

World Tunnel Congress & Exhibition



WTC 2019

ITA - AITES General Assembly and World Tunnel Congress

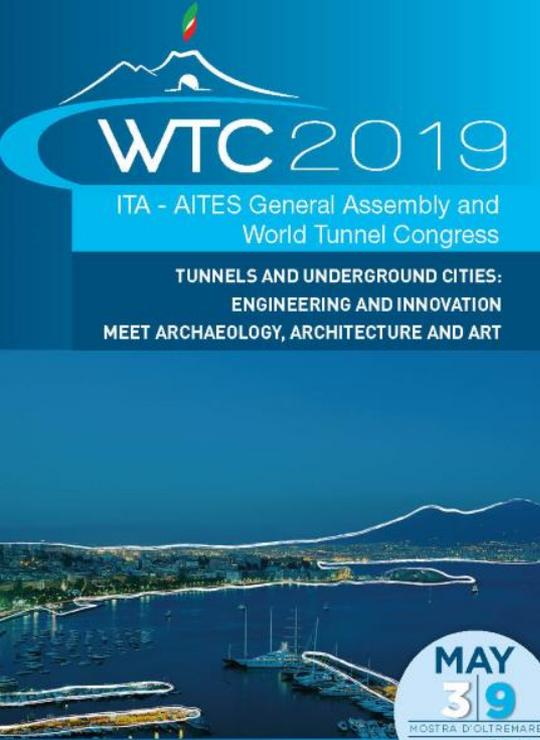
**TUNNELS AND UNDERGROUND CITIES: ENGINEERING
AND INNOVATION MEET ARCHAEOLOGY, ARCHITECTURE AND ART**

MAY
3 | 9
MOSTRA D'OLTREMARE
NAPLES 2019



Società Italiana Gallerie
Italian Tunnelling Society





The use of Artificial Intelligence for a cost-effective Tunnel Maintenance

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Presenting Author: O. Schneider

Facts & Figures Amberg Group Ltd



Amberg Group is addressing the challenges of growing urbanisation with solutions for a smart use of space both underground and aboveground.



Foundation

Since 2016 Holding
“Amberg Group Ltd”



Facts

- 100 % family owned
- 4 companies
- 400 employees worldwide
- 8 subsidiaries on 3 continents



Offerings

- Engineering Services
- Surveying Solutions
- Test Gallery
- Logistics solutions

Facts & Figures about Amberg Technologies AG



Amberg Technologies has been developing user-friendly surveying solutions for more than 35 years. We propose customer-tailored solutions and practice-proven products in the fields of railway and tunnel surveying, tunnel seismics and geomonitoring.



Foundation

The company was founded in 1981 out of Amberg Engineering



Facts

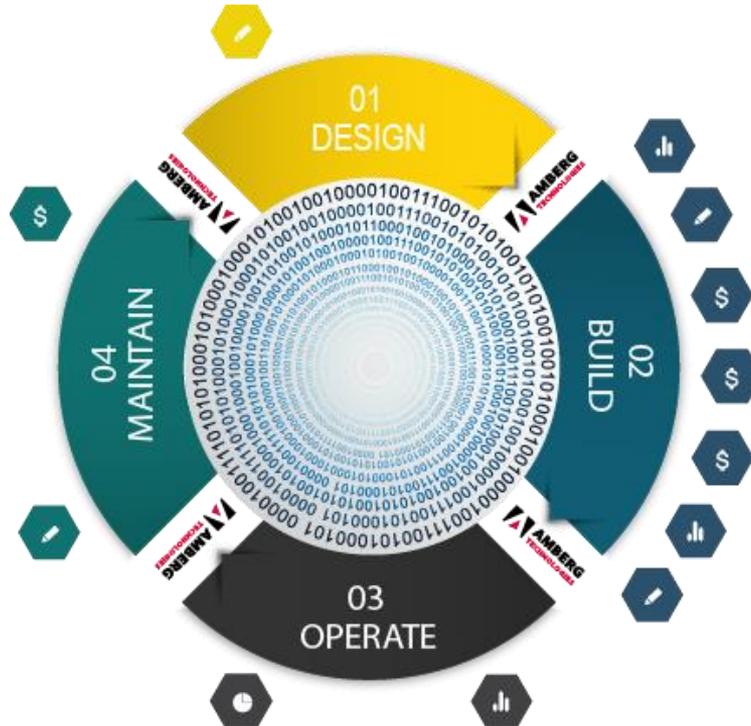
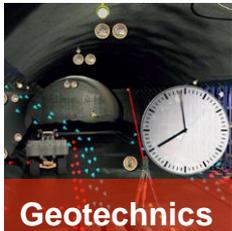
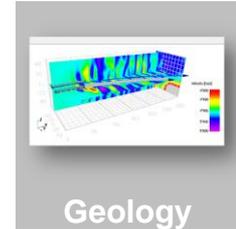
- 74 employees
- 2 locations
- > 30 distribution partners



Business areas

- Tunnel surveying
- Railway surveying
- Geophysics
- Services

Cover the entire Tunnel life-cycle process





Tunnel Inspection with Artificial Intelligence

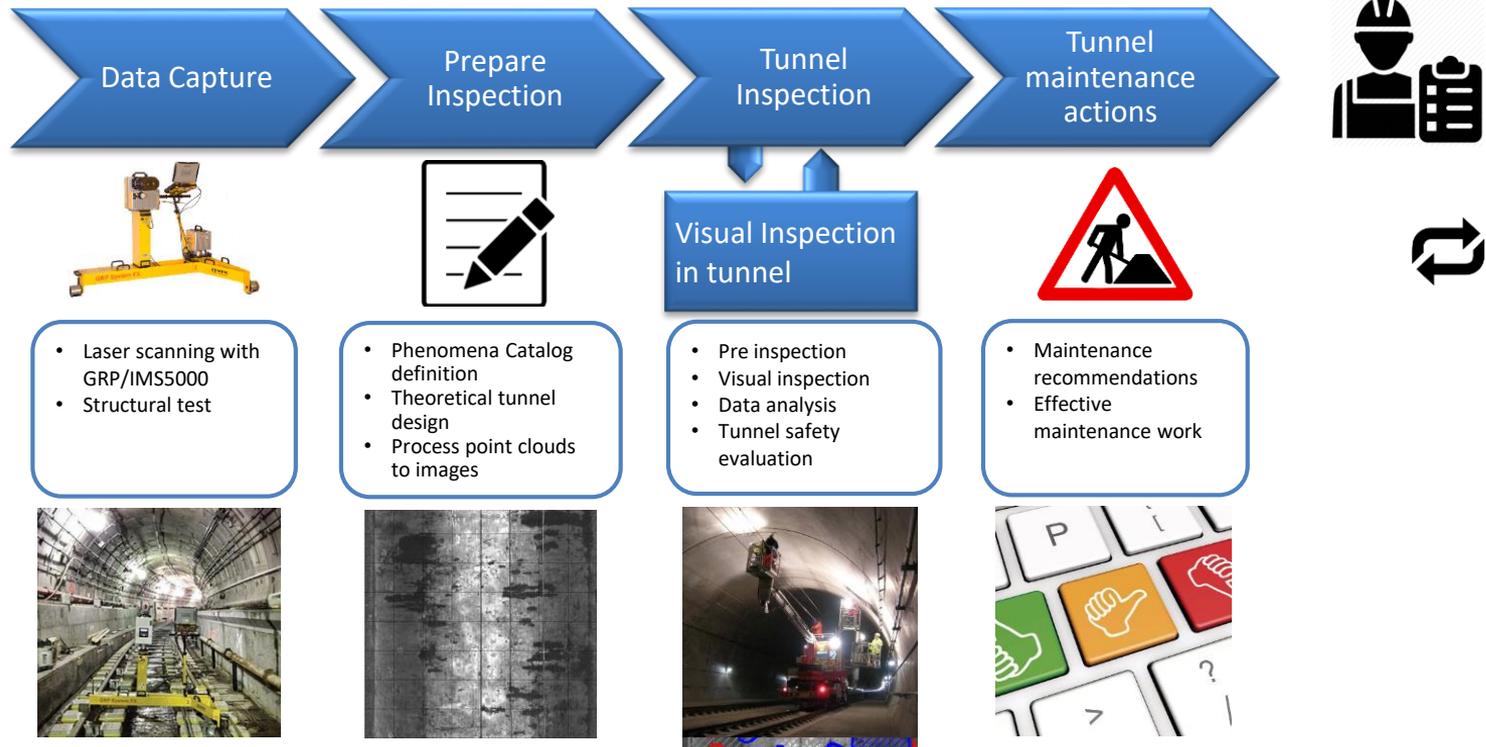
Old Lötschberg line, around midnight
Switzerland September 2018





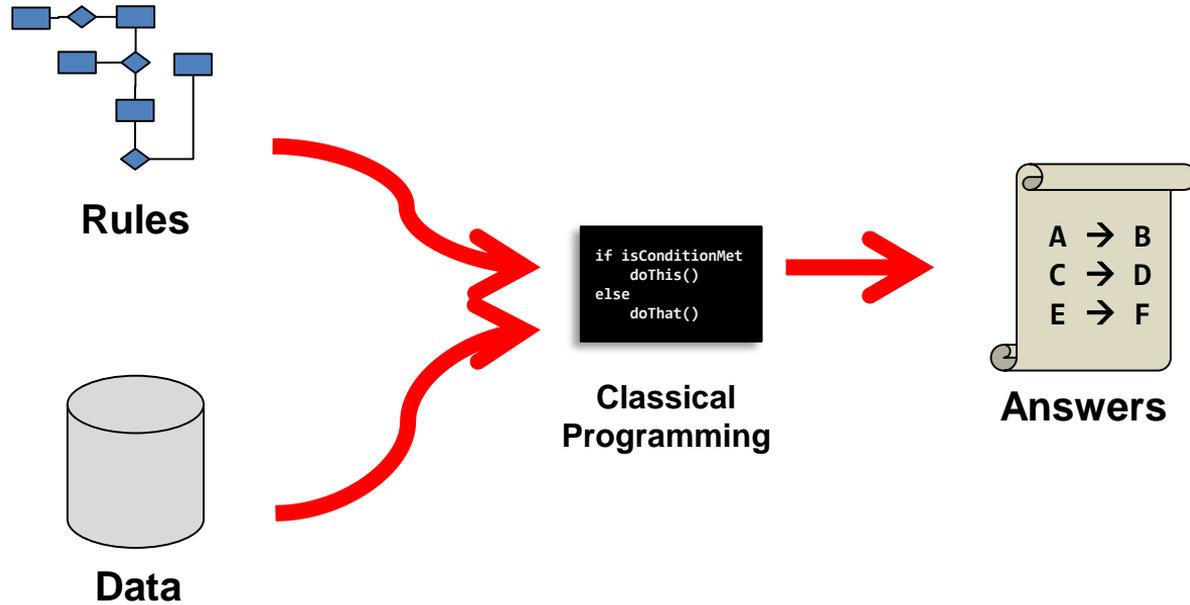


Tunnel Inspection workflow

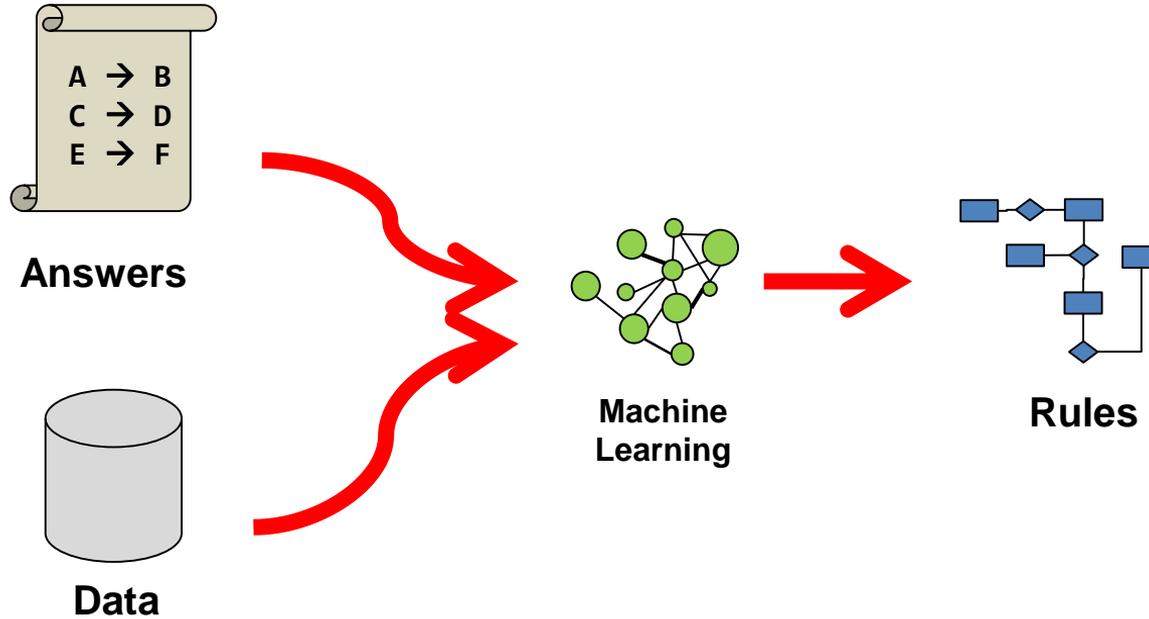


What is Artificial Intelligence?

Paradigm Shift

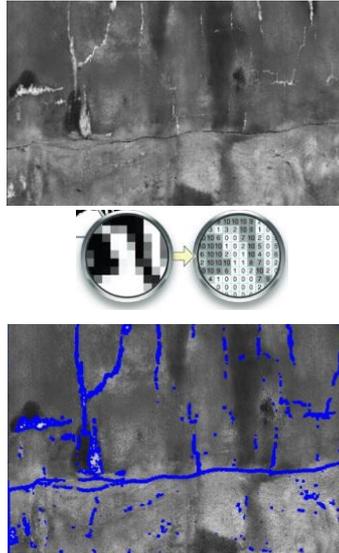


Paradigm Shift

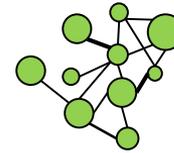
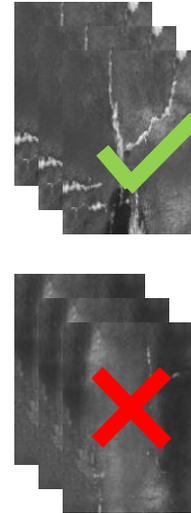


So we did this for tunnel inspection ...

Classical

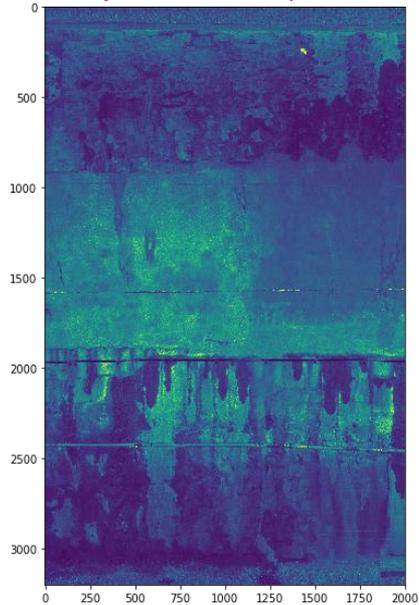


Machine Learning

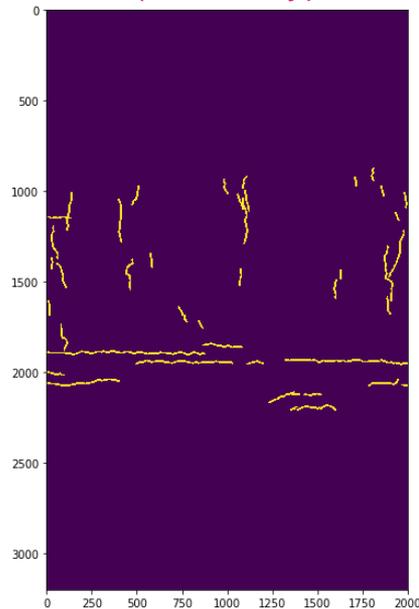


Results of deep learning – cracks in sprayed concrete lining

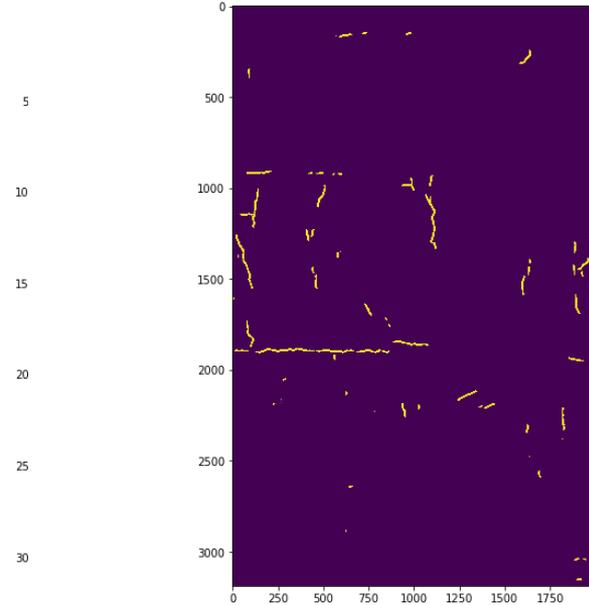
Source Image (pre-processed)



Human inspection (manually)

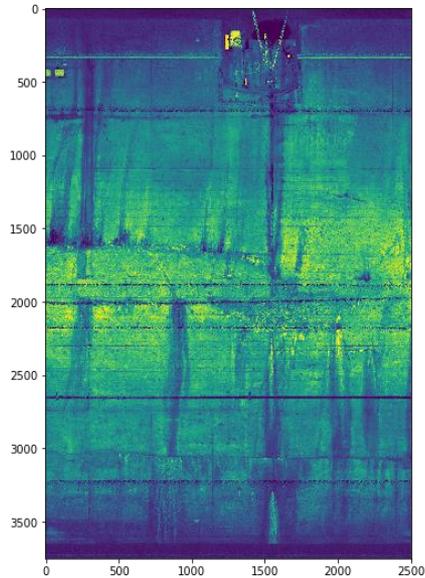


Deep learning (automatic)

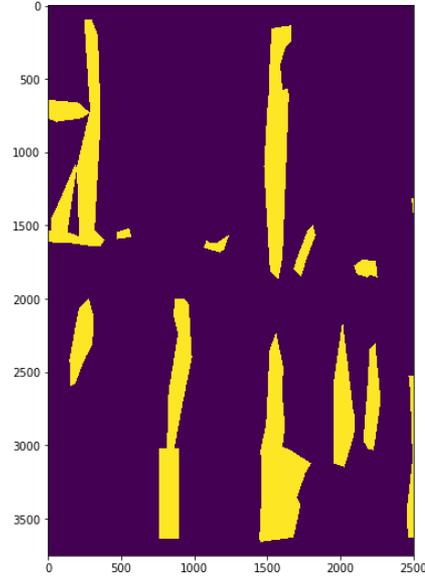


Results of deep learning – wet area in concrete linings

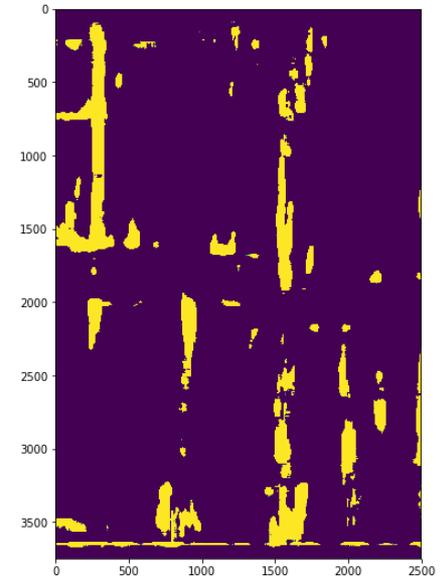
Source Image (pre-processed)



Human inspection (manually)

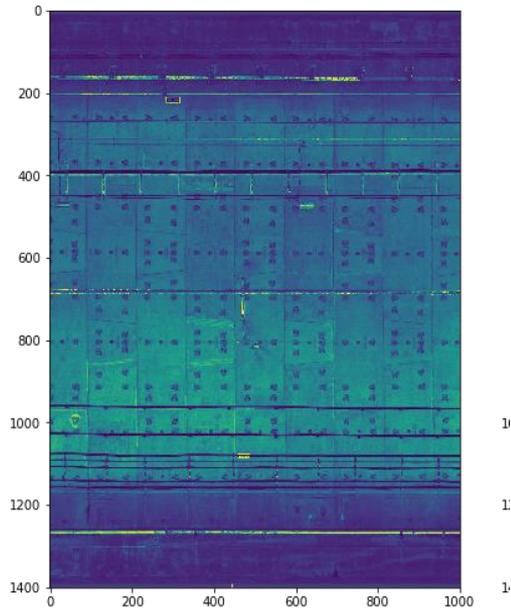


Deep learning (automatic)

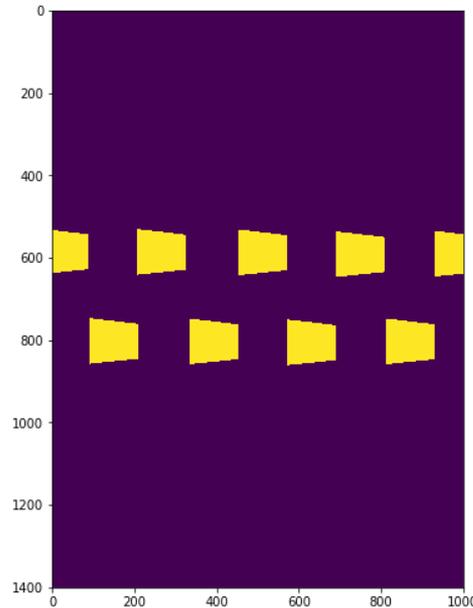


Results of deep learning – key stone segment tunnel

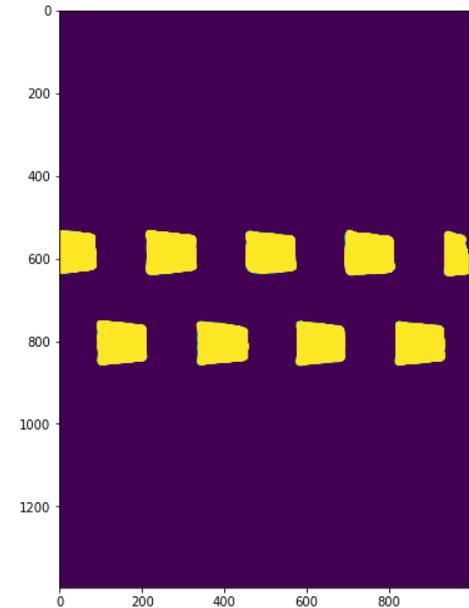
Source Image (pre-processed)



Human inspection (manually)

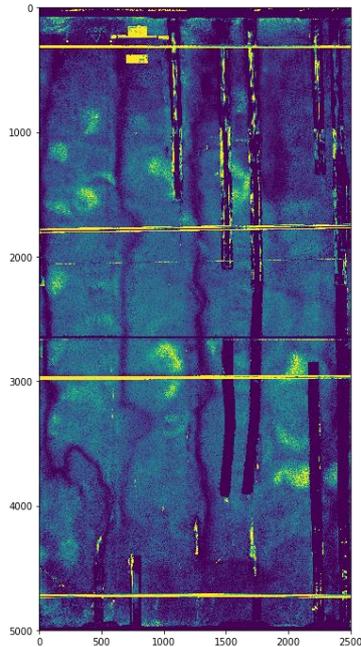


Deep learning (automatic)

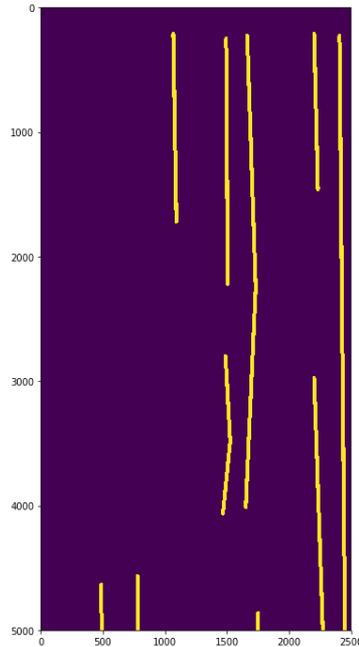


Results of deep learning – steel arch

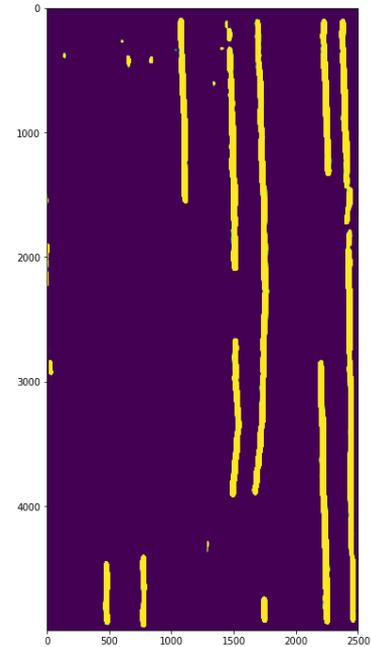
Source Image (pre-processed)



Human inspection (manually)

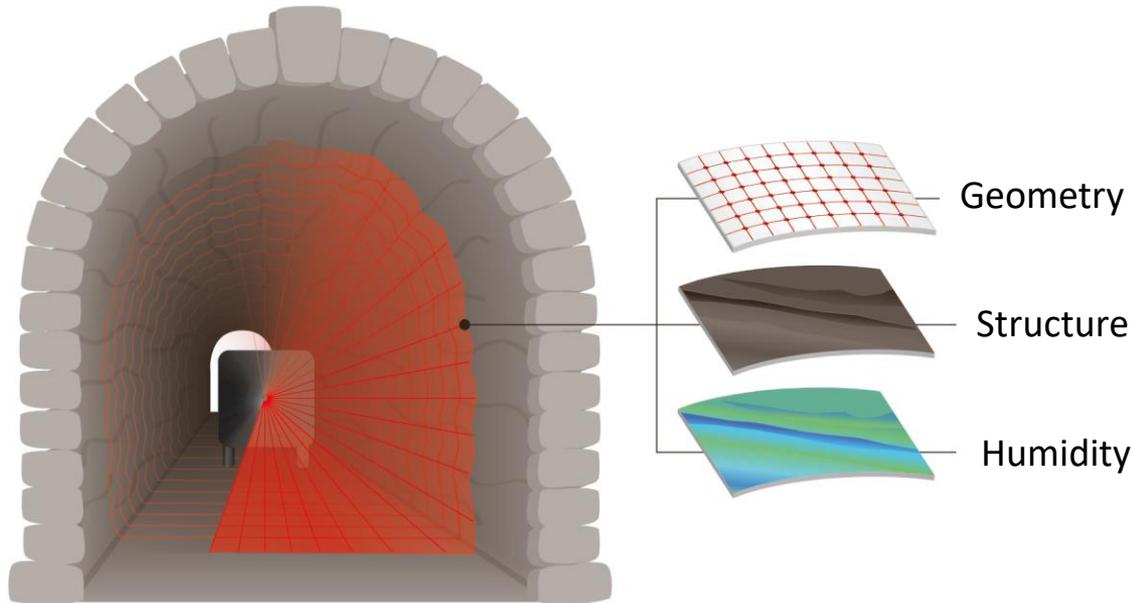


Deep learning (automatic)



Outlook – New 3D Reality capture

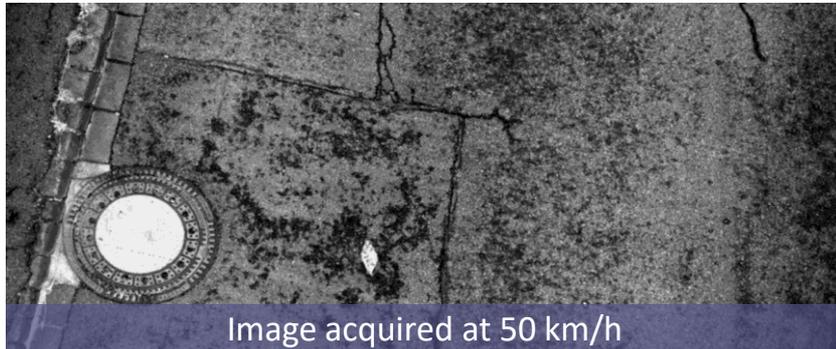
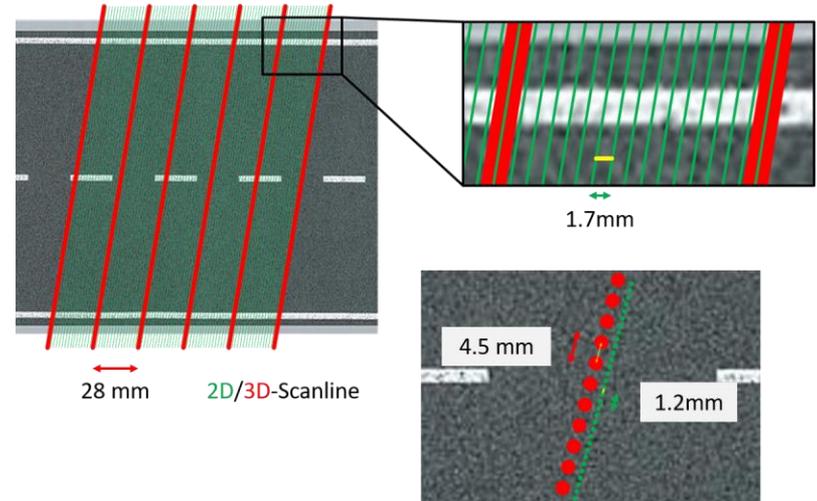
Tunnel Inspection Scanner – EU research project OpOrTunlty



Outlook

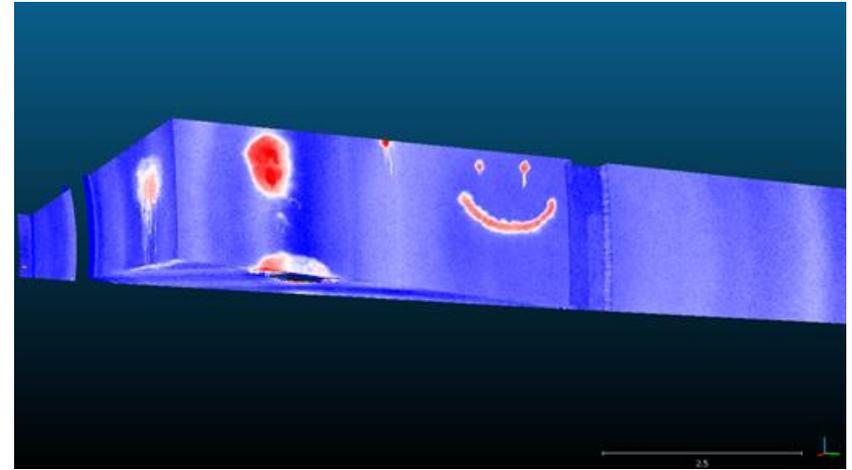
Tunnel Inspection Scanner

- 64 x higher scanning resolution for image data
- Planned resolution at 80 km/h: 1.7 mm
- Still 5mm resolution at 235 km/h



Outlook

Humidity scanning channel



Summary & Outlook

Amberg Inspection

- Increase efficiency by up to 60% when using Artificial Intelligence
- Use Amberg competence for training the networks
- Works with GRP/IMS 5000 and third party data
- Classification of entire infrastructure
- Open API for intersection with other infrastructure (e.g. BIM2FM) tools
- Change tunnel inspection from periodically to event driven maintenance





Thank you for your attention

Questions?

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