

A conceptual graphic showing a white, realistic human head in profile on the left and a glowing blue, stylized human brain on the right. The background is a dark grey grid with white lines and nodes, suggesting a digital or neural network. A red diagonal banner is on the left side.

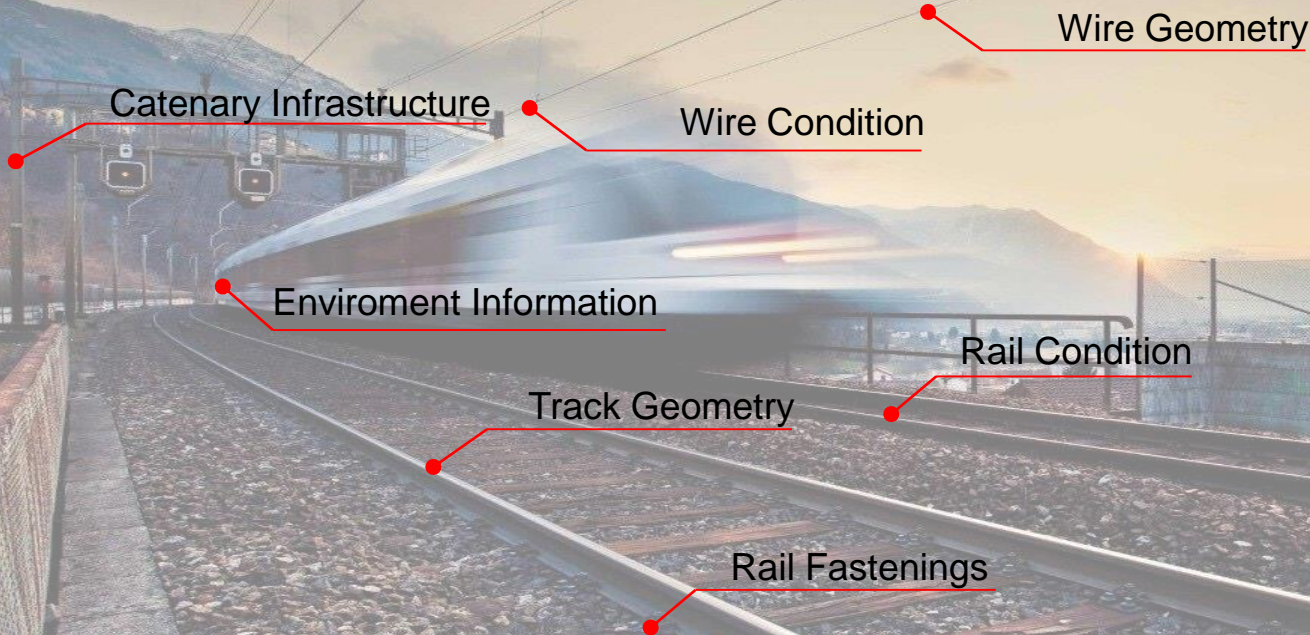
# Railway Inspection with Deep Learning.

Marcel Zurkirchen, SBB AG





# Infrastructure Condition Monitoring.



Safety.



Availability.



Costs.



Know-how.



# SBB Diagnostic Vehicle and Coach.



Production Speed up to 200 Km/h  
18 installed High-Speed Camera Systems  
with a Data Output of 10 GB/Km



# BIG DATA.



## Geometry

- Forms, Shapes
- Types
- Switch

## Artefacts

- Dirt, Garbage
- Leaves
- Chewing gum

## Weather

- Rain, Snow, Ice
- Fog, Humidity
- Sun, Clouds

Harsh Environmental Conditions.

460 012-8



Defect Detection



Fingerprinting



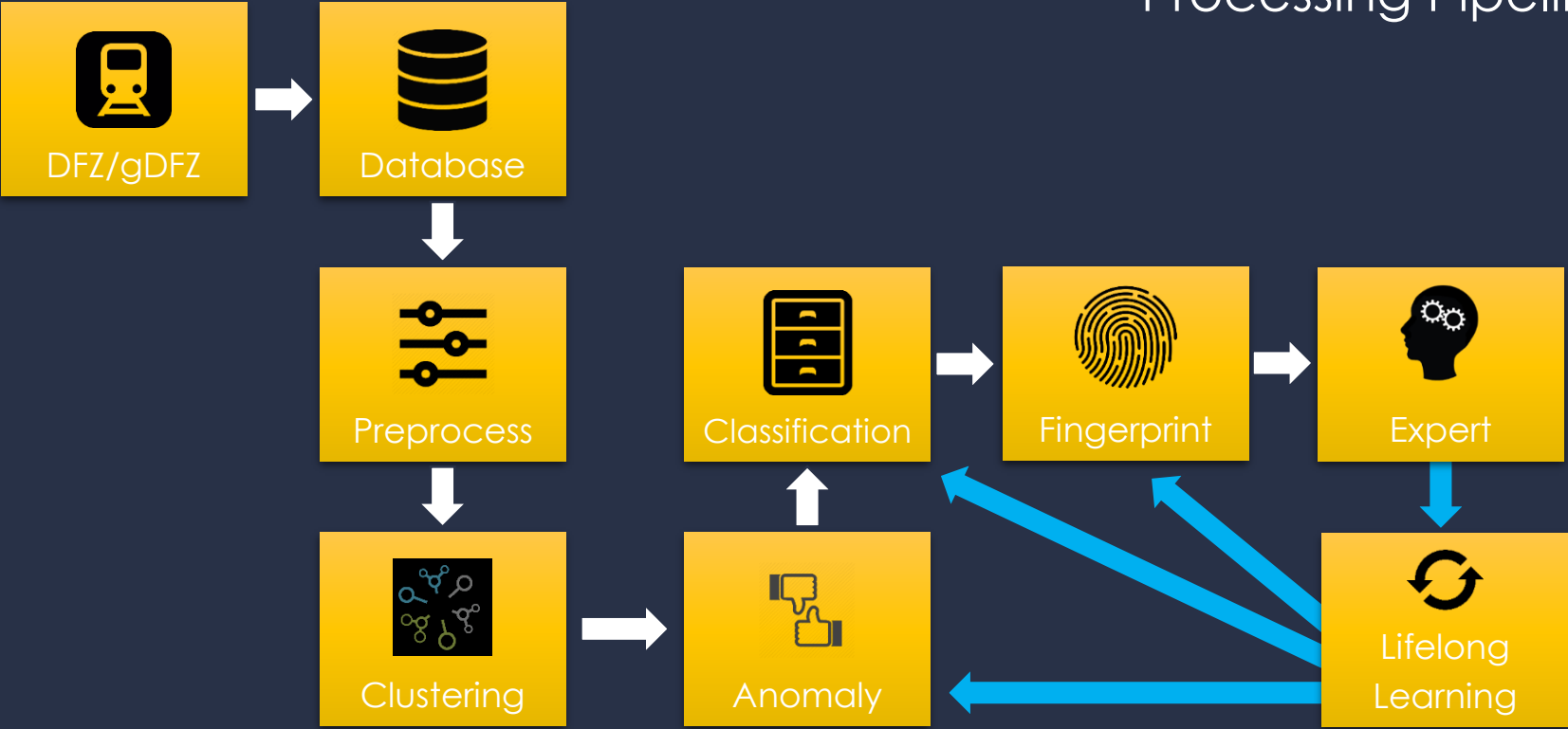
# AISI

Artificial Intelligence Schienen Inspektion.

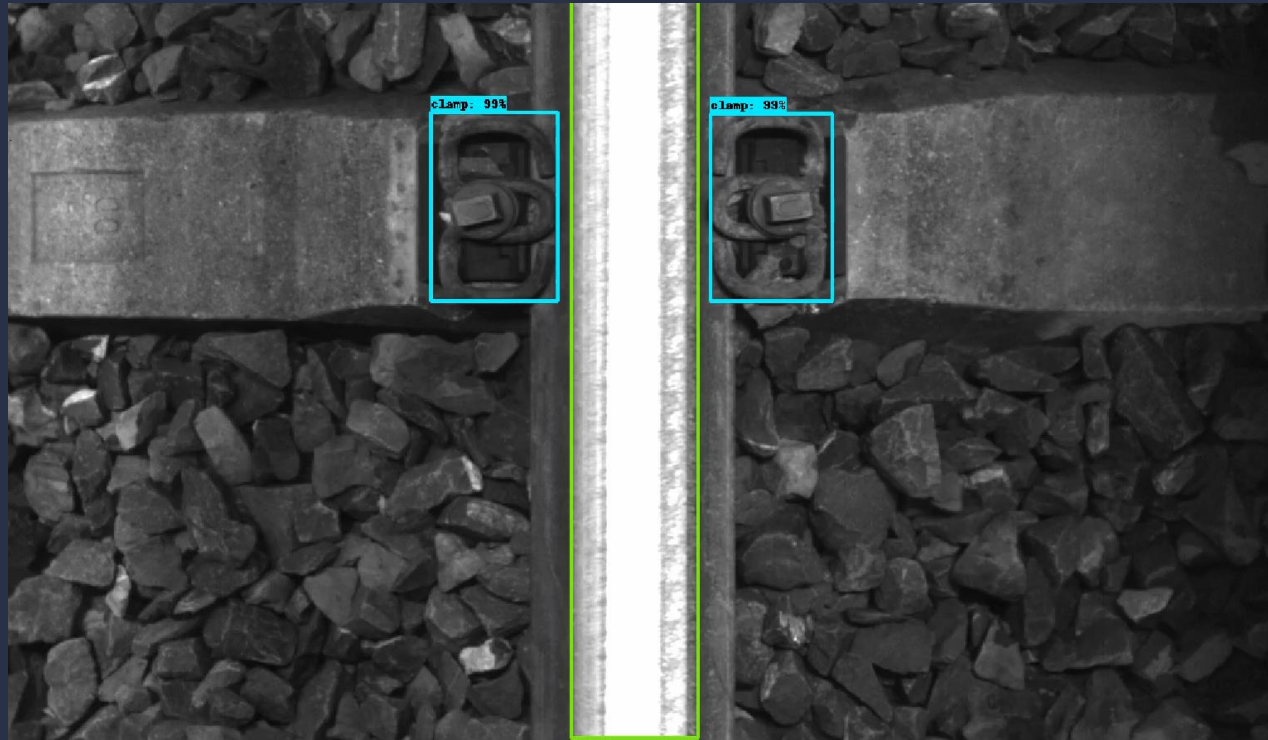
 SBB CFF FFS

 Csem

# Processing Pipeline.

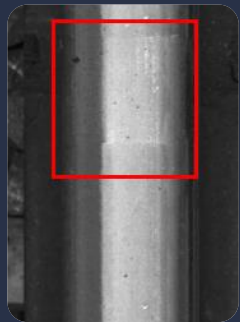


# Preprocessing.

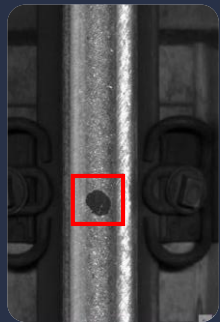




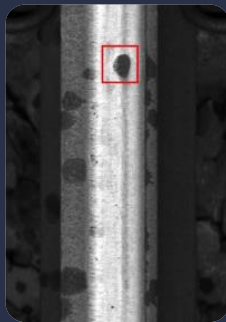
# Classification.



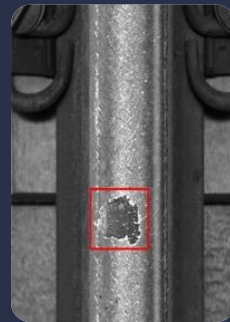
Welding



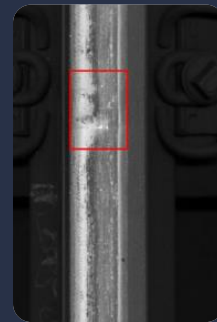
Plastic Particle



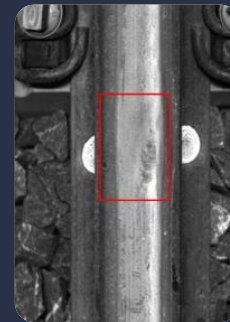
Surface defect



Chewing gum



Squat



Wheel slip

# Data Labelling.

**SBB Labeling Tool v0.9.17.0 - RailCheck\_SBB.kip**

Home Image Batch Processing Export

File Image File Browser Navigation Labels View Image Tools

Image File Browser

Track Information

### Live Position (km)

\\MUD-SERVER01\Diamond\_data\Surveys\TSIMS  
 Valid info found for image  
Official km: 73.267279

FileName	Date Time
SCount	452802
S51Count	113200500
LineID	415
TrackName	INK121.1-56N7011.2
TrackID	21163200
TrackType	1
Officialkilometer	73.267512762046
MeasuredSpeed	118.6944
Date	19.09.2017 14:29
VehicleOrientation	Forward
Kilometrage	Decreasing
Temperature	11.49667
Latitude	47°11.41412' N
Longitude	7°48'37.82920' E
Altitude	461.3
PassengerSpeed	200

Label Settings

Misc	
Category	Cyan
CreationTime	15.11.2017 11:35
Description	
ID	Oberflächenfehler
Rectangle	(x=177.0214; y=11065.95; ...)
Size	83.74463; 103.6074
Tags	

Templates

#	ID	Category	Type
G	GOOD	Image	Image
B	BAD	Image	Image
O	Oberfläch...	Rectangular	Rectangular
J	Joint	Rectangular	Rectangular
N	NOT CLEAR	Rectangular	Rectangular
S	Squat_Ein...	Rectangular	Rectangular
T	Schleuder...	Rectangular	Rectangular
W	Welding	Rectangular	Rectangular

Go to position

Line ID: [Dropdown]  
Track: [Dropdown]  
Kilometer: 0.000000

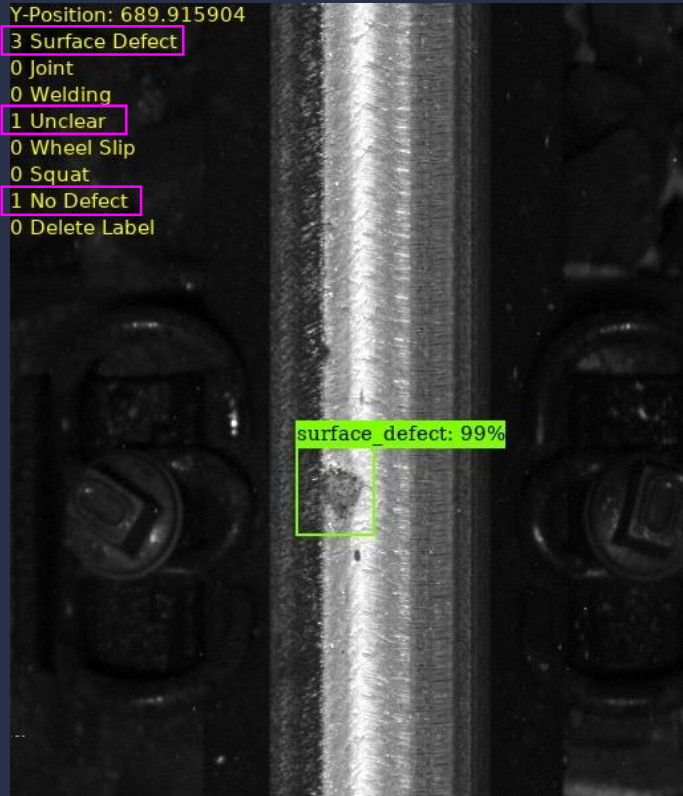
Record 639 of 1128

Search 20170919\_162415

\\MUD-SERVER01\Diamond\_data\Surveys\TSIMS\DFZ\RHS\_R\_PNG\20170919\20170919\_162415\20170919\_162415#21\_00452785\_0113196465.png Labels of image: 3

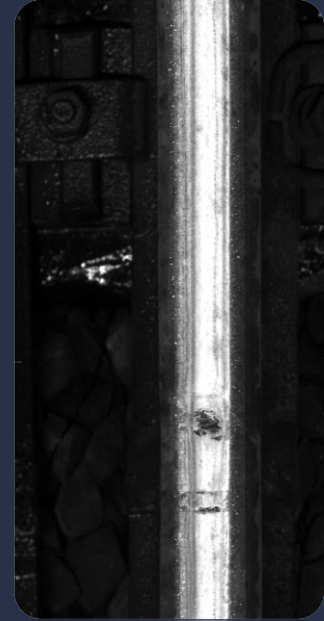
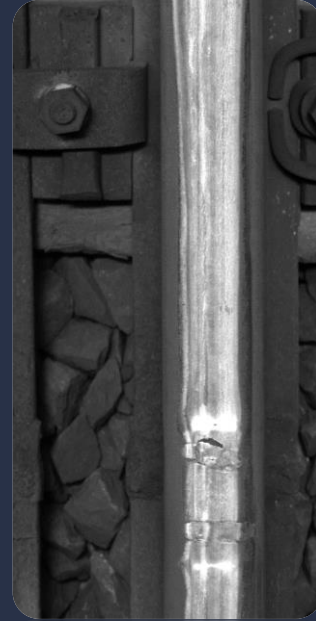
512x1992

# Experts, Know-how and Crowd Labelling.



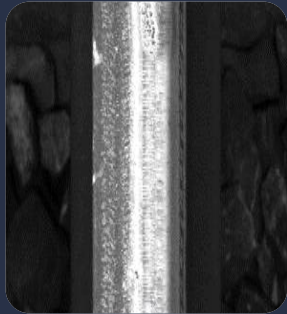


Fingerprinting.



∞ ∞

# Evolution of a Defect.



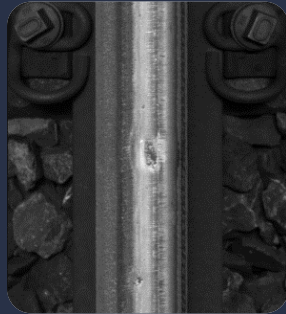
November 2016



February 2017



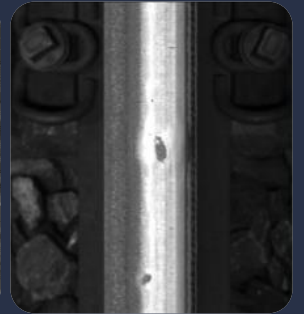
April 2017



Mai 2017



June 2017



August 2017

# FALSE POSITIVES.

(WITHOUT FINGERPRINTING, PER KM)

Classical Algorithms  
(10 years optimized)



Neural Network  
(after initial training)



Tunnels

160

-95%

10

Open Track

20

-50%

10

# Improving Predictive Maintenance.



Zürich, Switzerland

