



四十五年齊臻善 創新蛻變展佳績

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## 臻善圈 決賽隊伍 提案摘要

### PROJECT SUMMARIES OF WIT FINALISTS



#### 磨軌圈 Mo Gui Circle

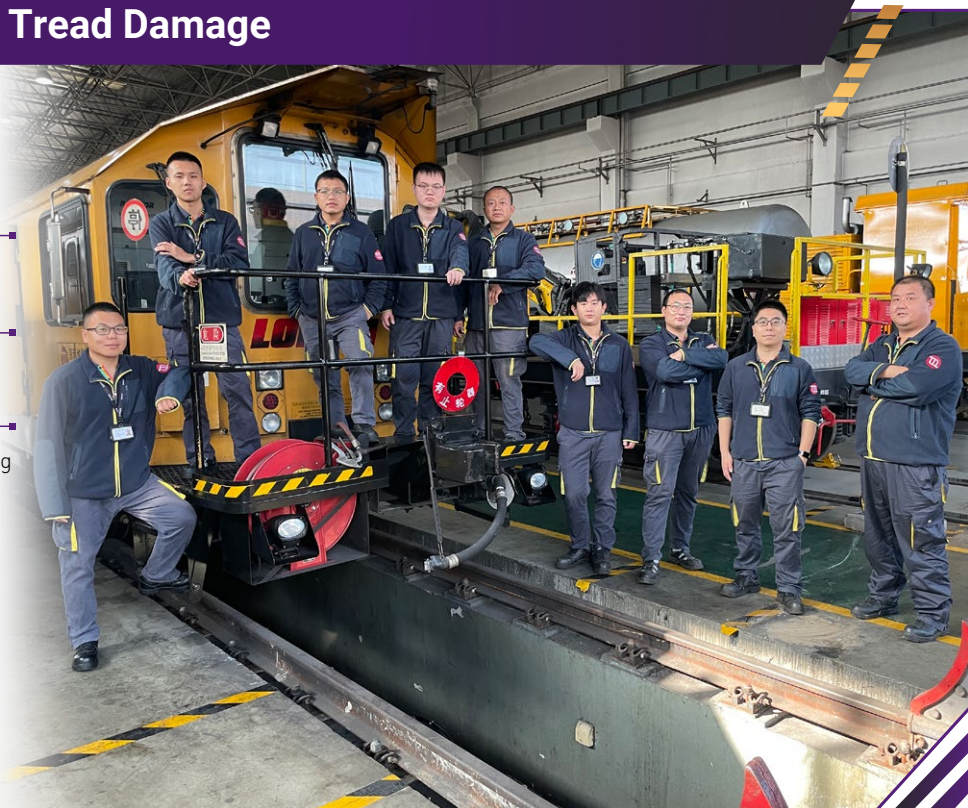
## 解決鋼軌踏面傷損無法量化識別問題 A Solution for Quantitative Detection of Rail Tread Damage

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#### 問題剖析

- 魚鱗紋、剝落掉塊等病害，會導致鋼軌傷損，降低鋼軌使用壽命，影響行車安全。由於無法對此等病害實現量化測量，判斷傷損程度及發展趨勢，難以為制定打磨策略提供有效依據。
- 使用傳統直尺和量角器無法對該病害的深度、面積、佔比、位置分佈等做到量化統計，同時存在測量數據誤差大，效率低的問題。

#### 改善方法

- 圈組利用思維工具，大膽創新，引入一種基於計算機視覺(CV)和人工智能(AI)的新技術，進行鋼軌踏面傷損量化識別算法的開發。
- 利用高清相機在現場進行鋼軌踏面圖像採集，將採集的圖像進行預處理和數據集標注，然後把標注好的數據集導入人工智能量化系統中進行自動識別計算學習，完善智能計算方法，並預測雲計算環境。
- 將新採集的圖像導入系統進行自動化識別計算，從而實現魚鱗紋、剝落掉塊和光帶等量化數據的輸出。

#### 總結成果

##### 有形得益

- 實現鋼軌踏面傷損檢測量化、自動化，工時節省約1280小時，檢測效率提升400%、檢測精度提升100%。
- 運用“鋼軌踏面傷損量化識別系統”後，每年可減少鋼軌打磨車作業約20次，成本節省40餘萬元人民幣。

##### 無形得益

- 降低了檢測工作的漏檢率、誤報率，降低了行車風險，提升了設備運營安全性，為乘客出行提供有力保障；
- 鋼軌踏面傷損的量化工作實現了自動化、智能化從無到有的突破。該技術將來有望進一步優化並推廣適用範圍，具有非常好的應用前景和市場價值。
- 圈員協作進取，探索新方法，務實高效的完成既有工作方式的改進，提升了團隊成員的工作能力和信心。



## Problem Analysis

- Micro-cracks and spalling will lead to rail damage, reducing the service life of the rail and affecting driving safety. At present, it is not possible to quantitatively detect such hazard to measure the extent of damage and predict its development trend, an effective basis for formulating a grinding strategy cannot be provided.
- The measurement methods using traditional rulers and protractors cannot achieve quantitative statistics on the depth, area, proportion, and location distribution of the hazardous damage. At the same time, there are problems with large measurement data errors and low efficiency.



## Improvement Methods

- The WIT team uses the analysis of the WIT thinking tool. With their bold innovation, they introduced a new technology based on Computer Vision (CV) and Artificial Intelligence (AI) to develop a quantitative detection algorithm for rail tread damage.
- High-definition (HD) camera is used to collect images of rail tread on site, and the collected images are preprocessed and marked with data sets. Then, the labeled data sets are imported into the artificial intelligence(AI) quantitative system for automatic recognition and calculation learning, and the intelligent calculation method is improved, and the cloud computing environment is predicted.
- The newly collected images are imported into the system for automatic recognition and calculation, so as to realize the output of quantitative data such as micro-cracks, spalling and light bands.



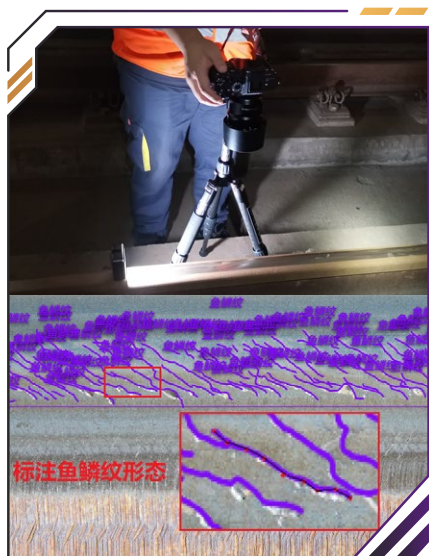
## Summary of Achievements

### Tangible Benefits

- It can realize the quantification and automation of rail tread damage detection, saving about 1280 working hours, improving detection efficiency by 400% and detection accuracy by 100%.
- It helps reduce the operation of rail grinding equipment by about 20 times, saving RMB400,000 every year.

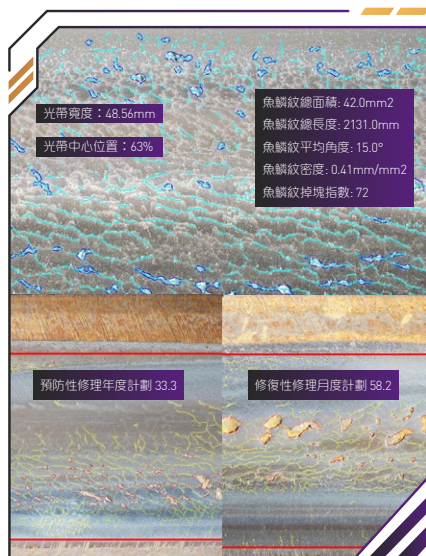
### Intangible Benefits

- It greatly reduces the missed detection rate and false alarm rate, and effectively reduces the security risk, improves the operational safety of equipment and greatly assures reliability of passengers' journey.
- The quantification of rail tread damage detection has achieved a breakthrough in automation and intelligence from scratch. This technology is expected to be further optimized and popularized in the future, which has a very good application prospect and market value.
- The circle members cooperated and made progress, explored the innovation, improved the original methods pragmatically and efficiently, and promoted the working ability and confidence of the team members.



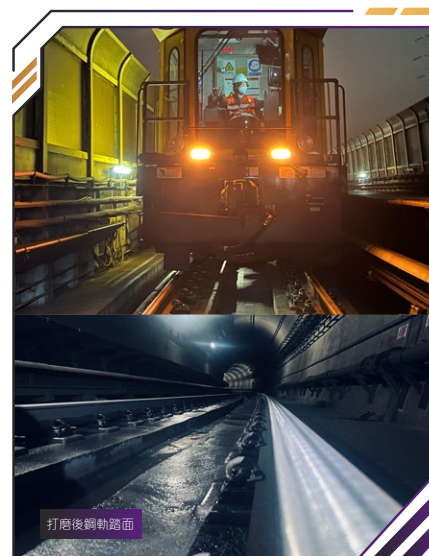
對鋼軌面傷損進行圖像採集並對圖像進行標注。

Image acquisition and image annotation of the rail tread damage.



“鋼軌路面傷損量化識別系統”自動識別傷損情況，為制定打磨策略提供有效依據。

“Quantitative Rail Tread Damage Detection System” identifies the damage automatically and provides an effective basis for formulating grinding strategy.



根據優化後的系統，制定打磨策略，節約打磨資源，提升打磨質量。

According to the optimized system, the polishing strategy is worked out to save polishing resources and improve polishing quality.