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#### Railway track quality, safety and reliability through train-track dynamics and advanced machine learning

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Citation for published version (Harvard):

Huang, J & Kaewunruen, S 2023, 'Railway track quality, safety and reliability through train-track dynamics and advanced machine learning', Clarke Lecture 2023, Birmingham, United Kingdom, 22/06/23 - 22/06/23.

Link to publication on Research at Birmingham portal

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# Railway track quality, safety & reliability through traintrack dynamics and advanced machine intelligence

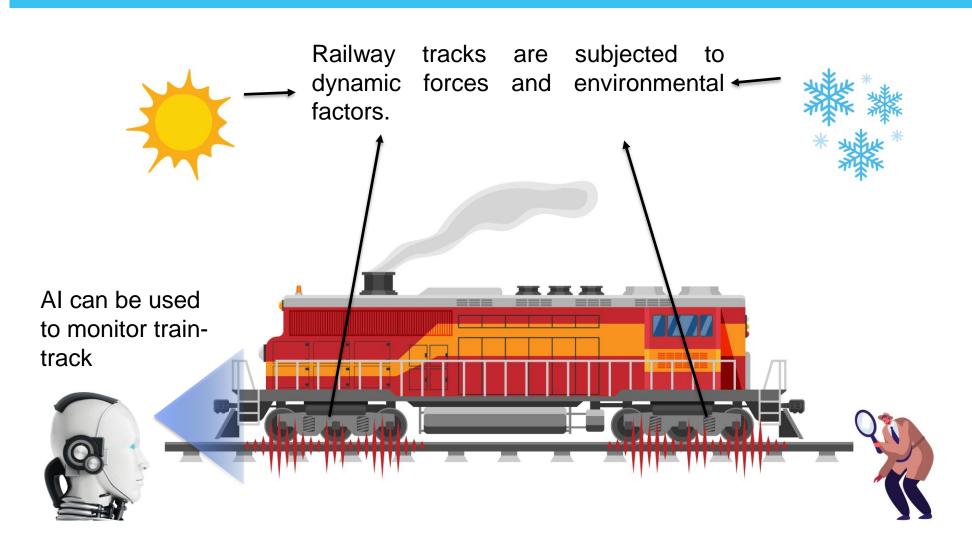


Junhui Huang, Dr Sakdirat Kaewunruen, School of Engineering

### **Research Questions**

- 1. How do characteristics, quality and reliability of railway tracks impact system performance?
- 2. What are the key factors influencing the tracks in dynamic operational conditions?
- 3. What benefits of leveraging AI in enhancing the performance of track?
- 4. How can AI be applied to determine real-time track conditions?

### **Contextual Background**

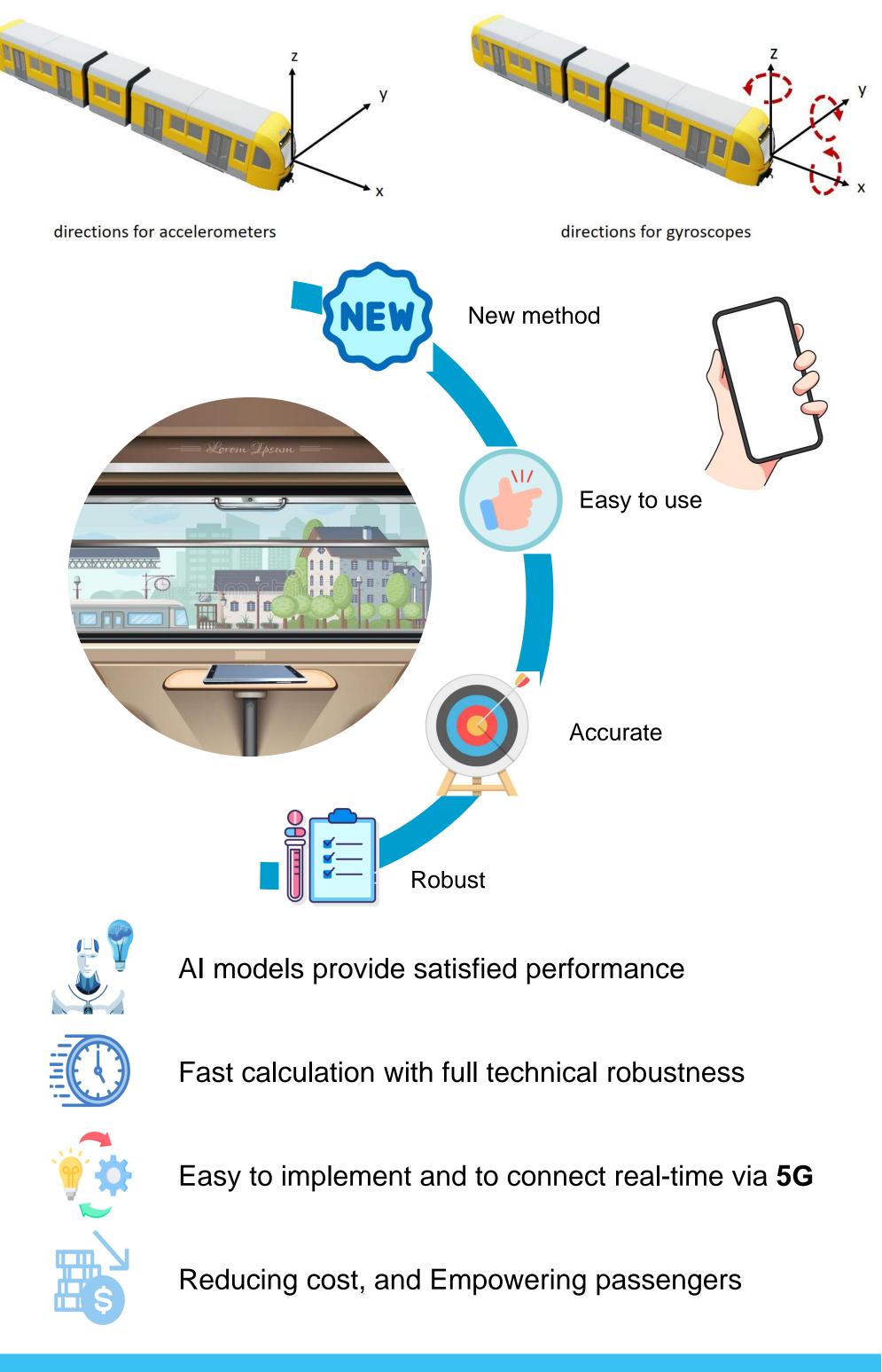


# **The Findings in Context**

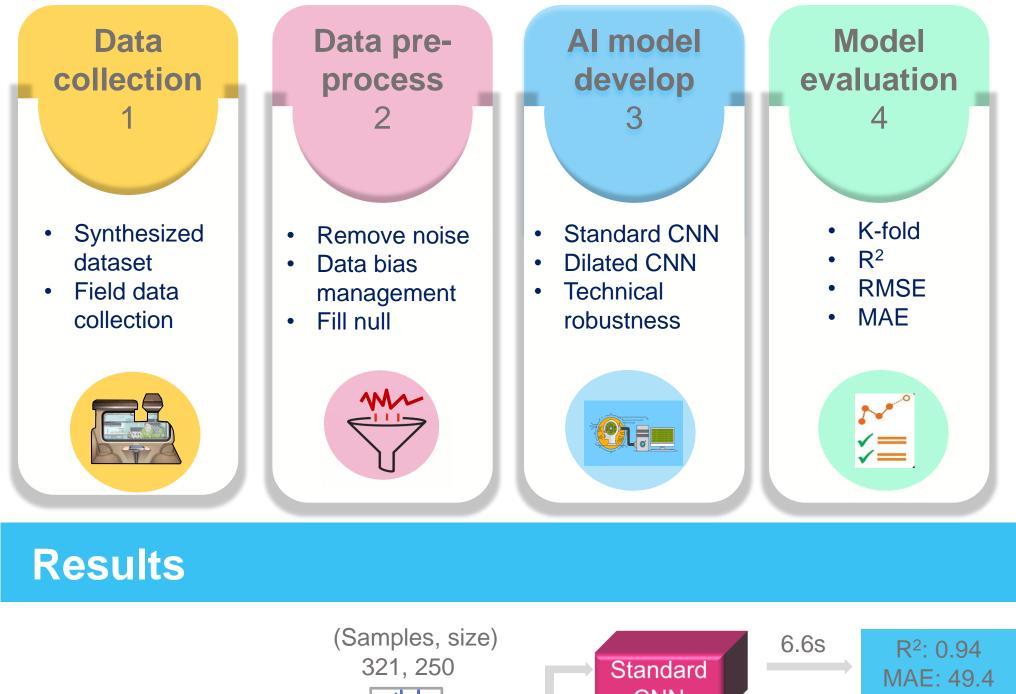
New mobile-phone **App** for Real-time Ride Comfort Assessment

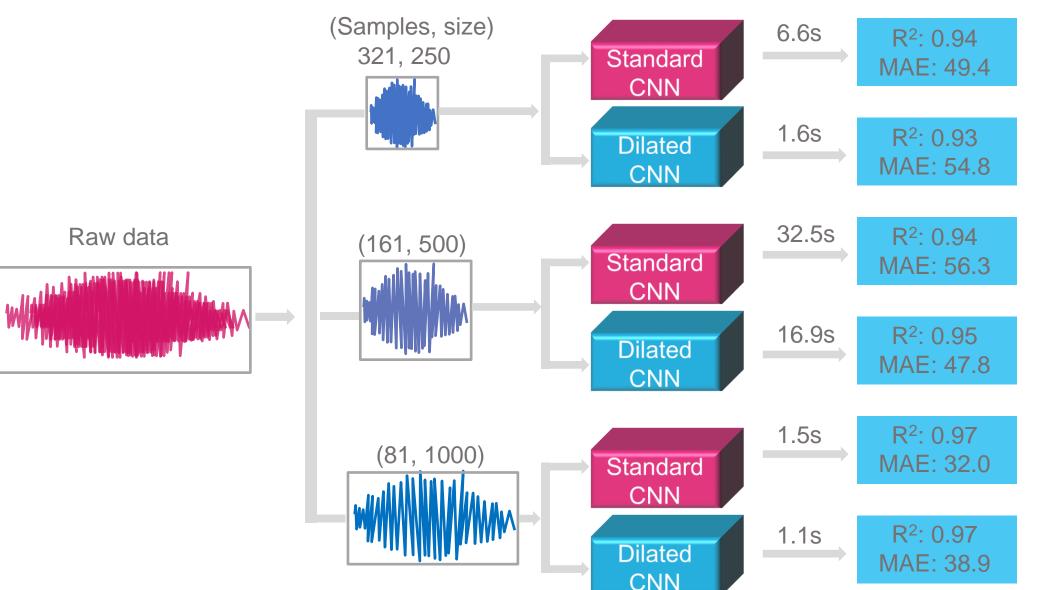
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#### **Methods**





#### Conclusions

- 1. We have proposed a dilated CNN using the sensory data acquired from axle box which is immune to speed up to 120 km/h and bad weather conditions as there are sophisticated accelerometers designed to tackle the extreme weather conditions.
- 2. We have confirmed that the performance of the proposed model is highly satisfied, the dilated technique contributes to saving computational cost, and the consideration of irregularities makes no significant difference to the model's performance.
- 1. Both the performance of the standard CNN and dilated CNN are above 0.90.
- 2. Considered factors: two different model types, three sample size, irregularities included.
- 3. Dilated CNN produces the best R<sup>2</sup> of 0.97 on the longest sample size.

- 3. An implication of this study is the possibility that wireless accelerometers can be mounted onboard service trains.
- 4. New smartphone App has been developed to assess real-time ride comfort using machine intelligence.

## **Key Publications**

- 1. Huang J, Yin X, Kaewunruen S. Quantification of Dynamic Track Stiffness Using Machine Learning[J]. IEEE Access, 2022, 10: 78747-78753.
- 2. Huang J. and Kaewunruen, S. Evaluation of Railway Passenger Comfort With Machine Learning, in *IEEE Access*, vol. 10, pp. 2372-2381, 2022, doi: 10.1109/ACCESS.2021.3139465.
- 3. Huang J and Kaewunruen S. Train-ride quality evaluation of the Elizabeth Line using machine learning. Front. Built Environ. 8:1034433. doi: 10.3389/fbuil.2022.1034433

