WP3: Collaborative Sensor Fusion System: Advancing Perception and Decision-Making

WP3 leader: Jerry Lin

Objectives

1

Data Aggregation

Seamless integration of data from various sensors and devices (e.g., cameras, LiDAR, radar, ultrasonics and GPS)

2

Perception and Decision-Making

improve its capabilities by fusion algorithms, recognize and understand objects (e.g., multi-dimension data, NLP, VLM can also be help with)

3

Realtime

Processing realtime data and make actions for decisoon making (lightweight models should be considered on the sensor devices)

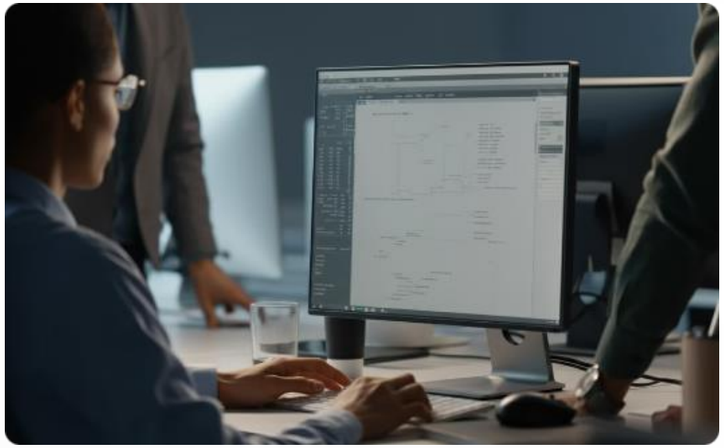
Task 1: Developing a Multi-Sensor Data Integration Framework

Multi sensors and IoTs

Multi-source data with different types and dimensions

Data integration

Pre-processing of the multi-dimension and modal (e.g., video, image, text, geo-data)



Data fusion

Fusion algorithms to process the integrated datasets.

Task 2: Object Recognition and Detection Models

Feature extraction

Algorithms to represent significant features from multisensor data.

Realtime tracking

Accurately identification of objects in dynamic and continuous environments.

3D perception

VR/AR models for enhanced spatial understanding.

Task 3: Application of Machine Learning, Visual Analytics and Explainable Artificial Intelligence ~~in the Healthcare Industry~~

Machine learning

Machine learning algorithms can analyze vast amounts of medical data to identify patterns and predict health outcomes, improving diagnosis and treatment.

Visual analytics

Visual analytics tools (XAI, e.g., SHAP, LIME) enable healthcare professionals to explore complex medical data through interactive visualizations, uncovering insights and facilitating better decision-making.

Task 4: Deployment and Evaluation of Developed Models and Tools in Real-world Scenarios

Implementation

Deployment of models in authentic industrial settings. Translates theoretical constructs into practical solutions

Validation

Rigorous testing in industry-specific contexts (e.g., AGV with AIUT). Assesses feasibility and performance of developed techniques.

Collaboration

Engagement with relevant sectors and stakeholders (e.g., AIUT)). Fosters partnerships to drive innovation and real-world application.

Main Considerations

1 Edge Computing Integration for Realtime Processing

Develop lightweight models for on-device processing. Reduces latency and improves real-time decision-making capabilities.

2 Adaptive ML/DL models

The ML/DL (CNN, RNN, LSTM, TinyML, FL, Edeg-computing) models should easily adjust to sensors or IoT devices for the integration and perception to minimize computational expenses.

3 Cross-Domain Applications

Extend sensor fusion techniques to new fields. Explores potential in smart cities, agriculture, and environmental monitoring.

Team in WP3

Jerry Lin

AI applications, optimization,
machine/deep learning,
data analytics

Rafal Cupek

Industry 4.0, AGVs, automation

Dariusz Mrozek

database, data warehouse,
OLAP, fuzzy theory

Research Focus			Time Series Analysis		Sensor Fusion		Federated Learning		Sustainability& trustworthiness			Commercial focus of the Associated Partner								Interdisciplinary aspects
RA/ WP/ UNI	Doctoral Candidate	Research Question	Visual Analytics	Transfer Learning	Accurate Perception	Lightweight Models	Privacy preservation and data security	Graph Neural Network	Safety critical CPS	Anomaly detection	AI Dynamics	CONFORM	ALMAWAVE	AIUT	CONTI	GMV	BioKeralty	TNP	NRS	
RA2 WP3 SUT	DC5	RQ2.1	r		**R**	r	r			r				**C**						**SM**
	DC6	RQ2.2	r		r	**R**	r			r					**C**					**A**
	DC7	RQ2.3		r	**R**	r		r		r				**C**						**SM**

R – main research; r – auxiliary research;

C – Company cooperation - applied research focus;

SM – smart manufacturing; **A** – Automotive;

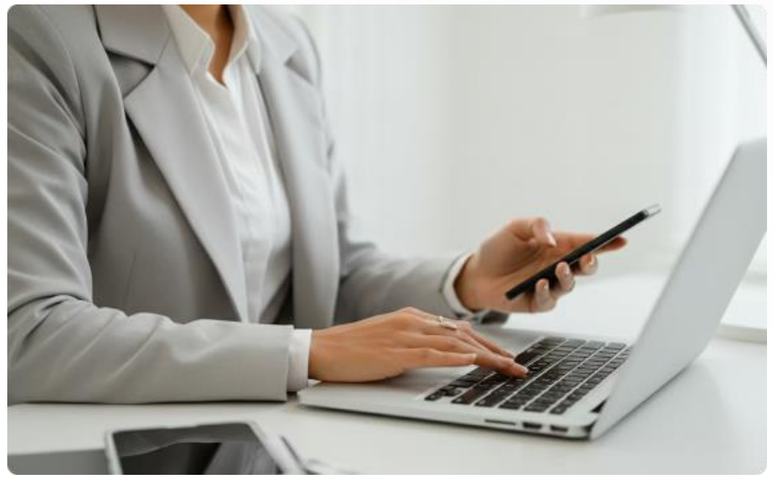
Recruitment plan

IEEE BigData 2024

3 sessions

IEEE PhD forum

Confirming



Disseminate to our networks

Workshop, seminar

open for discussion

Other ideas

Mid of Nov for the advertisement