CRII: CPS: Modeling Subsurface Features and Connected Autonomous Vehicles as Cyber-Physical Systems for Reciprocal Mapping and Localization

Shuai Li, Department of Civil and Environmental Engineering, University of Tennessee Knoxville

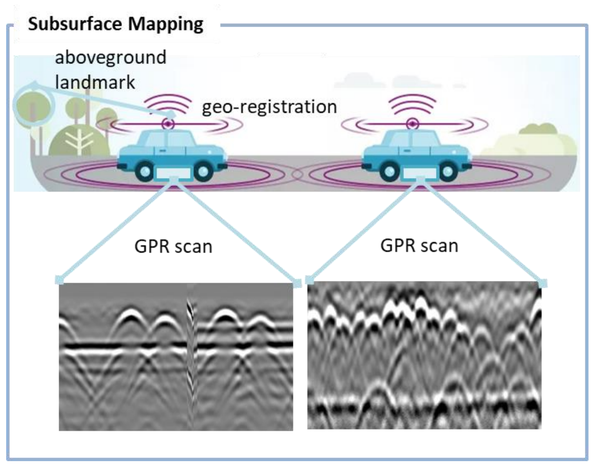
https://www.nsf.gov/awardsearch/showAward?AWD_ID=1850008&HistoricalAwards=false

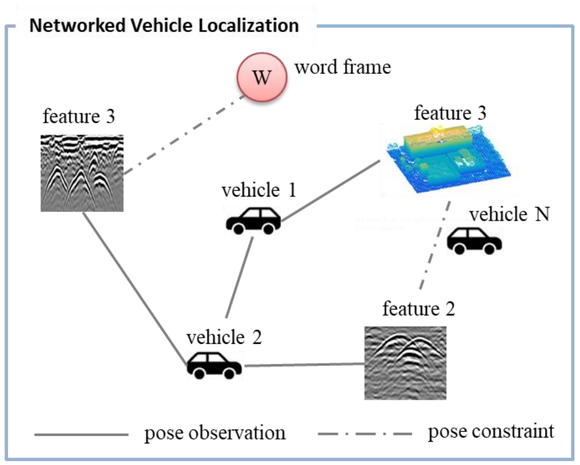
Two Problems

- Mapping and labeling subsurface infrastructure are hindered by the congested nature of urban subsurface, the limited mobility of sensor platforms, and the absence of data processing algorithms.
- Autonomous vehicles require accurate and reliable localization, which remains a critical challenge in unstructured, dynamic, and cluttered urban environments.

One Solution

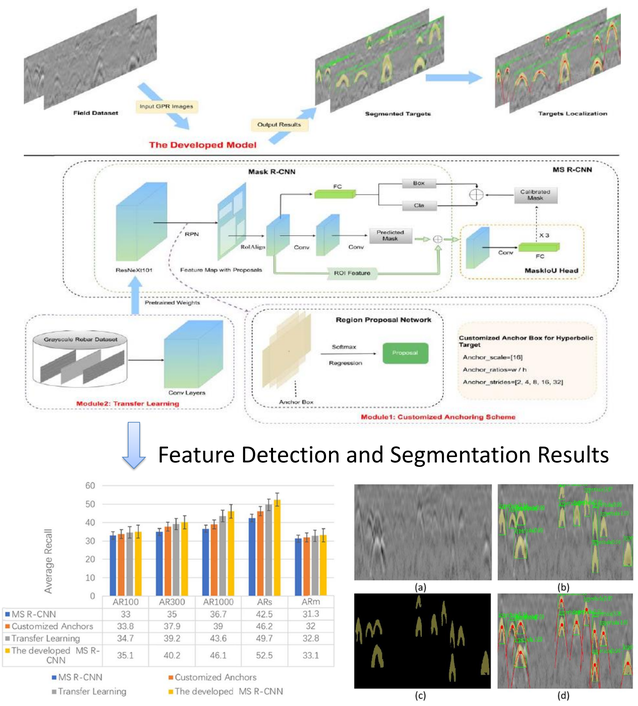
- Autonomous vehicles, when equipped with ground penetrating radar (GPR), are able to detect, locate, and characterize buried features to produce crowdsourced subsurface maps.
- Matching invariant and geo-registered subsurface features will provide new data streams for accurate vehicle localization.



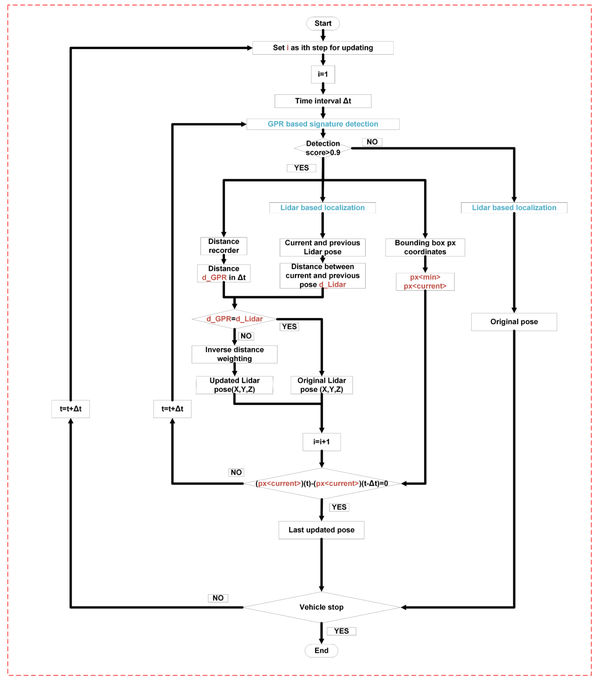


Project Update

GPR-Based Subsurface Feature Detection



LiDAR-GPR Integration for Localization



Scientific and Broader Impact

- Offer a new approach to produce crowdsourced subsurface map to improve the buried infrastructure and public safety
- Improve the reliability and accuracy of autonomous vehicle localization and navigation under adverse conditions such as snow and cyberattacks such as GPS spoofing
- Contribute to the improved public science literacy and the improved education