Use of Big Data to Quantify Walkability in Binghamton Metropolitan Area, NY

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Introduction

Walking is the most common form of physical activity. However, according to the nationwide personal transportation survey, walking rates in the United States has been dropping steadily in the past twenty years.

Walkability can be defined as how conducive the neighborhood environment is for lifestyle physical activity. It is an important topic in sustainable urban design.

Purpose

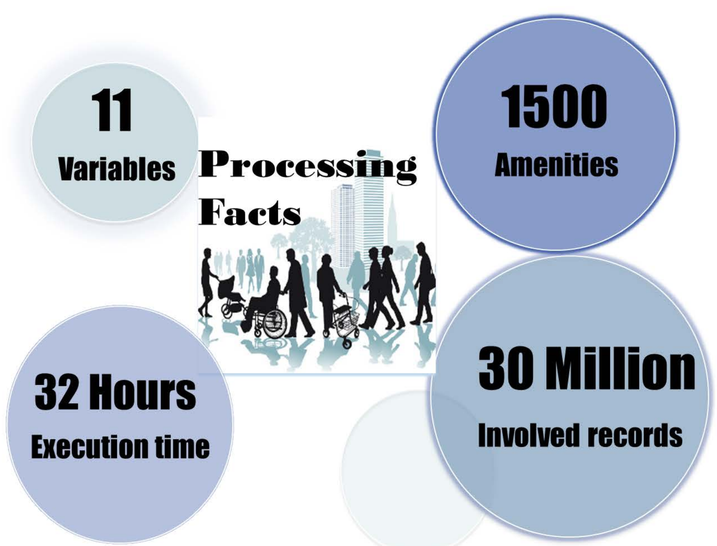
- The main objective of this study is (1) to develop a Walkability Index by improving existing walkability studies and (2) to estimate the walkability status in Binghamton Metropolitan Area, NY.

Literature Review

- Study shows that specific built environment factors are related to walkability, such as street connectivity, land use mix and residential density (Frank et al., 2005).
- Walk Score™ has been proved as a valid and reliable walkability indicator for estimating access to objectively measured walkable facilities (Carr et al., 2010). This indicator, however, is only available for online inquiry. Also, its principle is not revealed, and therefore, how it is created is still unknown to the public.

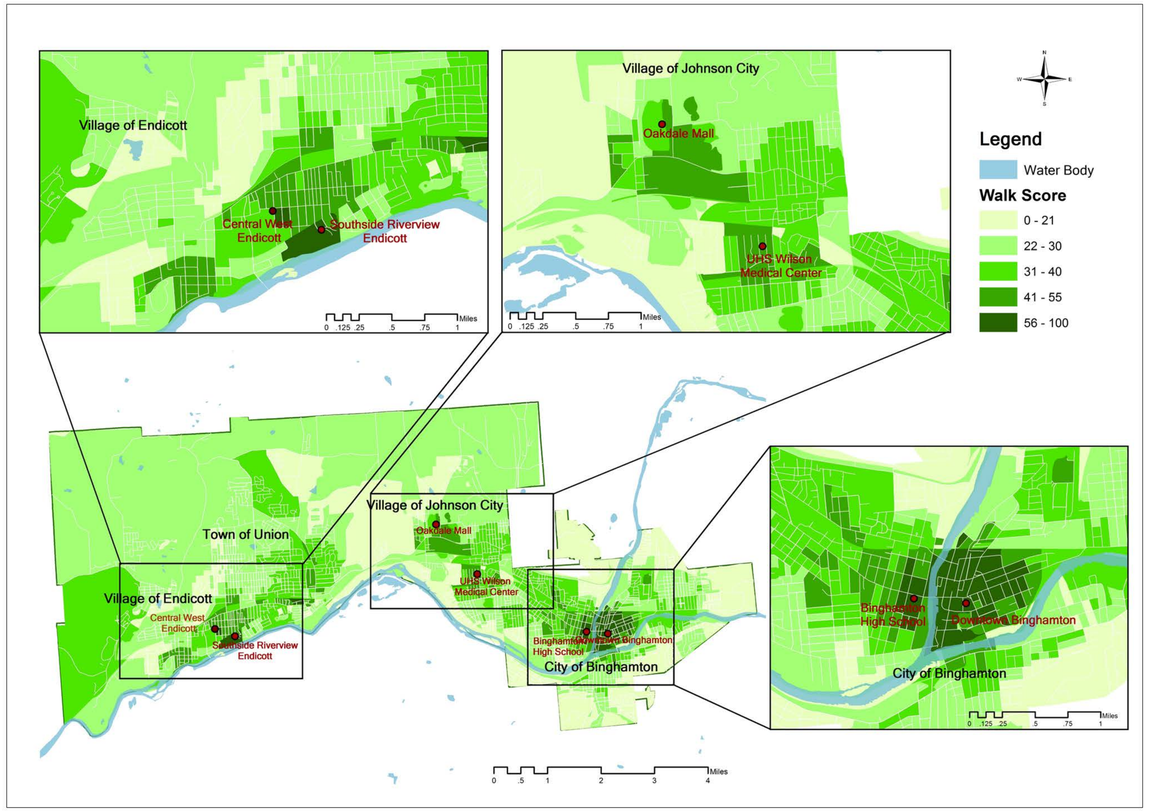
Null Hypotheses

- H_{01} There is no relationship between walkability and the access to near amenities.
- H_{02} There is no relationship between walkability and street networks.
- H_{03} There is no relationship between walkability and population density.
- H_{04} There is no relationship between walkability index and Walk Score™.



Results

Map result：

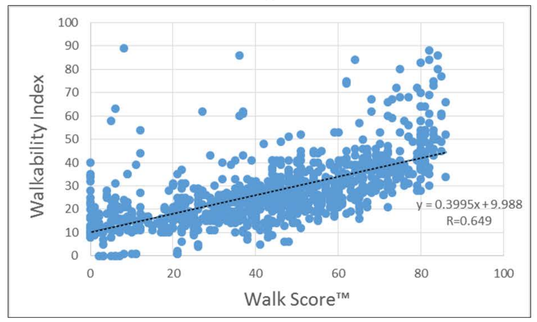


PCA result:

Component Matrix[a]

	Component			
	1	2	3	4
Dining service	.904	.086	.262	.037
Grocery	.811	.028	.359	-.008
Shopping store	.842	-.015	-.015	-.002
Daily service	.879	.038	.134	.069
Street intersection	.196	.070	.901	.153
Bus stop	.293	.115	.880	.069
Land use types	.027	.300	.273	.686
Street density	.076	.291	.302	.753
Housing density	.037	.967	.084	.105
Population density	.041	.966	.081	.097
Residential area	-.010	-.173	-.168	.807

Scatter Plot of Walkability Index and Walk Score™



Data & Method

Data source:

- Walk Score™ website
- Broome county parcel data
- American Community Survey 5-year estimates (US Census Bureau)

Variables of study:

- Dining service density
- Grocery density
- Shopping store density
- Daily service density
- Street intersection
- Proportion of residential area
- Bus stop density
- Number of land use types
- Street density
- Population density
- Household density

Method for Walkability Index:

- To generate service areas and buffers of 1km around central point of each parcel and relevant variables.
- PCA was used to reduce the data dimensions and to generate walkability index.

Comparison of walkability index and Walk Score ™ :

- Walk Score™ records were derived online based on the geocoding addresses. Correlation analysis and a scatter plot were used to examine the relationship between the developed walkability index and Walk Score™ in Binghamton metropolitan area.

Discussion and Conclusions

- The scatter plot and the high correlation coefficient of 0.649 demonstrate that there is a significant positive relationship between walkability index and Walk Score™, which supports the walkability index created in this study as a reliable and valid tool for estimating walkability in Binghamton metropolitan area.
- There are four major factors that extracted from eleven original variables: the access to amenities (principal component 1), crowdedness (principal component 2), transportation system (principal component 3), and urban design (principal component 4).
- The walkability index map demonstrates that the Central West Endicott, Southside Riverview Endicott and downtown Binghamton are highly walkable. In Johnson City, the walkability index shows high around the Oakdale Mall and UHS Medical Center areas. The walkability index score drops substantially as the distance to the three centers increases.

Reference

- Carr LJ, Dunsiger SI, Marcus BH. Validation of walk score for estimating access to walkable amenities. *Br J Sports Med* 2011 Nov;45(14):1144-8.
- Frank LD, Schmid TL, Sallis JF, Chapman J, Saelens BE. Linking objectively measured physical activity with objective measured urban form. *American Journal of Preventive Medicine* 2005 28(2S2):117–125.

Acknowledgment

- I am greatly thankful to my advisor, Prof. Chengbin Deng, for his patient guidance and support during the completion of this study.