Automating Work Orders for Winter Weather Operations Using GPS Tracks
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Motivation
- Snow and ice can decrease transportation efficiency and cause deadly threats to drivers on >70% of U.S. roadways.
- INDOT’s number one priority during the winter is snow and ice removal.
  - More than 29,000 lane miles of interstate highways, U.S. routes and state roads
  - More than 1,000 snowplows to work alternating 12-hour shifts, 7 days per week, if needed
- Significant record keeping burden on operators/managers
  - Need automated work order verification and generation of geospatial vehicle tracks for operators/ managers

Work order record verification is fully automated based on GPS data. Furthermore, extra details revealed can enhance existing/future records.

Full Automated Work Order Verification
- Implemented in Matlab R2021b
- Only requires the date and vehicle of interest
- Key steps
  o Extract GPS points of interest
  o Label samples by road names and mile markers
  o Group records on highways
  o Generate work order records for comparison

GSP Records from INDOT Data Warehouse
- Winter: 12/2/2020–4/30/2021
- In total: 1,051 vehicles; 5,115,844 location points
  - Sampling time
    o All ≥ 1 min
    o ~34% = 1 min
    o ~14% > 5 min

Case Studies and Data Visualization
- Traditional geospatial data visualization methods fall short even for the simple one-vehicle patrolling scenario.
- New activity overview methods are proposed to concisely show maintenance efforts, possibly covering multiple roads, in both time and space.

Discussion
- GPS data usage and quality evaluation
  o Systematically inspected INDOT GPS records
  o Improvement in data will benefit this project.
- Full automation
  o Only requires GPS + date + vehicle ID
  o Removes/Lightens record keeping burden
- Rich details
  o Activity records with minute level precision
  o Various compact visualization methods
  o May solve existing challenges faced by INDOT
- Future work: activity matching over multiple dates

Acknowledgements
Sponsorship for this work was provided by the Joint Transportation Research Program under project SPR-4605. Map data shown on this poster were from Google Maps.