

System Overview

To achieve accurate indoor and outdoor localization in Track 6, we plan to adopt various technological methods, including Pedestrian Dead Reckoning (PDR), Vehicle Dead Reckoning (VDR), and fingerprint matching. The specific methods and principles are as follows:

Methods and Principles:

1. **Neural PDR:** Considering the complex and variable movement patterns of pedestrians, we use a trained deep learning model that processes smartphone IMU data to output the three-dimensional displacement of pedestrians.

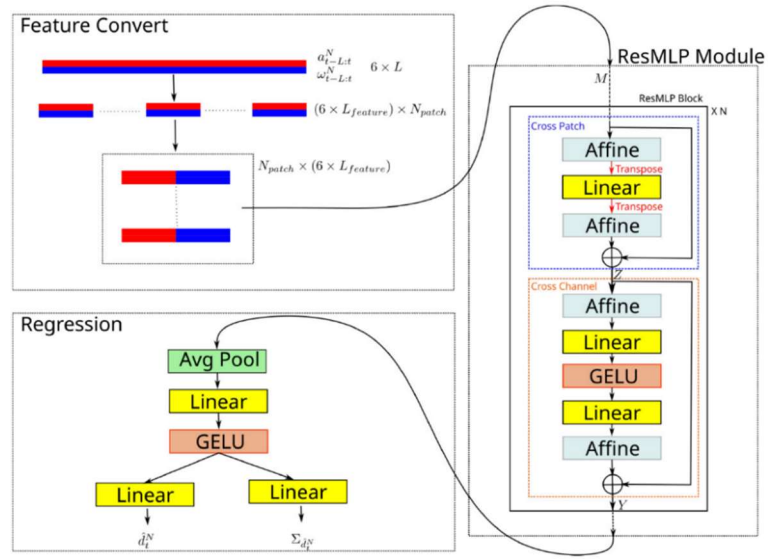


Figure 1 Framework illustration of neural PDR

2. **Smartphone-based VDR:** Constraints based on vehicle motion patterns are applied to improve the accuracy of Vehicle Dead Reckoning (VDR).

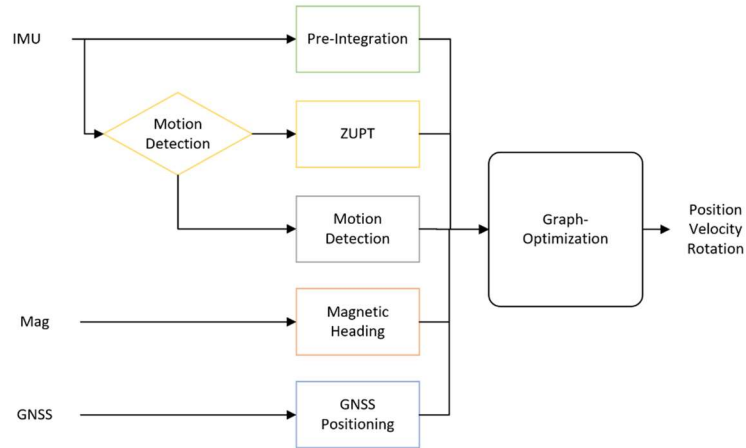


Figure 2 General scheme of VDR

3. **Fingerprint Localization:** The pre-collected database of Wi-Fi, Bluetooth, and magnetic field characteristics is used. Fingerprint localization is used to find the current location by comparing the signals from the smartphone with those in the database.

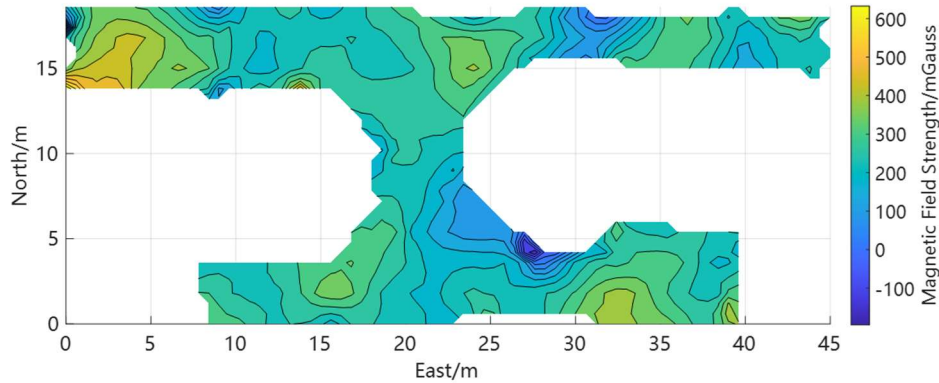


Figure 3 The magnetic field strength map

4. **GNSS Localization:** In open outdoor environments, GNSS is used to provide position and velocity information. This data is combined with inertial navigation using factor graph optimization to enhance localization accuracy.
5. **Scenarios Recognition:** Different scenarios, such as elevators, escalators, handheld and in-vehicle smartphones, are recognized by using multi-source data. Then, the system switches to the appropriate localization algorithm.

System Workflow:

1. **Indoor Localization:** In indoor or other GNSS-restricted areas, we use PDR, VDR, Wi-Fi, Bluetooth, and magnetic field matching for localization. These technologies ensure continuous and accurate positioning for pedestrians and vehicles indoors.
2. **Outdoor Localization:** In open areas, GNSS is used to obtain position and velocity information. This data is combined with IMU data and smoothed by using factor graph optimization.
3. **Feature Matching:** In areas with rich magnetic, Wi-Fi, and Bluetooth features, we use fingerprint matching to get precise location data. This data is used as an absolute measurement to enhance positioning accuracy.
4. **Scenarios Switching:** The system dynamically switches localization algorithms based on real-time scenarios recognition results.