A Coarse-to-Fine Approach for Motion Pattern Discovery

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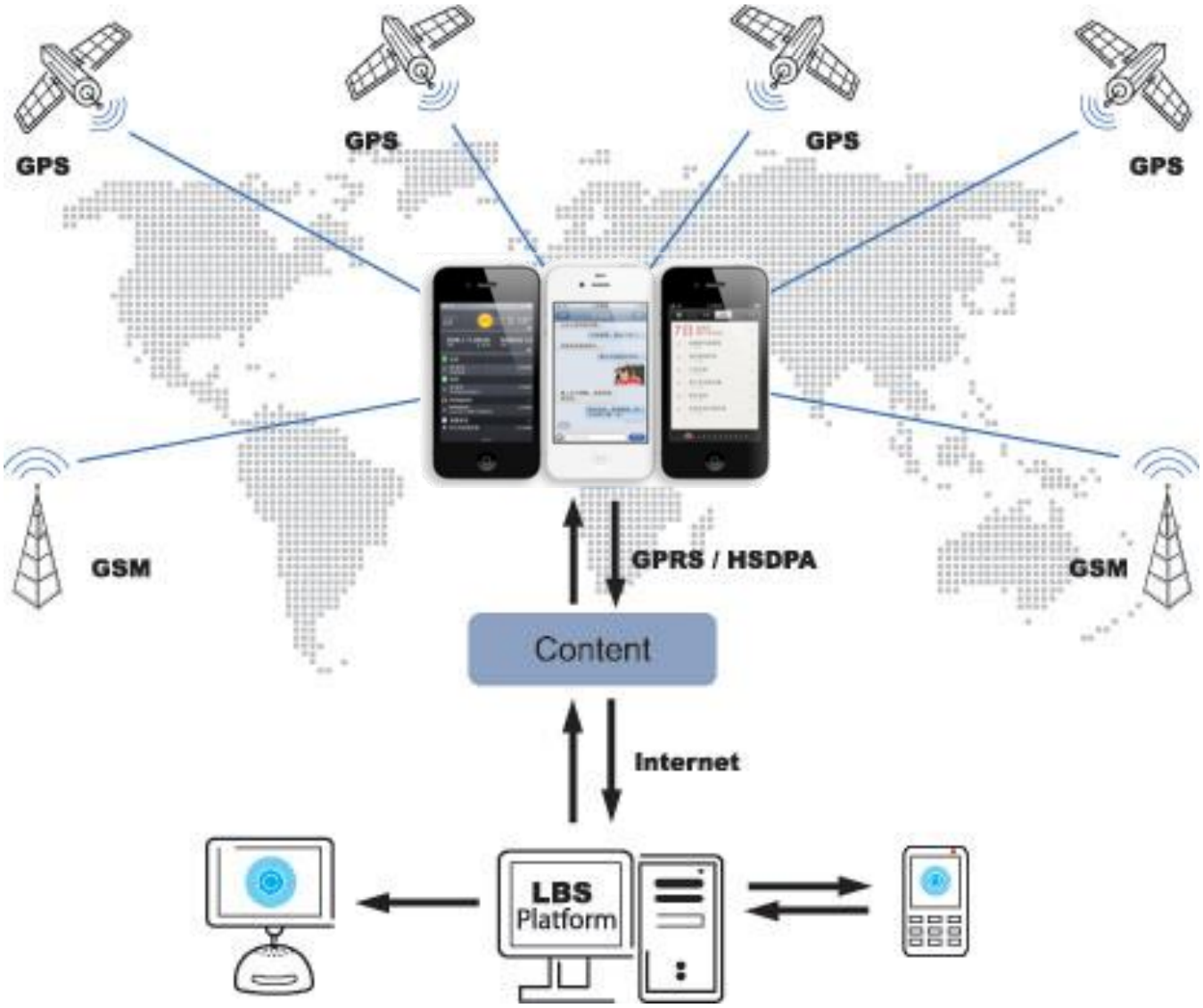
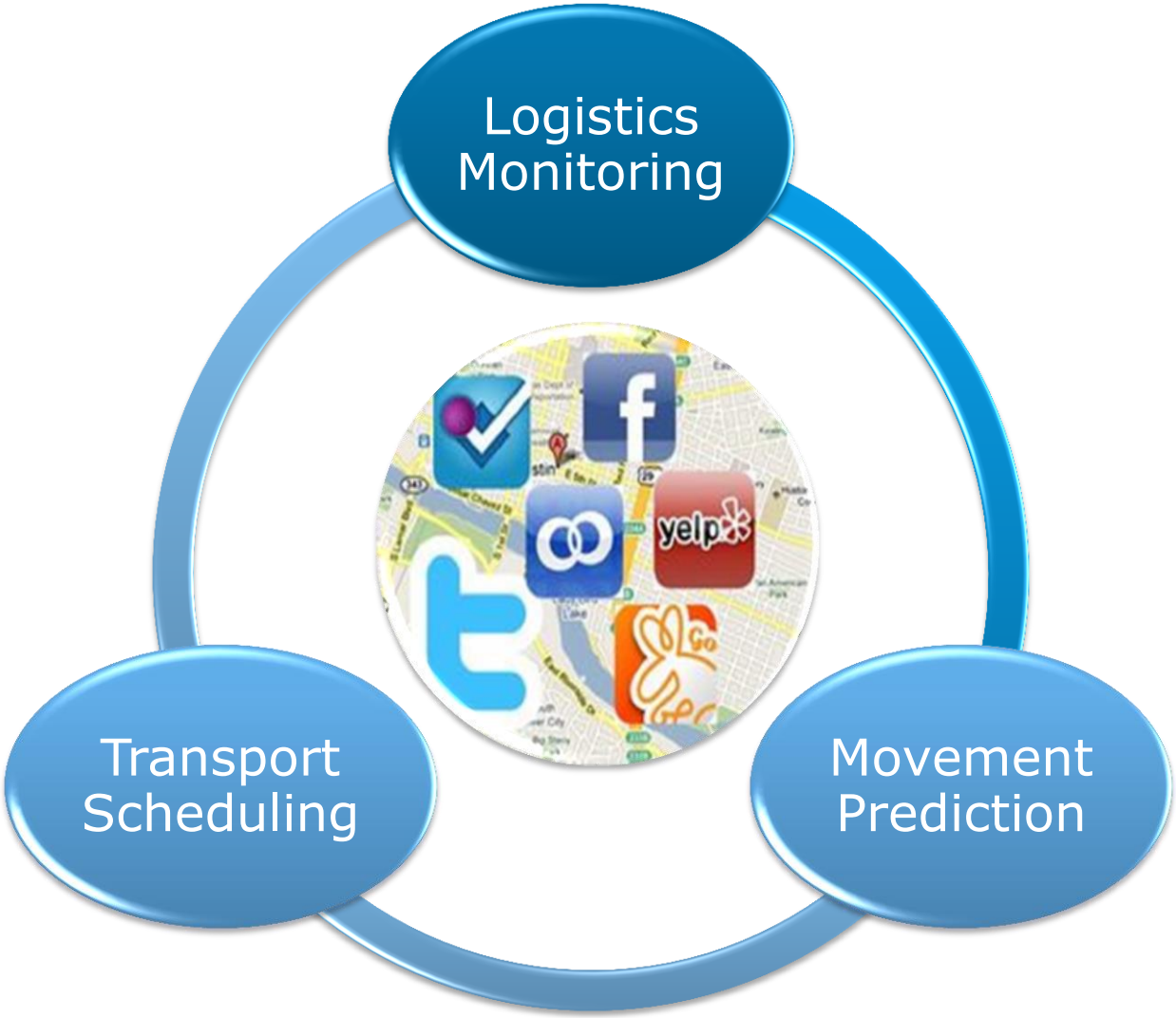
LBS


GPS
GPS
GPS
GPS
GSM
GSM
GPRS / HSDPA
Content
Internet
LBS
Platform

Promising Applications



Problem Model

Home

Bus Station 1

Factory

Bus Station 2

Coarse-to-fine Approach

★ Coarse Clustering

A Median-based GMM

★Refined Separation

Fisher optimal division method

Coarse Clustering

I

$$P(v_i) = \sum_{k=1}^{K} \pi_k N(v_i|\mu_k, \sigma_k)$$

II

$$\sum_{i=1}^{L} log\left\{\sum_{k=1}^{K} \pi_k N(v_i|\mu_k, \sigma_k)\right\}$$

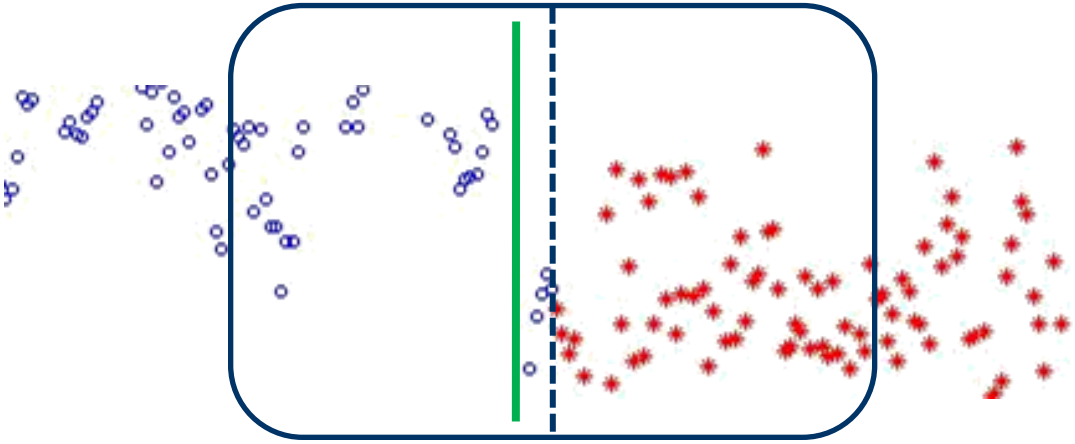
III

$$\gamma(k|v_i) = \frac{\pi_k N(v_i|\mu_k, \sigma_k)}{\sum_{j=1}^{K} \pi_j N(v_i|\mu_j, \sigma_j)}$$

VI

$$\Gamma(k|v_i) = \frac{\gamma'(k|v_i)}{\sum_{k-1}^{K} \gamma'(k|v_i)}$$

Refined Separation

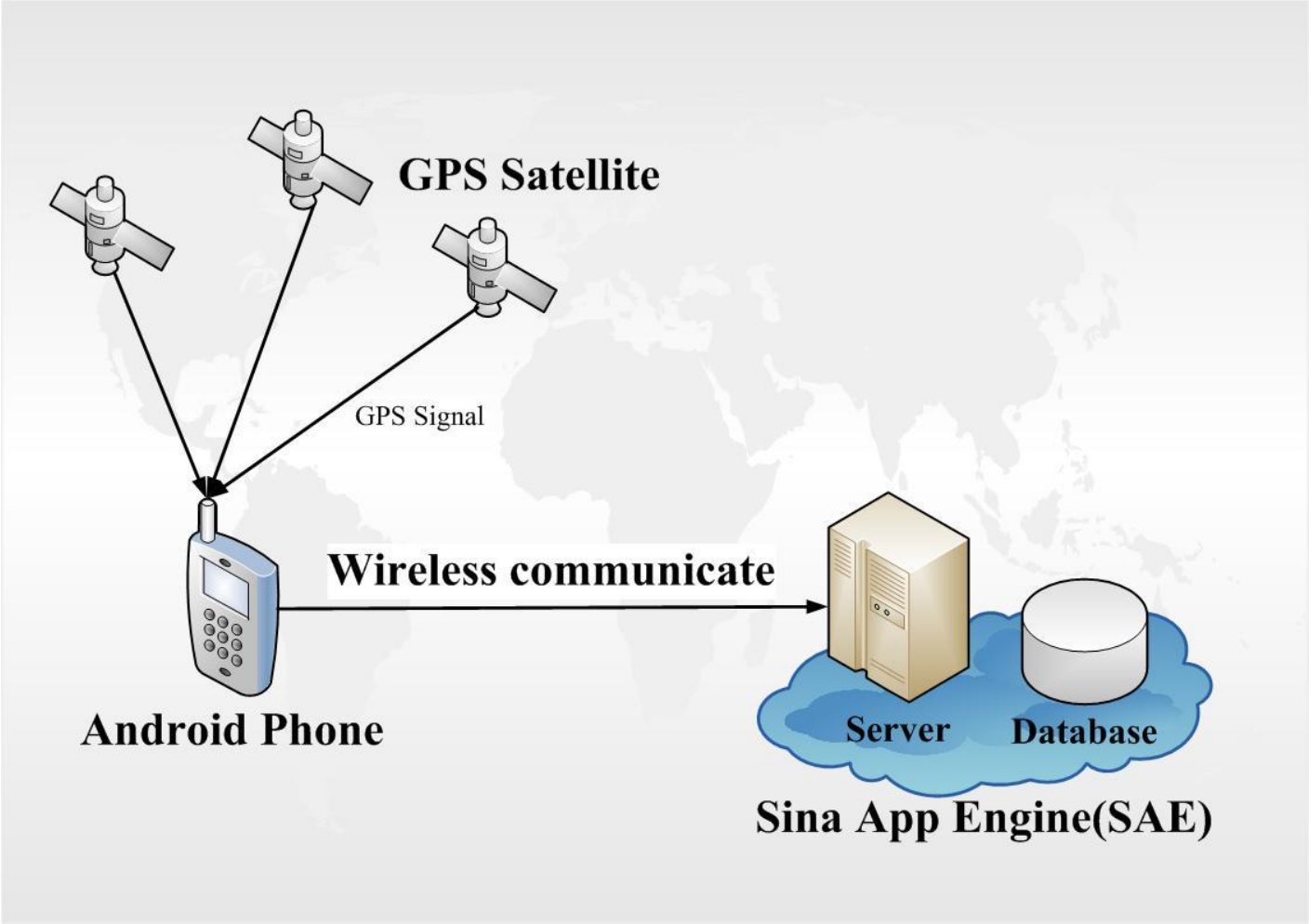


$V_{i'-n}, \ldots, V_{i'}, \ldots, V_{i'+n}$

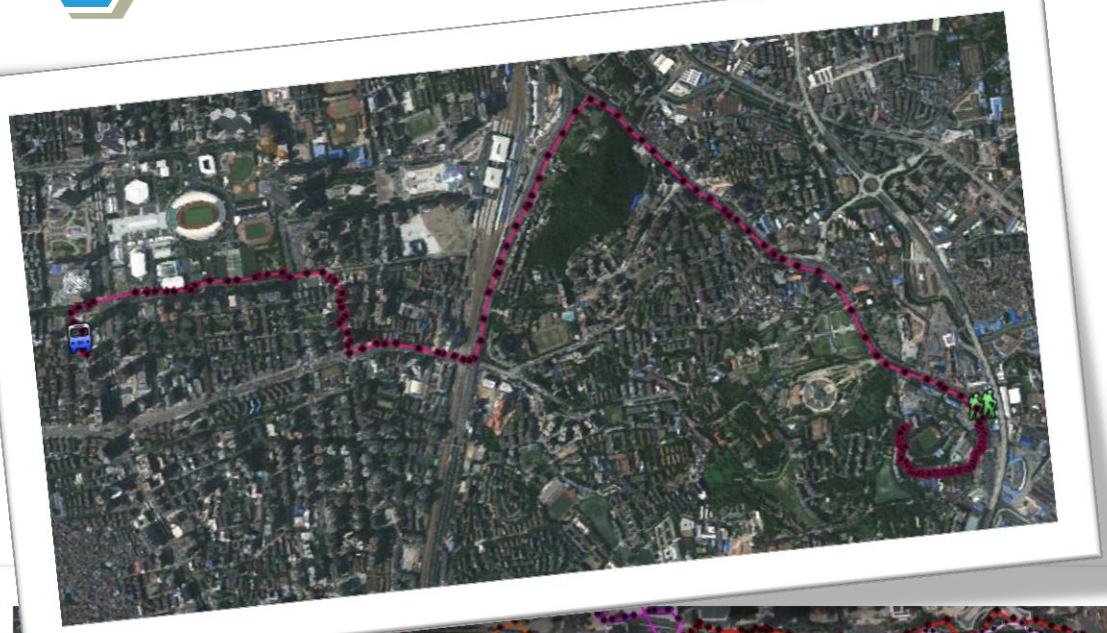
$$D_k(i'-n, i'+n) = \sum_{t=i'-n}^{i'+n} (v_t - \bar{v})$$

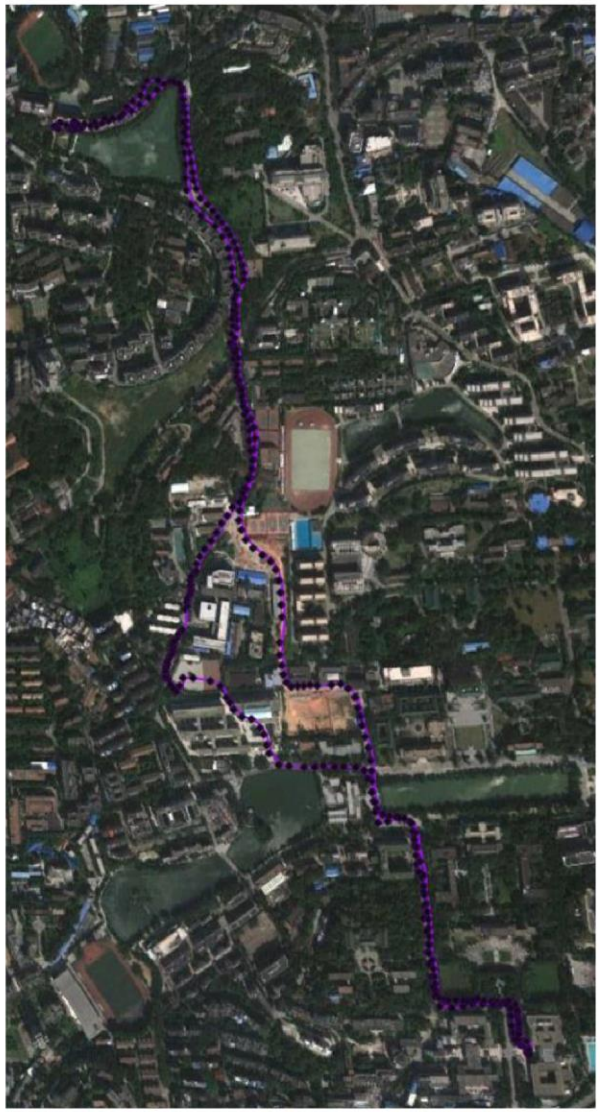
$$c = \underset{i'}{argmin} \sum_{k=1}^{K} D_k(i'-n, i'+n)$$

Data Collection System

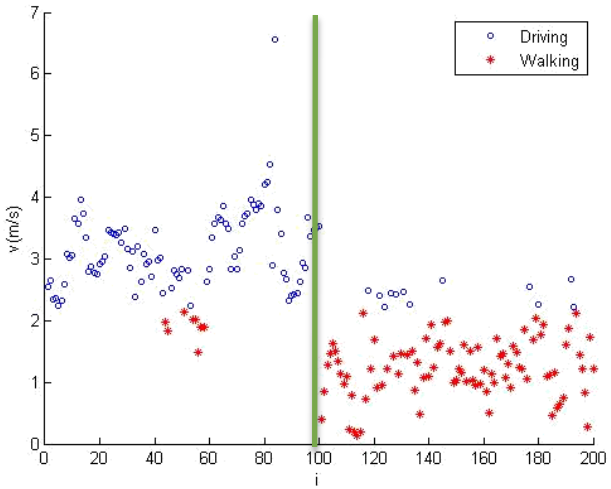


The Real GPS Data

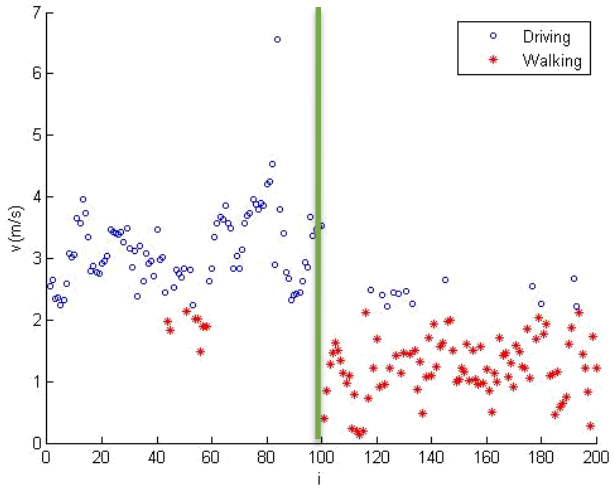




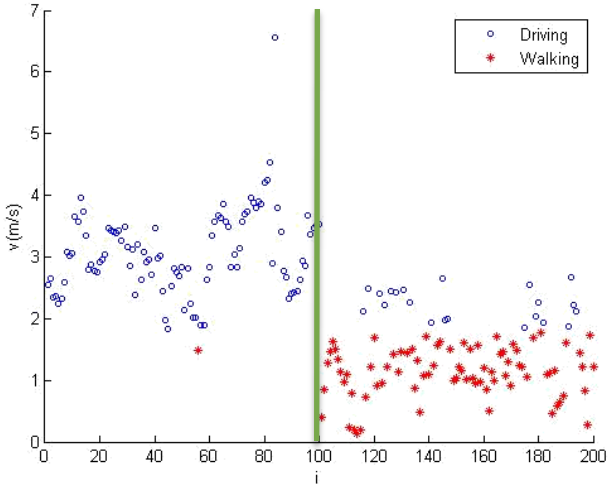
Clustering Result



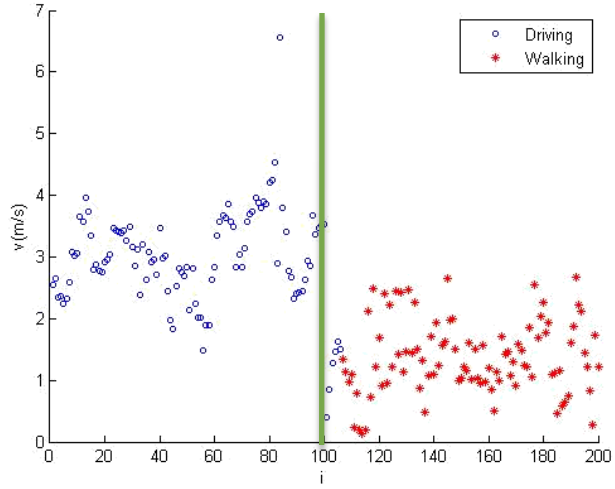
K-means



FCM



GMM



The proposed algorithm

Accuracy by Different Methods

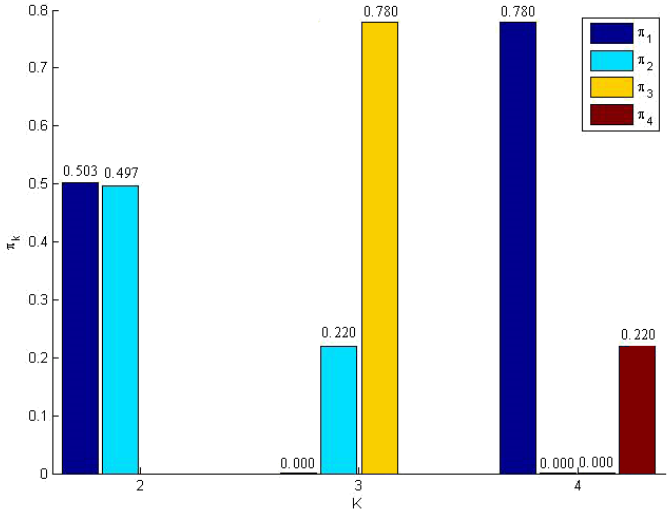
Table1 Accuracy on the LDPA data set

	K-means	FCM	GMM	Proposed Algorithm
Accuracy	78.04%	78.64%	79.75%	88.15%

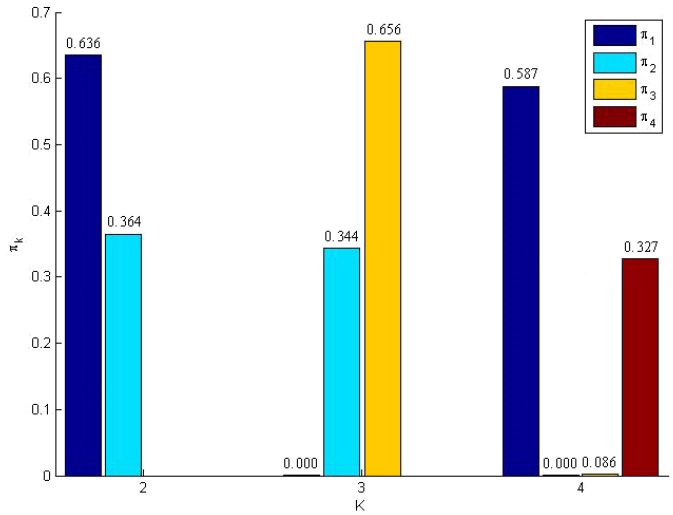
Table2 Accuracy on the real GPS data

	K-means	FCM	GMM	Proposed Algorithm
Accuracy	79.65%	79.73%	83.38%	93.74%

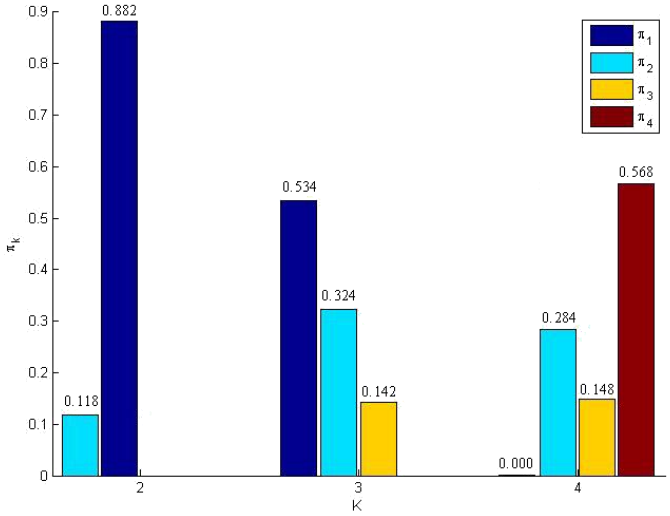
π_k for different motion patterns



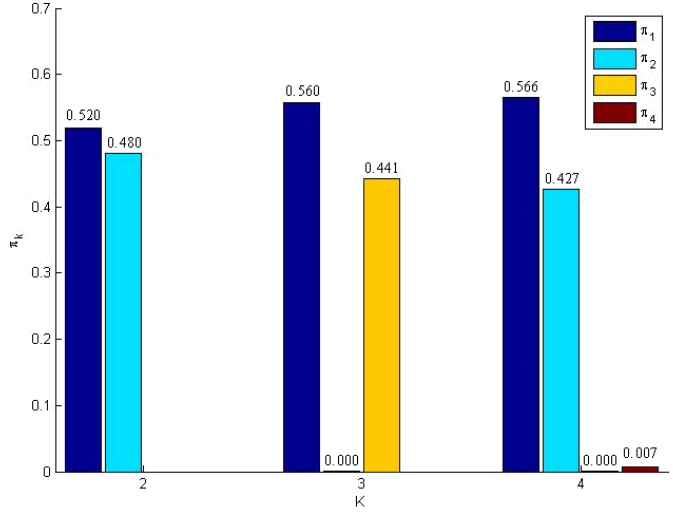
Driving→Biking



Walking→Biking

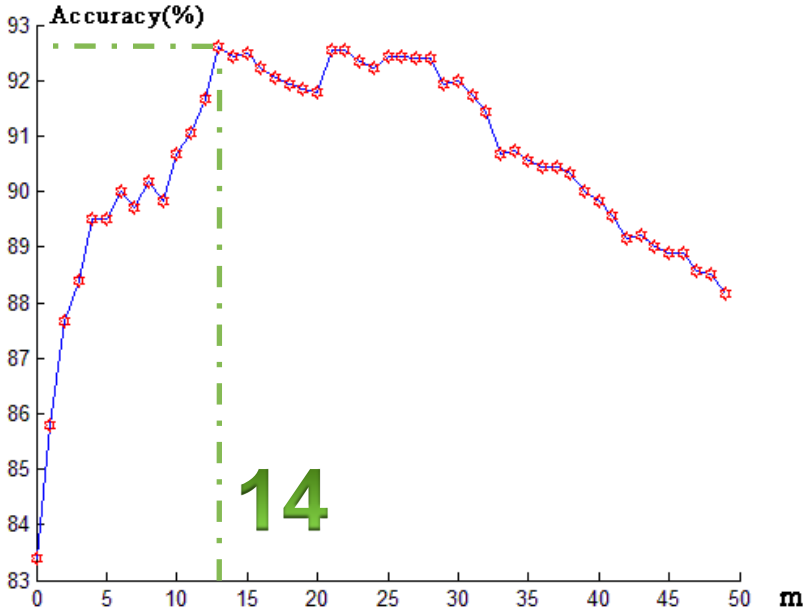


Walking →Driving →Biking

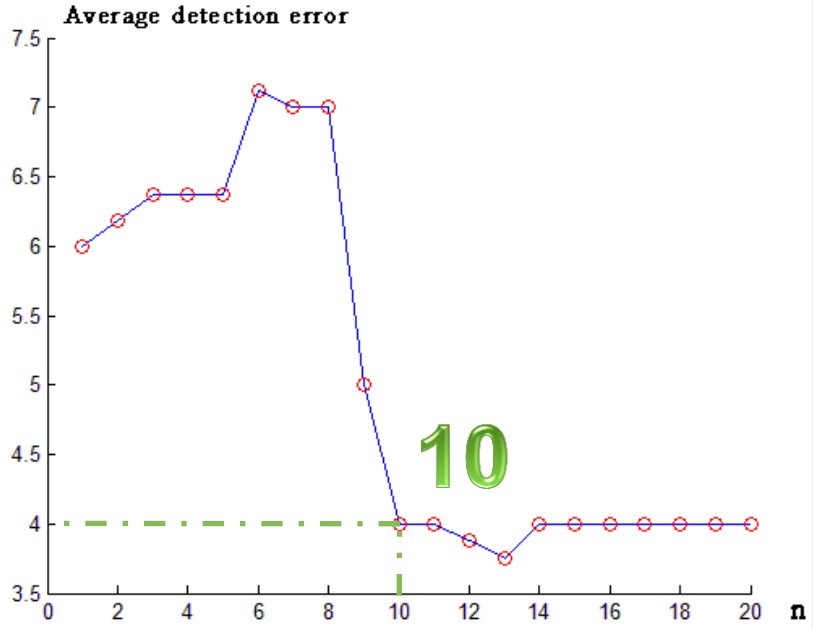


Walking→Biking →Walking

The parameter selection



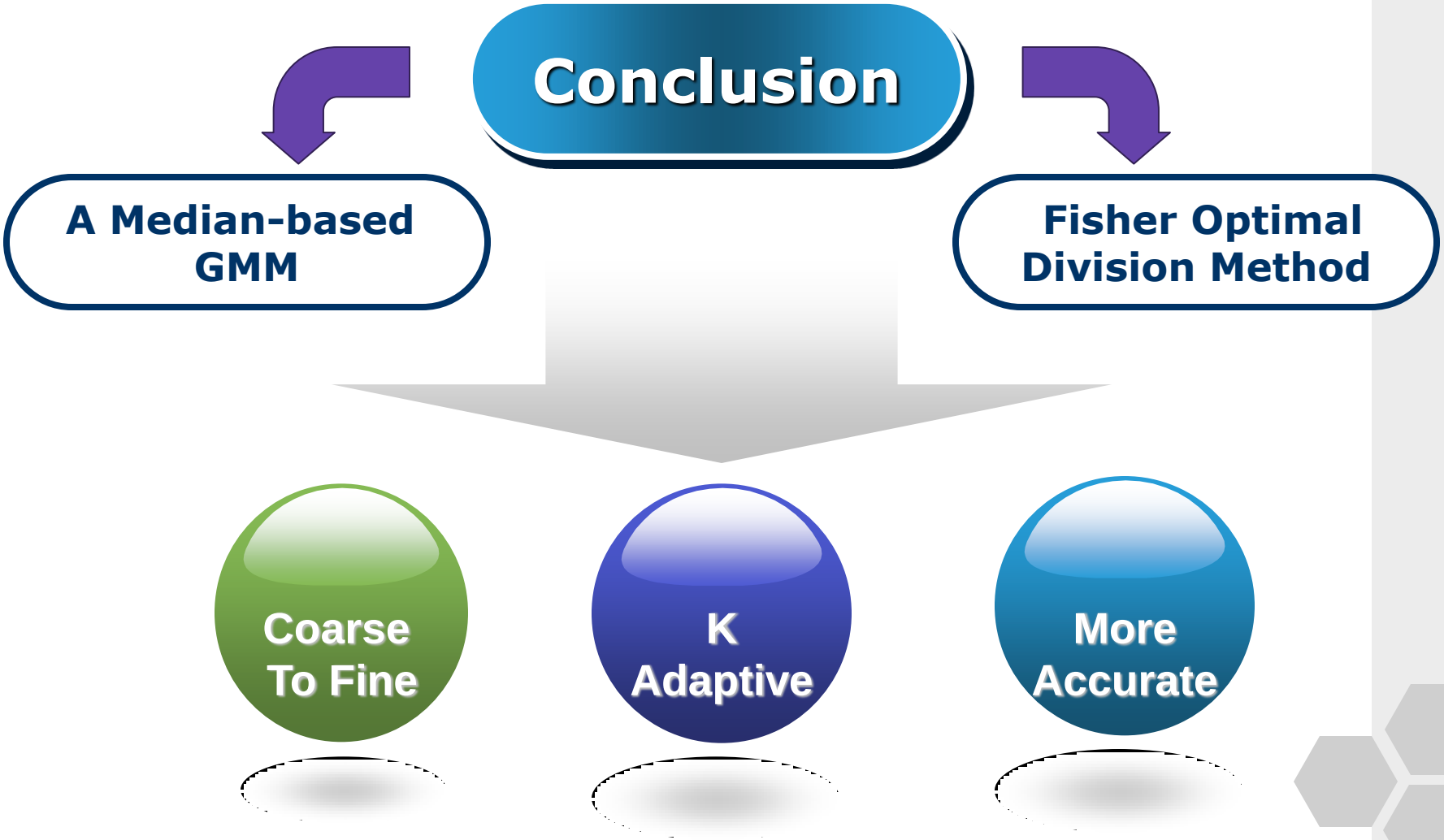
The effect of m on the accuracy



The effect of n on the accuracy

$$\gamma'(k|v_i) = Median_{j=i-m}^{i+m}\,\gamma(k|v_j) \qquad D_k(i'-n, i'+n) = \sum_{t=i'-n}^{i'+n}(v_t - \overline{v})$$

Conclusion


Conclusion
A Median-based GMM
Fisher Optimal Division Method
Coarse To Fine
K Adaptive
More Accurate

Thank You !