実環境下での映像データ収集による鉄道と鹿の衝突回避策の検討

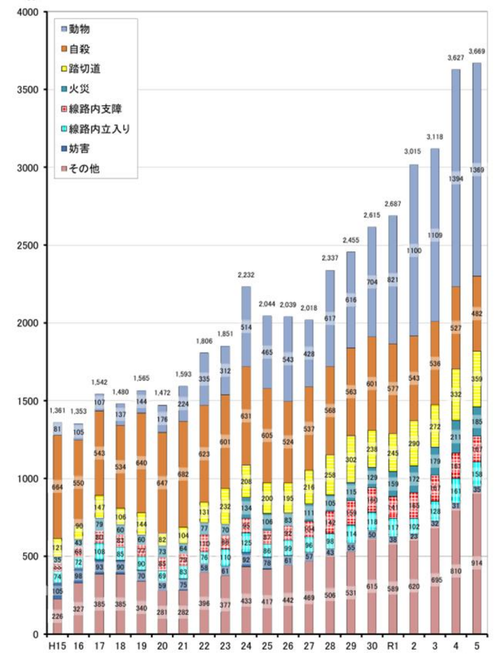
Investigation on Deer Collisions Preventing Methods with Video Recorded in Railway Operation Environment

Partner: WILLER TRAINS, Inc.

Background

- Railway disruptions involving animals have been increasing these years
- Some prevention methods exist, but cannot be regarded effective enough
- Animal disruptions have more severe influence in rural areas
    - Few vehicles: Higher cost effectiveness of on-vehicle countermeasures
- “Marin-Saponin” effective for repelling birds such as craws
    - It generates light that birds are sensitive to, while humans are not
    - It also has repelling effect to deer [1]

Reference: [1] Yamanta et al., “’Marine Saponin’ Application of wildlife repellent –Verification report to deer,” *Symposium on Wildlife and Traffic*, 2023



External reasons for railway disruption in FY2023. Source: MLIT

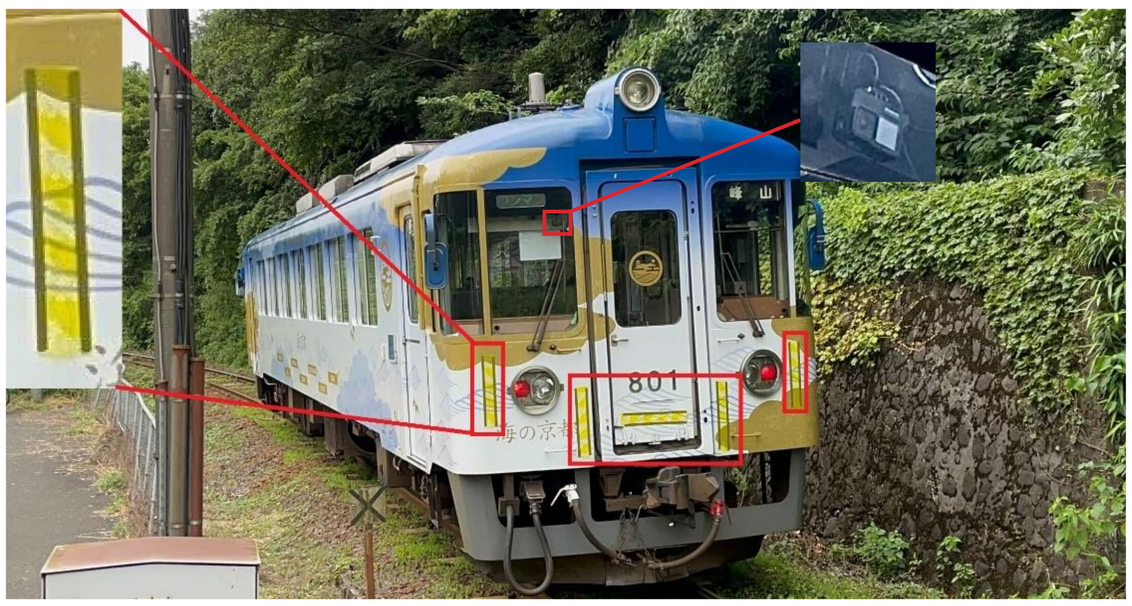
Goal

Verification of the efficacy of “Marin-Saponin” in real railway operation environment

- Field experiment using vehicles on Miyazu Line operated by WILLER TRAINS
    - More than 400 cases of animal disruptions every year recently
    - Not only numbers of disruption but also reactions of deer are to be analyzed

The Experiment

- “Marin-Saponin” containing tapes on railway vehicles as the experiment group
- Cameras on both sides of the vehicles (Toyooka direction, Nishi-Maizuru direction)
- Auto power function: video recording starts and stops with the engine of vehicles



A rolling stock in normal service with tapes and cameras applied

Data

- 2 experiments, 154 [trains × days] (4 × 22+2 × 33)
    - Scientific control experiment (experiment 1: control 1)
    - 1,708 hours of videos recorded

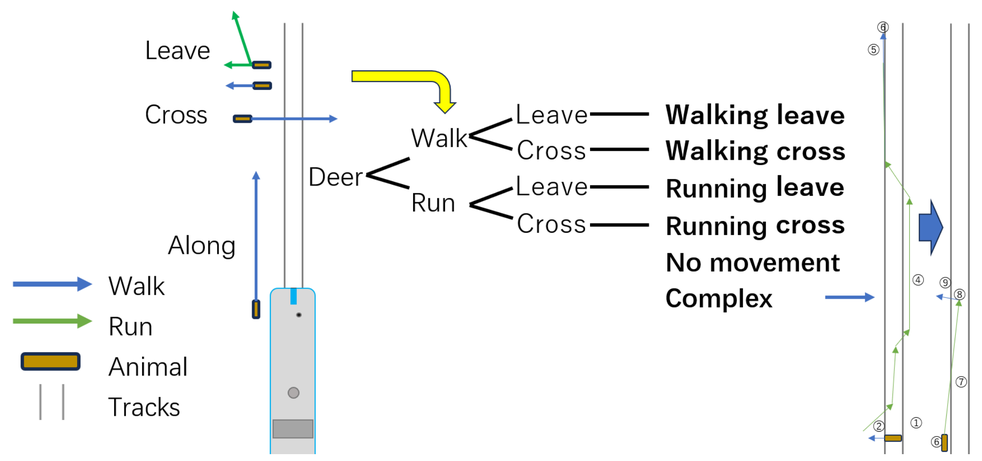
➢ Detection of deer not being hit using machine learning
- Cases without collisions were not reported by law
- 108.2 hours of nighttime videos analyzed

- 0.25 deer collided with a train per day in average
- 2.7 deer spotted with a train per HOUR in average (293 total)

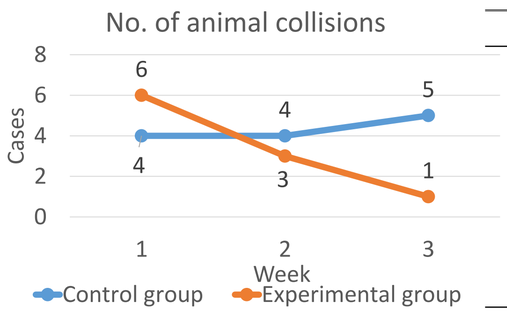
A scene right before a collision

A scene without collision

Categorization of Deer Behaviors



Experiment Results



Behaviors	Experiment		Control	
Leaving	4	12.1%	2	10.5%
Walking	1	3.0%	3	15.8%
Fleeing	6	18.2%	5	26.3%
Running	17	51.5%	8	42.1%
Still	5	15.2%	1	5.3%
Complex	0	0.0%	0	0.0%
Total	33	100.0%	19	100.0%

Findings

- Analysis was accelerated with machine learning based tools
- The efficacy of “Marine-Saponin” is expectable
- Far more animals spotted compared to number of accidents

Future Works

- Verification of currently used object recognition model
    - Comparison between computer and human eye
- Daytime videos analysis
- Deer behavior psychological analysis

Publications

[1] L. LAI, K. SHIMONO, K. ISHII, H. YOKOMIZO, Y. SUDA, T. IIJIMA, Y. HATAYAMA, K. MASUI and A. FUJITA, “Verification of the Efficacy of Animal Deterrent for Preventing Deer Collisions in Railway Operation Environment with Video Data Recording,” *32th JSME Transportation and Logistics (TRANSLOG)*, Tokyo, Japan, Nov. 2023, doi: 10.1299/jsmetld.2023.32.PS1-2

[2] L. LAI, K. SHIMONO, K. ISHII, H. YOKOMIZO, Y. SUDA, T. IIJIMA, Y. HATAYAMA, K. MASUI and A. FUJITA, “Study on a Deterrent against Deer Collisions in Railway Operation Environment,” *RAILWAYS*, Prague, Czech, Sept. 2024, doi:10.4203/ccc.7.11.2, ISSN 2753-3239 (Reviewed)

[3] L. LAI, K. SHIMONO, K. ISHII, H. YOKOMIZO, Y. SUDA, T. IIJIMA, Y. HATAYAMA, K. MASUI and A. FUJITA, “Study on a Deterrent against Deer Collisions in Railway Operation Environment,” *Symposium on Wildlife and Traffic*, Sapporo, Japan, Feb. 2025, ISSN 1347-3190