

AI FOR TUNNEL MANAGEMENT

*Presented by
Jonathan Nuttall
Joost Bredeveld*

Project Team:

J.D. NUTTALL, A. RÓZSÁS, L. TEALDI, J.M. WILMS

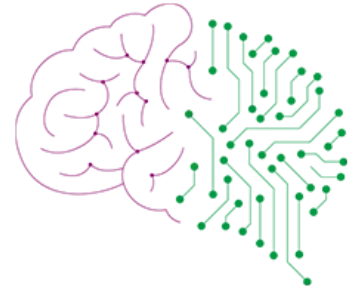


› Motivation

How to use science to increase the decisiveness of tunnel managers in planning the renovation of the civil parts?

In addition to instruments like Data-Enhanced Modelling and the Intake Information Template, and with sufficient SHM results, pattern recognition can:

- support the (technical) experts with objective information
- improve the planning ahead of tunnel renovations, enabling to
 - focus a renovation on specific areas
 - avoid unnecessary downtime / costs / hindrance
 - determine the effectiveness of previous measures



Aims:

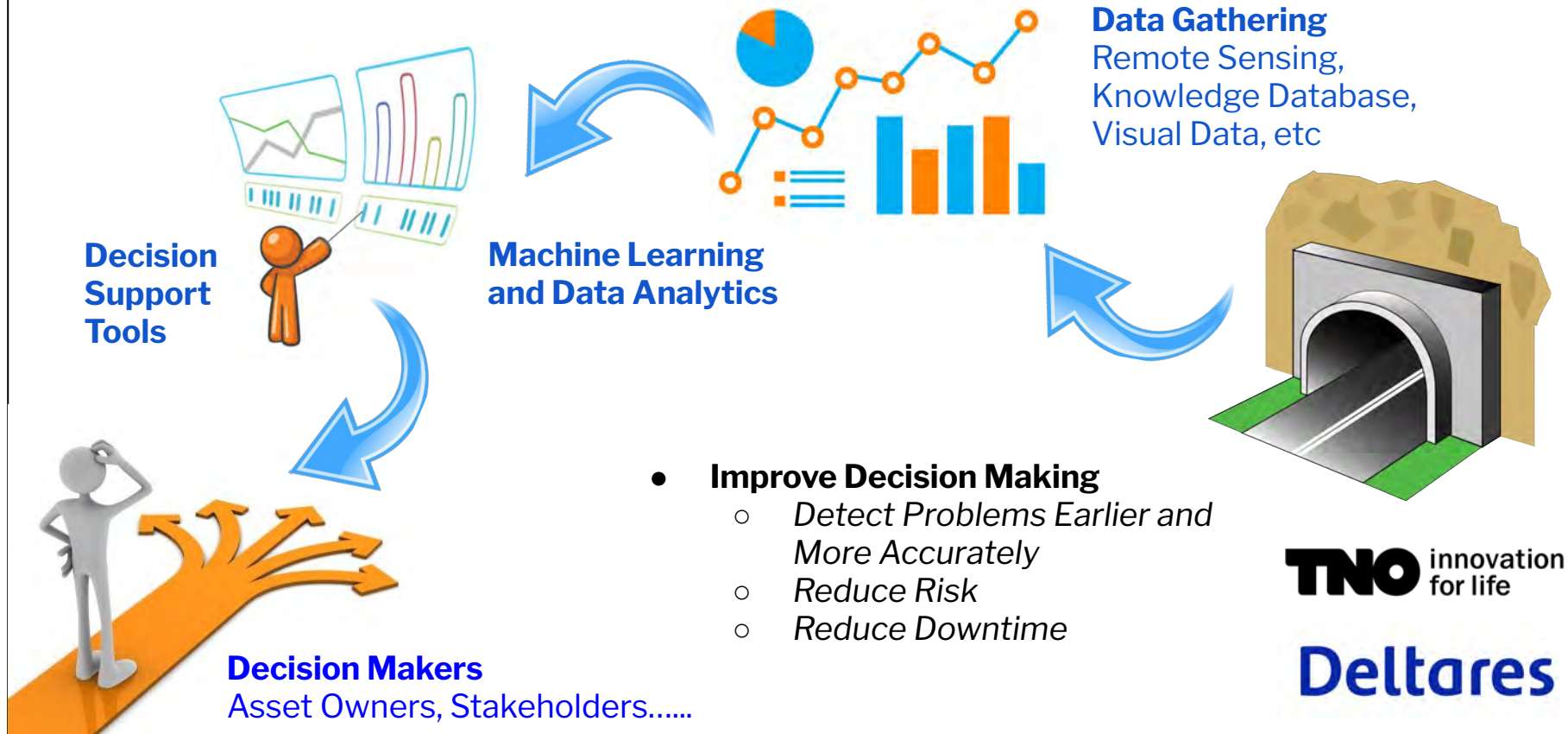
- provide an outlook on the opportunities when the full power of SHM is 'unleashed' with Data Analytics and Artificial Intelligence techniques
- grow interest, trust and ownership for these techniques

TNO innovation
for life

Deltares

› Data Analytics and Structural Health Monitoring

Our Vision



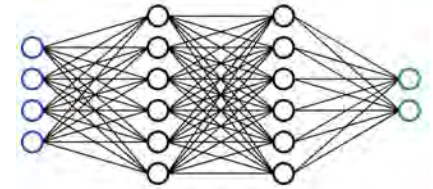
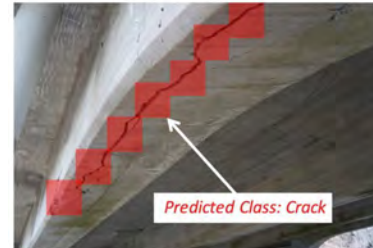
Automatic Crack Detection and Crack Growth Monitoring Using Convolutional Neural Networks

Challenge

- “Manual” inspection is time consuming and can be inaccurate.

Proposal

- Automatic (no human involvement) processing of images of surfaces, e.g. concrete tunnel walls:
 - Crack detection.
 - Crack growth (length and crack width) monitoring.

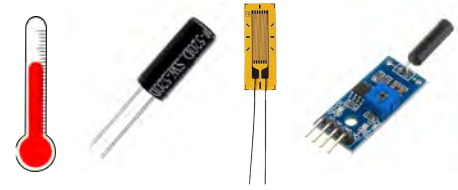


Added Value

- More accurate and consistent in time measurements.
- Monitoring is less expensive and time consuming.
- Early warnings if the system detects worrying changes in the cracks.

› Anomaly Detection

Using an Encoder-Decoder Neural Network

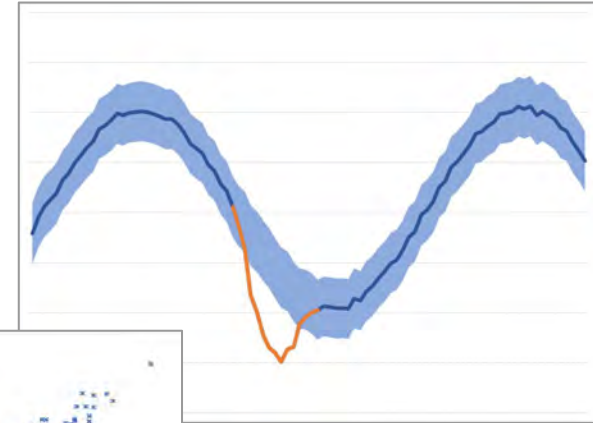


Challenge

- Automatic detection of anomalous deformations in tunnels.

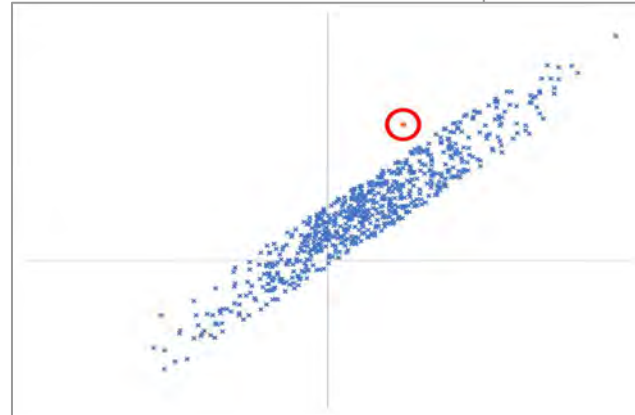
Proposal

- Automatic processing of multiple sensor time-series data for tunnel motion to determine if deformations are posing a safety risk.



Added Value

- Reduce false alarms from conventional anomaly detection methods.
- Early warnings if the sensors detects worrying changes in the deformations.



TNO innovation
for life

Deltares

› **Thank you**
Questions ?



TNO innovation
for life

Deltares