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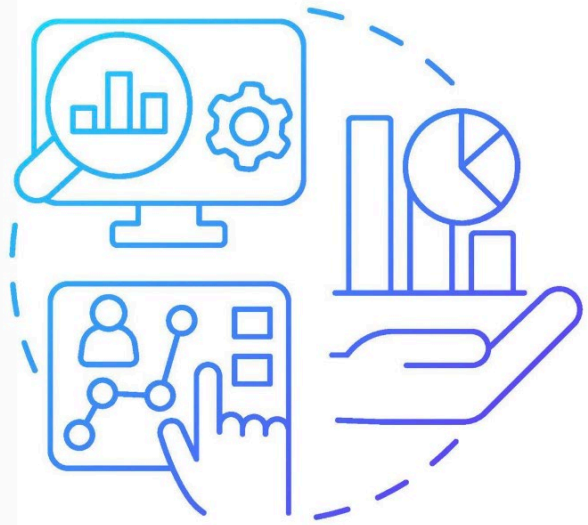
Towards AI powered manufacturing services, processes, and products in an edge-to-cloud-knowlEdge continuum for humans [in the loop]

AI-driven Decision Support System

Finnish Industrial Internet Forum (FIIF) , Tampere, 14.03.2024



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Presentation Outline

- What is a Decision Support System (DSS)?
- knowlEdge Decision Support Framework
  - Architecture
  - Implementation Technologies
  - Hybrid Recommender
  - CausaLogic Recommender
  - UIs Design
  - Pilot Applications
  - Examples

What is a Decision Support System?

- A decision support system (DSS) is a software application used to improve a company's decision-making capabilities.
- It analyzes data and presents possible options available as a suggestion
- Decision support systems bring together data and knowledge from different areas and sources to provide users with information beyond the usual reports and summaries.
- Mainly a DSS components are databases, software/algorithms and User Interfaces (UIs)

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knowlEdge Decision Support Framework (DSF)

- ✓ An AI-driven DSS supporting various AI/ML algorithms for both Data Analysis and Inference
- ✓ In terms of connectivity, it supports HTTP protocol, MQTT, web sockets and IDS Connectors
- ✓ It supports various types of recommenders
- ✓ It provides web-based user interfaces
- ✓ It offers eXplainable AI (XAI) mechanisms to boost AI interpretability
- ✓ It supports KPIs visualization & management

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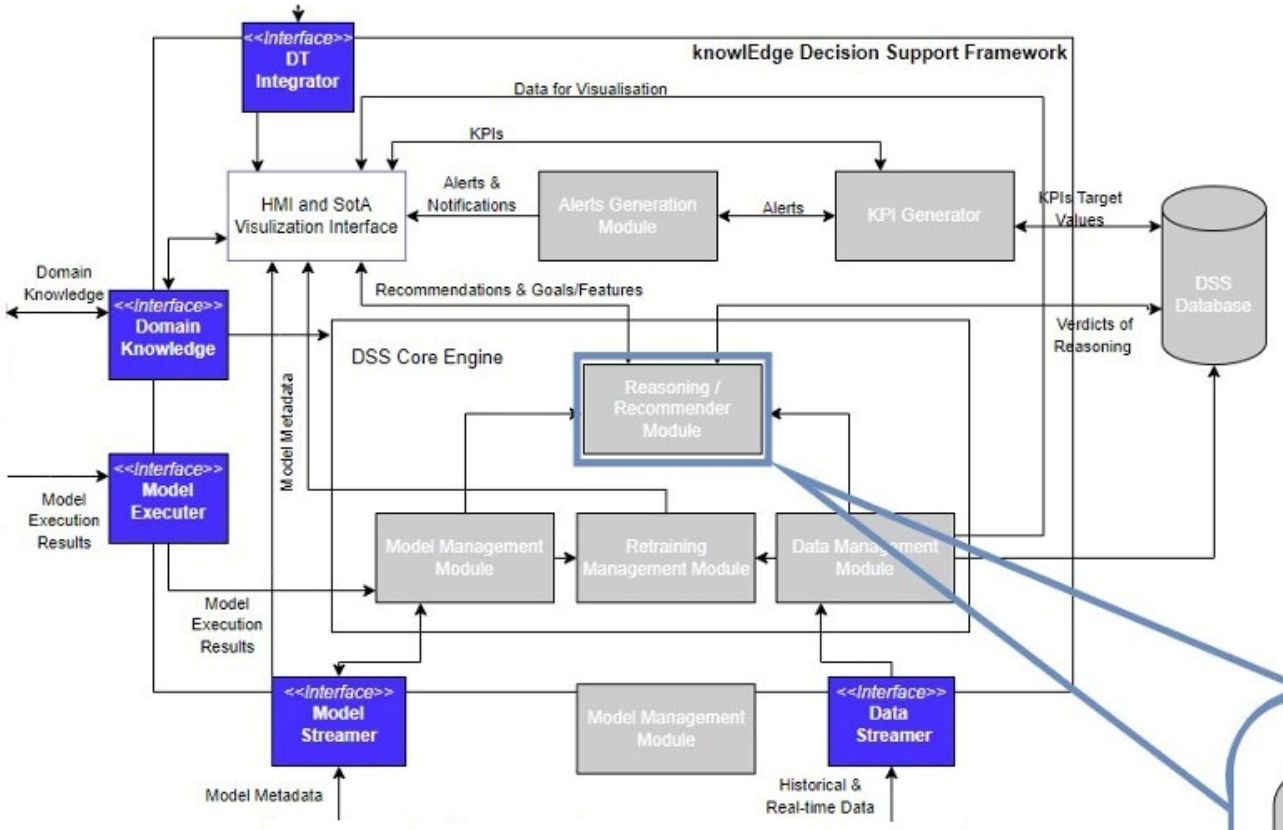
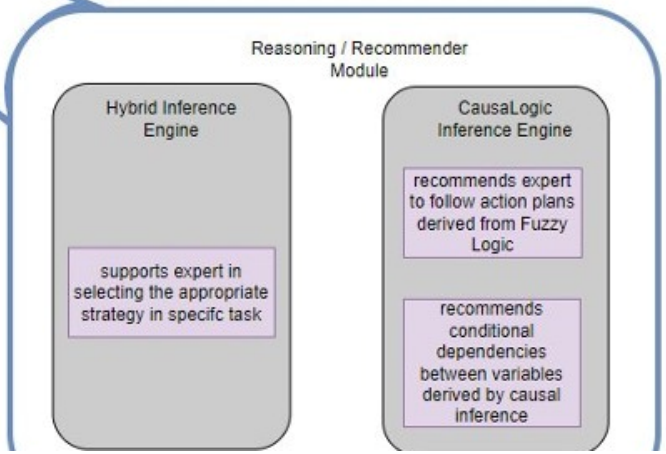
knowlEdge DSF Architecture





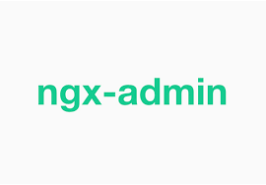
knowlEdge Decision Support Framework (DSF) – Implementation Technologies

knowlEdge DSF: Back-end

- **Python for Recommenders Development**
- **Neo4j for Ontological Graph Development**

knowlEdge DSF: Front-end

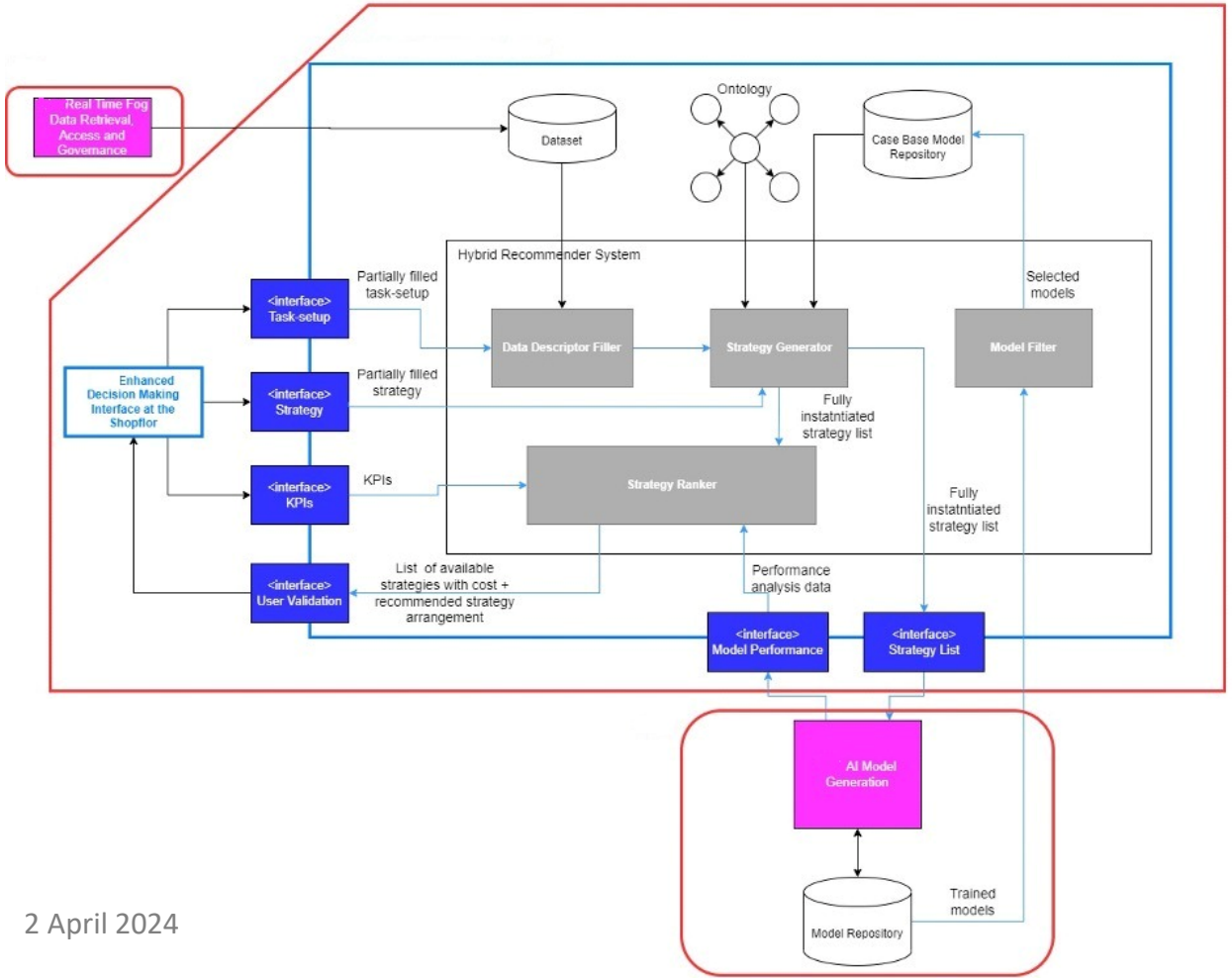
- **ngx-admin Framework**
  - a template for faster implementation because it is efficient, customizable and claims to optimize 480 hours of development time
- **Angular Material, Nebular and Bootstrap**
  - for prebuild components
- **ChartJS for graphs etc.**

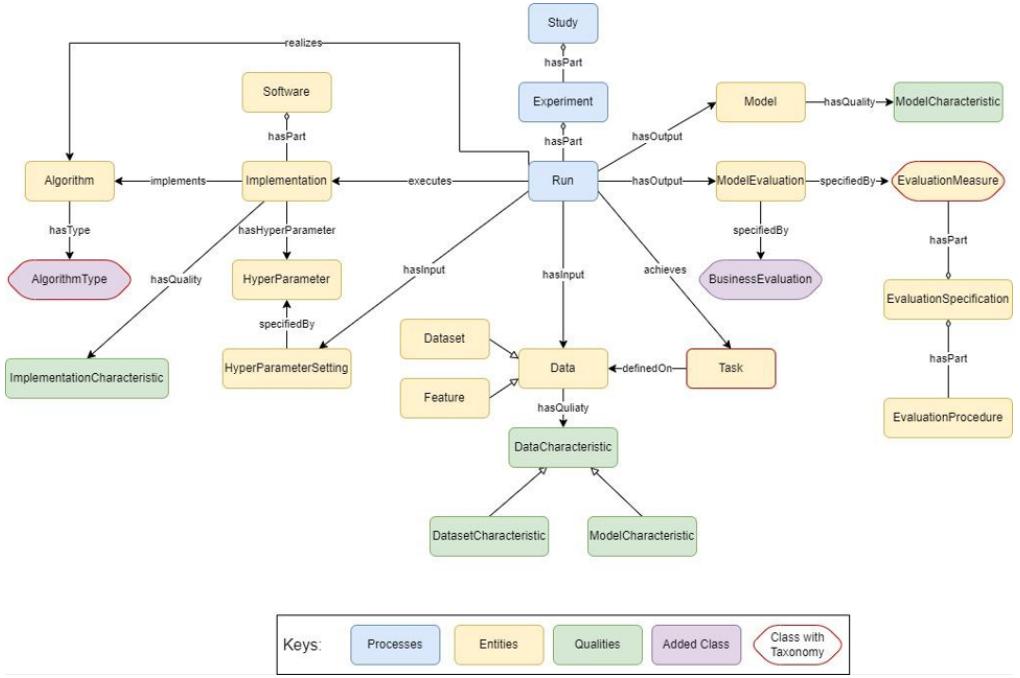


knowlEdge DSF: Deployment, Communication and Security

- **KEYCLOAK** for Identity Management
- **WebSockets** and **Flask**
- **NGINX HTTP Server** and **REST Services**
- **Elastic Search** and **Kibana**

Hybrid Recommender for Optimal AI Model Selection





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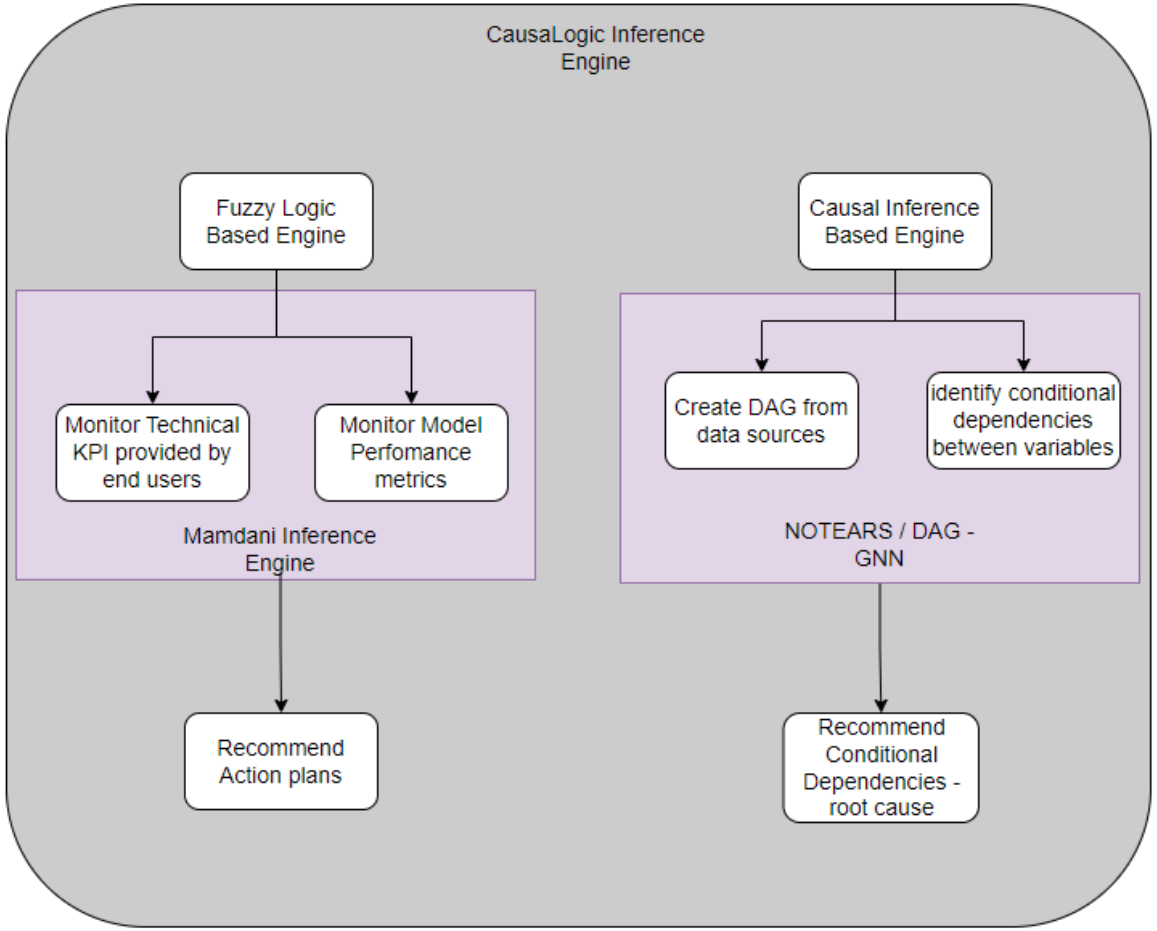
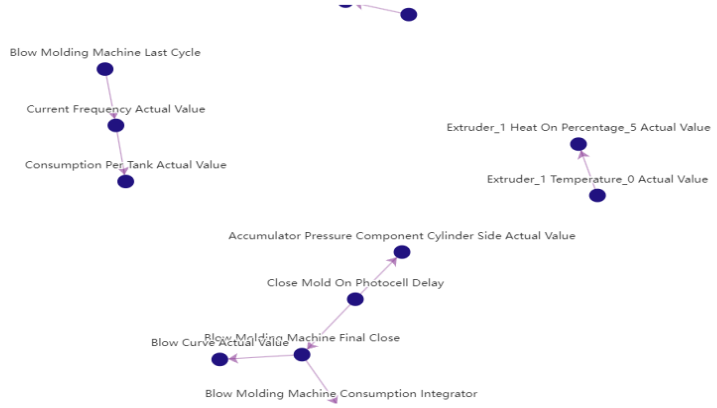
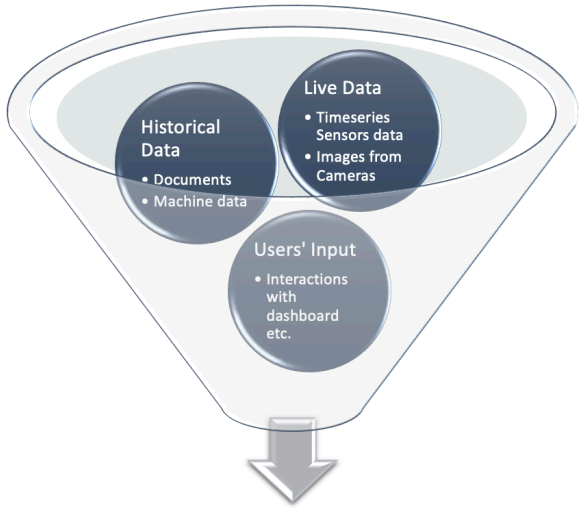
CausaLogic Recommender



DAG-GNN Method

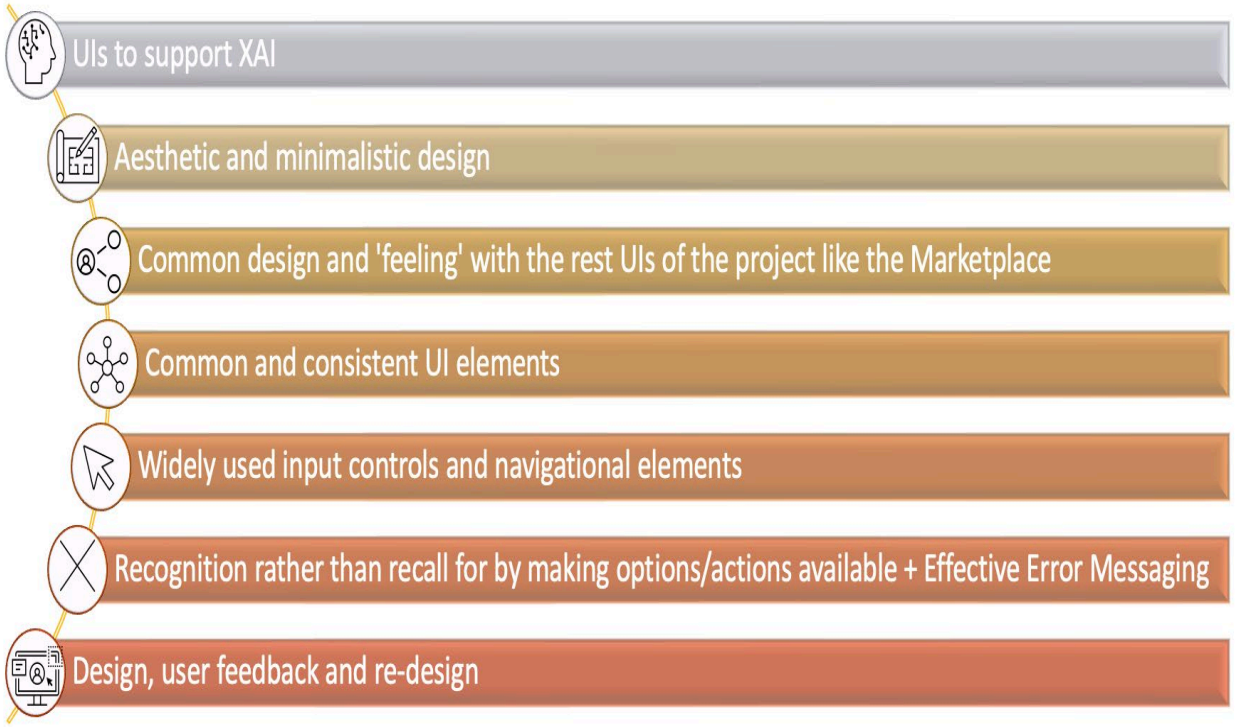


Action Plan Crisp Value	Deffuzified Value
low	Simple notification indicating that production process is performing accurate
medium	1.Notification about the value of the KPIs 2.Recommendation to conduct XAI analysis to the model 3.Information on how to increase KPIs based on historical data if any 4.Notification about the products that their production deviate
high	1.Alert Generated from dashboard 2.Recommendation to conduct XAI analysis to the model 3.Information on how to increase KPIs based on historical data if any 4.Notification about the products that their production deviate 5.Root Cause analysis if applicable



Expected Input and Outputs

UI Design Principals



knowlEdge DSF – UIs Design

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Pilot Applications

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parmalat

Sales Forecasting & Production Scheduling

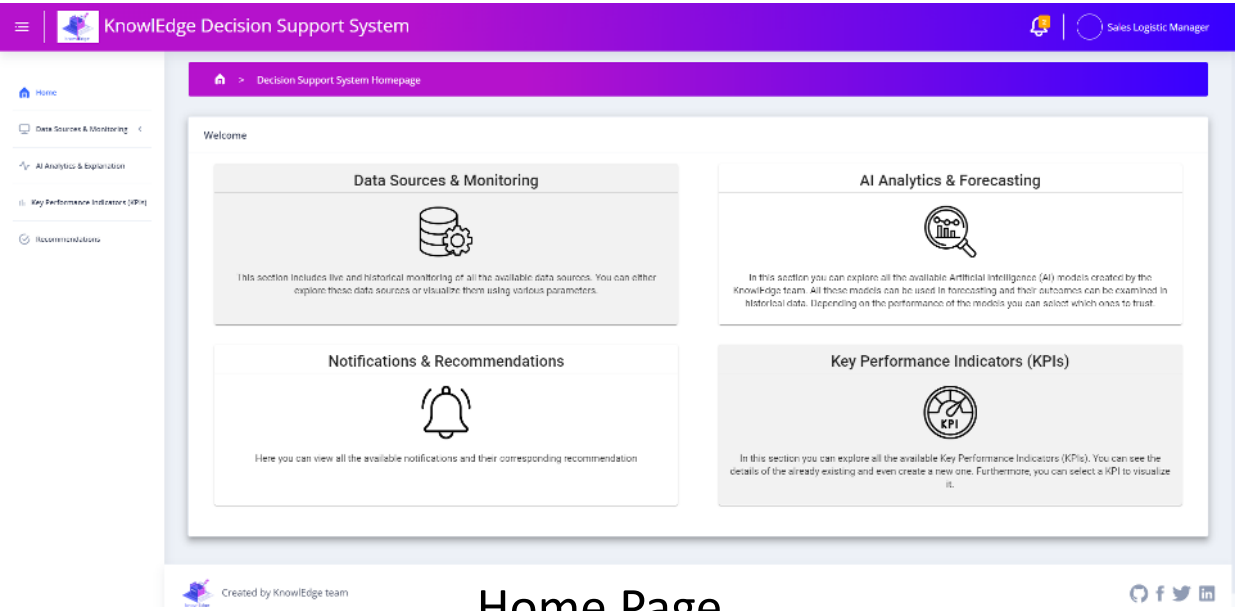
Bonfiglioli
Forever Forward

Zero-defect Manufacturing

KAUTEX
A Textron Company

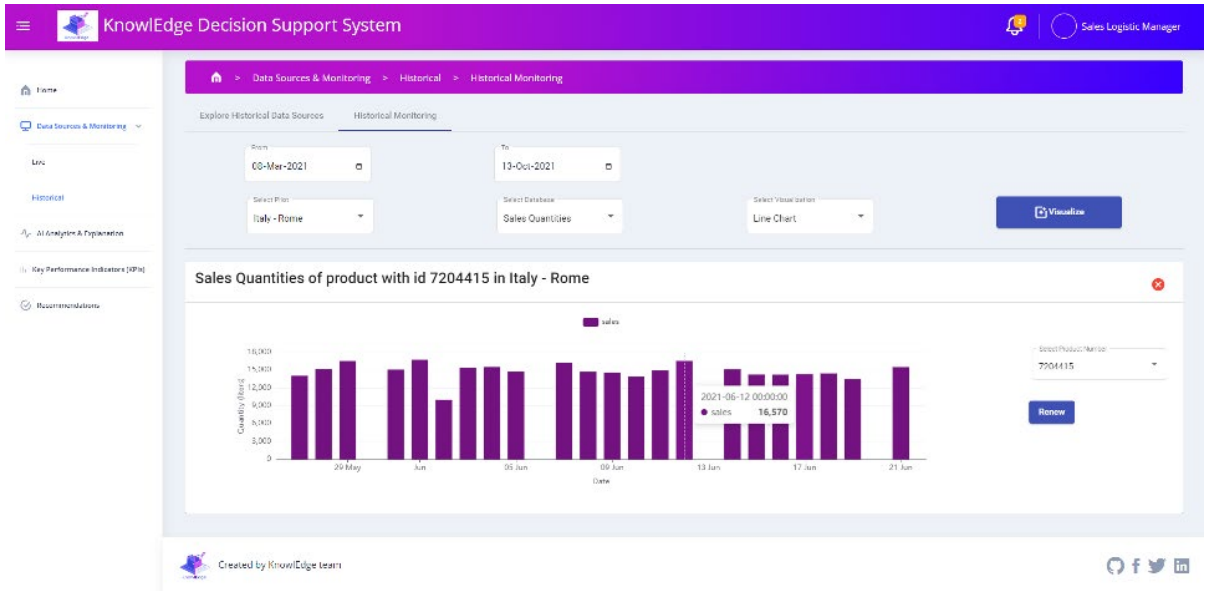
Anomaly Detection

knowlEdge DSF UIs - Examples

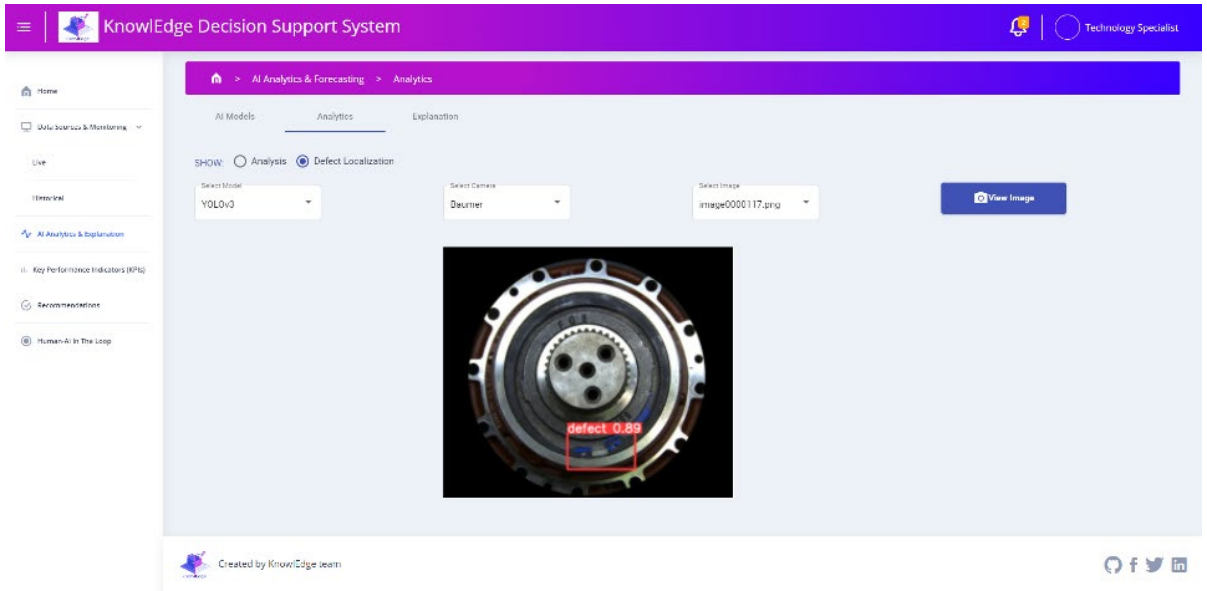


Home Page

Historical Data Monitoring



Defect Localization



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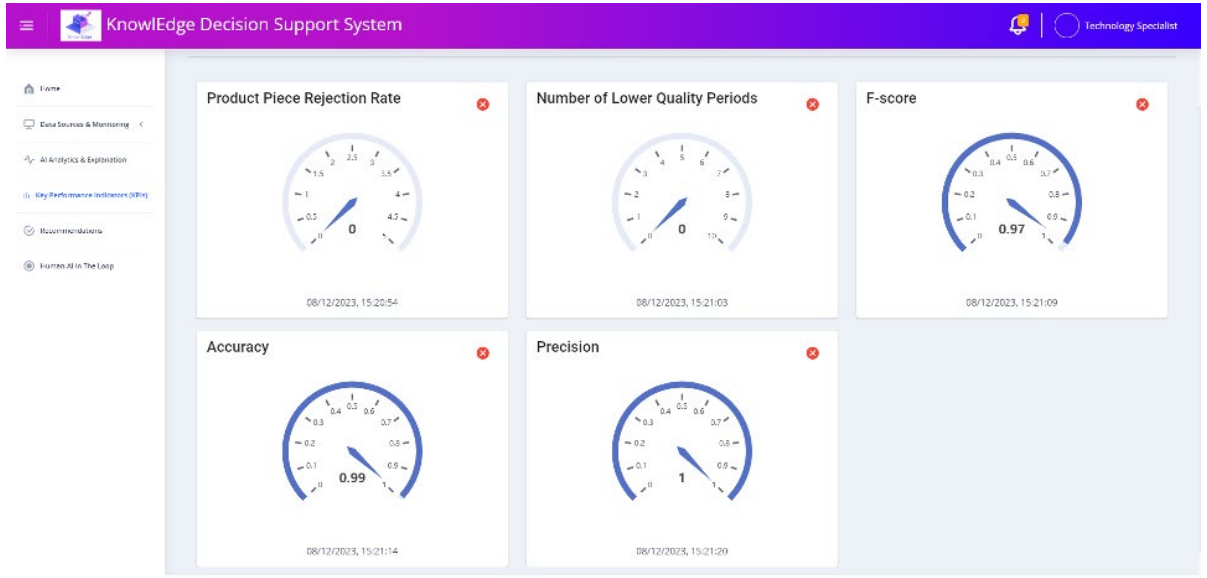
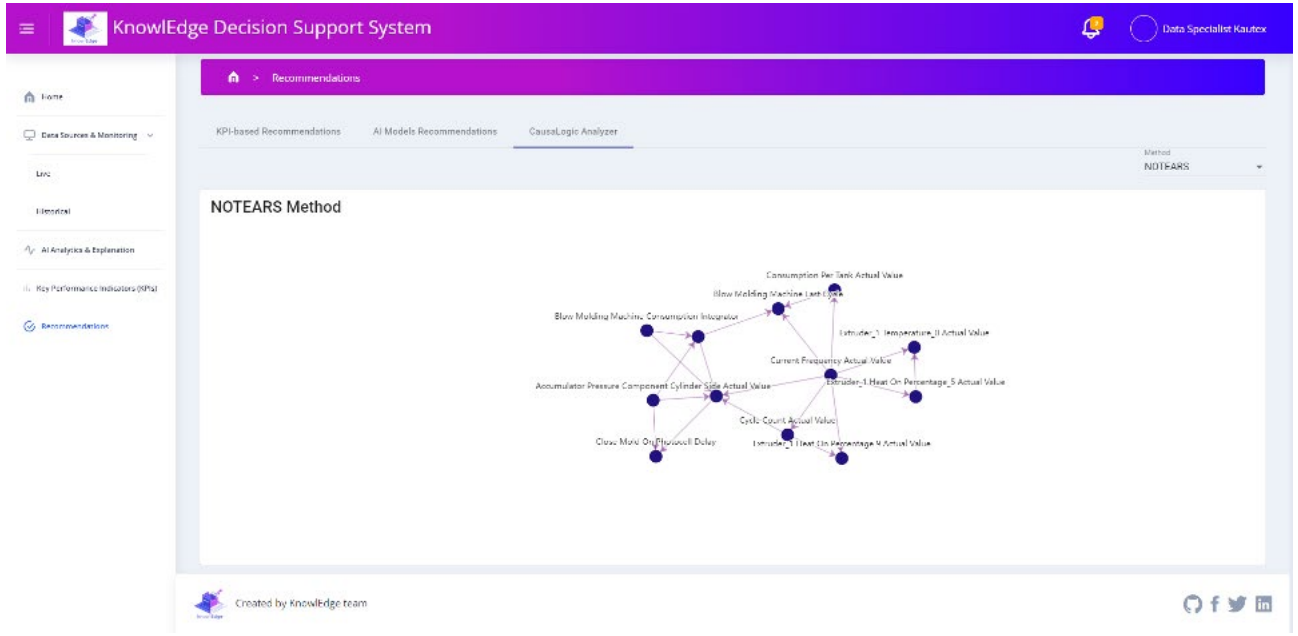
knowlEdge DSF UIs - Examples (2)

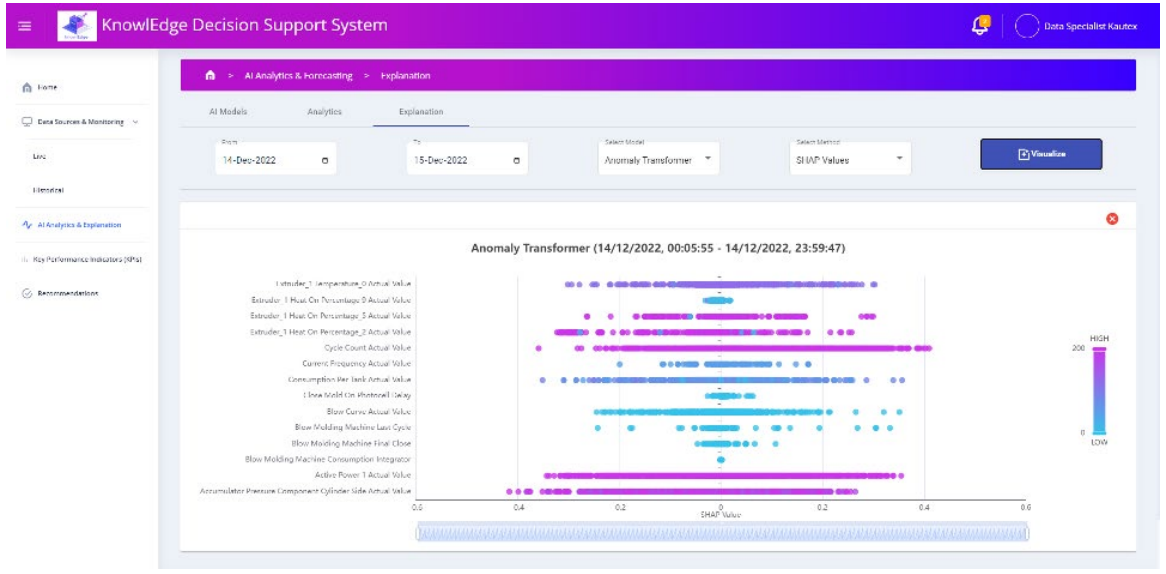
KPIs Monitoring



Causal Inference Recommender



XAI Dashboard



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knowlEdge DSF Demo(s)

Please wait!!!

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Thank you!