



Automotive Diagnostic Technology Solution

Tunnel Scan System
with
**Deep Learning solutions for cost-effective
tunnel maintenance**

Tunnel Scan System (TS) uses multiple high-speed linear cameras and laser scanner to acquire 2D images and high-resolution 3D profiles of tunnel wall.

The **TS** is the top of technology on tunnel scan diagnostic system. It can scan tunnels with **1mm** resolution on longitudinal and transversal direction up to 60Km/h. The entire wall can be captured in only one **pass**.

What is Tunnel Scan System

DESCRIPTION	
Max Speed	up to 60 km/h
Sampling Step	1mm
LED Light	1600W
Vision System	18000 pixel
Max target distance	9 m
Profiler	Yes
Defect Measurement	yes
Defect Report	yes



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Main system modules

- Cameras system;
- Profiler;
- Set of Illuminators;
- High definition encoder;
- Computer;
- Sync generator;



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What is Tunnel Scan System



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What is Tunnel Scan System



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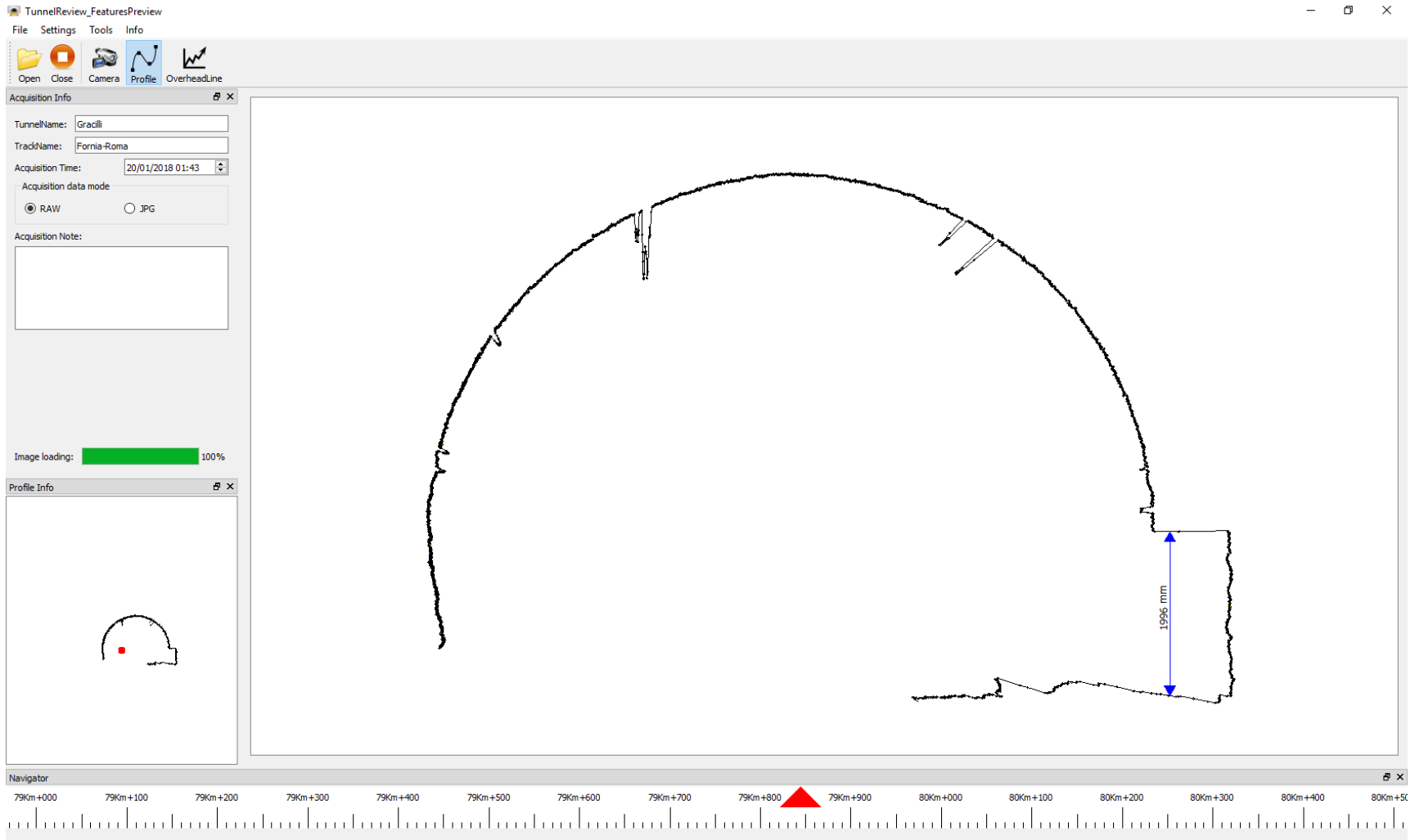
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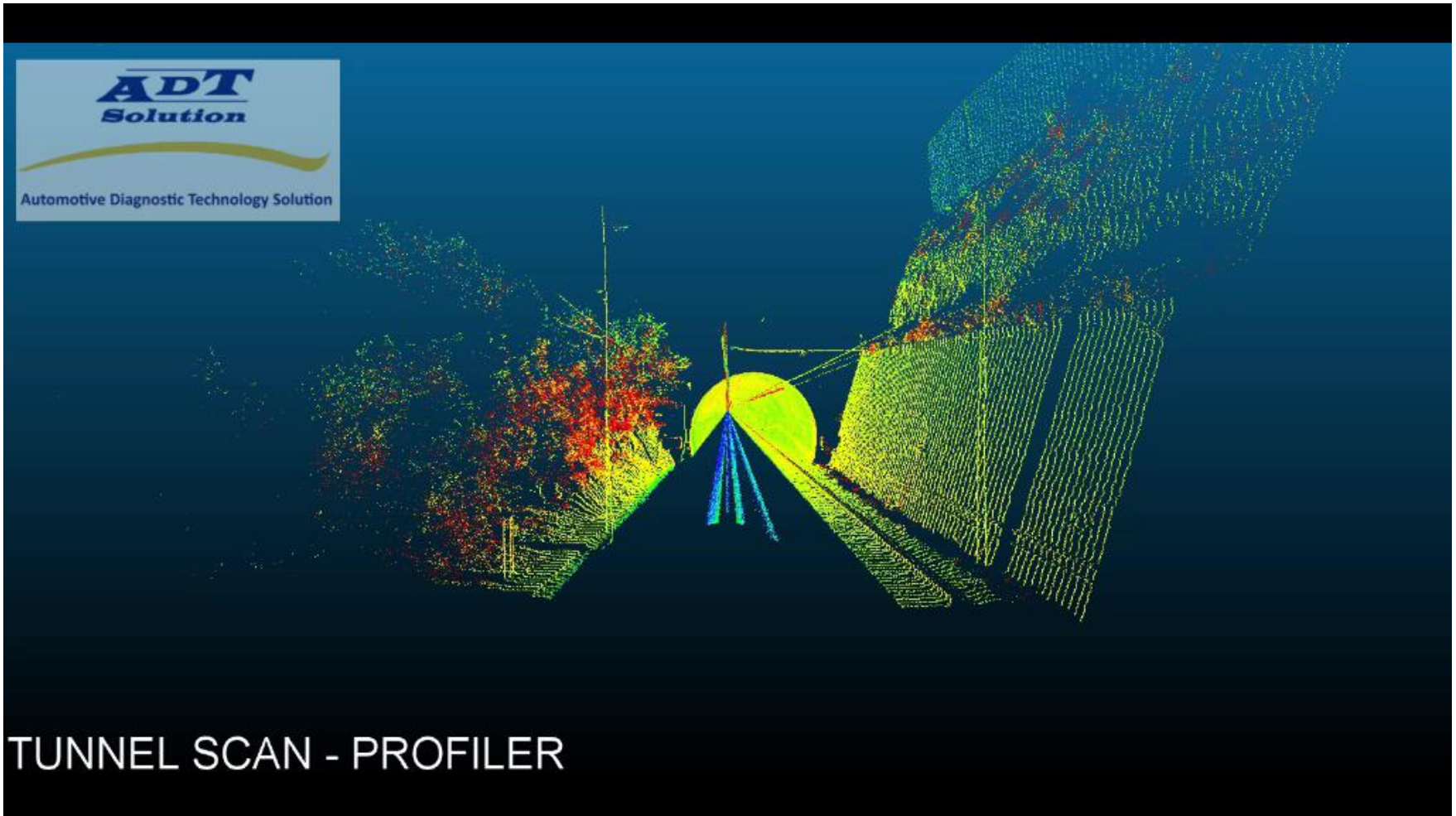


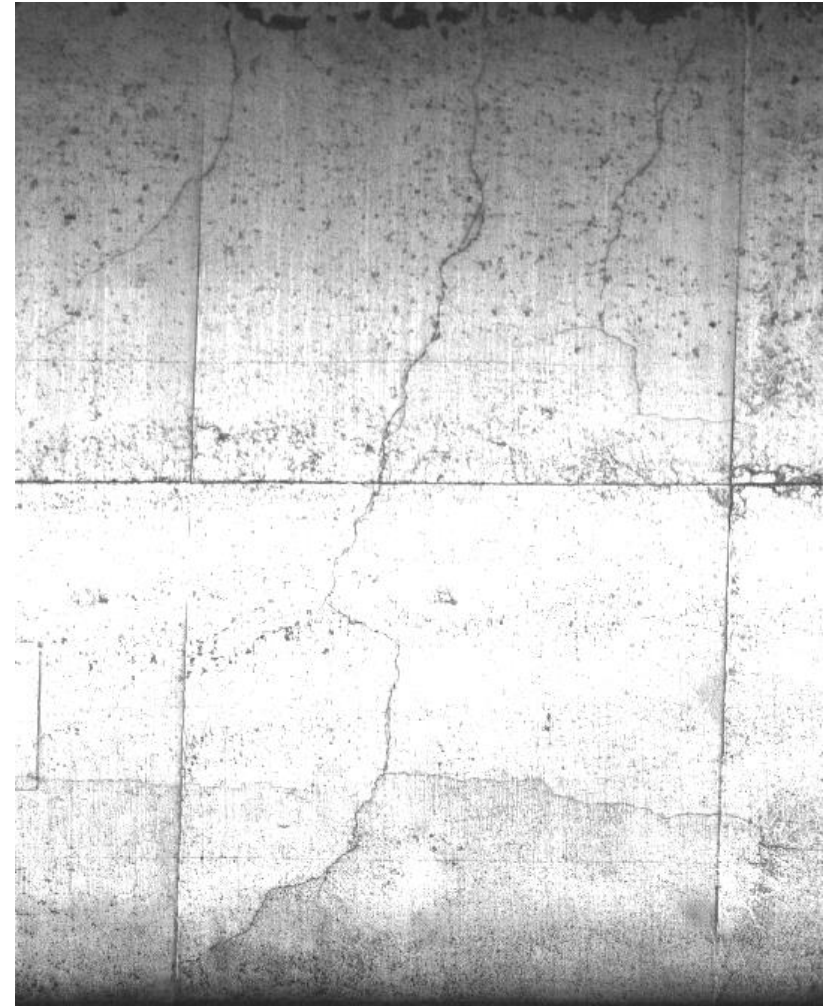
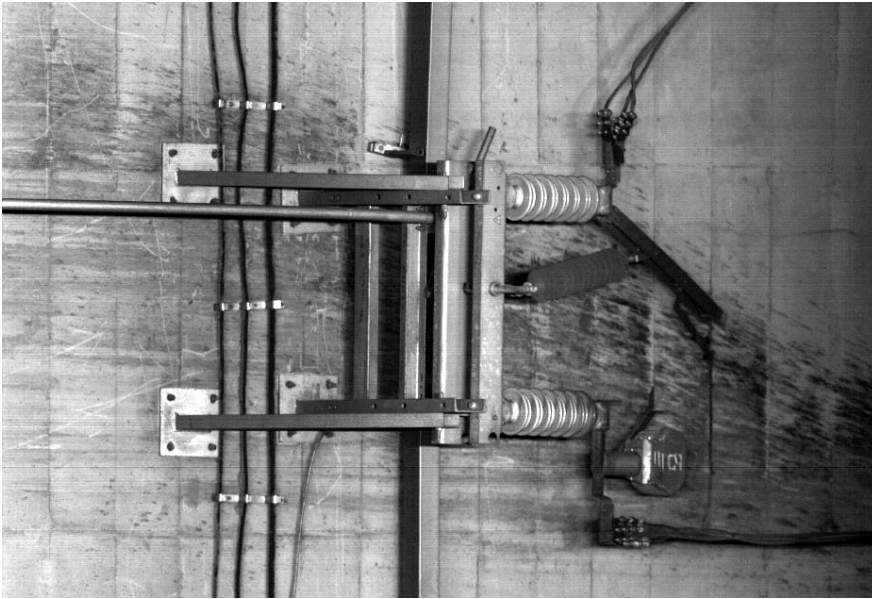
Defect Measurement

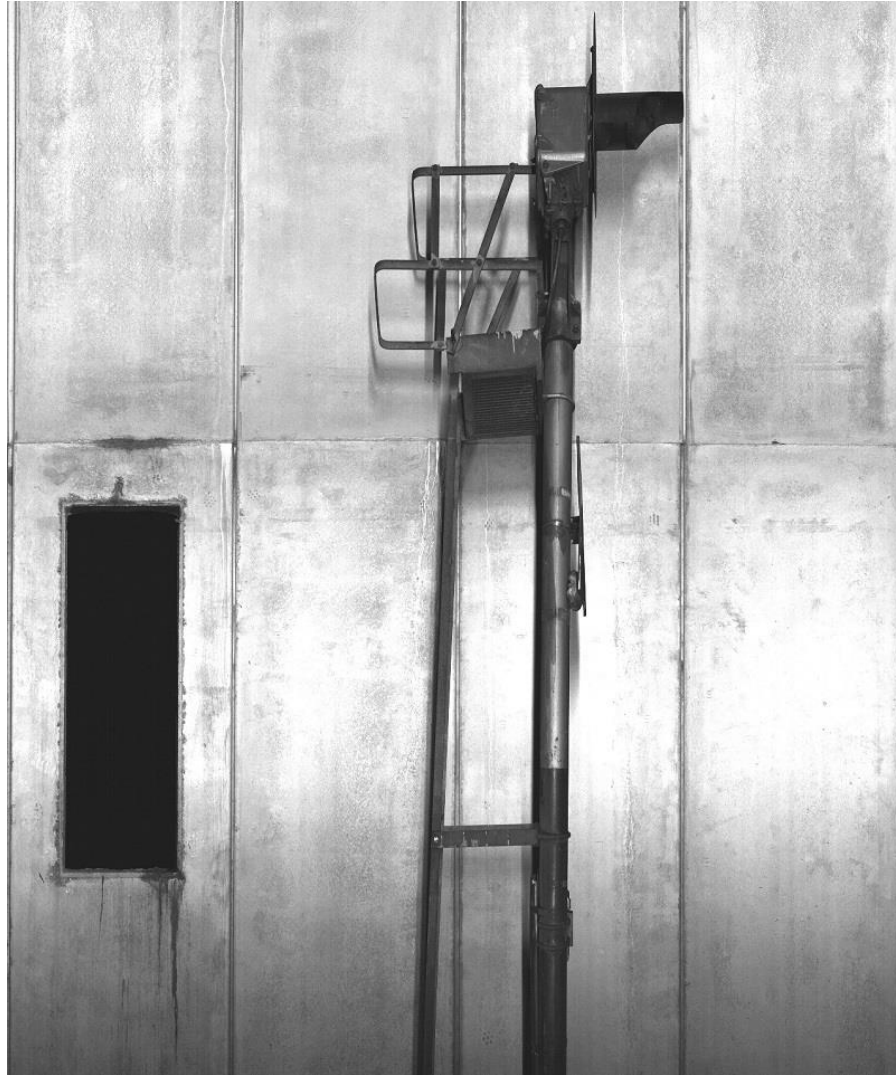
The screenshot displays the TunnelReview software interface. The main window shows a grayscale image of a tunnel wall with a red trapezoidal defect highlighted. A horizontal red line is drawn across the defect, with a measurement value of 1.660 displayed above it. The interface includes a menu bar (File, View, Settings, Export, Report, Tools, Info), a toolbar with various icons, and several panels: Acquisition Info (TunnelName: Test - Cai, TrackName: Test, Acquisition Time: 26/03/2019 02:26, Acquisition data mode: RAW/JPG, Auxiliary Note: 2600m), Defect List (Position: 0 Km + 076 m), Measure List (Position: 0 Km + 076 m, Measure: 1.660 m), and Auxiliary Info (containing a circular diagram). A navigation bar at the bottom shows a scale from 0Km to 0Km+140, with 0Km+080 highlighted in red.



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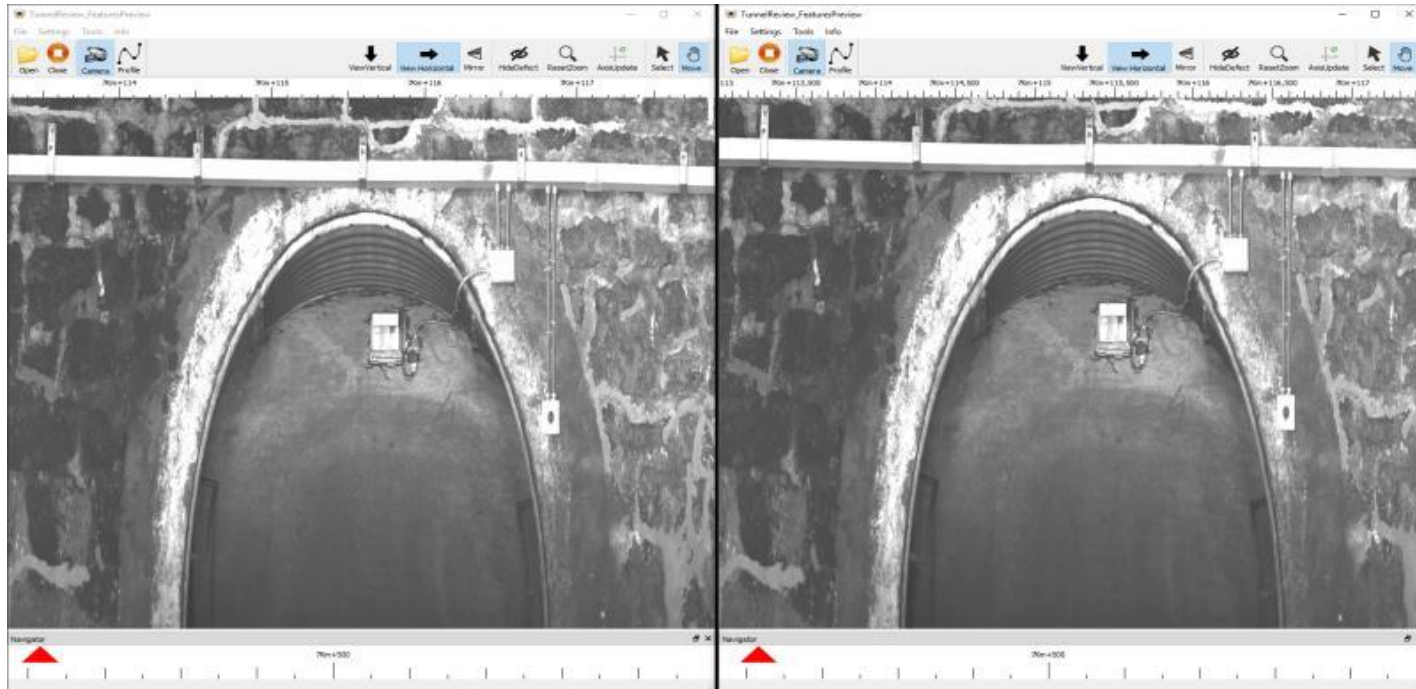




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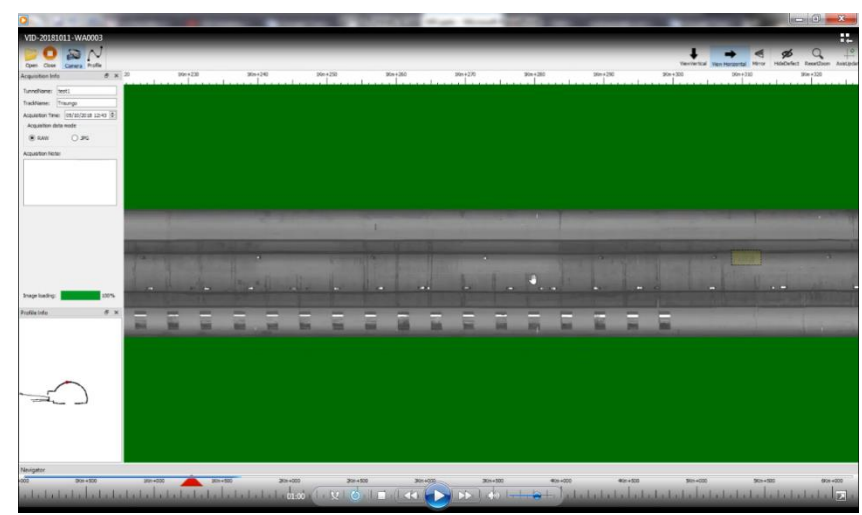
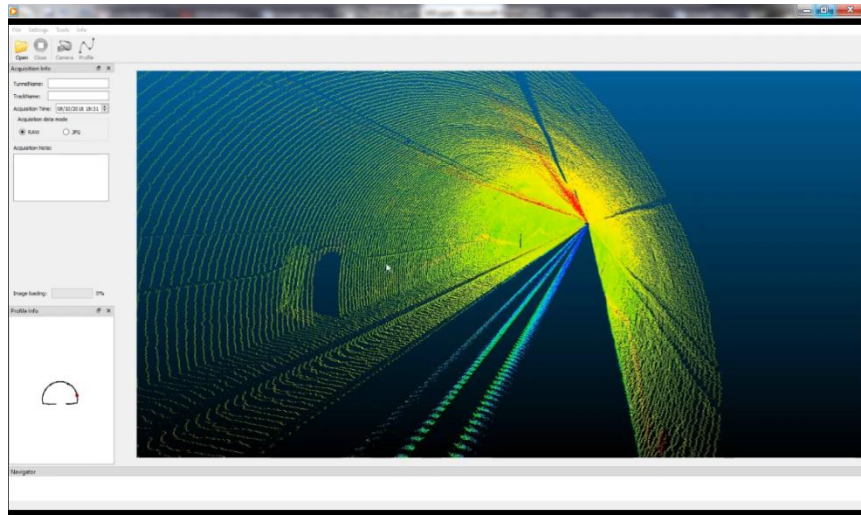
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Two different acquisitions recorded on two different days

RESULTS



[Click to see the VIDEO!](#) 

[VID-20181011-WA0003.mp4](#)

NOTE: The video file has to be in the same folder of this file



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Report on Review Software

The screenshot displays the TunnelReview software interface. The main window shows a tunnel scan with several defects highlighted by yellow arrows and a yellow circle. The defects are:

- Vertical Crack on concrete (0 Km + 951 m)
- Loss of water (0 Km + 951 m)
- Loss of water (0 Km + 953 m)
- Diagonal Crack (0 Km + 960 m)

The software also shows a Measure List with the following data:

Position	Measure
0 Km + 960 m	3.061 m
0 Km + 970 m	2.685 m

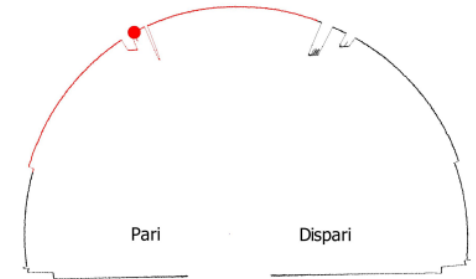
The interface includes a menu bar (File, View, Settings, Export, Tools, Info), a toolbar with icons for Open, Save, Close, Camera, Profile, Trajectory, View Vertical, View Horizontal, Mirror, HideDefect, ShowDebugLine, ImageFilter, ResetZoom, and Select. The main window has a scale from 0Km+945 to 0Km+975. The bottom navigation bar shows a scale from 0+00 to 1km+500, with a red triangle indicating the current position at 1km+000. The license status is shown as 'License: ✓'.

Report generated by Review Software

1Km+750m
Pari

Fessure verticali: presenza di fessure con andamento prevalentemente verticale riscontrabili sulla superficie degli elementi strutturali in cls

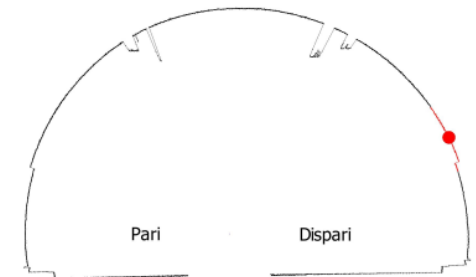
18.745



1Km+755m
Dispari

Percolazione attraverso fessure e giunti: passaggio di acqua attraverso fessure, giunti, nicchie con conseguente presenza di materiale organico (ad. es. muschio)

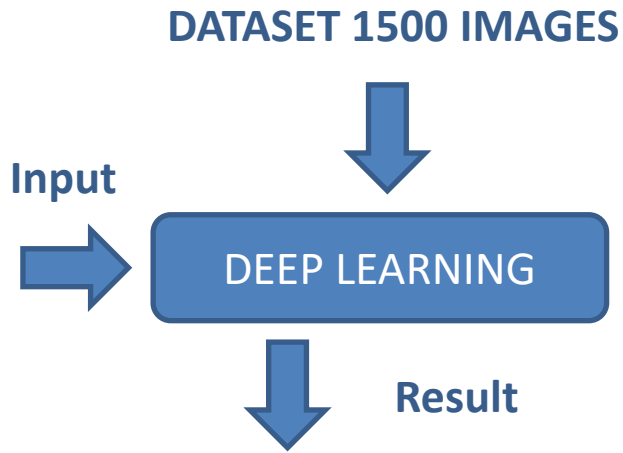
0.866



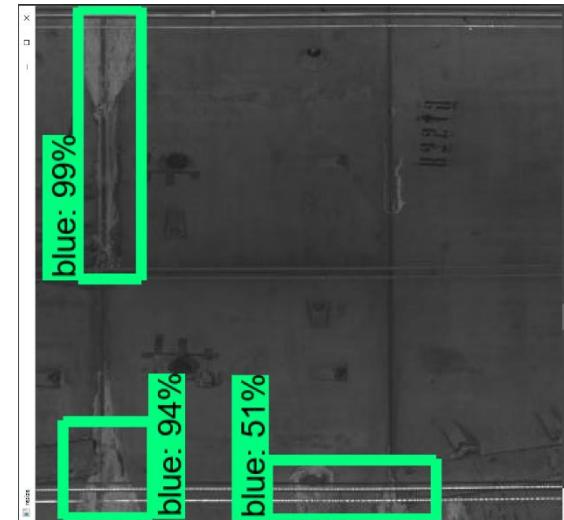
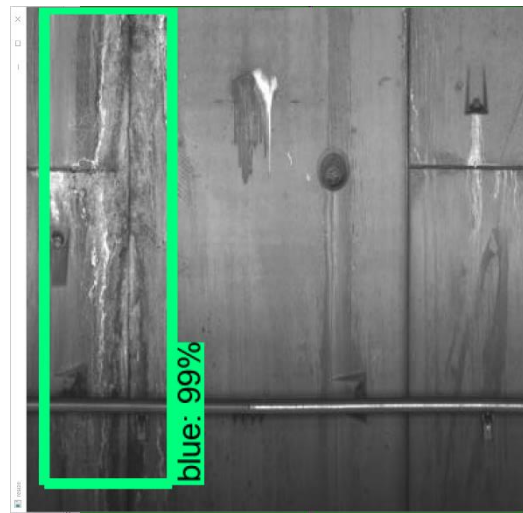
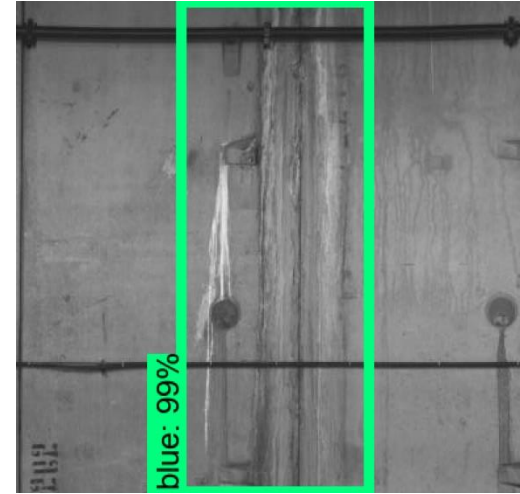
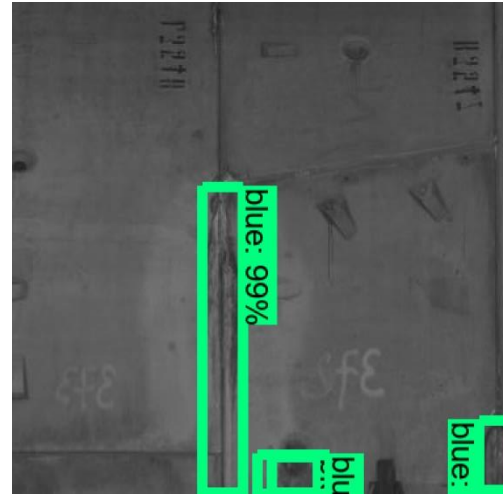
Tunnel Market

- 5000 Km of tunnels built per year;
- 7% of the global infrastructure market;
- 7% annual growth;
- European tunnel market per year: 10 billion €;

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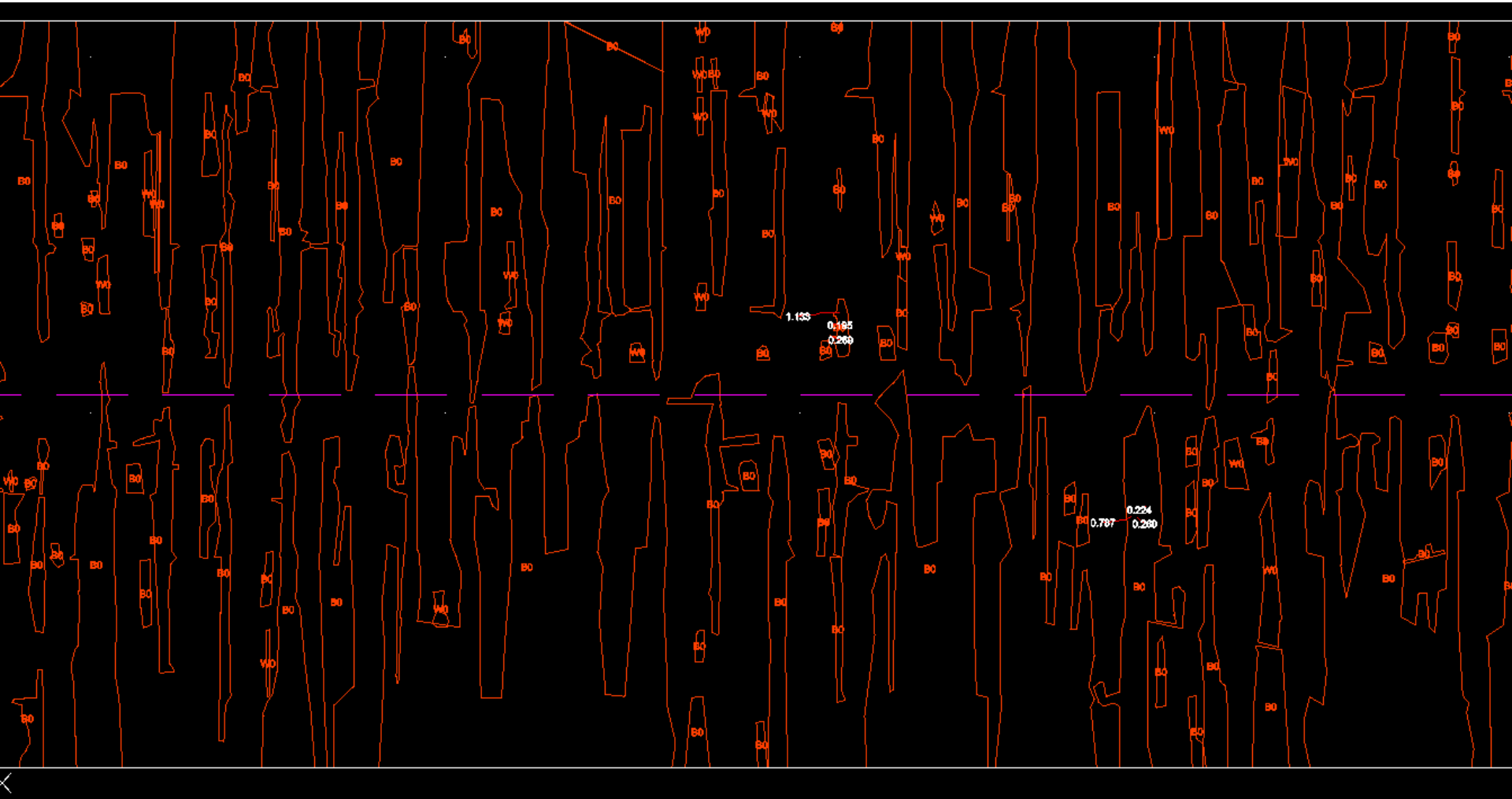


90%
with > 80% certainty



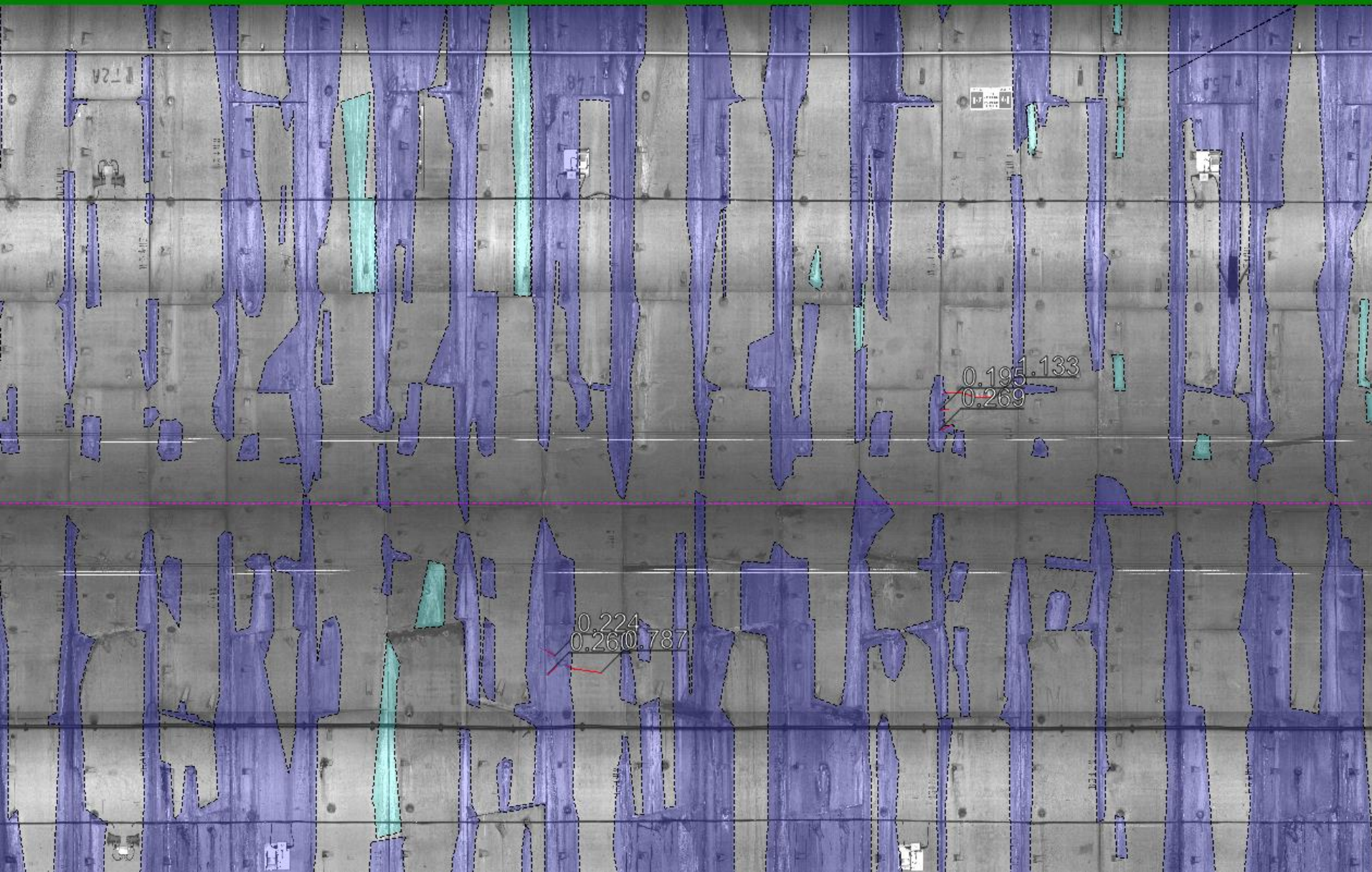
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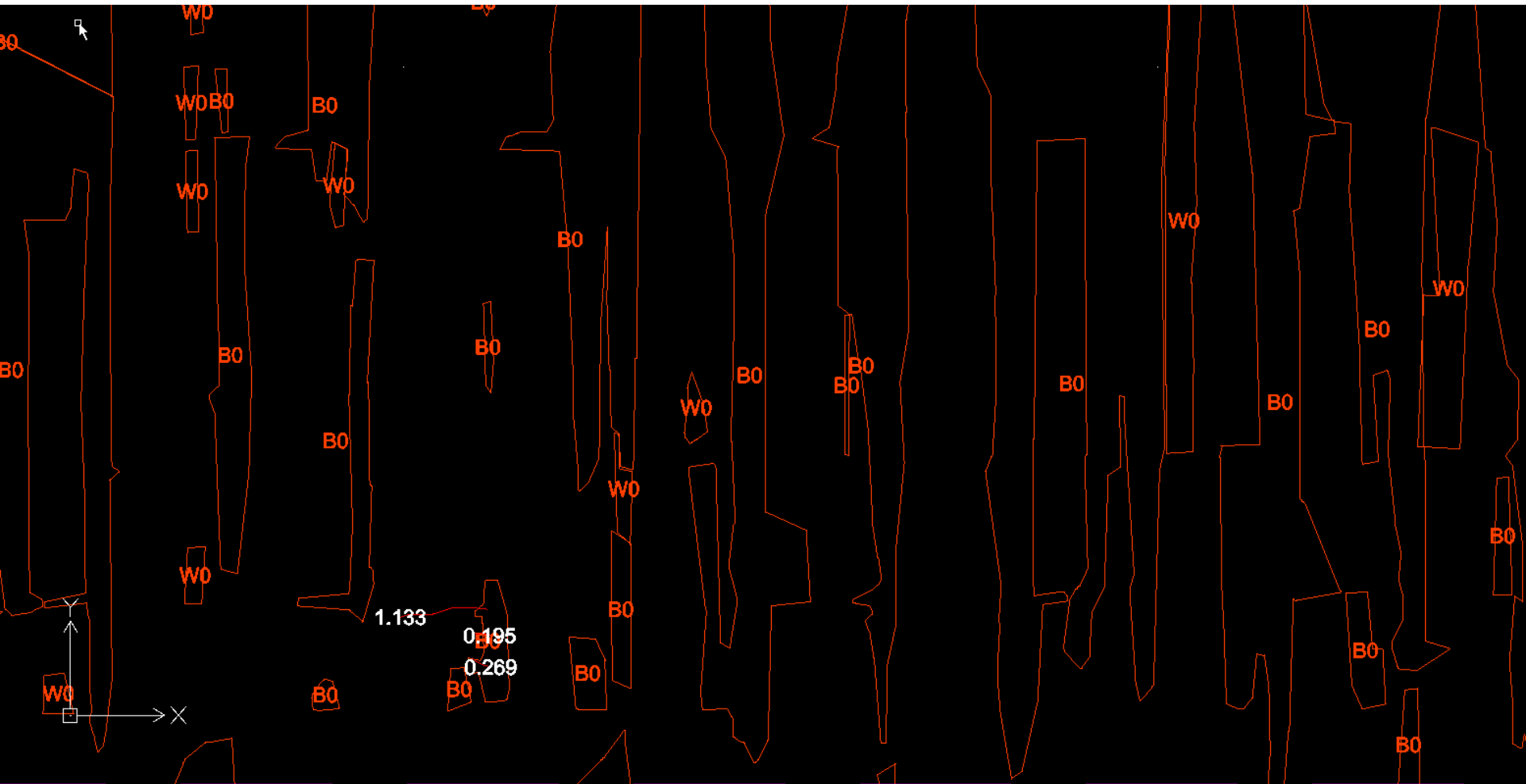
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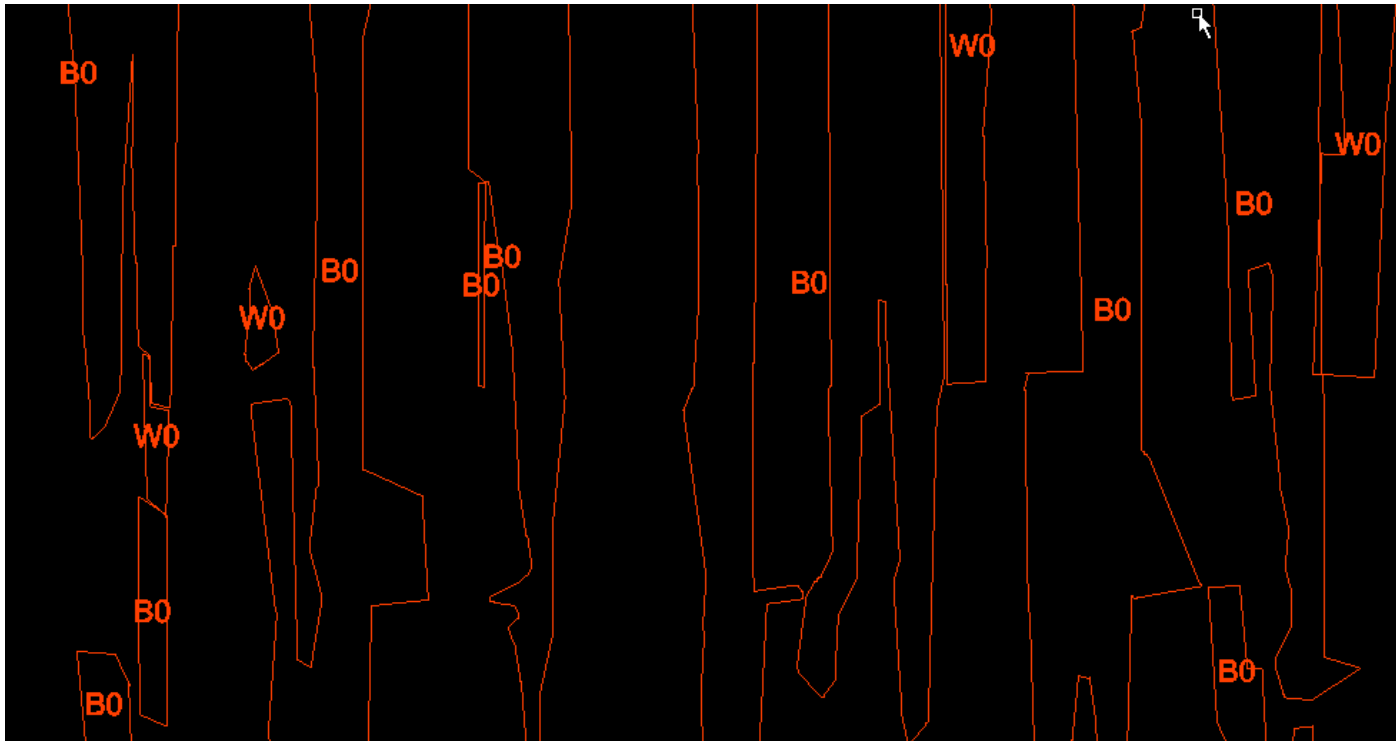
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RESULTS Artificial Intelligence Algorithm

- B0 : Trained
- W0 : Untrained

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Automotive Diagnostic Technology Solution s.r.l.

Via dell'Economia 8/M
Trebaseleghe
Padova
Italy

e-mail: info@adts.it



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