The Enabling Technologies for Digitalization in the Chemical Process Industry

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Who are we?

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  - Postdoctoral researcher in Data Fusion at Maastricht University
  - PhD in Electrical and Computer Engineering

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- Paul Grefen
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  - Principal Architect at Eviden
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- **Perspective**: computer science, artificial intelligence, digitalization, and business process experts

Our goals

- Strengthen **collaboration** with the Brightsite initiative at Chemelot Campus in Geleen

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- Identify areas for **digitalization** at Chemelot for collaboration
- Difficult without common **starting point/language**
- **First step:** identify the enabling technologies that make the digital transformation possible

Our work

- Insights mainly gained through **interviews** with (mainly) Chemelot site users and existing literature

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- The chemical process industry is facing several **challenges**:
  - A **skills shortage** in the labour market
  - Reaching its **sustainability goals** in the face of changing climate realities
  - Transitioning from existing **feedstock and energy sources** to alternative, more sustainable ones

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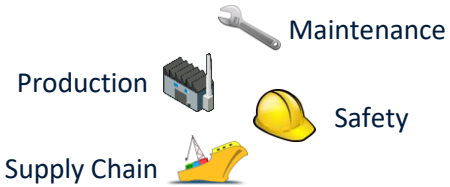
- Our work focuses on investigating how **digital solutions** can be leveraged to solve these problems by:
  - **Identifying** and **categorizing** the enabling technologies for digitalization
  - Identifying the **problem domains** that characterize the chemical process industry and connecting them to **development aspects**
  - **Selecting** the technologies **most essential** for bridging the gap between problem and solution
  - Providing **case studies** to cast a spotlight on the use of state-of-the-art technologies

Problem Domains



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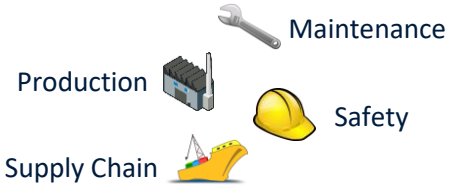

Challenges

Digital Technologies

Big data and analytics
Extended reality
Cybersecurity
Autonomous robots
Simulation
5G
Cloud computing
Artificial intelligence
Additive manufacturing
Industrial internet of things
Horizontal and vertical integration

Problem Domains

Development Aspects

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Application

Problem Domains


Maintenance

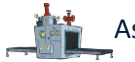
Production 


Safety

Supply Chain 

Solutions

Development Aspects


Assets

People 


Feedstock

Energy 


Spare Parts

Site 

Challenges

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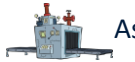
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Use Cases

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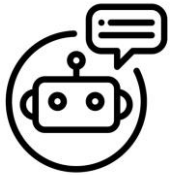
- Get a **gentle introduction** into the technologies that enable digitalization
- Get a holistic understanding of the **interactions** between development areas and enabling technologies
- To stay up-to-date with **industry trends** in digitalization
- Identify the areas in your **own work** that can benefit from digitalization
  - This has led to **collaboration** between Chemelot site users and Maastricht Univertsity

Examples of projects with Chemelot

- LLM-based **chatbot** for material science document retrieval and query answering



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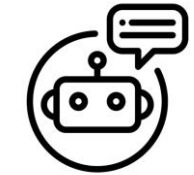
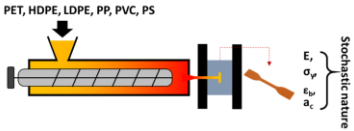
- Capturing variability in **material property predictions** for plastics recycling via machine learning





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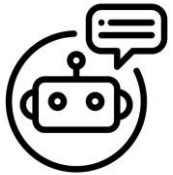
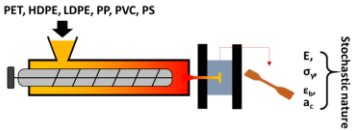
- **Plastic waste classification** using low-cost spectroscopy and machine learning





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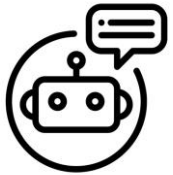

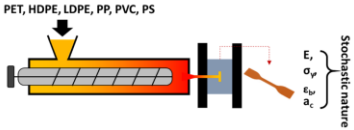

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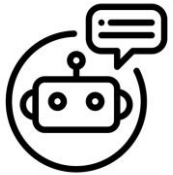
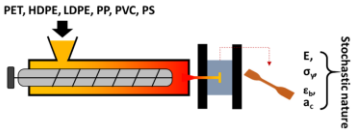
- Looking for **collaboration** from Chemelot site users on future projects
  - Currently focused on predictive maintenance / asset health monitoring





Takeaways

- **Read our paper** to learn about digitalization opportunities (QR code to the right)
- **Contact us** for collaboration on projects regarding digitalization
  - We are looking for **student projects** at all levels, from Bachelors to PhD
- marcin.pietrasik@maastrichtuniversity.nl