



ProRail

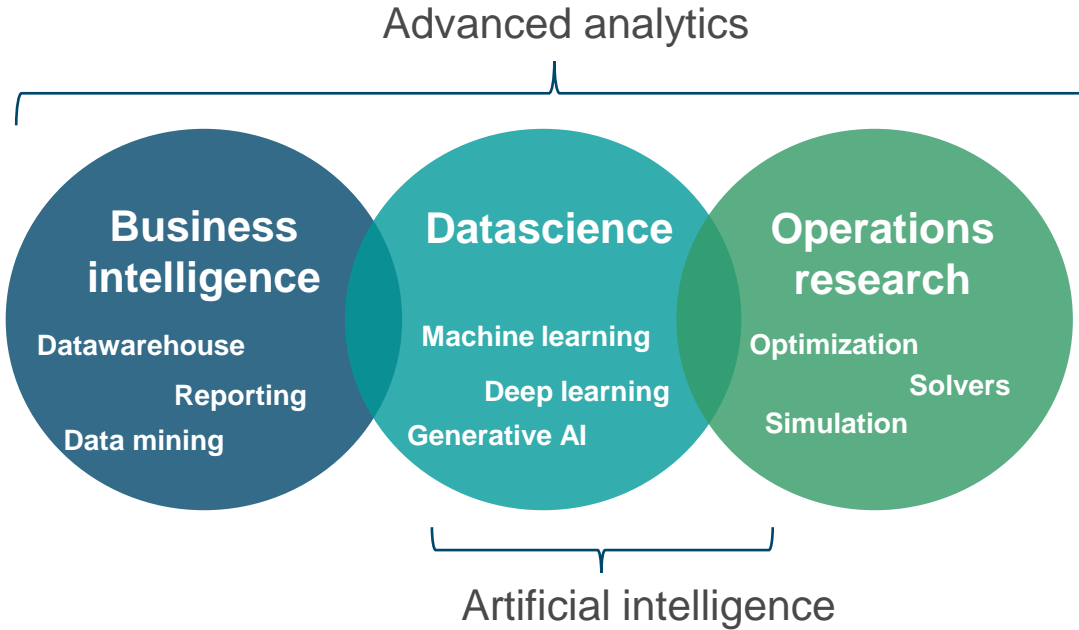
Artificial Intelligence in rail

Digital innovations at ProRail



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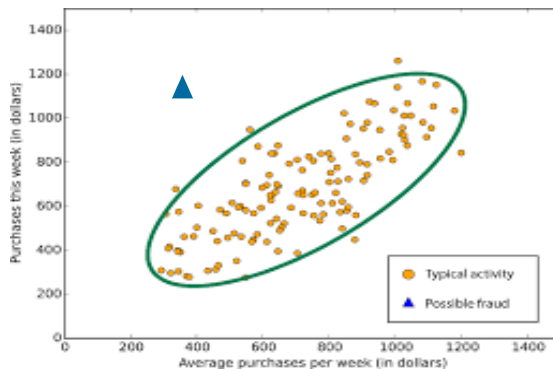
Artificial intelligence (AI)

is technology that enables computers and digital devices to learn from data (experiences) for recognising, explaining, predicting, creating

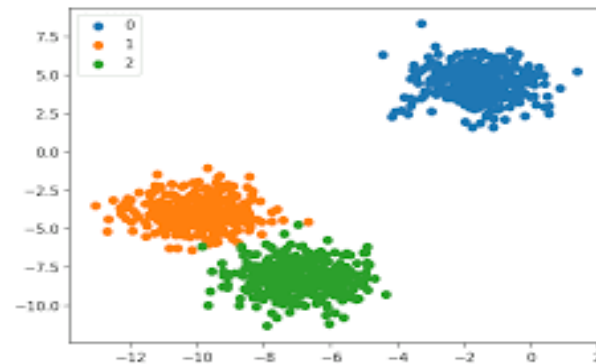


How to learn from big data

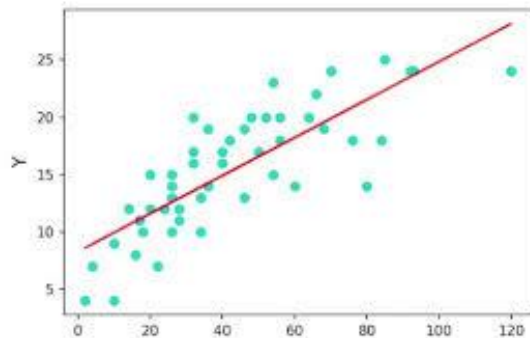
Some methods
(from basic to complex)



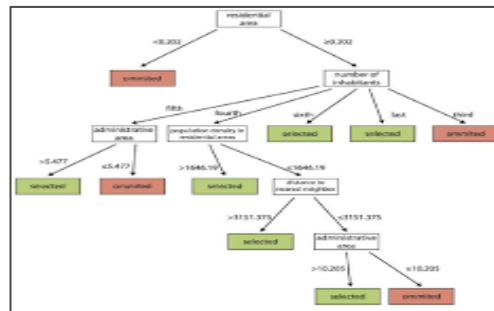
Anomalies & outlier detection



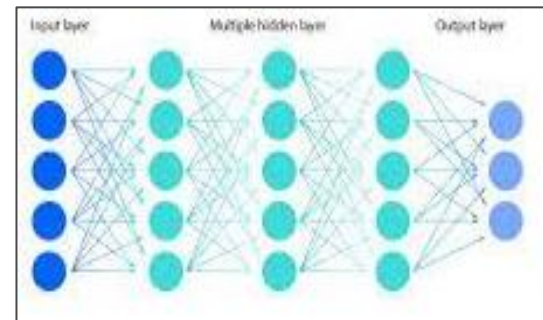
Classification



Regression (with 1 variable)



More variables (fe. Decision tree)



Neural network

Rail damage detection

Anomalies

ProRail

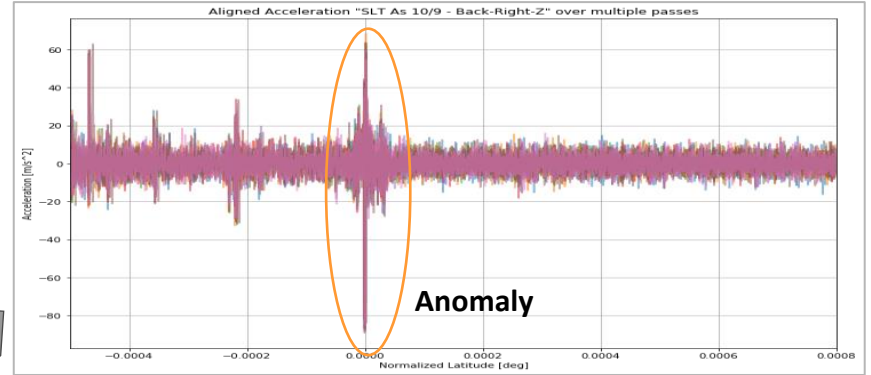
Sensor on passenger train



Raw data



Analytics



Inspect & fix



Fiber Optic Acoustic Sensing

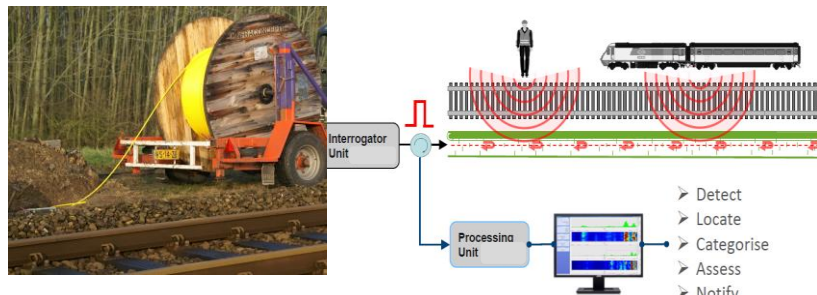
Classification

ProRail

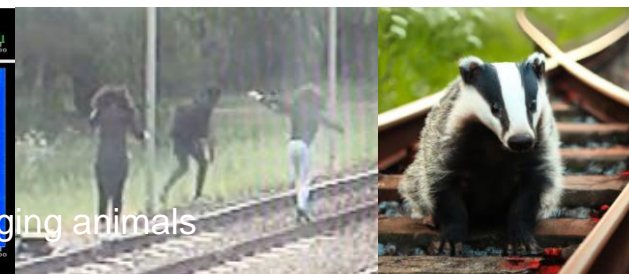
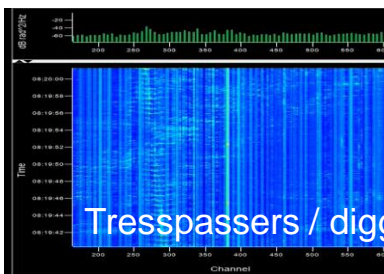
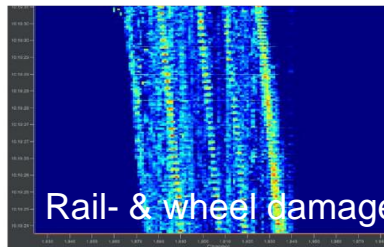
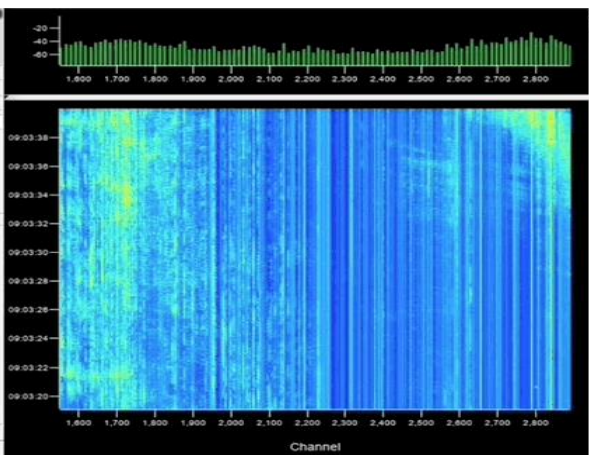
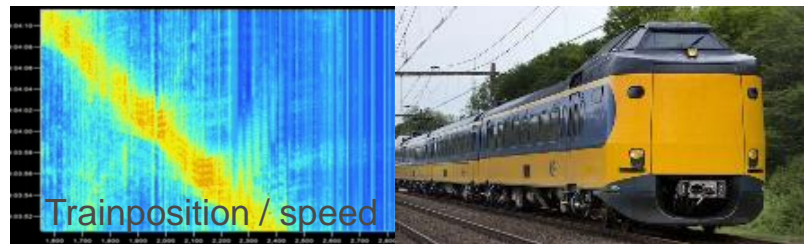
NetworkRail



Fiber cable becomes a sensor



Patterns -> classification



Rail wear prediction

Regression

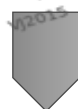
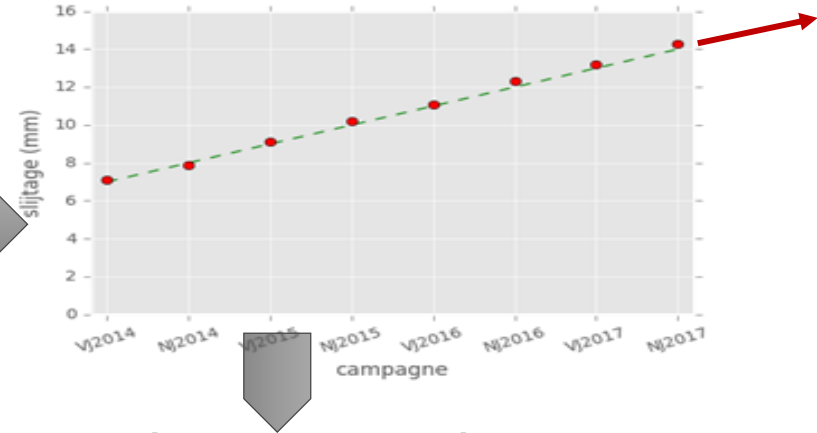
ProRail

Which rails should be replaced in 5-10 years?

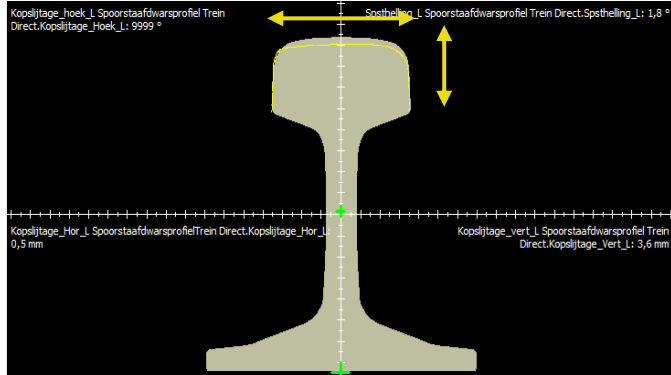
Measurement train



Wear rate (per 3m rails)



Railbar wear measurements



Predicted exceedance in 5-10 yrs



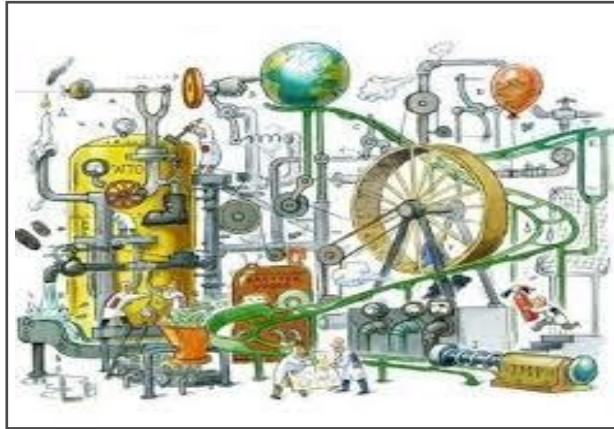
Energy demand prediction

What will the future required capacity be per substation (5-15 yrs) ? What are bottlenecks?

Substation data



Machine learning model



Substation setup

Historical power demand

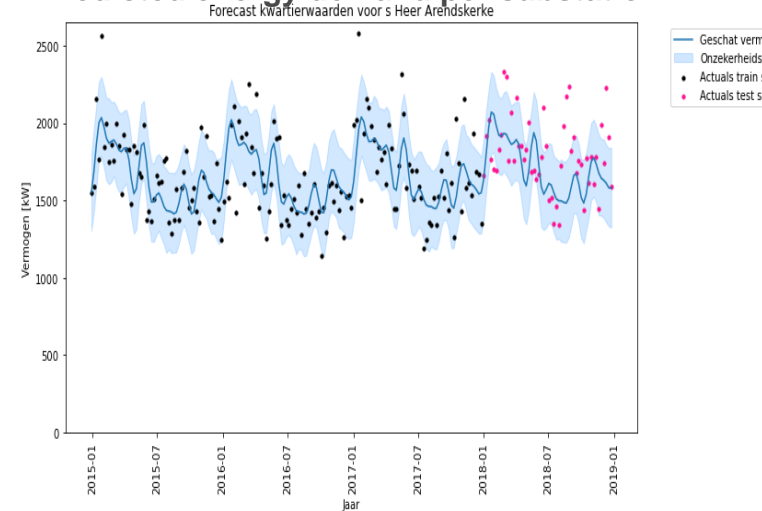
Timetable

Train types, behaviour

Season / temp

Etc.

Predicted energy demand per substation



Substations adjustments: not too late, not too early,

New AI techniques



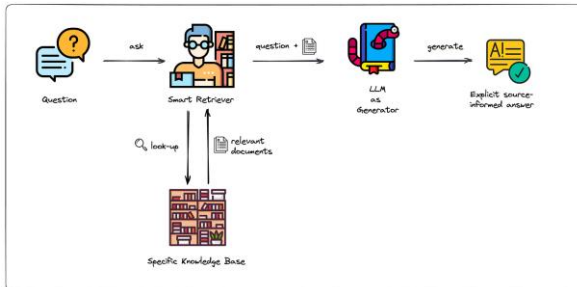


There is a bomb threat at Utrecht Central Station, track 5. As a train dispatcher, I have never experienced that before.

*What should I do?
ChatGPT, what do you recommend?*

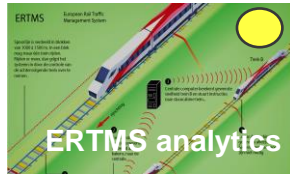
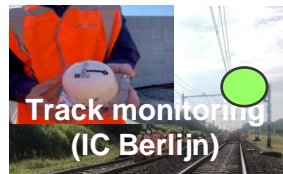
Pressure cooker of 3 days

- Concept is feasible
- Risk of hallucination
- Measures: smart retriever & structuring
- Development project is being started

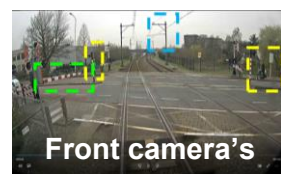


Main DataLab projects (2017 – 2024)

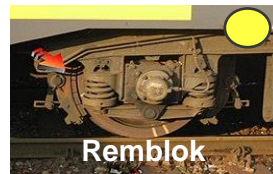
Asset monitoring & voorspelling



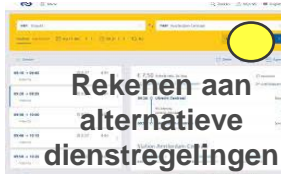
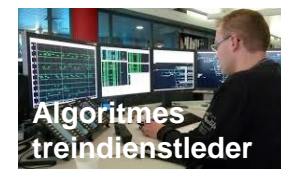
Monitoring from passenger trains



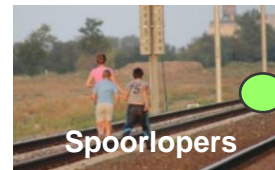
Wayside train monitoring




Train Logistics



People and behaviour



-  (being) Implemented
-  Innovation project 2024

Spreading datascience capabilities

Building capabilities

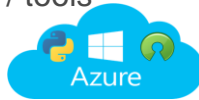


Innovations

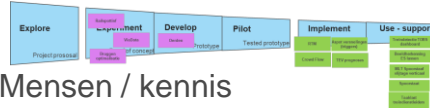
>50% geadopteerd door BE's

Way of working

- Middelen / tools



- Methoden



- Mensen / kennis



Datascience teams

AMI Beeldherkenning

AMI ADLT

Power All

Reizigerstrein als meetrein

Crowd Flow

ART Spoorvrij

Audise

Business units



Building datascience capabilities in the business units = digitization.



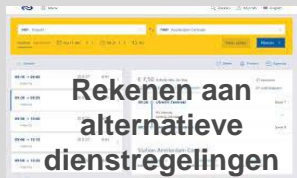
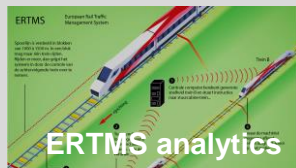
ProRail | Questions?

ProRail

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Innovating with datascience and sensing, build capabilities and spread knowledge.

Innovation projects 2024 (what)



Stop talking, start testing.

Blijven verbinden

Spread knowledge

In de organisatie

- Adoptie door 6 datascience teams in bedrijfseenheden
- Datascience community

In de spoorsector

- Webinar serie 'Datascience in het spoor': 25 keer, >200 deelnemers per keer
- Uitwisselingen EU sector

Way of working (how)

Mensen

- ProRail datascientists
- Externe flexibele schil

Middelen

- Azure
- Python
- OsiSoft

Bouwen met de winkel open

Methoden

- Experimenteren, pilots
- Datascience funnel
- Scrum werkwijze

