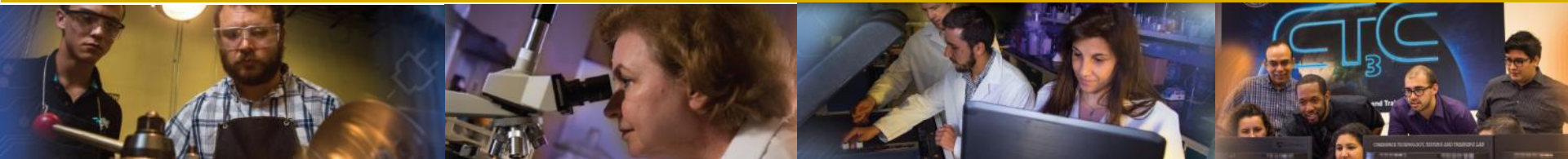
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Knowledge Management Information Tool (KM-IT)

www.dndkm.org

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KM-IT Modules

- D&D Hotline
- Technology Module
- Vendor Module
- D&D Research
- Mobile applications
- Lessons Learned
- Documents
- Pictures/videos
- Search tools
- Training
- Specialists
- Best Practices

www.dndkm.org

The screenshot shows the D&D KM-IT website interface. At the top, it says "D&D KM-IT" and "Deactivation & Decommissioning Knowledge Management Information Tool". There is a search bar and a "Search" button. Below that, there are navigation tabs: "Home", "Contribute", "About", and "Contact". A "Welcome Guest" message and a "Login" button are also present. The main content area features a large map of the United States and the text "Powered by the Global D&D Community". Below this, there is a grid of yellow buttons for various modules: "Hotline", "Technology", "Web Crawler", "Mobile System", "Lessons Learned", "Best Practices", "Picture Video Library", "Document Library", "Specialist Directory", "Vendors", "D&D Research", and "Training". There are also buttons for "U.S. Registration" and "International Registration". A section titled "Additional Features" includes "D&D RESEARCH", "Fixative Module", "ITSR Module", "Search SRS ISSC Reports", and "Prioritization Tool". A "Quick Links" section lists "DOE EM D&D", "SRS ISSC", "ALARA Center", "EFCOG", and "COGENTUS". The bottom section features "Industry News" with articles like "Demolition Continues at Hanford's Plutonium Finishing Plant" and "SRS Employees Further Safety, Create Efficiencies in Plutonium Downblending". A "Contribute" button is prominently displayed with the text "Share your knowledge and experience through D&D KM-IT."



Task 3 – Knowledge Management Information Tool (KM-IT)

Accomplishments Year 9:

- KM-IT development and enhancement.
- FIU completed enhancing and optimizing the web crawler to search and retrieve information related to D&D from within KM-IT as well as from OSTI and identified internet sources/websites.
 - Search KM-IT
 - OSTI Search
 - Search Web

D&D KM-IT
 Deactivation & Decommissioning Knowledge Management Information Tool

Home | Contribute | About | Contact | More Modules

Web Crawler | Search D&D KM-IT | Search WEB | OSTI Search | Help

Search the D&D KM-IT: Search

Welcome Guest | Login

Share page:

Web Crawler

Search the web or the D&D KM-IT for all of your D&D needs.

D&D KM-IT features two types of search capabilities. The first integrates a Google-type web search process into D&D KM-IT, which allows the user to search the web in a manner similar to a Google search without leaving the D&D KM-IT system. The difference is that this type of search only retrieves information from predefined D&D websites which helps to reduce irrelevant results. The second type of search capability provides a search of the entire D&D KM-IT repository across all of the modules (ALARA Reports, Technology, Lessons Learned, Best Practices and more).

Web Crawler

- Lessons Learned (5.1)
- Best Practices (5.2)
- Document Library (5.3)
- General Information (5.4)
- News/Alerts (5.5)
- Video/Picture Library (5.6)

Google Search Integration

- OSTI Info Bridge
- OSTI Lessons Learned
- Science.gov
- NBC
- OSHA
- CRSSE
- MLA
- Science Accelerator

Provide Google Search Capability From D&D KM System

Want to Show Up In Our Results? Contact us so that we may index your website for use with our crawler.

[Contact Us](#)

[Search D&D KM-IT](#) | [Search WEB](#) | [OSTI Search](#)

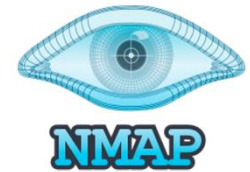


Task 3 – Knowledge Management Information Tool (KM-IT)



Accomplishments Year 9:

- Researchers and DOE Fellows continued to research the latest penetration testing, malware analysis and forensics tools to secure KM-IT system and infrastructure
 - Regularly performed penetration testing on network, KM-IT database and application servers.
 - Trained DOE Fellows in DOE-EM Cybersecurity lab on advanced security tools commonly used in the industry.

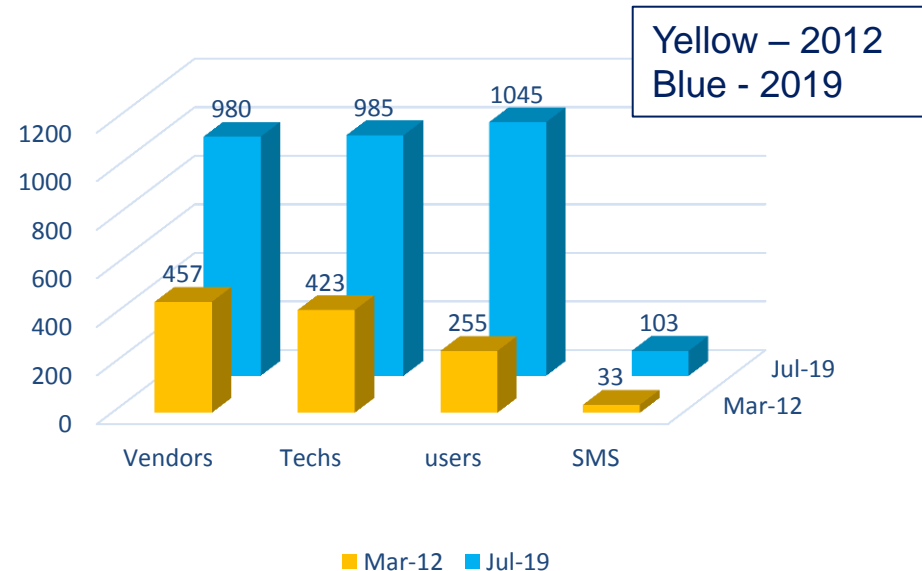




D&D KM-IT Statistics as of July 2019



- D&D KM-IT web analytics to track usage metrics.
- 985 D&D technologies
- 1045 registered users
- 980 D&D vendors
- 195 Hotline questions/solutions
- 103 subject matter specialists



Growth from March 2012 to July 2019

Fully searchable resources – Original sources no longer available

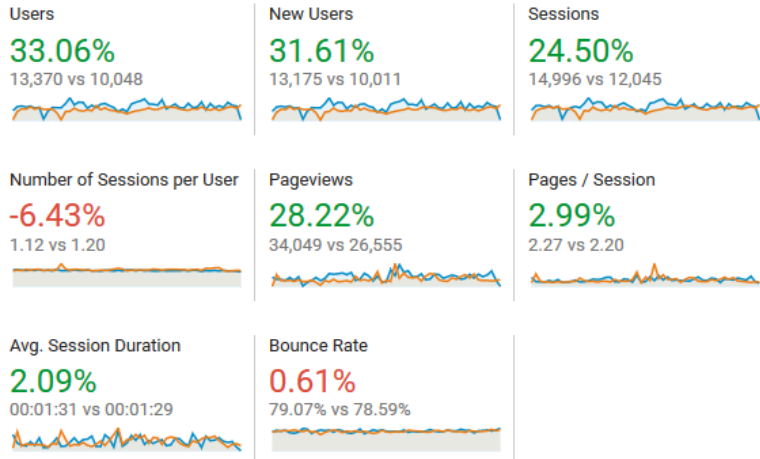
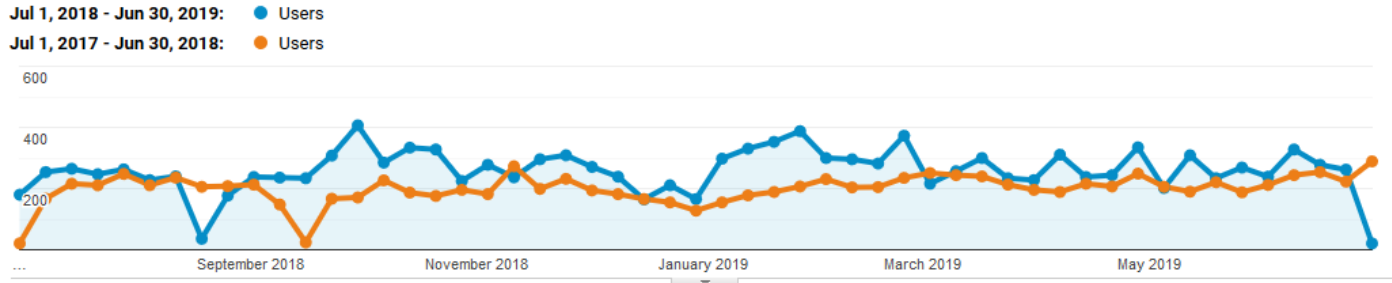
- 169 ALARA Center reports archived (Hanford and SRS)
- 231 Innovative Technology Summary Reports archived



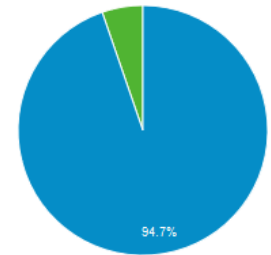
D&D KM-IT Statistics as of July 2019



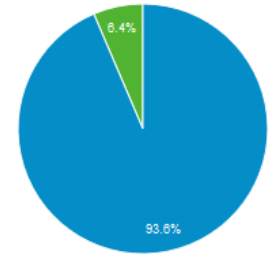
- Year comparison activity on D&D KM-IT (2019 vs 2018)
- Double digit percentage increase on: Users, New users, Sessions and Pageviews
- Minor increase on: Pages per session and Avg. session duration
- Unchanged bounce rate



■ New Visitor ■ Returning Visitor
 Jul 1, 2018 - Jun 30, 2019



Jul 1, 2017 - Jun 30, 2018





Task 3 – Knowledge Management Information Tool (KM-IT)



Accomplishments Year 9:

- FIU presented D&D KM-IT research at WM2019, demonstrated at FIU booth and student alumni pavilion

Abstract: 19107

Title: Robotics on KM-IT Platform

Authors: Himanshu Upadhyay,
Walter Quintero, Leonel Lagos,
Peggy Shoffner

Session: D&D General - Posters





Task 3 – Knowledge Management Information Tool (D&D KM-IT)



Proposed Scope for Year 10

- KM-IT Development and Enhancement
 - Enhance D&D Research module for multiple DOE EM sites, universities and national labs
- KM-IT Outreach – Community Support
 - Participation in industry conferences and workshops
 - Newsletters and mass communications
 - User support, including requested ad hoc specialized reporting
- KM-IT Maintenance & Administration
 - Cybersecurity & Administration of KM-IT Infrastructure
 - Content Management (Published technologies/vendors, news, lessons learned/best practices on the KM-IT platform)
 - Web Analytics (Quarterly update of Google analytics, server log analysis, and metrics reporting)
 - KM-IT Application and Database hardware upgrade



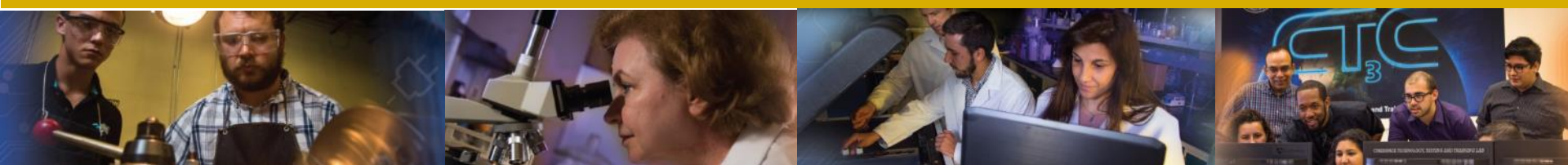
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Waste Information Management System (WIMS)

<https://www.emwims.org>

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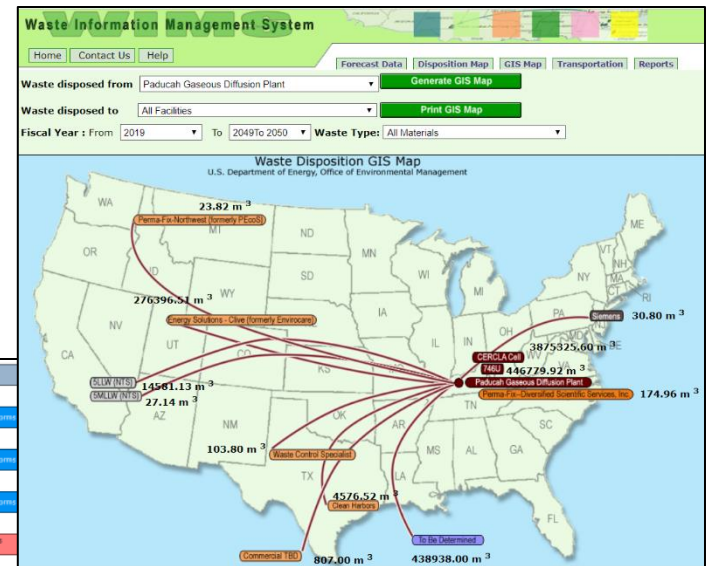


Task 1 – Waste Information Management System



Accomplishments Year 9:

- Easy-to-use tool to visualize and understand the forecasted DOE-EM waste streams & transportation information.
- WIMS is deployed and available at <https://www.emwims.org>
- Various modules of WIMS are Forecast Data, Disposition Map, Successor Stream Map, GIS Map, Transportation, Reports and Help.



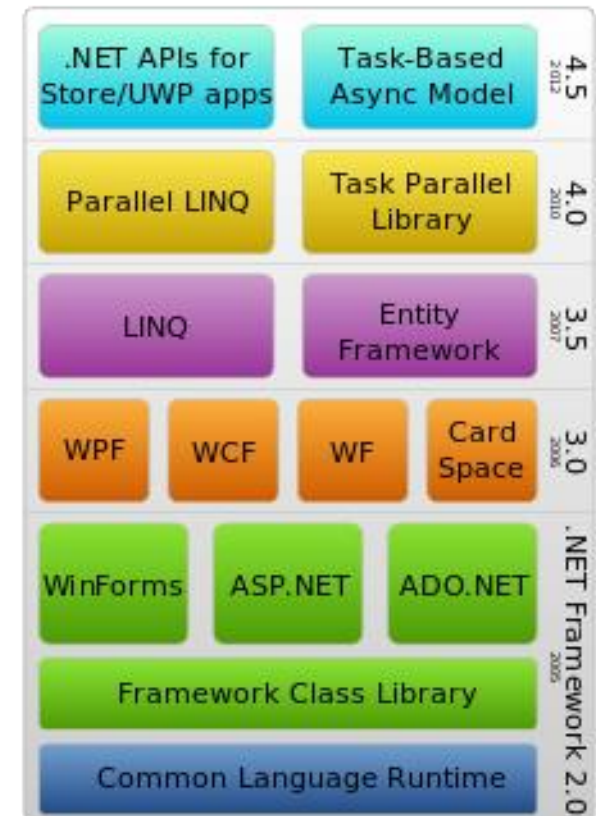


Task 1 – Waste Information Management System



Accomplishments Year 9:

- Upgraded WIMS application framework & published updated system on March 30, 2019.
- FIU successfully upgraded the WIMS application to the latest Microsoft.Net framework 4.6.1 from framework 1.1 (Win 2003)
 - Deployed Database and Application servers with updated framework.
 - Configured WIMS application to execute on upgraded framework.
 - Upgraded WIMS components, controls and modules to the new framework.





Task 1 – Waste Information Management System



Accomplishments Year 9:

- FIU presented WIMS research in 2019 Waste Management Symposia.

Title: Waste Information Management System with 2018-19 Waste Streams

Authors: Himanshu Upadhyay, Walter Quintero, Leonel Lagos, Peggy Shoffner

Abstract and Session: 19106, Poster Session 2 – Characterization



Walter Quintero presenting WIMS poster at WM2019



Task 1 – Waste Information Management System



Proposed Scope for Year 10

- Integrate 2020 waste stream and transportation data into WIMS.
 - Update WIMS modules – Forecast Data , Waste Stream and GIS map
 - Update and Publish reports
 - Update and Publish Transportation Module
 - Publish updated application on secured socket layer
- WIMS Identity Management
 - Design and develop Registration Database
 - Develop Authentication Module
 - Authorization Module Development
- Upgrade WIMS Report Server & Report Function
 - Deploy and integrate report server
 - Design, develop and publish reports
 - Integrate report in WIMS application

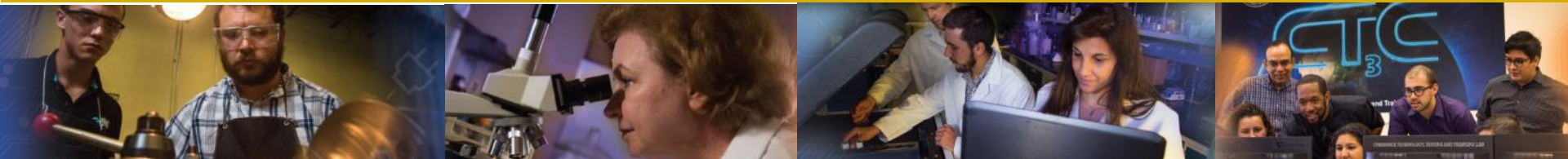


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Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies

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Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Site Needs:

Assess the structural integrity of aging facilities in support of ongoing surveillance and maintenance (S&M) across the DOE complex.

Objectives:

Under this subtask for FIU Performance Year 9, FIU will develop a pilot-scale infrastructure to implement structural health monitoring using scanning technologies, machine learning / deep learning and big data technologies. This pilot system is intended to serve as a starting point to engage the DOE field sites on related data sets and their decision making needs.



Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9:

- Set up mock-wall in outdoor test facility that simulates structural conditions of D&D facility.
- Collected over 28,000 images from different wall sections.
- Data variation contains different light exposure, wall angles and scale ratios.
- Image data sets are stored in the Big Data Platform.
- Data subsets are replicated in local storage networks for increased I/O transfers.



Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9:

Baseline Model Development and Categorization

The baseline was created from images collected from the outdoor D&D mockup facility.



- A total of 28,000 images were collected.
 - 14,000 images were classified as “baseline” (all sections containing “CL” tag).
 - 14,000 images were classified as “deteriorated”.

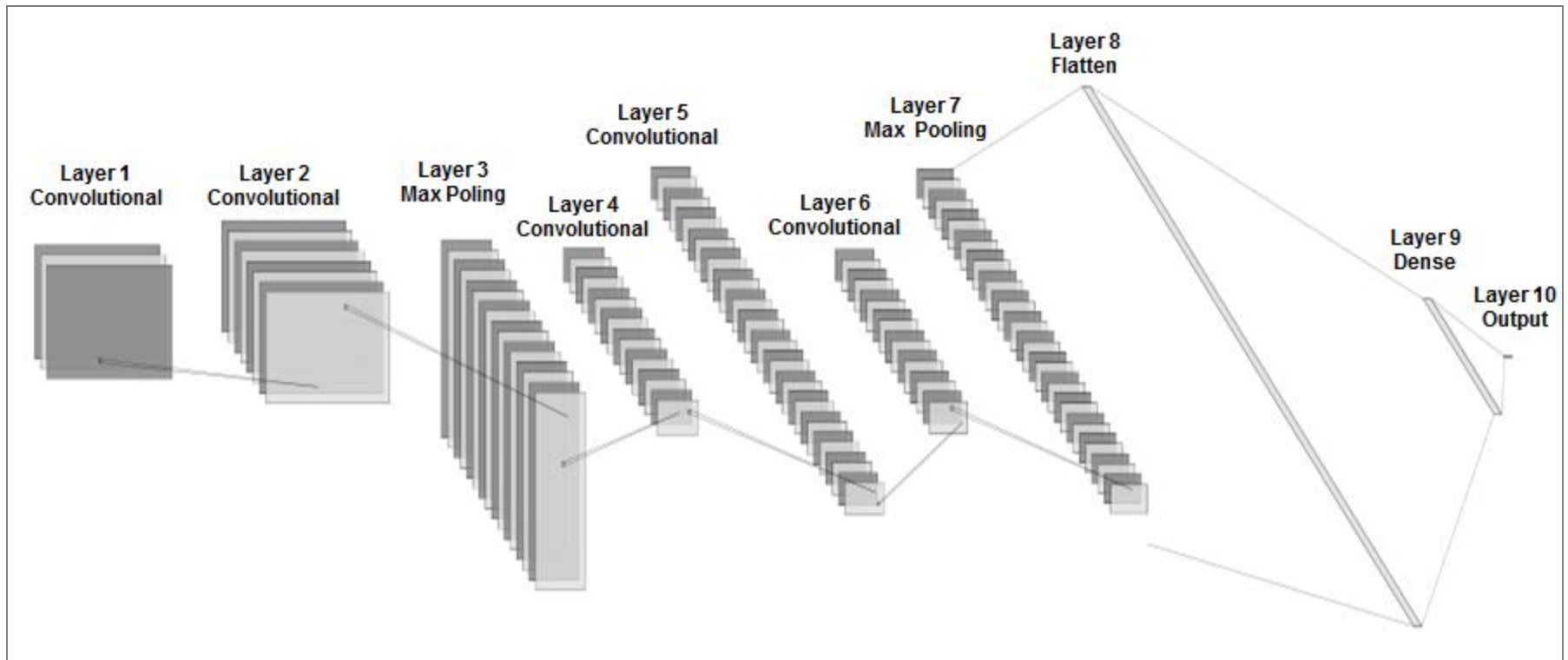


Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9:

Deep Convolutional Neural Network Architecture:

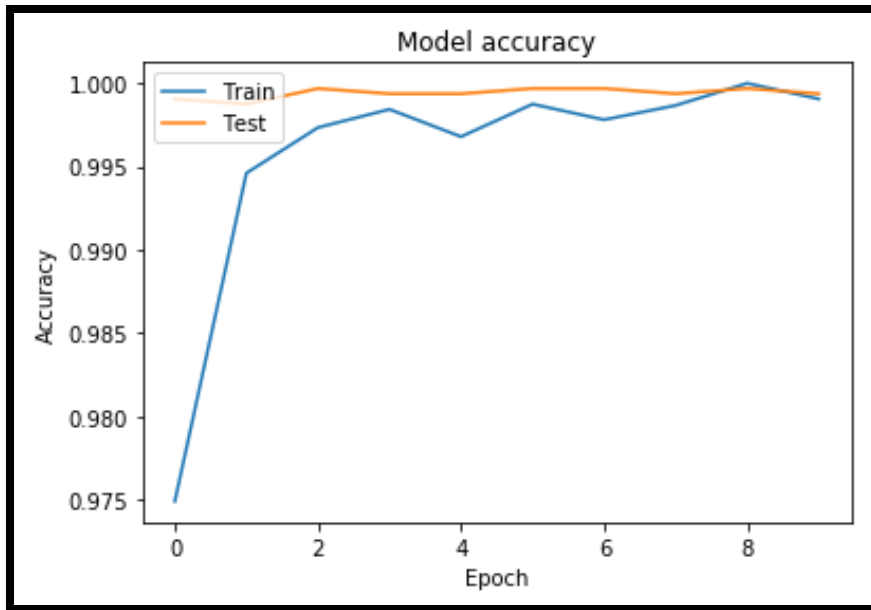




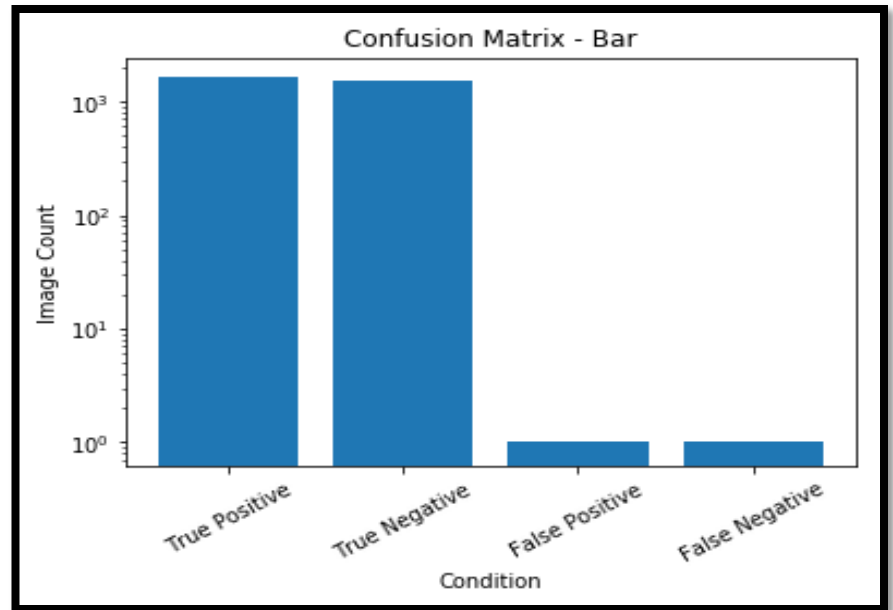
Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9: Results



Model Accuracy



Confusion Matrix



Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9: Classification of Wall Images

Sample Baseline Images



Input image feed to CNN model for Classification



Model Prediction = “Baseline”
94.35% probability



Model Prediction = “Degraded”
97.13% probability



Model Prediction = “Baseline”
87.63% probability



Model Prediction = “Degraded”
97.16% probability



Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9:

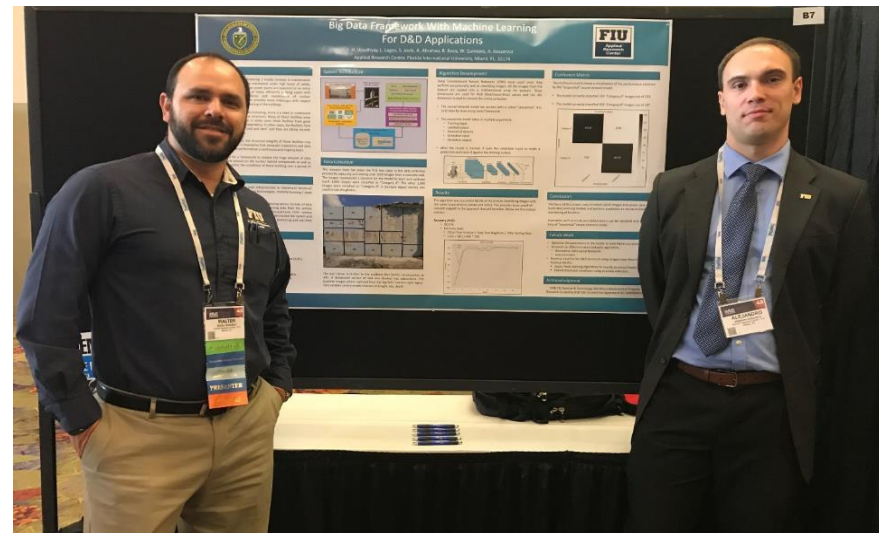
Presented this research at WM2019.

The poster focused on the methodology and approach of this research. Conference attendees had a lot of interest in this research focused on Artificial Intelligence and Big Data technologies.

Abstract: 19108

Title: Big Data Framework with Machine Learning for D&D Applications

Authors: Himanshu Upadhyay, Leonel Lagos, Anthony Abrahao, Walter Quintero, Santosh Joshi



Walter Quintero and Alejandro Koszarycz at WM2019 presenting poster.

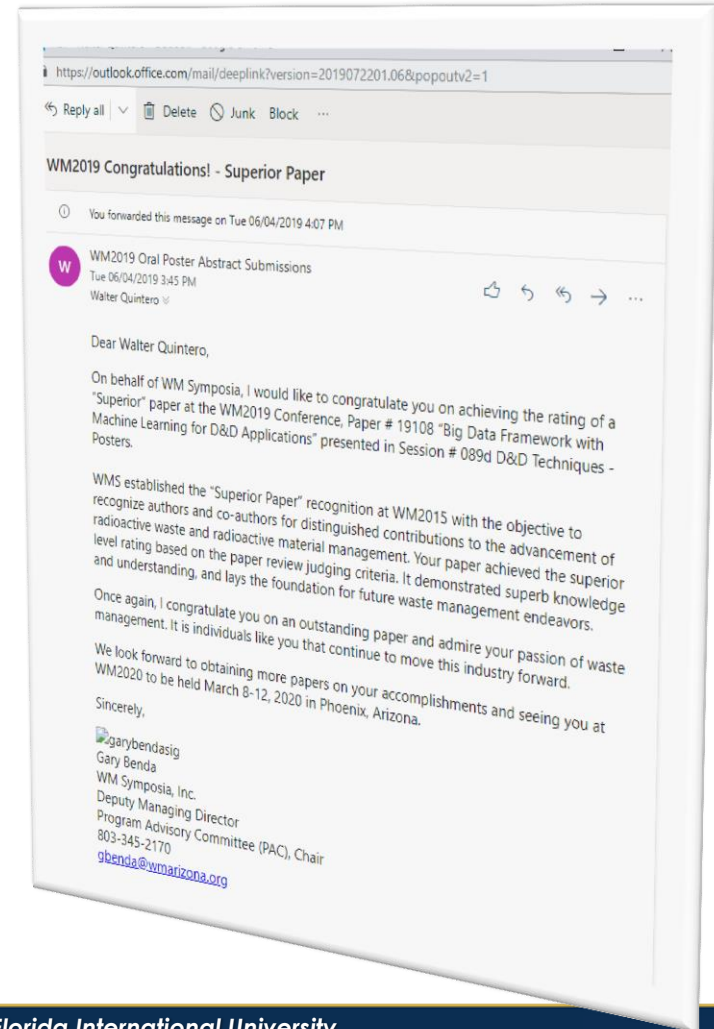


Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Accomplishments Year 9:

WM Symposia awarded the rating of a “Superior Paper” for the “Big Data Framework with Machine Learning for D&D Applications” paper.





Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Proposed Scope for Year 10

- FIU will use the LiDAR technology to collect point cloud data by scanning the D&D mock up facility at FIU.
- The point cloud data collected from LiDAR will be stored on a Hadoop distributed file system for storage and processed with distributed nodes using parallel processing.
- FIU will continue to work on the development and optimization of the convolutional neural network algorithm to classify structural wall images using the point cloud data and images.
- FIU will research, design and develop the object recognition algorithm using computer vision to identify cracks and structural defects in the mock up wall.



Task 6 – Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies



Proposed Scope for Year 10

- FIU plans to deploy an integrated big data and machine learning server infrastructure using Docker containers and a Kubernetes orchestration framework for image data storage and processing.
- Algorithms and big data technologies developed under this research will help in surveillance and maintenance of D&D buildings to identify cracks, defects and other irregularities using LiDAR or other scanning/imaging technologies.
- Identifying anomalous sensor data collected from various monitoring applications across DOE-EM sites.
- This research task will also support the Ph.D. studies of the DOE Fellow – Roger Boza working on image recognition, neural network design and optimization for image processing and object recognition.