News Release

Railway Technical Research Institute

January 13, 2026

RTRI Develops AI-based Method for Visibility Enhancement

The Railway Technical Research Institute (RTRI) has developed an artificial intelligence (AI) model that enhances the forward visibility in video images of trains running in conditions such as snowfall and rainfall (hereinafter referred to as the “visibility enhancement AI”).

1. Development background

Outdoor inspection and monitoring activities in railways are significantly affected by natural environmental disturbances. Among these factors, reduced visibility, particularly that caused by snowfall and rainfall, can degrade the performance of camera-based monitoring systems and increase the workload of staff who perform visual inspection tasks.

For example, during snow removal operations performed by snowplow vehicles in snowfall conditions, staff visually monitor the surroundings and operate with the utmost caution under poor train-forward visibility.

To reduce the workload on staff in such visual inspection tasks and to prevent performance degradation of camera-based monitoring systems caused by environmental disturbances, RTRI has developed an AI model that enhances the forward visibility for railway vehicles.

2. Outline

The visibility enhancement AI takes images captured by a camera as input and enhances visibility by removing noise such as falling snow from the images. In addition to such noise, the AI is trained to suppress camera noise, eliminate motion blur and defocus, and enhance low-light images.

3. Effects and features

- This AI model can remove factors that impair visibility, such as falling snow, from the input video images and can output images with improved visibility (i.e., clearer images) (Figure 1). It can enhance image clarity regardless of the falling speed or density of the snow, including fine powder snow.
- Conventional image enhancement methods tend to emphasize falling snow as noise, whereas the developed visibility enhancement AI can remove falling snow in the images by utilizing temporal changes in the video (Figure 1).
- Although the developed AI model is currently tailored for processing forward-view images captured from trains, it can also be applied to other types of monitoring, such as fixed-point monitoring of railway equipment.

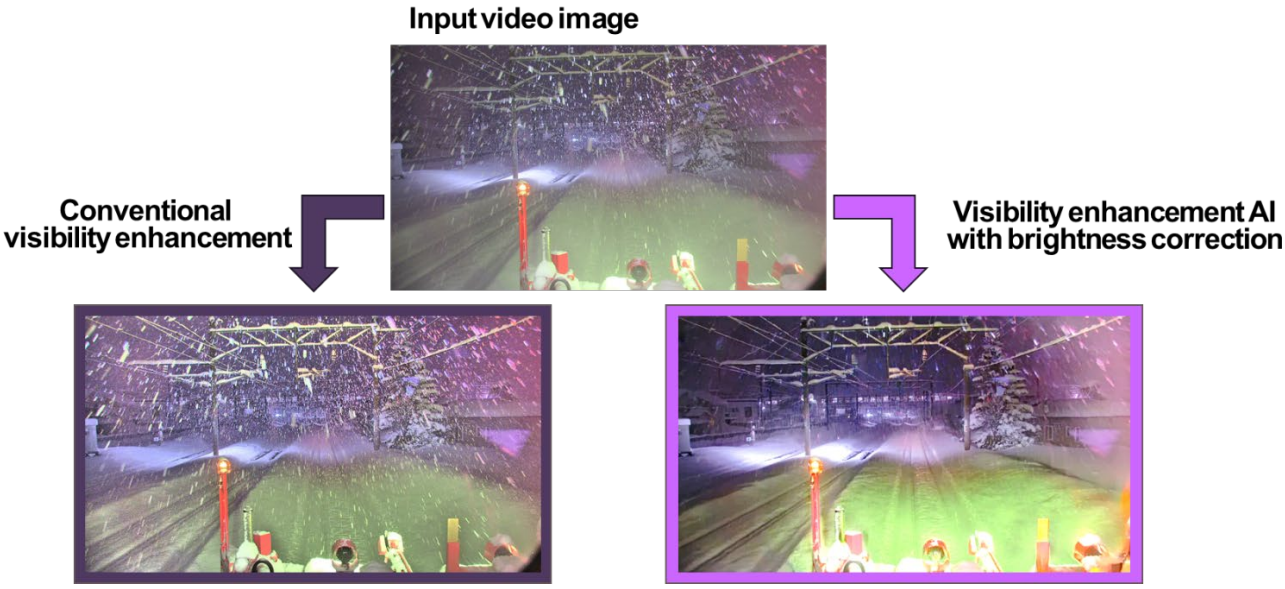

Figure 1 Comparison between conventional visibility enhancement and the visibility enhancement AI

4. Future applications

Verification of the AI model will be conducted by railway operators, with the aim of implementing it in an onboard system that assists train-forward monitoring during snow removal operations (Figure 2). Furthermore, applying this model to level crossing monitoring and forward monitoring from trains is also under consideration.

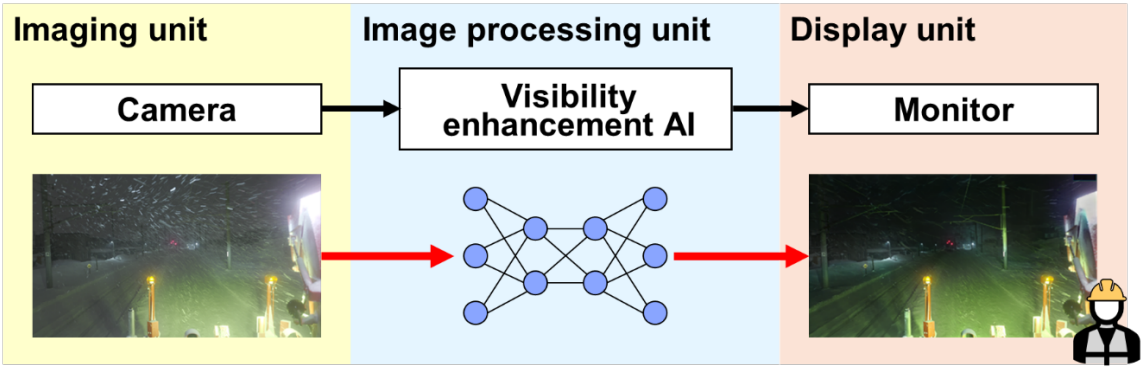

Figure 2 Processing flow of video images performed by the onboard system under development