

Challenges  
proposed by

*renfe*

# BACKGROUND



Renfe is Spain's leading railway operator and has been developing an Artificial Intelligence strategy since 2025 as a key enabler of its Digital Transformation Plan. Through open innovation initiatives and internal programmes, the company is exploring how AI can improve operational efficiency, sustainability and decision-making across the railway ecosystem.

## AREAS OF INTEREST

SUPERCOMPUTING / HPC

SUSTAINABILITY

ARTIFICIAL INTELLIGENCE

DATA & ANALYTICS



# CHALLENGE 1

TITLE

AI-Powered Digital Twin for Railway Network Simulation and Operational Optimisation

DESCRIPTION

Develop a digital twin of the railway network capable of simulating train circulation, infrastructure constraints, passenger demand, incidents and operational disruptions in near real time.

The solution should leverage AI and HPC capabilities to analyse thousands of potential scenarios, supporting traffic planning, capacity management, disruption recovery and operational decision-making. The expected outcome is a more resilient, efficient and sustainable railway system.

KEY WORDS

Digital Twin · AI · HPC · Railway Operations · Simulation · Optimisation · Predictive Analytics · Sustainability



# CHALLENGE 2

TITLE

Predictive Railway Operations Through Digital Twins and Multimodal Data Analytics

DESCRIPTION

Investigate how digital twins can integrate infrastructure, rolling stock, IoT and operational data to anticipate failures and assess their impact on network performance.

By combining predictive models with large-scale simulation capabilities, Renfe seeks to improve maintenance planning, reduce service disruptions and optimise asset utilisation across the railway ecosystem.

KEY WORDS

Digital Twin • Predictive Maintenance • AI • Data Analytics • Sensor Data • Operational Resilience



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