AUTONOMY RESEARCH CENTER FOR STEAHM

Autonomy for Sustainability

Workers And Technology Together (WATT)

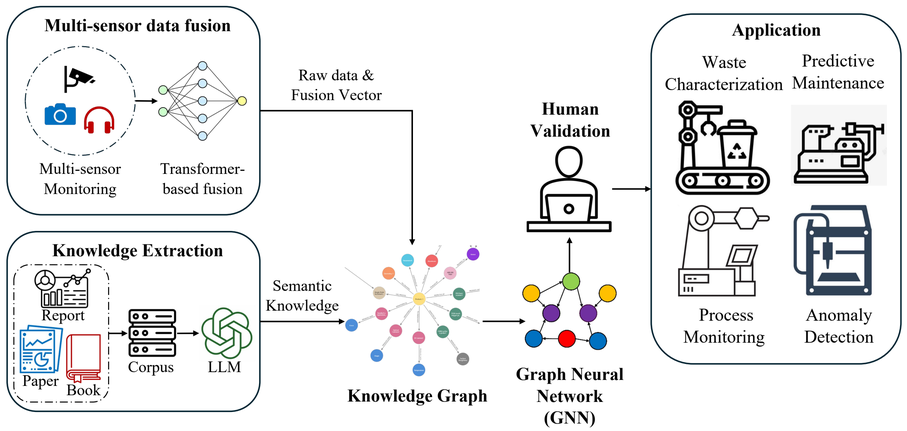


Fig 1. KG and data fusion-based monitoring and diagnosis framework

Fig 2. Real time Detection result

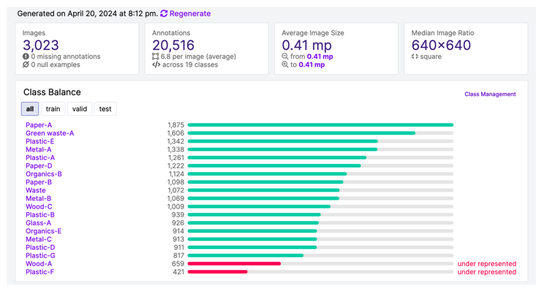


Fig 3. Dataset visualization

Machine vision for Waste Detection (Real-time ops vs off-line model development)

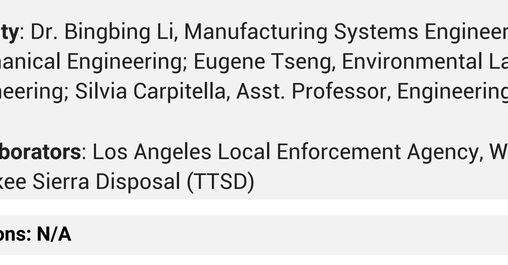
OFF-LINE

Model Preparation & Training

1. Collect Data (Images)
2. Annotate and label images manually (Review of datasets)
3. Train Model (YOLOv8 and SSD)

- MODEL Preparation
- MODEL Training

REAL-TIME OPS



- MODEL Deployment
- MODEL Prediction

Fig 4. Model Development in Real-time vs Off-line

Synopsis

- Workers and Technology Together (WATT) aims to provide socio-technological solutions to address the challenges with separation, conversion to energy, adaptation of best practices, and climate change analyses in the context of organic waste processing.
- The project will help determine if applying autonomy technologies to key organic waste processing functions will increase the capture of organic waste, reduce hazardous job functions for line workers and enforcement agents, and increase efficiency and profitability of organic waste processing.
- The students will leverage multi-sensor data fusion to develop highly intelligent AI model for waste sorting and management.

Research Objective

- WATT will facilitate convergence research, employing multidisciplinary perspectives to better understand the “pain points” for individual workers, owner/operators, enforcement agents, and across the organic waste processing infrastructure.
- From this research, the project team will develop frameworks — legal & business, sociological/anthropological/psychological, computer science/engineering/robotics — to produce a concept of operations for implementing automation technologies into the processing of organic waste.

Research Approach

- Based on the analyzed pain points, the project team will develop frameworks (sociological/anthropological/psychological/design, legal & business, computer science/engineering/robotics) to produce a concept of operations (ConOp) for implementing automation technologies into the processing of organic waste, and ensuring workers are trained to work alongside and in collaboration with assistive technology.

Research Results and Products

- Develop a highly intelligent AI model that can integrate multimodal data (captured by optical, thermal, IR, acoustic, density, and chemical sensors), digital twin, robotics, AI reasoning, and machine learning to harness, interpret, predict, and guide the optimization of the operation and behavior and safety of material recovery facility workers.
- Build and validate AVATAR technology (AI-powered Vision and Augmented reality for Teleoperation Assisted Recycling) by adapting the scientific methods of computer vision, AI, and inference engines to provide intuitive and personalized assistance to workers performing complex reasoning and problem-solving tasks.

Commercialization and/or Societal Impact Opportunities

- **Application:** Develop an AI model to help workers, owners, and operators leverage cutting-edge waste management technology
- **Key Values:** Improve the operational efficiency and working conditions in waste processing facilities
- **Potential Customers:** Material recovery facilities

Team Names & Collaborators

Fellows: Monitha Davuluri, M.S. Computer Science; Eric Liu, Ph.D. Mechanical Engineering; Faria Binta Taher, M.S. Manufacturing Systems Engineering; Lucas Liu, B.S Computer Science; Cesar Aranibar Paredes, M.S. Manufacturing Systems Engineering; Ruchit Rajubhai Radadiya, M.S. Manufacturing Systems Engineering

Faculty: Dr. Bingbing Li, Manufacturing Systems Engineering; Dr. Nhut Ho, Mechanical Engineering; Eugene Tseng, Environmental Law and Environmental Engineering; Silvia Carpitella, Asst. Professor, Engineering Management

Collaborators: Los Angeles Local Enforcement Agency, Waste Management, Tahoe Truckee Sierra Disposal (TTSD)

Citations: N/A

CSUN. WASTE MANAGEMENT TTSD Tahoe Truckee Sierra Disposal CalRecycle NASA Partner

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