Florida Department of Transportation Research

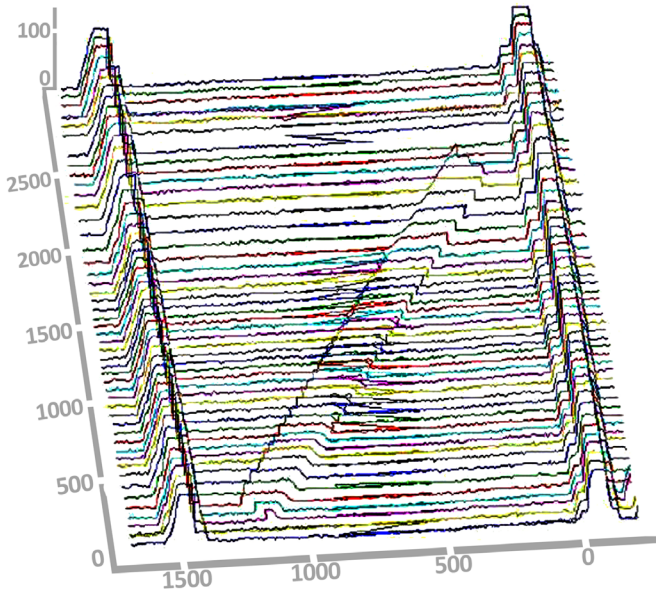
Automated Visual Inspection/Detection of Railroad Track
BD550-08

The Florida rail system comprises 2,800 miles of mainline track. The millions of tons of freight carried on these tracks would require millions of heavy trucks. The rail industry serves thousands of customers and supports thousands of jobs, contributing hundreds of millions of dollars each year to Florida's economy. It is critical to the efficient and safe operation of Florida's rail system that tracks are well maintained for both freight and passenger traffic. The Federal Railroad Administration reported that track defects caused 190 of the 527 train incidents that occurred from 2000 to 2010, resulting in injuries, fatalities, repair costs, and environmental damage.

Track inspection is a continuous and tedious process of viewing sample sections of track. Track geometry defects, such as incorrect width, are located by specialized rail cars on heavily used mainline tracks, but defects in track structure, such as damage to cross-ties or missing tie-plates, fasteners, bolts, etc. must be detected visually. Two inspectors perform this work for the State of Florida, locating hundreds of defects each year.

The Florida Department of Transportation (FDOT) contracted the University of Central Florida's Computer Vision Lab to develop an automated railroad track inspection system to aid inspectors. Computer Vision Lab researchers created a software and hardware system using both estabilshed and novel technologies. The system was deployed on FDOT's Hi-Rail truck that travels on railroad tracks, checking track geometry.

Track geometry was measured using data acquired by a laser scanner. Track structure was inspected with a line-scan camera. Specific image processing software was developed for each type of track structure defect. Data from the laser and the camera were delivered to a computer on board the Hi-Rail vehicle. The computer was equipped with a graphical user interface (GUI) that assisted the inspectors in operating the system.



A section of track as seen by the laser scanner. Dimensions are in millimeters.

Researchers field-tested the system over several miles of track, collecting over one terabyte of data. The track geometry system was found to be useful to the track inspector, providing warnings through audio cues whenever the gage was outside limits. Algorithms to find defects such as missing bolts, cracks in rails, and engine burns, performed satisfactorilty in lab tests, but field tests have been less consistent. Challenges to the system include variations in lighting and lengthy computation time taken by computer vision algorithms. Work continues to seek software and hardware solutions to these problems.

Inspectors found the system very helpful, and it will be improved over time. In some cases, the system has detected defects which required attention and could have have resulted in incidents. The ability of the system to log the exact location of defects will help create a more accurate history of inspection and measure of deterioration over time.

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