



Live Direction

Do not look at the map, just check the direction alarm



2019 창의적 통합설계 : 최종발표
Park Ji-Han , Maryam Sadat Daneshvarian

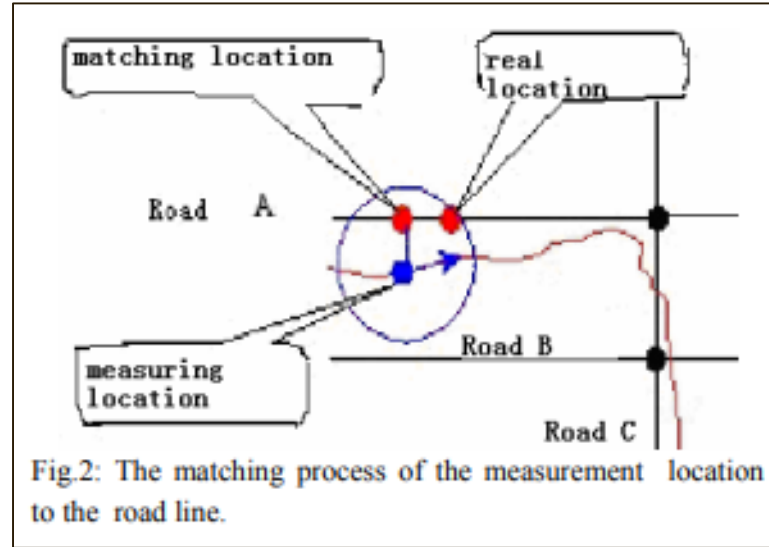
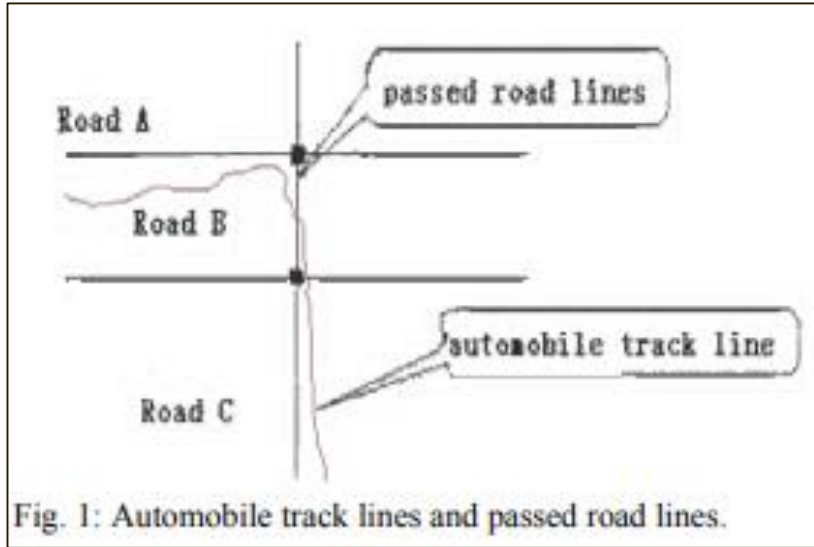
Motivation & problem:

기존의 어플은 방향을 꺾어야 하는지에 대한 정보는 지도 상에서만 위치로 표시되어 있고 아무런 정보를 주지 않는다.

그래서 특정 이벤트가 일어났을 때 곧 좌회전이나 우회전을 해야 되는 상황 등을 알림으로 사용자에게 알리려고 한다.

• Map matching

- Find Road(location에 가장 타당해 보이는 road를 선택)
- Find Current Position(앞서 찾은 road에서의 위치를 추정)



Background

• Hidden Markov Model

- Viterbi Algorithm(Dynamic programming)
- Max probability states

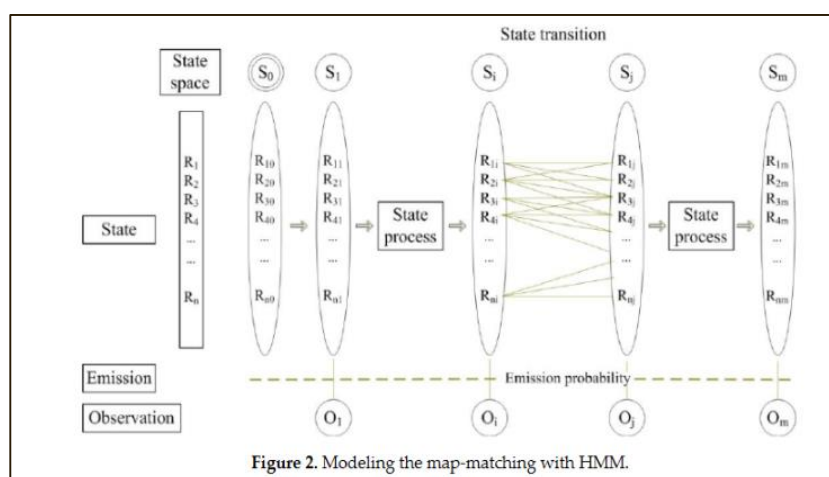
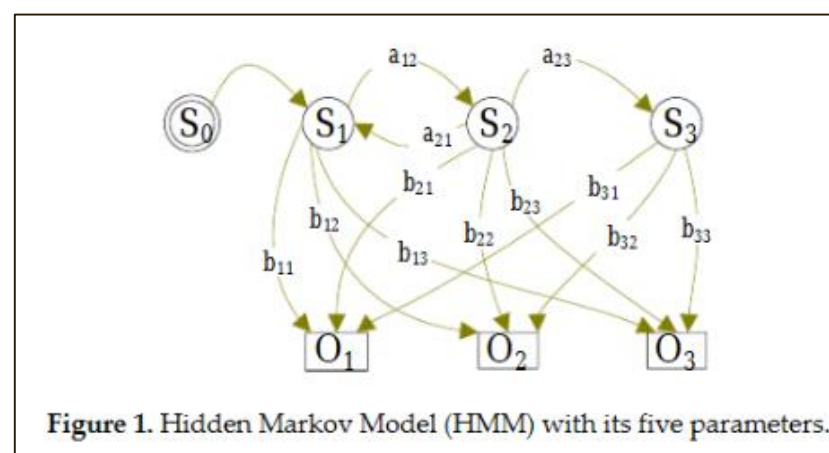
• Transition Probability

- From road to another Road

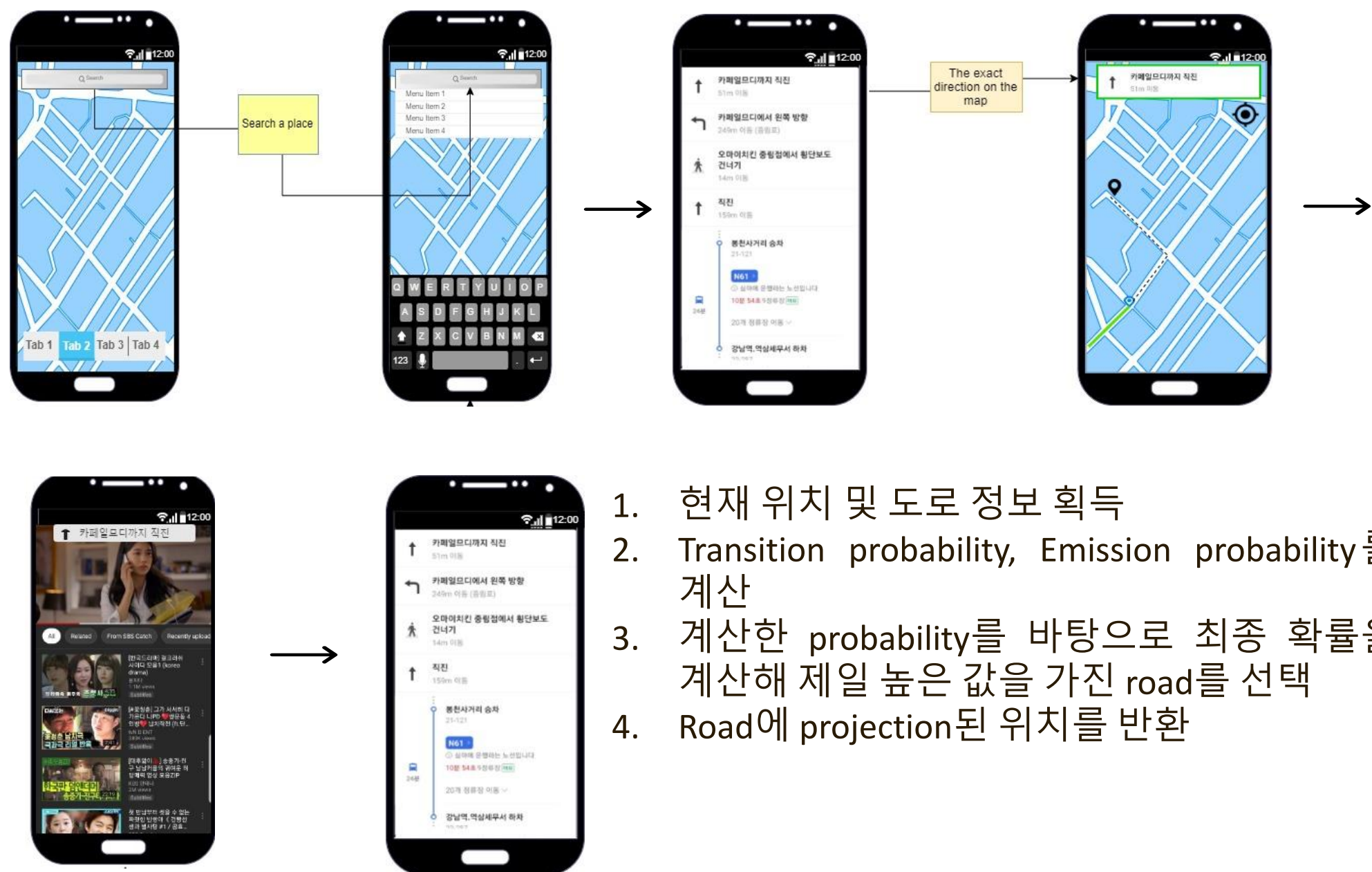
• Emission Probability

- 특정 road에서 location이 나타날 확률

• But, How to know **probability model**??



Project Architecture



- 현재 위치 및 도로 정보 획득
- Transition probability, Emission probability를 계산
- 계산한 probability를 바탕으로 최종 확률을 계산해 제일 높은 값을 가진 road를 선택
- Road에 projection된 위치를 반환

Schedule

Date	Expected	Details
0921~0927	주제 선정	
0928~1004	사전 조사	기획문서발표
1005~1011	기본적인 Application UI 개발	
1012~1018		
1019~1025	Map matching 알고리즘 개발	
1026~1101		30% 중간발표
1102~1108	알고리즘 제출 및 피드백	
1109~1115	알고리즘 수정	
1116~1122	알고리즘 최종 수정	
1123~1129	Application UI 개발	
1130~1206	Application 최종 개발 및 수정	20%
1207~1213	최종 수정 및 제출	최종발표

- Application Fundamentals(Activity, Services, ...), Design Pattern(Observer, Factory, ...), new language(Kotlin)
- Algorithm 30% : Preprocessing, factor optimization, compare accuracy
- Application 20% : background notification, search bar

Application

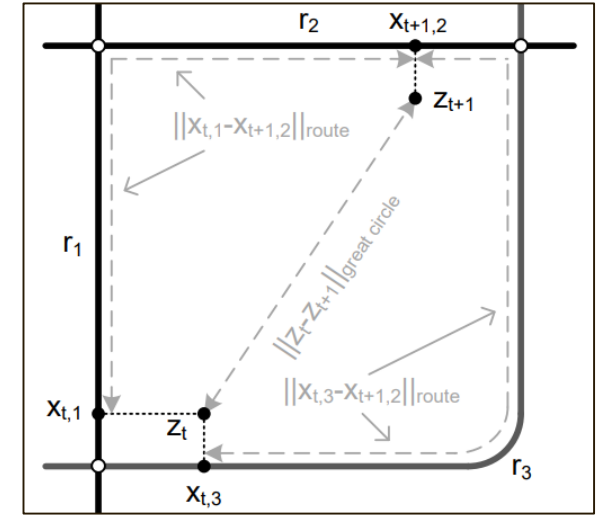
• Map Matching

- Transition probability

$$p(d_t) = \frac{1}{\beta} e^{-d_t/\beta}$$

Here

$$d_t = \left| \|z_t - z_{t+1}\|_{great\ circle} - \|x_{t,i} - x_{t+1,j}\|_{route} \right|$$



- Emission Probability

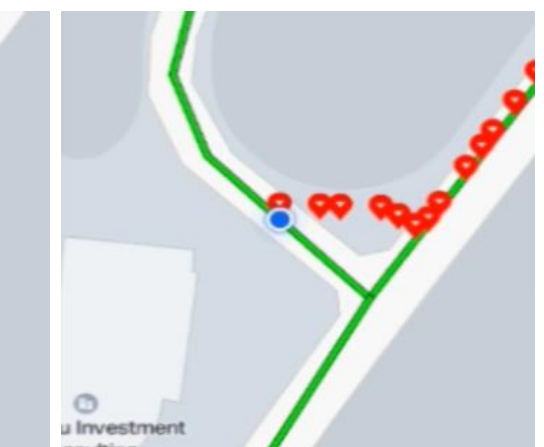
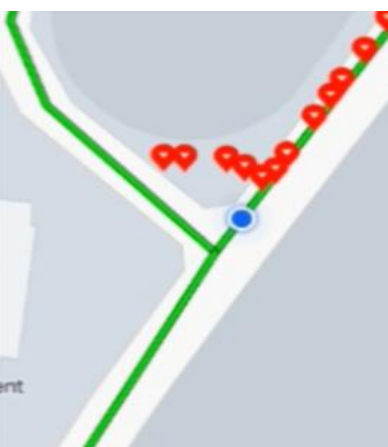
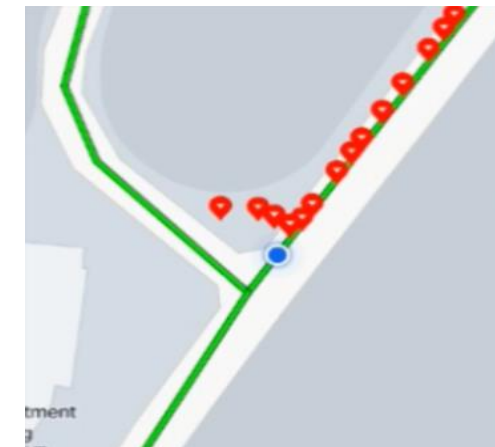
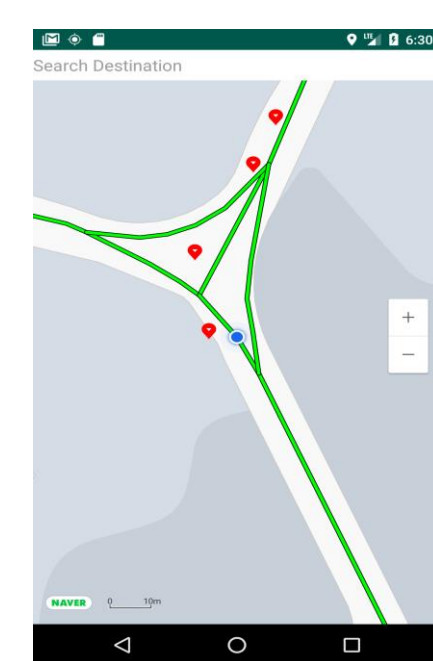
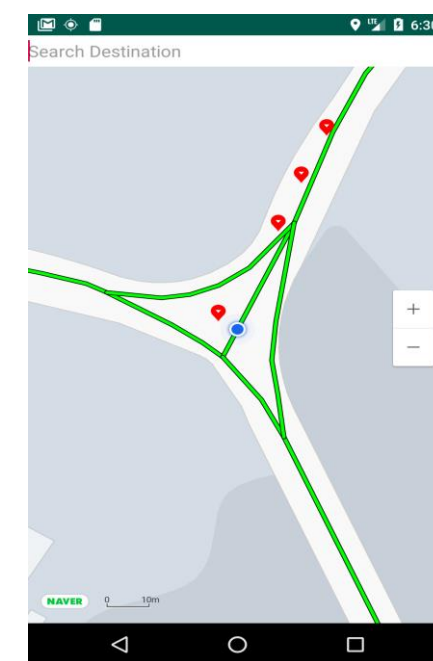
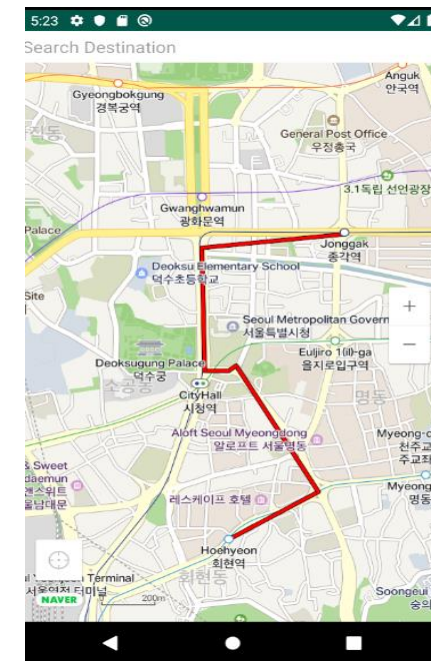
$$p(z_t|r_i) = \frac{1}{\sqrt{2\pi}\sigma_z} e^{-0.5\left(\frac{\|z_t - x_{t,i}\|_{great\ circle}}{\sigma_z}\right)^2}$$

- Preprocessing

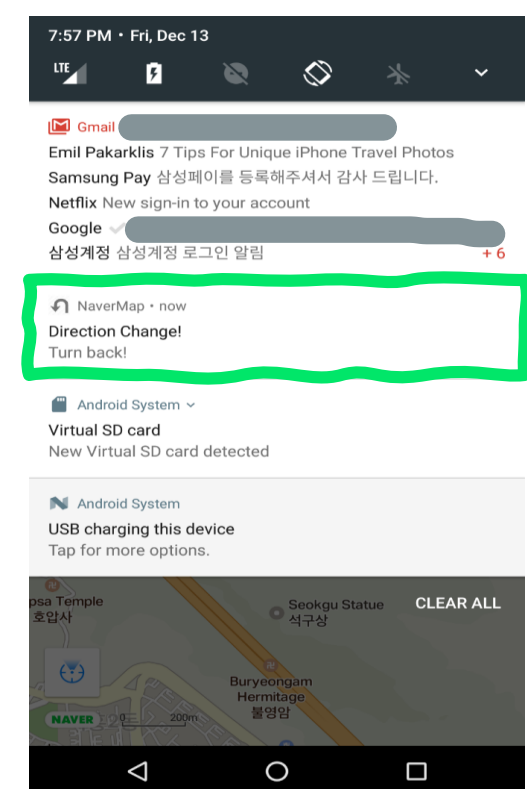
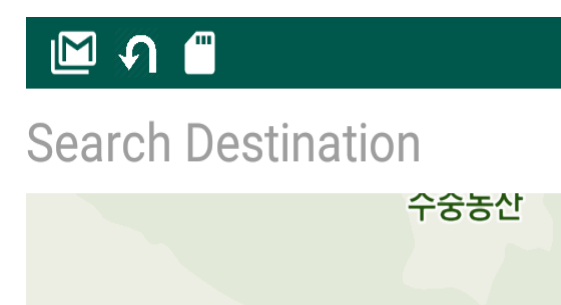
$$\Delta x + accuracy + C$$
$$\Delta x = v_0 t + \frac{1}{2} a t^2$$

- Calculation cost optimization

- Route localization(200m 이내의 road만 계산)
- Delete low probability road(< 2.0%)



• Notification



Future Work

- Calculate transition probability, emission probability with machine learning
- More accurate, efficient preprocessing
- Background notification
- Search destination by name(not latitude, longitude)

Reference

- Xi, Lianxia & Liu, Quan & Li, Minghua & Liu, Zhong. (2007). Map Matching Algorithm and Its Application. 10.2991/iske.2007.127.
- Jagadeesh, G., Srikanthan, T., & Zhang, X. (2004). A Map Matching Method for GPS Based Real-Time Vehicle Location. Journal of Navigation, 57(3), 429-440. doi:10.1017/S0373463304002905
- Luo, An & Chen, Shenghua & Xu, Bin. (2017). Enhanced Map-Matching Algorithm with a Hidden Markov Model for Mobile Phone Positioning. ISPRS International Journal of Geo-Information. 6. 327. 10.3390/ijgi6110327.
- Paul Newson and John Krumm. 2009. Hidden Markov map matching through noise and sparseness. In Proceedings of the 17th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (GIS '09). ACM, New York, NY, USA, 336-343. DOI: <https://doi.org/10.1145/1653771.1653818>