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# Industrial Security Analytics Research Fields

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Department for Software Design and Security

Projekt

# RADIUS

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## Research in Artificial Intelligence for Development, Innovation and Upgraded Security

- **Zeitraum:** 1.1.2025 – 31.12.2029
- **Förderschiene:** „FH - Forschung für die Wirtschaft 2024“
- **Umfang:** > 15.000 h
- **Projektteam:** Derzeit 28 Personen aus fünf Instituten

- **Ziele:**
  - **Kompetenzaufbau im Bereich** KI, speziell in den Themen Generative KI und LLMs.
  - Erforschung/Entwicklung von **KI-Anwendungsmöglichkeiten im Software Engineering und in der IT Security**.
    - Methoden & Best-Practices
    - Frameworks & Tools
    - Trainings & Lehre
  - Erprobung und Anwendung der akquirierten Kompetenzen in **Use-Cases von Partnerinstituten**
  - Zurverfügungstellung von **optimierten Lösungen für die Wirtschaft** unter der **Akquisition von Folgeprojekten**
  - Weitergehende **Dissemination** in Form von Publikationen, Konferenzbeiträgen, Artikeln etc.

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Projekt

# RADIUS

## Research in Artificial Intelligence for Development, Innovation and Upgraded Security

- **AI-Systeme**
  - Know-How Aufbau LLMs
  - Aufbau einer on-premise Umgebung
  - Spezialisierung von AI-Systemen
  - Bewertungssystem für von AI erzeugten Artefakten
- **AI in der Security**
  - AI-Unterstützung im Penetration Testing
  - Verbesserte Code Security durch AI-Einsatz in der Analyse
  - Automatisierte Vulnerability Detection
- **AI im Software Engineering**
  - Anforderungsanalyse und -verifikation
  - Automatisierung im Softwaredesign
  - AI-Support in der Implementierung
  - Qualitätssicherung und Testing
- **Use Cases**
  - Banken und Versicherungen
  - Embedded Systems
  - Luftfahrt

# RADIUS - TEAM


Foto: FH JOANNEUM

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# RESSEL ZENTRUM

voestalpine
ONE STEP AHEAD.

AVL
DITEST

Bundesministerium
Arbeit und Wirtschaft

Christian Doppler
Forschungsgesellschaft

# RESSEL ZENTRUM (2)

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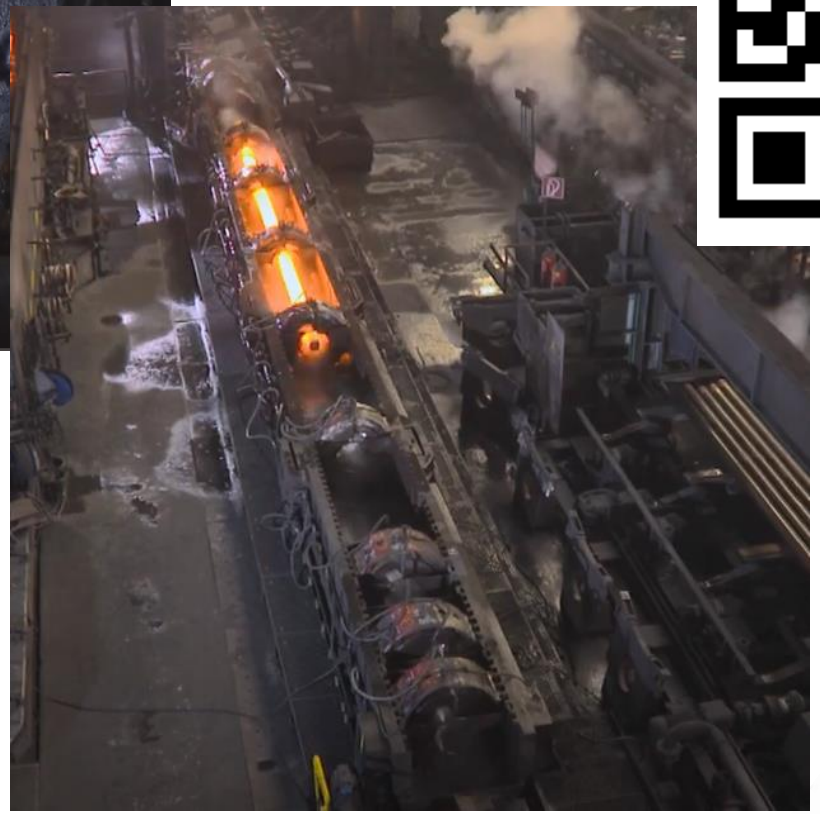
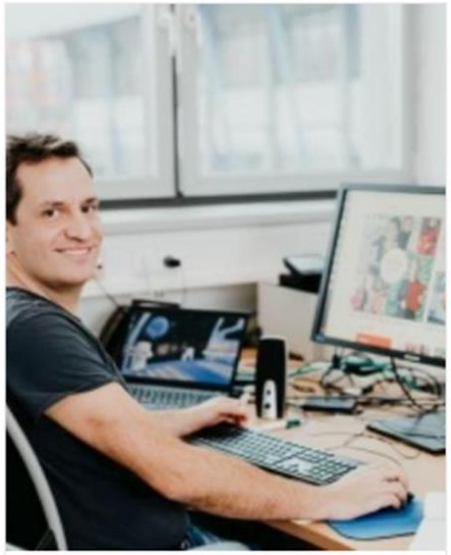
JOSEF RESSEL ZENTRUM FÜR
**ZEITREIHENBASIERTE FEHLERVORHERSAGE UND -VERMEIDUNG**

# VOESTALPINE TUBULARS



# RESSEL ZENTRUM - TEAM

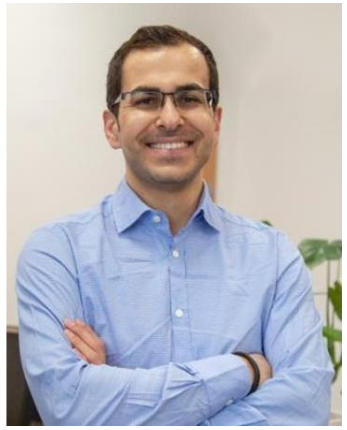


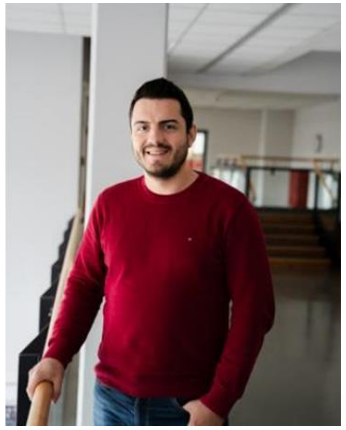
FH-Prof. Priv.-Doz. DI Dr.

**Joachim Schauer**

Assoziierter Professor (FH)


https://www.fh-joanneum.at/news/neugier-podcast-42-josef-ressel-zentrum-zeitreihenbasierte-fehlervorhersage-vermeidung/





# KOOPERATION & KONTAKT

- RADIUS:
  - AI & LLM
  - IT-Security: Secure Coding, Penetration Testing, Anomaly Detection
  - Kontakt:
    - helmut.lindner@fh-joanneum.at
    - wilhelm.zugaj@fh-joanneum.at
    - michael.hammer@fh-joanneum.at
    - florian.temel5@fh-joanneum.at

- Ressel Zentrum
  - Machine Learning, Data mining, predicitve maintenance,…
  - Kontakt:
    - joachim.schauer@fh-joanneum.at

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# Industrial Security Analytics

## Convergence of Process and Security Analytics

Raphael Hartner
Lecturer Digital Technologies
Deputy Head of the Smart Production Lab
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# RESEARCH GROUP DIGITAL TECHNOLOGIES

- Head of the research group:
  Associate Professor Stefan Muckenhuber, PhD
  *stefan.muckenhuber@fh-joanneum.at*

- Deputy head of the research group:
  DI Raphael Hartner, MSc
  *raphael.hartner2@fh-joanneum.at*

- The whole team can be found on our website and consists of 6 additional researchers focusing on specific topics and projects

- Websites:
  https://spl.fh-joanneum.at/en/
  https://www.fh-joanneum.at/en/institute/industrial-management/

- Professor of computer science:
  FH-Professor Vitaliy Mezhuyev, PhD, ScD
  *vitaliy.mezhuyev@fh-joanneum.at*

- Professor of AI and smart production:
  Associate Professor Dr. Paul Hofmann
  *paul.hofmann@fh-joanneum.at*

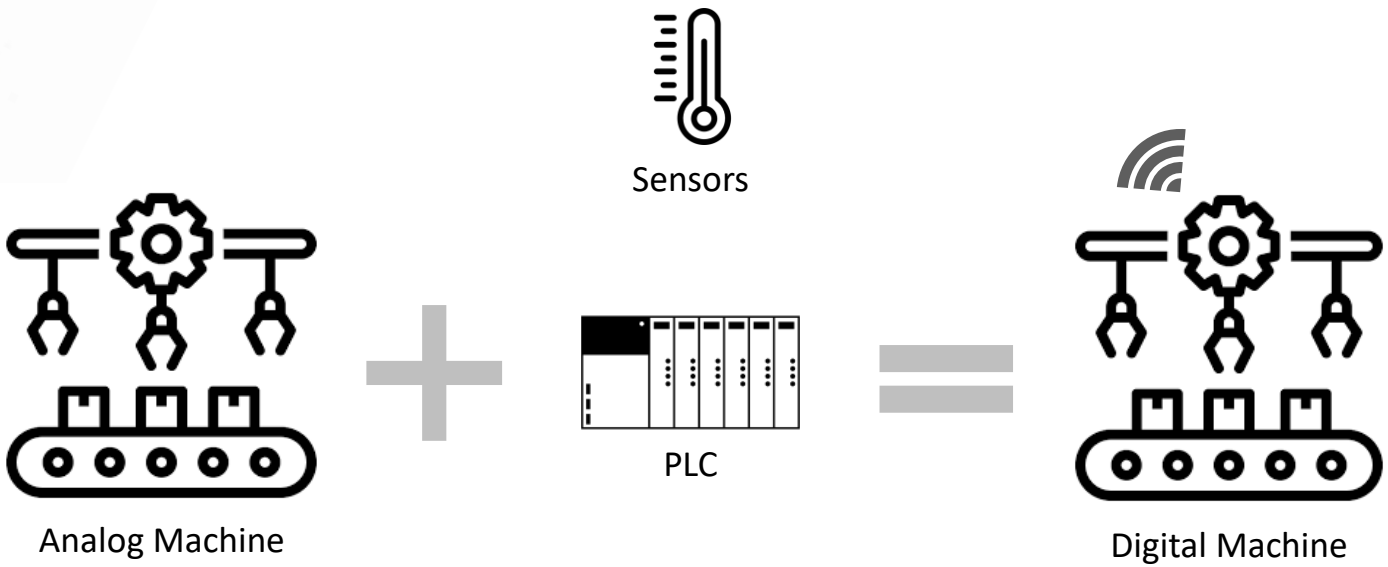
- Head of machinery:
  DI (FH) Helmut Ropin
  *helmut.ropin@fh-joanneum.at*

# MAIN TOPICS OF THE RESEARCH GROUP DIGITAL TECHNOLOGIES

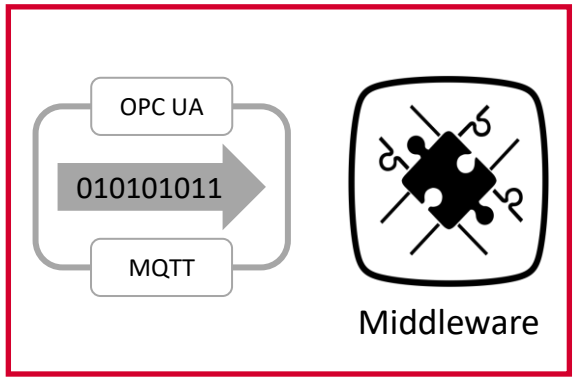
| | |
|---|---|
| Data Acquisition | • Digital retrofit<br>• Sensor technologies<br>• Communication protocols |
| Data Pipeline | • Industrial IoT architectures<br>• Module type package (MTP) & data spaces<br>• Business integration |
| Data Usage | • Data-efficient machine learning<br>• Quality prediction & anomaly detection<br>• Data-driven process optimization |

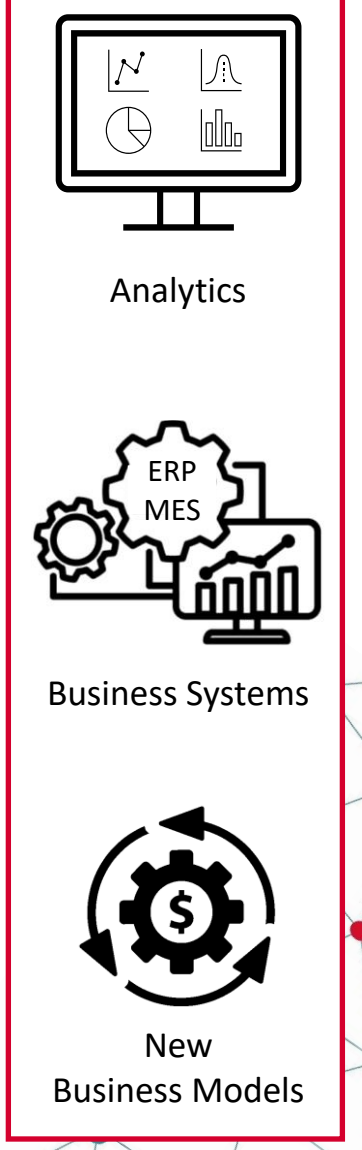
- Prototyping
- Research
- Teaching

# DATA ACQUISITION & PIPELINE

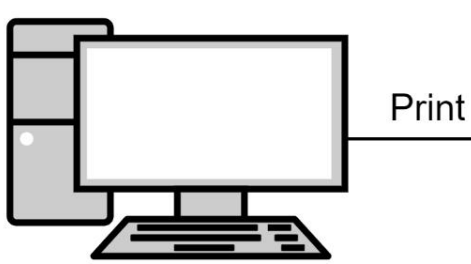



Overlapping area of
IT and OT tools and methods



# CONDITION MONITORING OF 3D-PRINTERS VIA SPLUNK

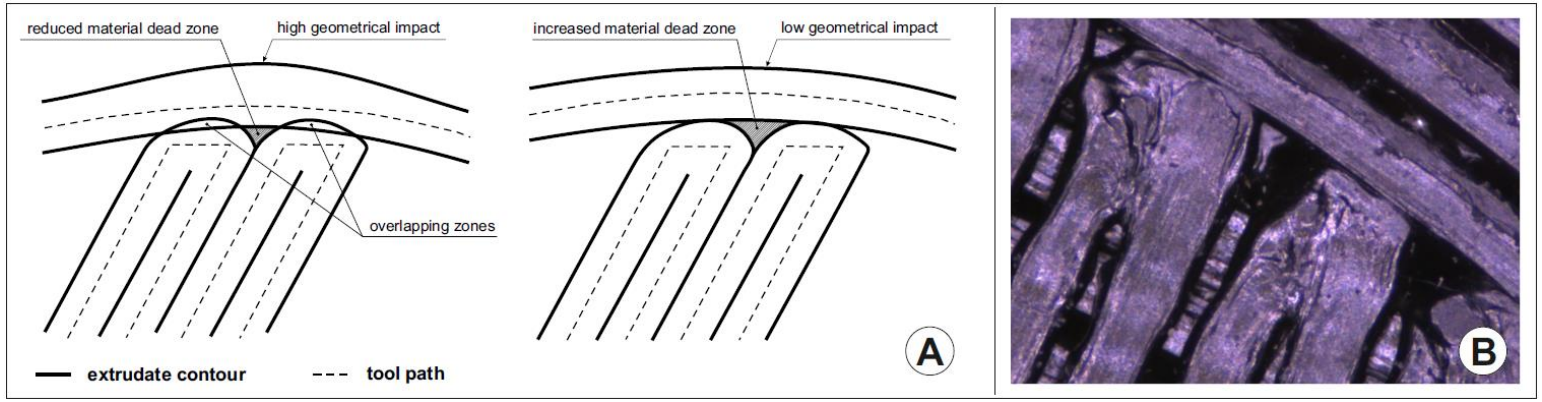


HAGE3D 140L

# QUALITY PREDICTION IN ADDITIVE MANUFACTURING

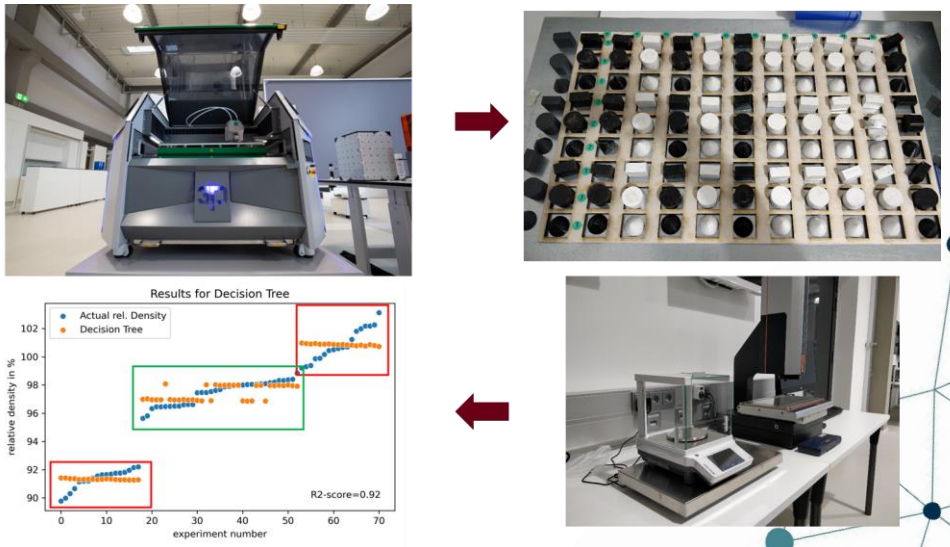
Challenges in additive manufacturing:

- Relative density is critical in additively manufactured parts
- Specific levels of relative density are difficult to achieve
- Finding proper printing parameters requires an extensive trial & error approach




Results to improve efficiency in additive manufacturing:

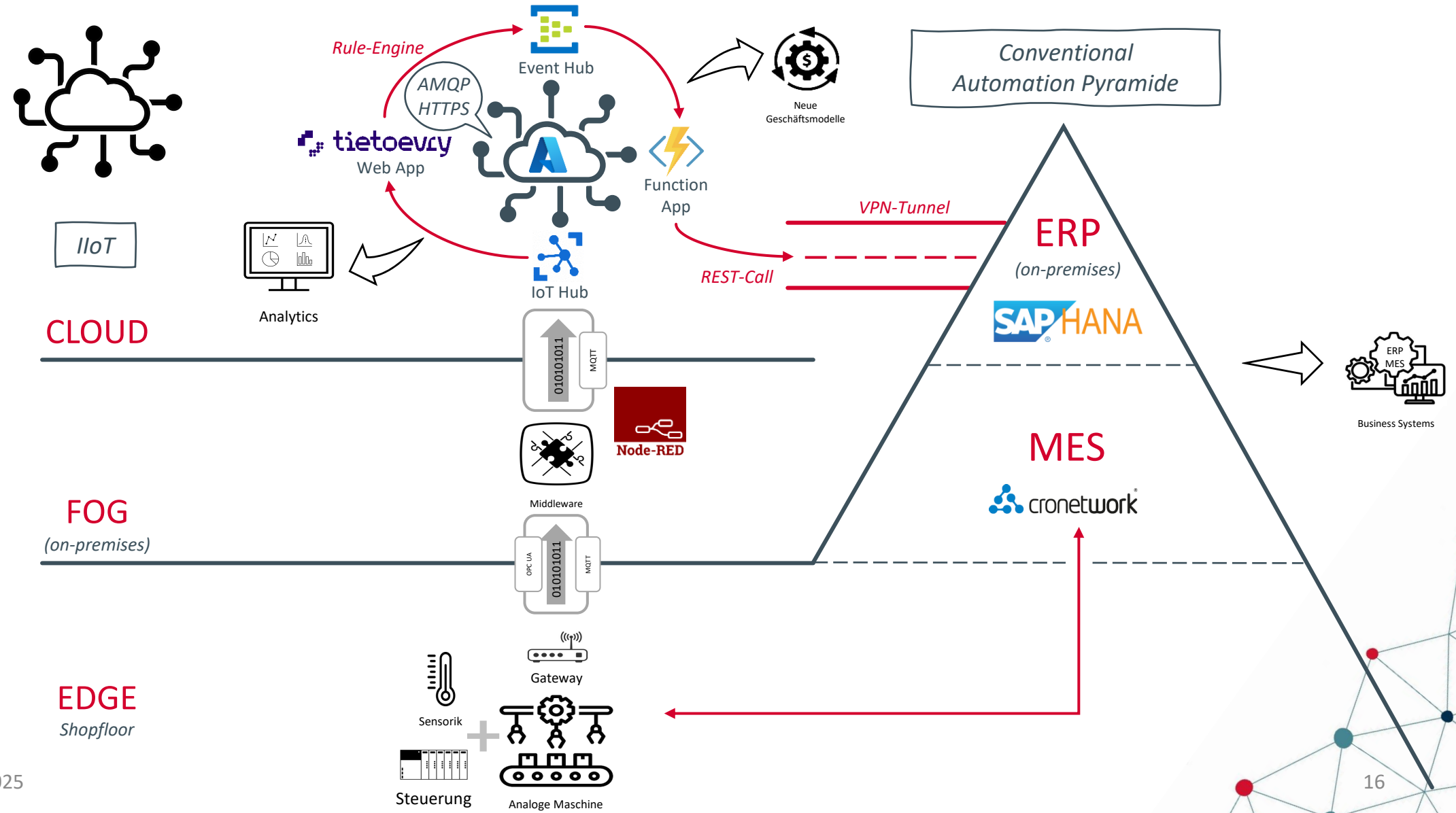
- Design of experiments to generate high-quality data samples
- Resulting predictive model achieves good accuracy
- Minimize trial & error period and time-to-market for new products






R. Hartner and S. Zigala, “Data-driven approach to optimize the relative density in additive manufacturing processes,” 2022 8th International Conference on Computer Technology Applications. ACM, pp. 57–63, May 12, 2022. doi: 10.1145/3543712.3543736.

# IOT Architecture in the Smart Production Lab



# DATA USAGE THROUGH INDUSTRIAL MACHINE LEARNING

/ Apply **machine learning in industrial process** to detect defective parts, predict quality characteristics and optimize entire plants

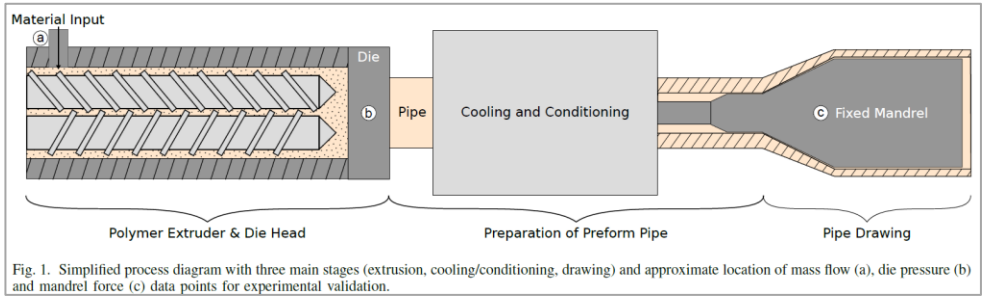
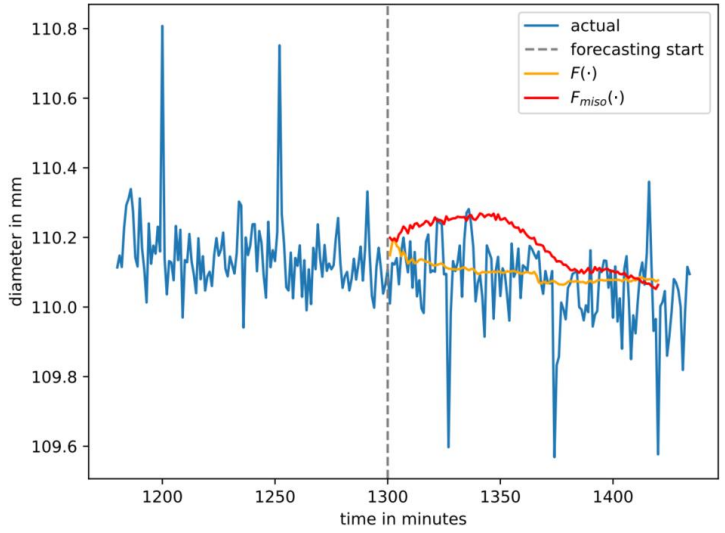
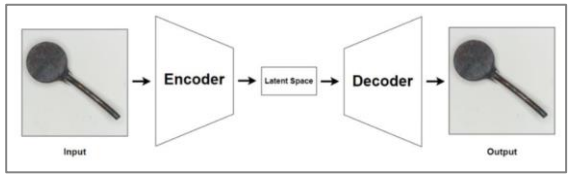
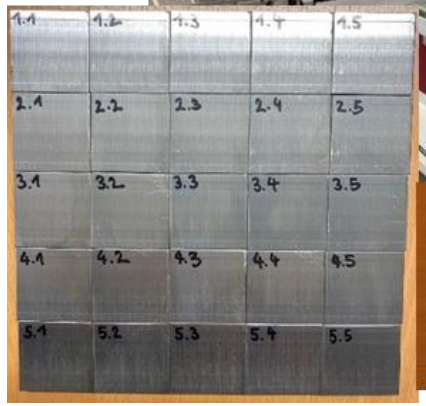
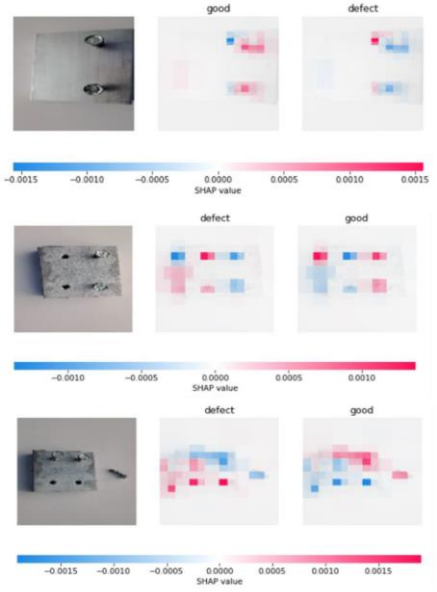


Fig. 1. Simplified process diagram with three main stages (extrusion, cooling/conditioning, drawing) and approximate location of mass flow (a), die pressure (b) and mandrel force (c) data points for experimental validation.



# CONCLUSION

- **Similar tools and methods can be applied for security and process analytics in the industrial domain**
- Using available resources and know-how from one field facilitates other fields of application
- Significant benefits are possible due to industrial (security) analytics

- Analytics is an active field of research with many ways to cooperate

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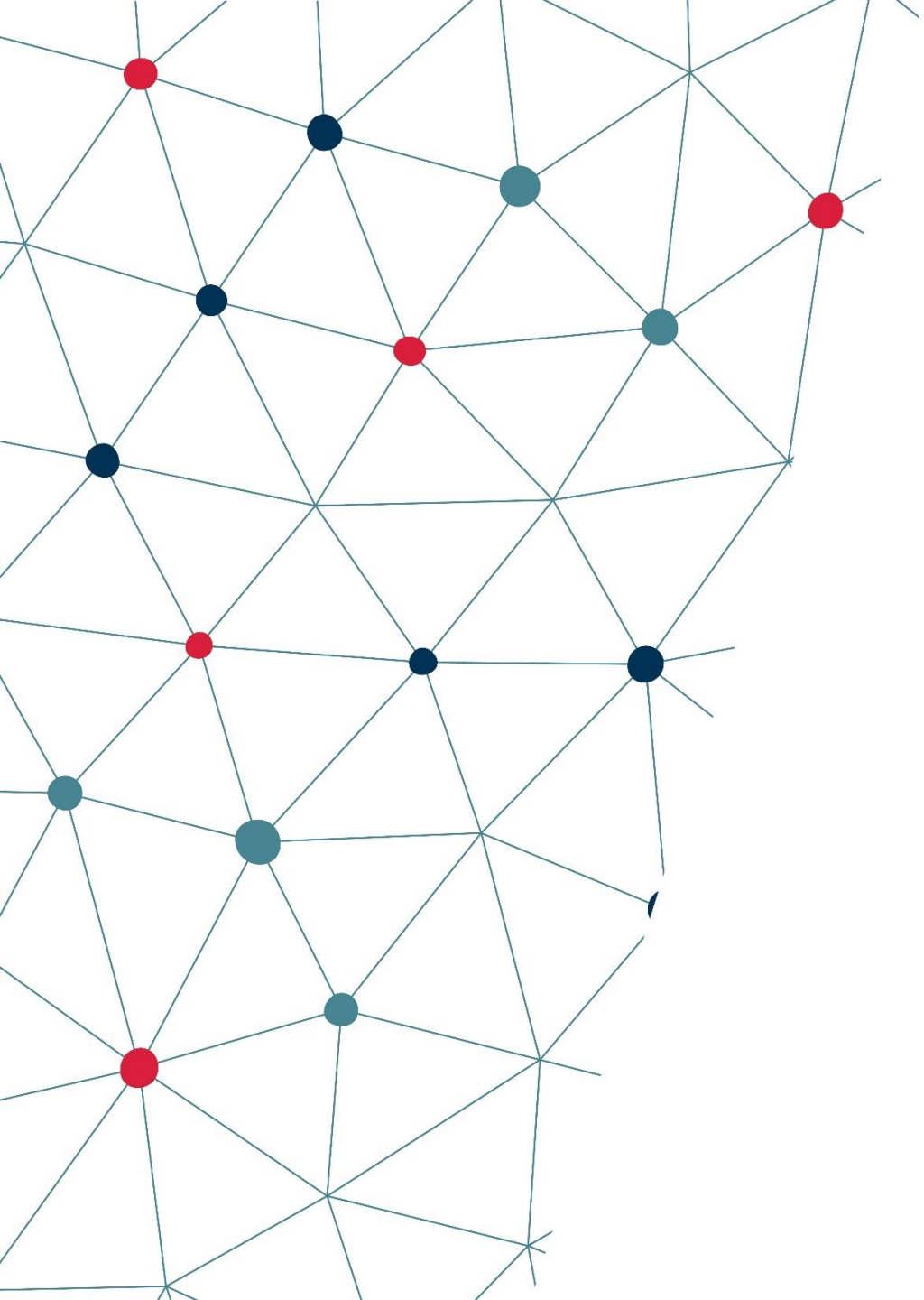
# TEASER:
# LIVE DEMO OF DATA USAGE AT BAND SAW



smart production lab

# WE PUSH INDUSTRY 4.0