

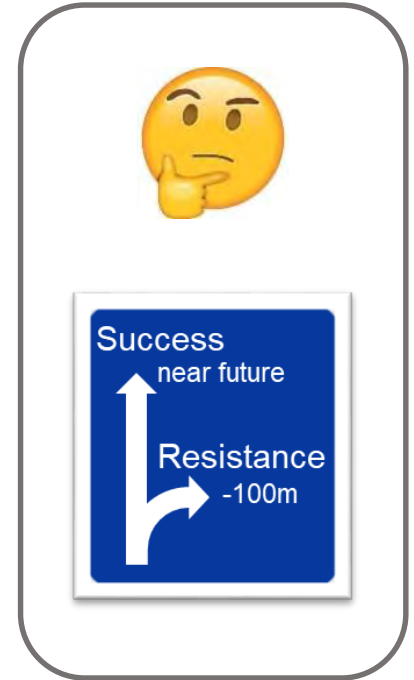
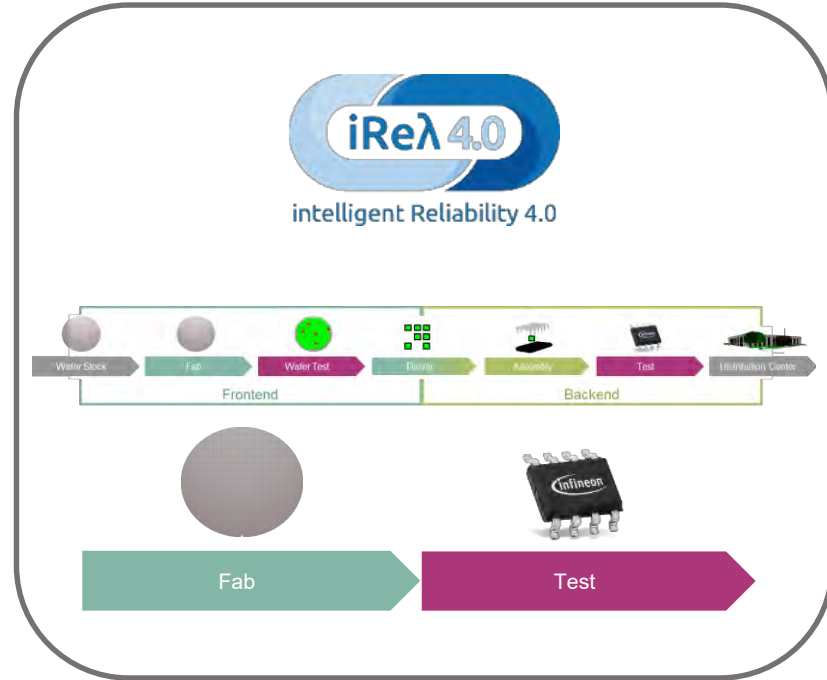
Applied Data Science

– Use Cases and Challenges in the Semiconductor Industry

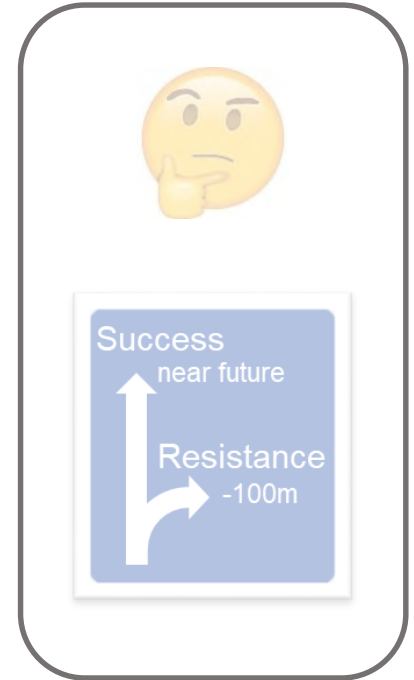
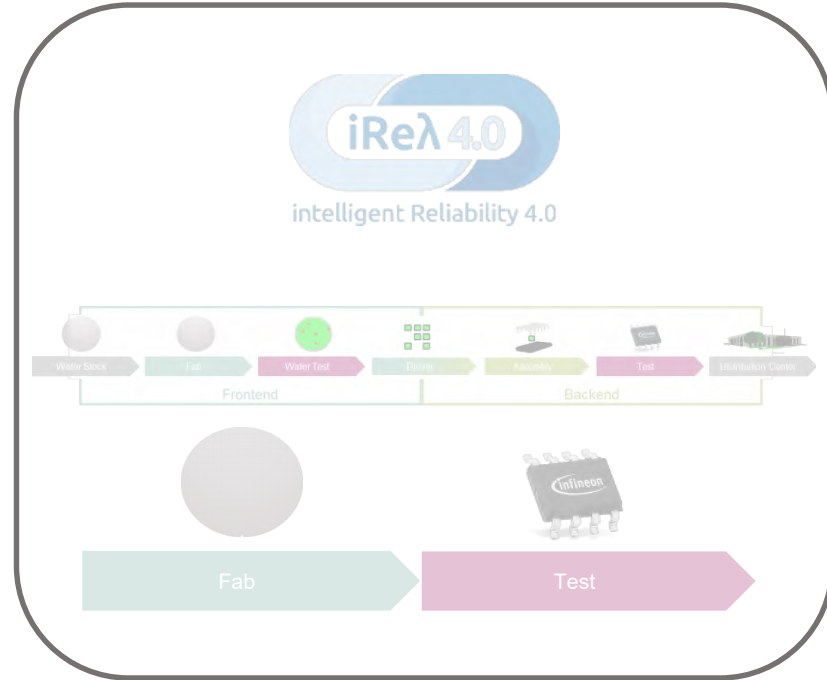
Anja Zernig
TEWI-Kolloquium, 26.11.2021



In this presentation I will talk about ...



In this presentation I will talk about ...



KAI Kompetenzzentrum Automobil- und Industrieelektronik GmbH



... is a well-established industrial research center with a broad national and international network of industrial and academic partners



... is a 100% subsidiary of Infineon Technologies Austria AG



... employs about 60 researchers, where more than half of them are PhD and Master students (directly at KAI or at the university partners)

Research Groups & Main Collaborations



Software Development & Data Management



Dr. Benjamin Steinwender



Device Physics



Dr. Gregor Pobegen



Application Stress Test Methodology



Dr. Michael Glavanovics

Research Groups

@



Materials Science & Simulation



Dr. Peter Imrich

Data Science



Dr. Olivia Pfeiler



Electrochemistry, Coatings, Analytics



Dr. Silvia Larisegger



Universidad de Castilla-La Mancha



KAI Data Science (DSC) Team



Pfeiler Olivia (KAI DSC)
Olivia.Pfeiler@k-ai.at



Pleschberger Martin (KAI DSC)
Martin.Pleschberger@k-ai.at



Scheiber Michael (KAI DSC)
Michael.Scheiber@k-ai.at



Kofler Corinna (KAI DSC)
Corinna.Kofler@k-ai.at



Alagic Dzenana (KAI DSC)
Dzenana.Alagic@k-ai.at



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Domenico.Pagliaro@k-ai.at



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Hautz Jessica (KAI DSC)
Jessica.Hautz@k-ai.at



Hundgeburth Laurenz (KAI DSC)
Laurenz.Hundgeburth@k-ai.at



Matteazzi Andrea (KAI DSC)
Andrea.Matteazzi@k-ai.at



Zernig Anja (KAI DSC)
anja.zernig@k-ai.at

Master @ KAI & AAU Institute of Statistics

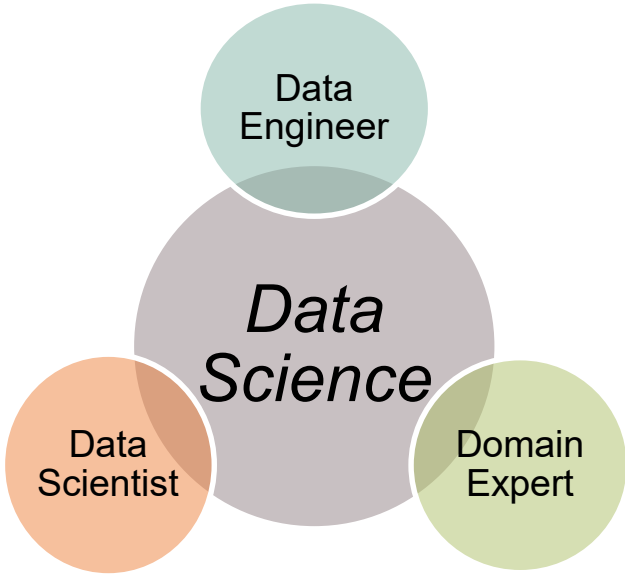
- Title: Optimal Design of Experiments for Semiconductor Data following a Mixtures-of-Experts Model



PhD @ KAI & AAU Institute of Statistics

- Title: Device Level Maverick Screening

Today: Project Manager KAI DSC

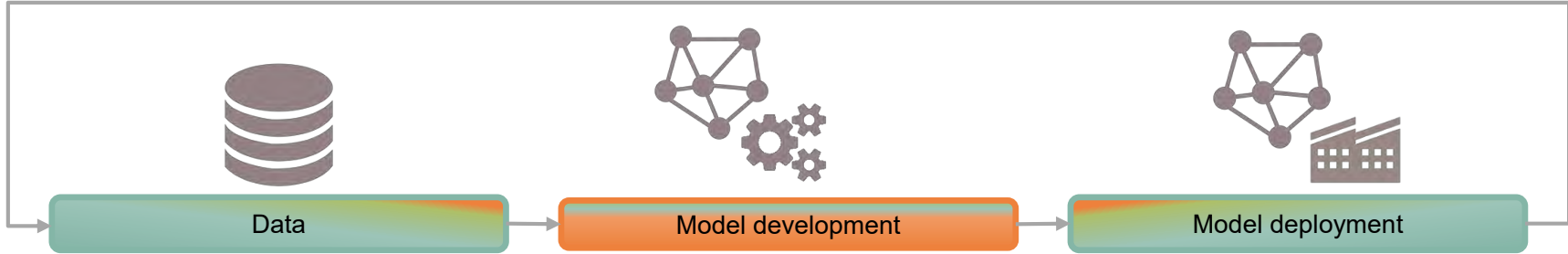
Data Science roles & competences



Data Science			
Profession	Data Scientist	Data Engineer	Domain Expert
Competence area	Mathematics & Statistics	Computer Science	Business domain knowledge
Skills/Profile	<ul style="list-style-type: none"> • Programming • Communication 	<ul style="list-style-type: none"> • Mathematics • Communication 	<ul style="list-style-type: none"> • Data analytics • Communication
Main activities	Model development	Data pipeline Infrastructure	Knows internal processes, e.g. business targets (KPIs), used tools, bottlenecks
			

Data Science lifecycle

re-training



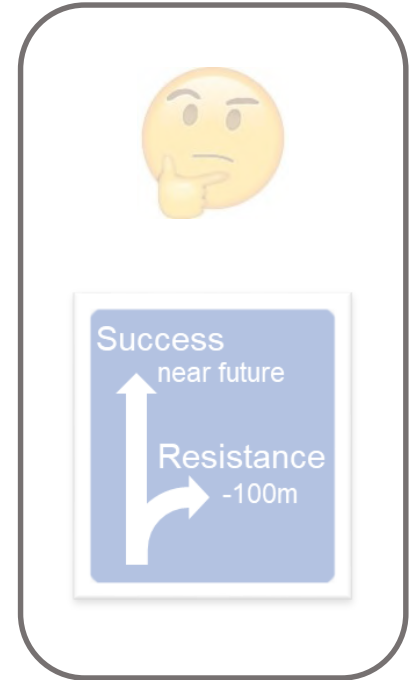
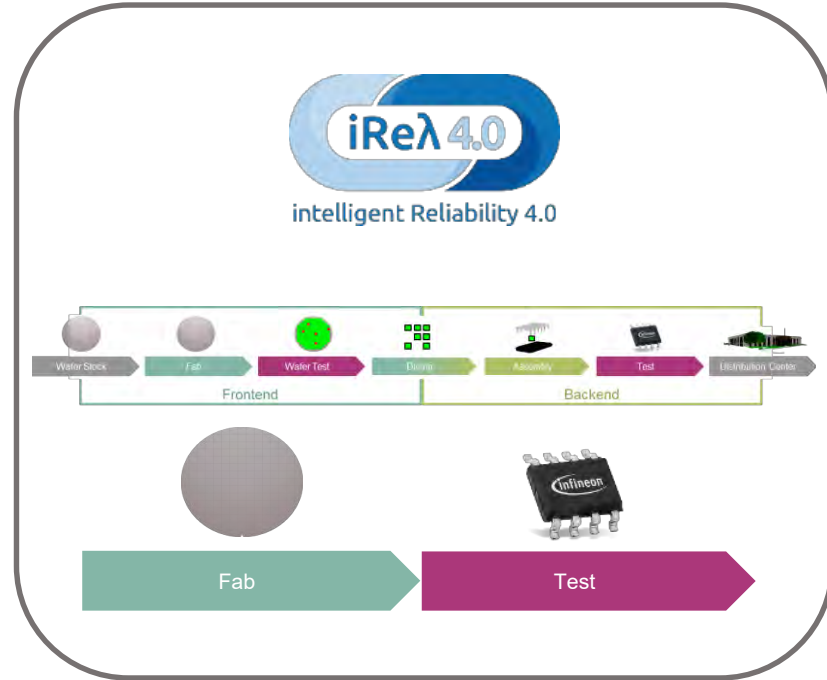
- Data Governance
- (Research) data management
- Data pipeline (data bases, warehouses)
- Unified data structure / interfaces
- Data Version Control

- ML vs. DL
- Generalization / Scalability
- Efficient model training
- Utilization of big unlabeled data
- Hyperparameter optimization
- Excursions

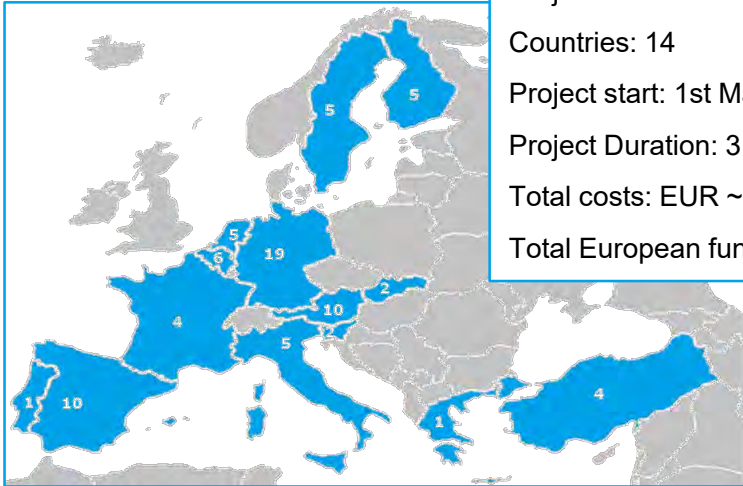
- Deployment platforms
 - Stand-alone tools (e.g. WebApp)
 - Integration into existing environment
- Maintenance
 - AI monitoring
 - Efficient re-training concepts

MLOps: Standardization and management of ML lifecycle

In this presentation I will talk about ...



iRel40 – intelligent Reliability 4.0

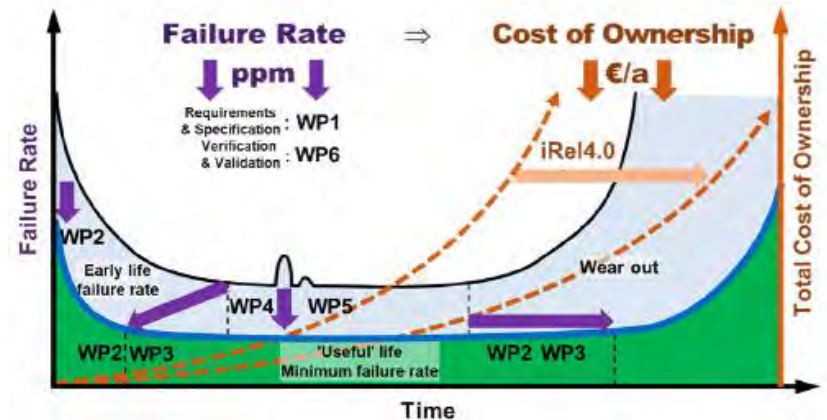


Project Partners: 79
 Countries: 14
 Project start: 1st May 2020
 Project Duration: 3 years
 Total costs: EUR ~ 103 millions
 Total European funding: EUR ~ 25 millions

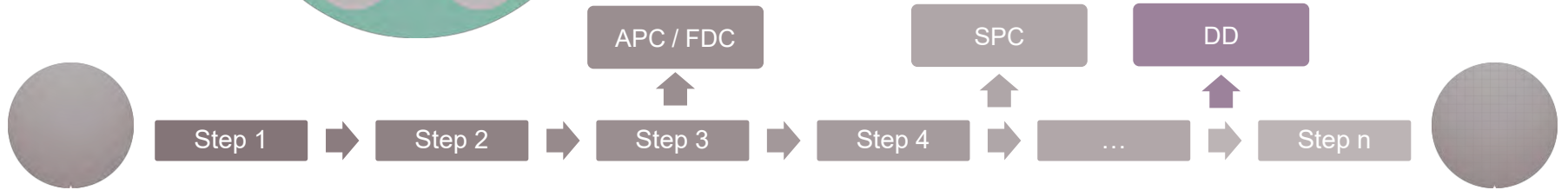
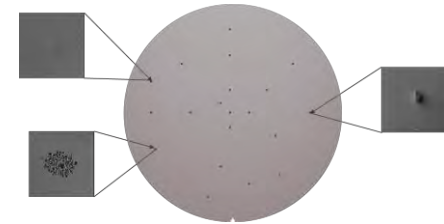
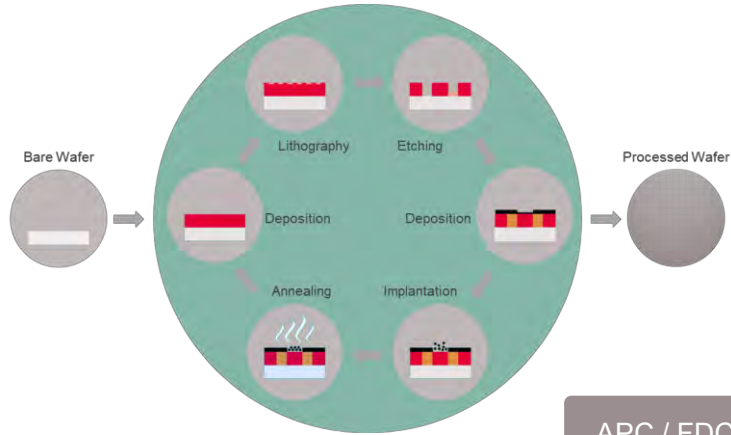
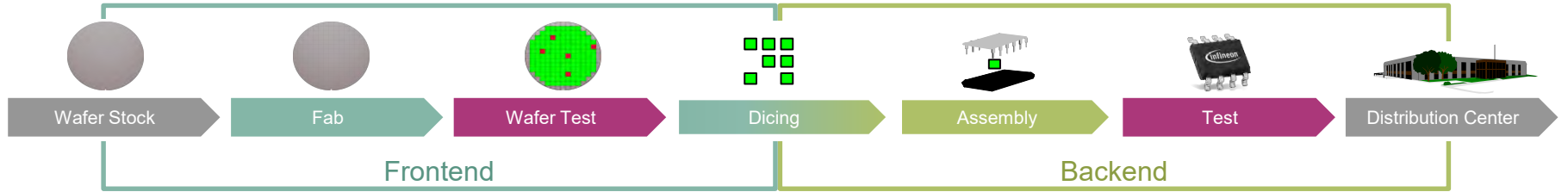
iRel40 has the ultimate goal of **improving reliability** of ECS by **reducing failure rates** along the entire value chain



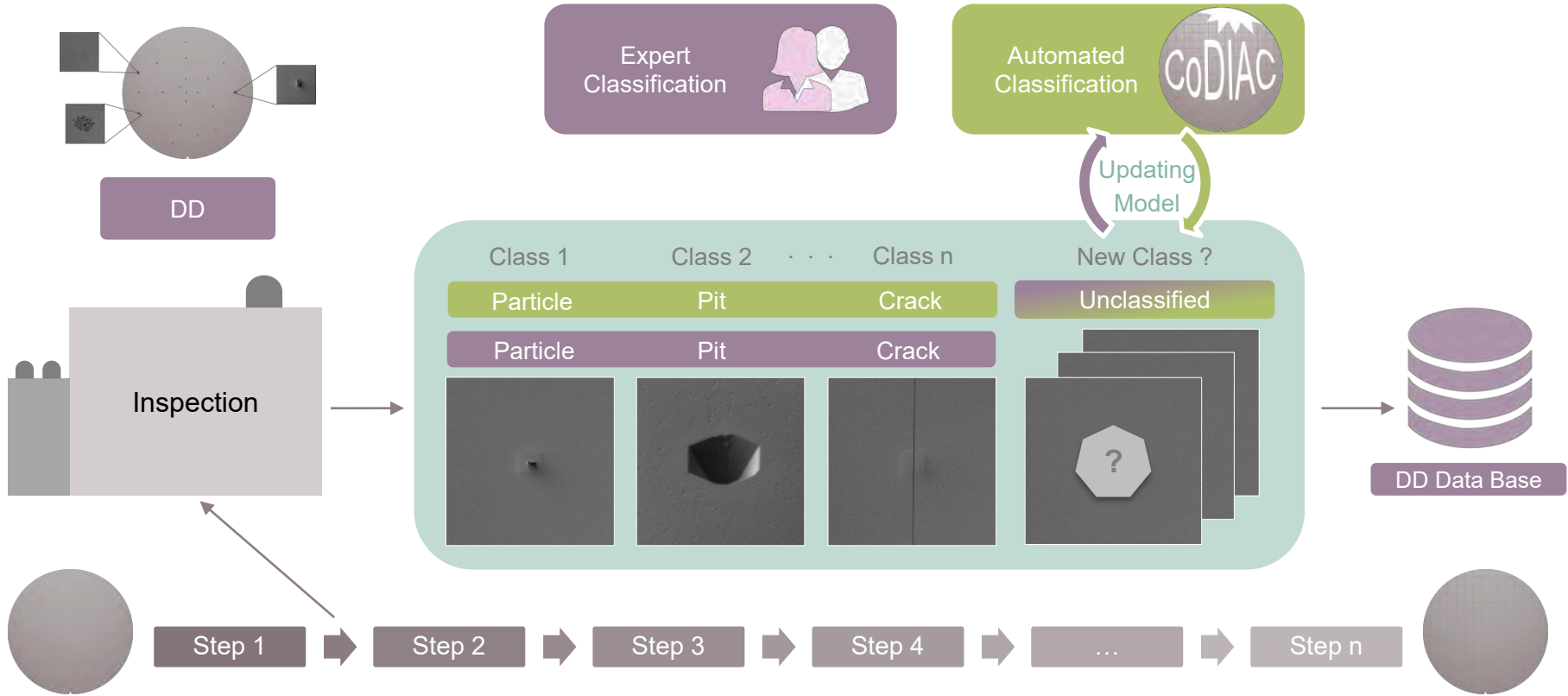
This project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 876659. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Germany, Austria (BMVIT-IKT der Zukunft, FFG project no. 877540), Slovakia, Sweden, Finland, Belgium, Italy, Spain, Netherlands, Slovenia, Greece, France, Turkey. The document reflects only the author's view and the JU is not responsible for any use that may be made of the information it contains.



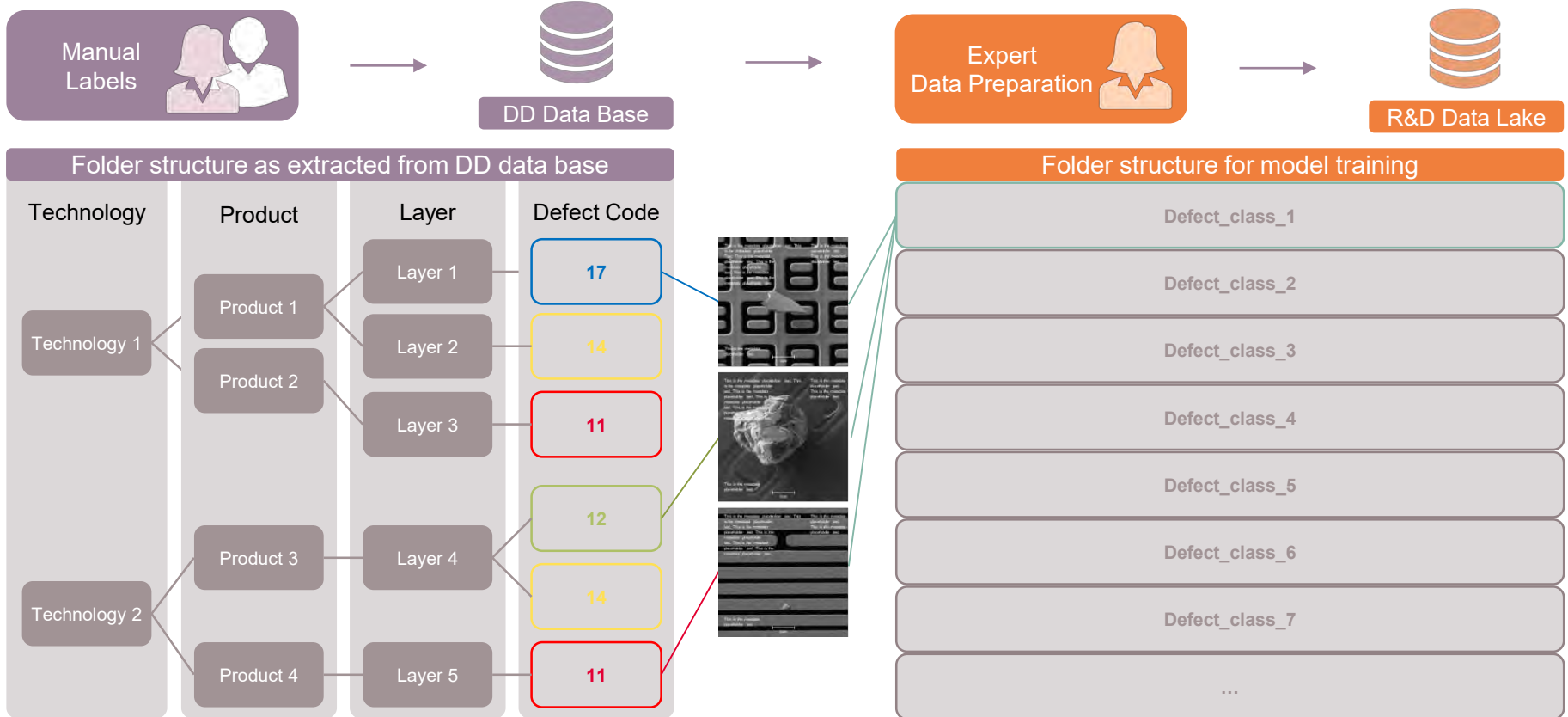
Semiconductor production chain - Fab



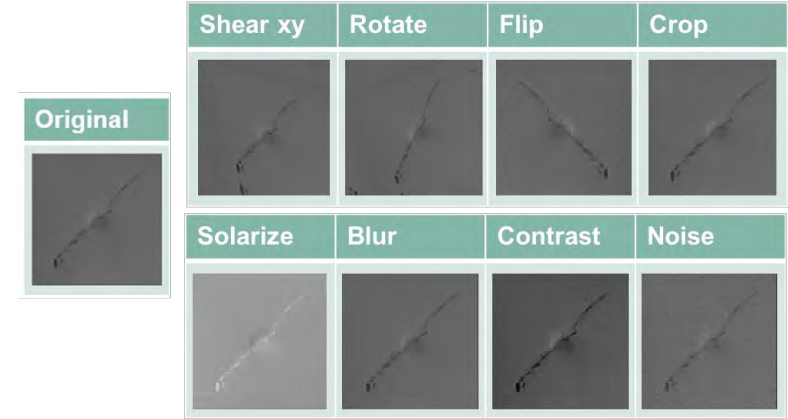
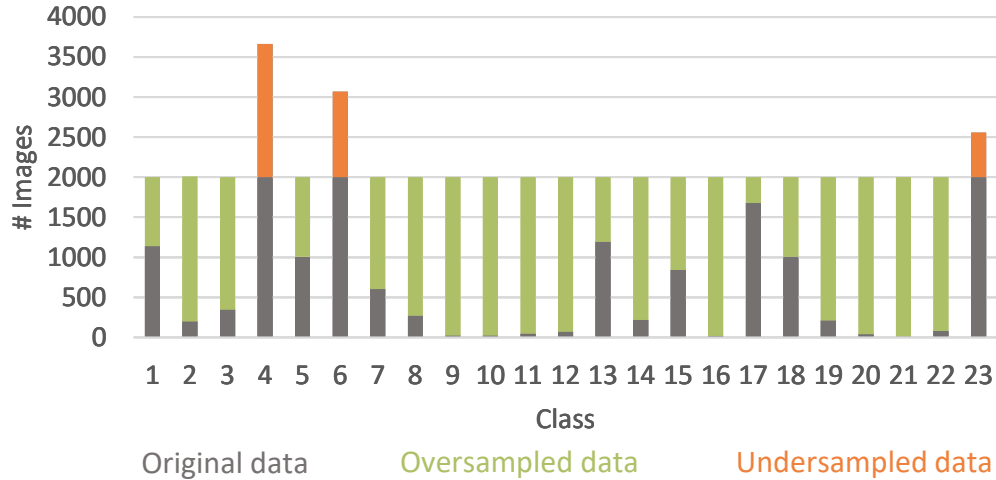
Automated image classification



Data preparation



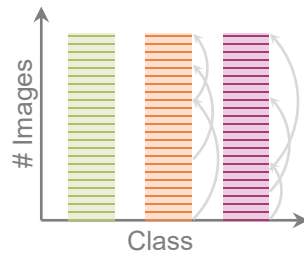
Sampling & data augmentation



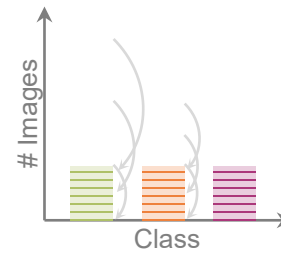
Unbalanced dataset



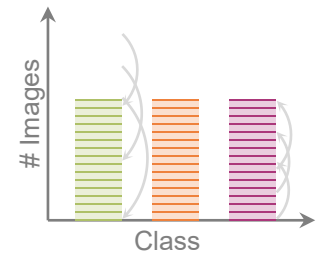
Oversampling



Undersampling

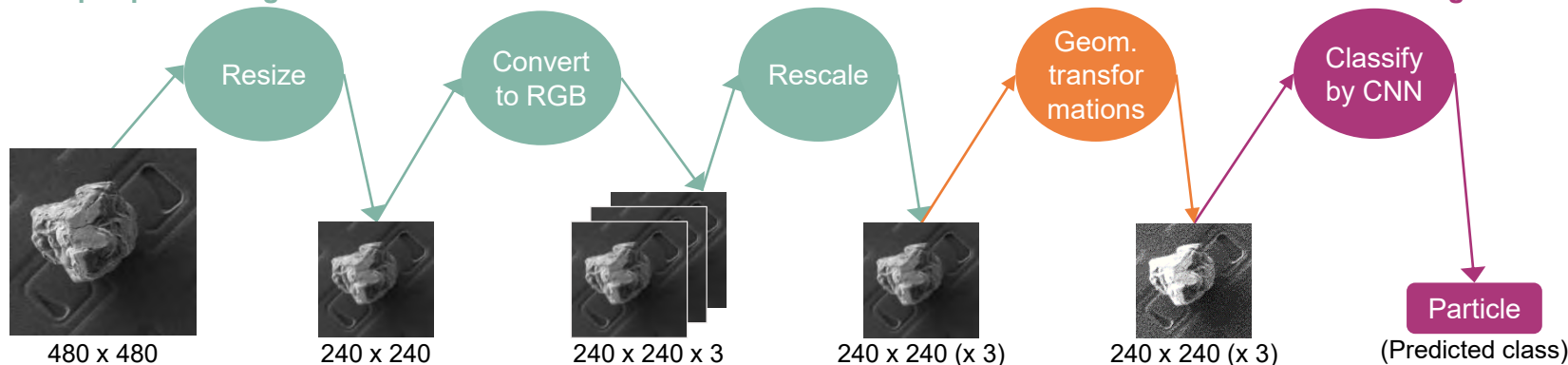


Hybrid technique

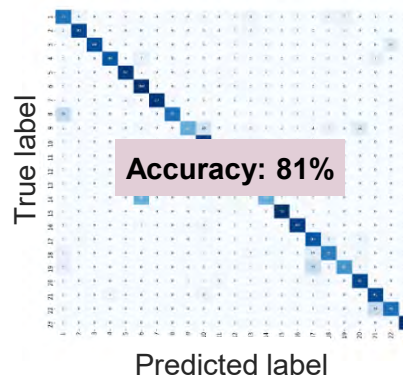


CNN classification

Data pre-processing

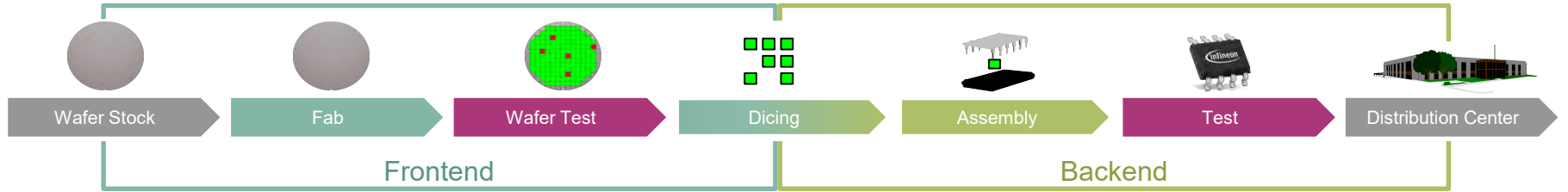


Master thesis:
Automated image
classification of defects
in SEM images

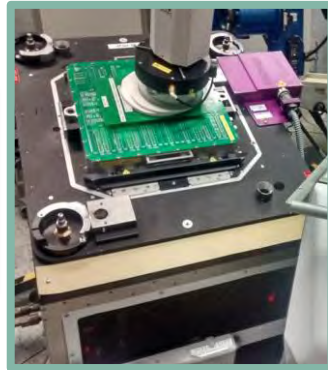


Parameter	Value
Model name	EfficientNetB1
Weights	ImageNet
Optimizer	RAdam
Loss function	Categorical cross-entropy
# of epochs	30
Batch size	32

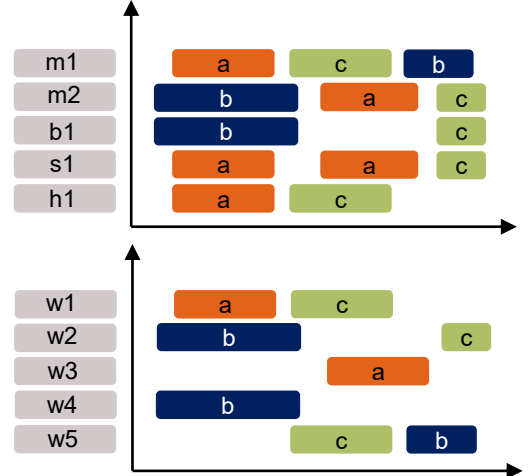
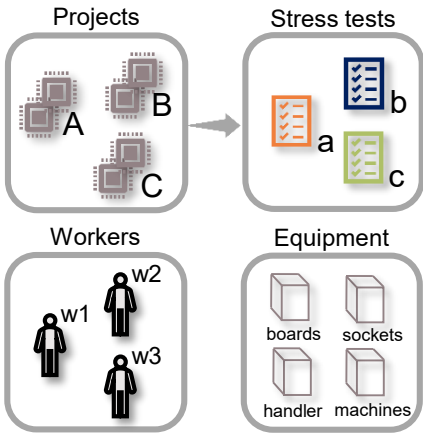
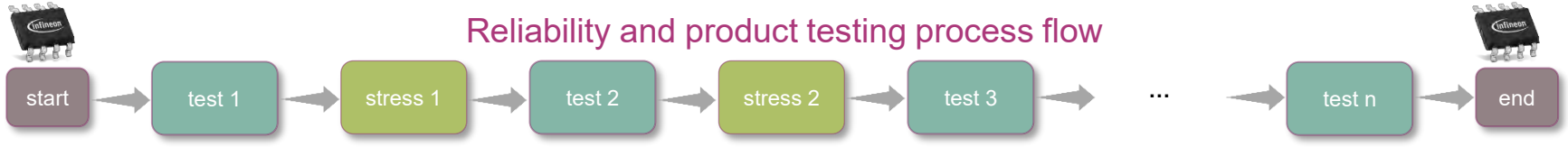
Semiconductor production chain - Test



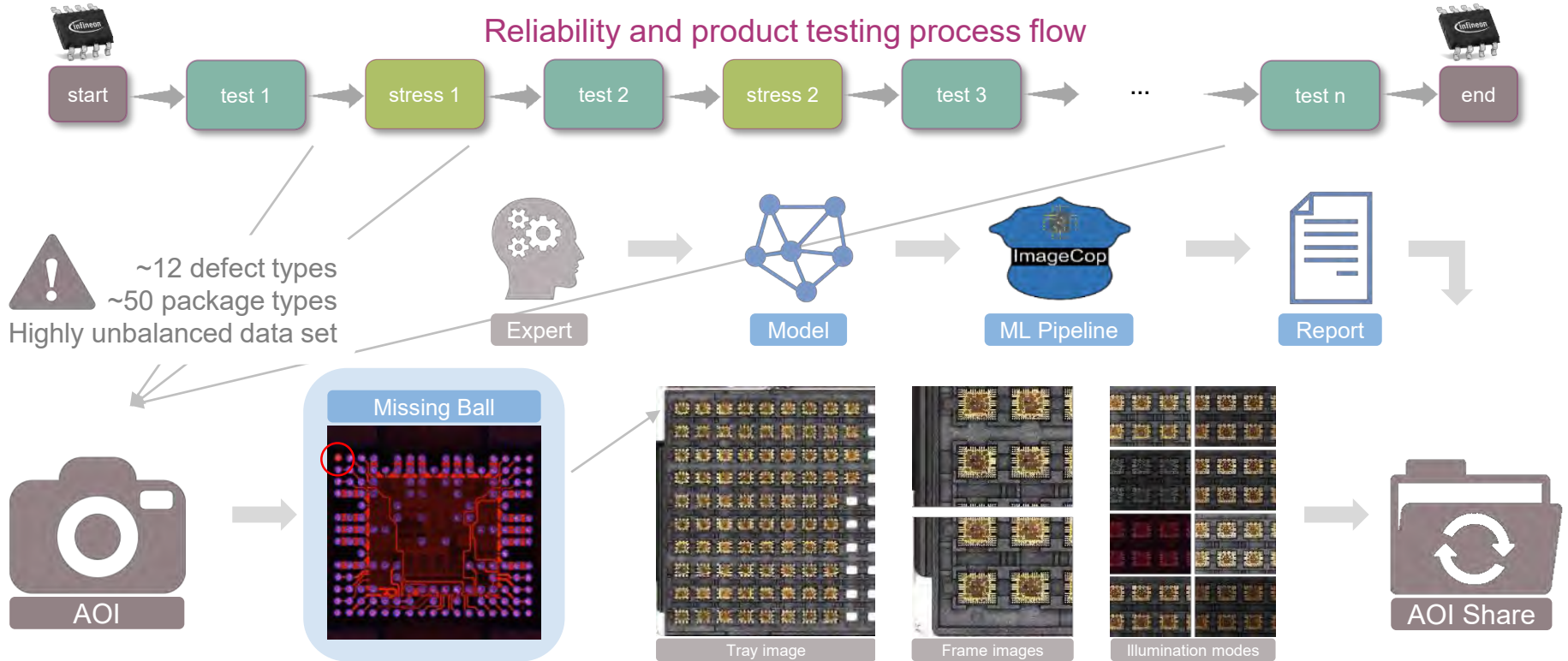
Reliability and product testing process flow



Scheduler

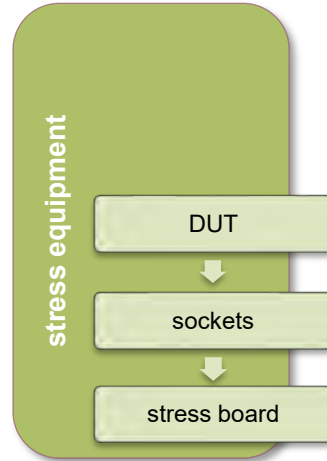
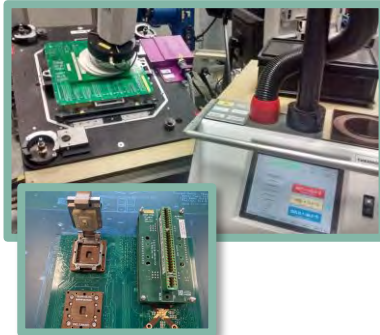
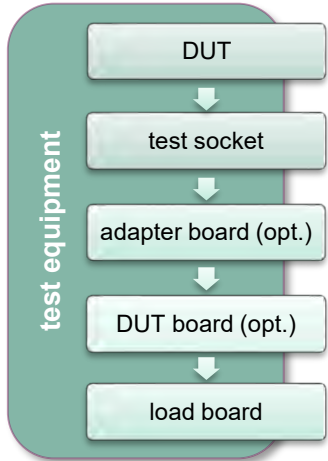
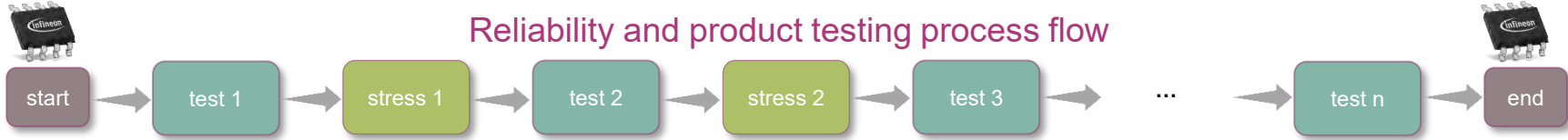


Anomaly detection



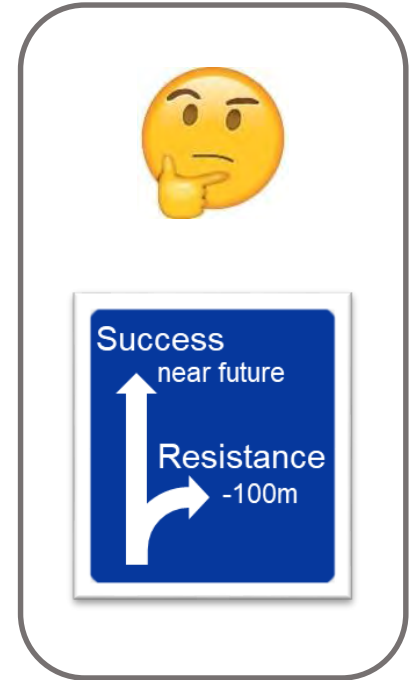
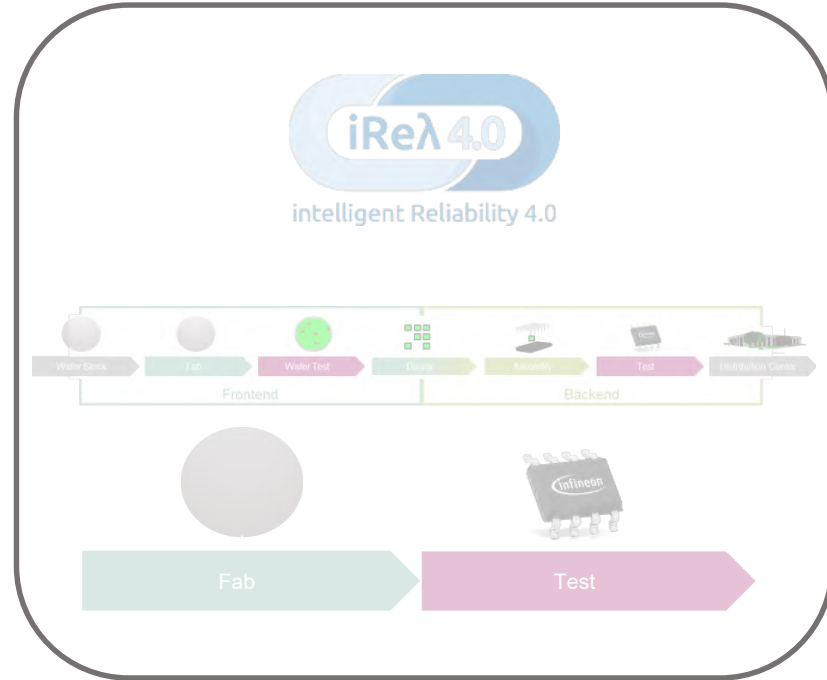
Goal: Flexible analysis pipeline to detect small and rare package defects

Equipment Monitoring



Master thesis:
Data-driven
equipment health
monitoring

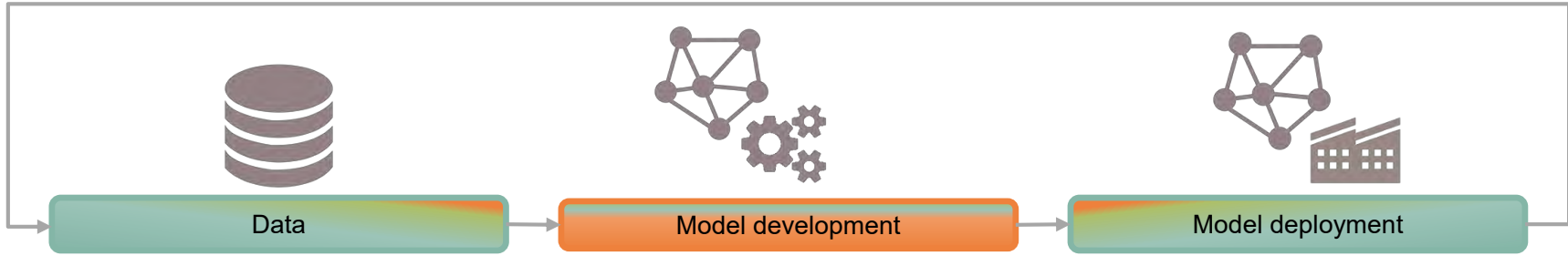
In this presentation I will talk about ...



Some provocative thoughts



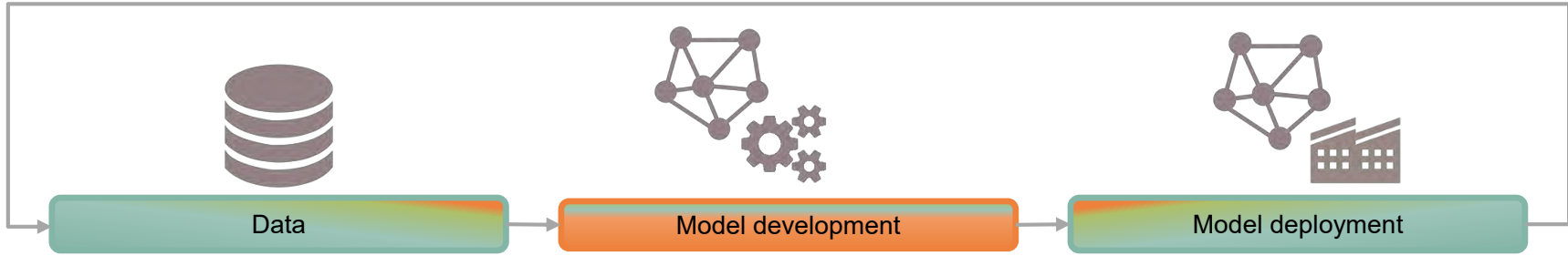
re-training



- > *More data is just more data*
 - > *Machines/Computers do not know what's interesting*
- > *A wrong attitude of expectation spoils your day*
 - > *That algorithms decide for us - is that what we want?*

Success factors

re-training



- > *Intensive collaboration*
- > *Faster deployment*
- > *Consideration of social aspects*
- > *Attention on lifelong maintenance*



Good news is, KAI & Infineon are aware of them!

Women in Data Science Villach



WOMEN IN DATA SCIENCE
VILLACH



WiDS Villach 2022
Data Science Conference

May 19, 2022
The 3rd annual Women in Data Science Conference Villach will be held in the centre of the rising high-tech region of Carinthia (Austria)

[DISCOVER VILLACH](#)

- WIDS Villach Team**
Meet our team members
- WIDS Villach 2021**
Conference summary
- Job Board**
Ready for the next career step?
- About WIDS**
Learn about the WIDS initiative

Welcome to Women in Data Science Villach | Austria
An independent regional initiative of WIDS at Stanford University

Women in Data Science (WIDS) started as a conference at Stanford in November 2015. Now, WIDS includes a global conference, with approximately 200+ regional events worldwide, a datathon, ...

[NEXT EVENT](#)

Thank you very much to all WIDS Villach 2021 Sponsors & Supporters!



Thank you for your attention!



Pfeiler Olivia (KAI DSC)
Olivia.Pfeiler@k-ai.at



Zernig Anja (KAI DSC)
anja.zernig@k-ai.at



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Martin.Pleschberger@k-ai.at



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Laurenz.Hundgeburth@k-ai.at



Matteazzi Andrea (KAI DSC)
Andrea.Matteazzi@k-ai.at

Check the **KAI website**

www.k-ai.at

for more information on

→ project work

→ available positions