How can we use the AI to develop better risk insights and help improve safety on the line?

AI uses cases in railway maintenance

Ignacio Jardí
Ferrovial. Construction experience

Since 1927...
More than 90 years of experience...
More than 50 countries in the 5 continents

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>5,200 km of New Railway Track</td>
<td></td>
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<tr>
<td>10,000 km Railway Track Maintenance</td>
<td></td>
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<tr>
<td>4,500 km of toll highways</td>
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<tr>
<td>30,400 km maintenance and re-pavement of roads</td>
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<tr>
<td>15,540 km new roads and expressways</td>
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<tr>
<td>+ 12.1 million m² industrial buildings</td>
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<tr>
<td>+ 13.5 million m² non residential buildings</td>
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<tr>
<td>+ 19 million m² residential buildings</td>
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<tr>
<td>540 km tunnels</td>
<td></td>
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<tr>
<td>+ 169 km of Metro (included 155 stations)</td>
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<tr>
<td>4,115 km channels</td>
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<tr>
<td>6,400 km water pipelines</td>
<td></td>
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<tr>
<td>3,850 km gas and oil pipelines</td>
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<tr>
<td>140 hospitals</td>
<td></td>
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<tr>
<td>148 dams</td>
<td></td>
</tr>
<tr>
<td>230 water treatment plants (RO, STP, WTP)</td>
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<tr>
<td>33 km quays and ports infrastructure</td>
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<tr>
<td>40 airports</td>
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<tr>
<td>20 football and Olympic stadiums</td>
<td></td>
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<tr>
<td>112 hotels</td>
<td></td>
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<tr>
<td>31 hydroelectric power stations</td>
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</tbody>
</table>
Ferrovial. Key figures

CONSTRUCTION ORDER BOOK (M€)
- 14,743
  +18.7%

WORKFORCE AT YEAR-END*
- 24,191
  *as of December 31, 2022

REVENUES* (M€)
- 2022: 7,551
- 2021: 6,910
  +9.3%
  compared to 2022

CAPITALIZATION (M€)
- 17,801

* Figures excluding Services, classified as discontinued operations.
Sentinel Project 2016-2018
Lessons learned

We can detect objects on the line

However

- Further developments were required
  - Low rate of automation
- Objects had to be predefined in advance
IAVE Project
IAVE Project

Can we detect plants on a railway line?
Irrigation areas

IAVE Project
Spanish High Speed Rail Network
Herbicide train
Herbicide train
IAVE Project

Phase 1. Segmentation

Phase 2. AI & Algorithms

PATENTED
IAVE Project
IAVE Project

The algorithm predicts correctly………………………… 99,47%

We irrigate things that are not plants……………………… 0,42% — Dana project

There is a plant but it is not detected……………………… 0,11%

100,00%
DANA Project
Dana Project. Goal

Can we use AI to automatically detect THINGS THAT SHOULD NOT BE on railway tracks?

- Objects
- Death animals
- Damaged sleepers
- Missing clips or screws
- Etc.
What we see

No ok

Ok
Dana Project. The problem

Can you send us some pictures of incidences on the track?

I'm sending you some pictures, but they're blurry. I'm sorry.

There are no incidents in my site!

Do you think that I take pictures of tools in the middle of the track?

Do you want pictures of dead animals? Really?
Dana project

If we can’t get those images, we will have to create them
Phase 1. Geometry

Access to these images has been restricted by the company that developed them, in order to protect their industrial property rights.

If you require additional information, please contact ignacio.jardi@ferrovial.com
Phase 2. Textures: concrete and ballast

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If you require additional information, please contact ignacio.jardi@ferrovial.com
Phase 3. Illumination

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Phase 4. Composition of previous phases

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If you require additional information, please contact ignacio.jardi@ferrovial.com
Phase 5. Environmental degradation

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Is it real or 3D?
DANA Project

- Missing clip
- Superficial damage
- Severe damage
- Broken sleeper
DANA Project
DANA Project
Can you find five (5) things that are not ok?
Solution

- Missing Screw
- Forgotten Tool
- Can of soda
- Clip
- Clip turned >45°
Conclusion

AI can automatically detect objects left on the line

- For any kind of railway track
- For any kind of illumination (24h)

- Detect tools
- Check the elements on the sleepers
- Analice sleepers integrity
For further information, please contact

ignacio.jardi@ferrovial.com
SAFETY WEBINAR
Objects left on the Line

8 November 2023

THANK YOU FOR YOUR PARTICIPATION!