

# URBAN CHANGES OF DETROIT

Advance Spatial Analysis  
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## 2009 TO 2018: Is Detroit growing or shrinking? Where does the changes happen? What are the driving factors?

While some US cities are experiencing expansion, the rust belt cities, old industrial cities such as Detroit and Cleveland, are being told to undergo a decline in population, economy, and size. Plenty of studies have addressed urban growth; yet, the urban shrinkage in many metropolitan areas in the US is also worth studying. Urban shrinkage is a complex process, and even scholars could not come to a consensus definition. Besides, the main causes of urban shrinkage in the US also need to be determined based on the local context. While industrial shift from manufacturing to service accounts for a greater part of the cause, other factors such as agglomeration economies or uneven regional development could also cause urban shrinkage (Ribant, 2018).

Based on the definition of (Ubareviciene et al, 2016) in which urban shrinkage is "territories experiencing population decrease, due to various reasons, and that may or maynot have started to spatially shrink", this study further defines urban shrinkage as a process of by which the total population is decreasing and the residential vacancy rate in an urban area is increasing. The study area is the city of Detroit, which is a well-known case for being labeled as a shrinking city. Thus, this study explores the spatial pattern of urban shrinkage of the City of Detroit from 2009 to 2018, a turmoil period of urban changes in Detroit.



### Spatial Regression

OLS Model Result Table

Variable	Coefficient	Standard Error	t-Statistic	Probability
Change in Residential housing value	0.002	0.026	0.084	0.933
% Change in African American population	-0.225	0.075	-3.011	0.003
% Change in unemployment	0.042	0.056	0.757	0.450
% Change in household income	0.108	.060	1.794	0.074
% Change in population density	-0.764	0.080	-9.543	0.000

### Spatial Pattern Comparison

#### Method 1

Landset Remote Sensing

#### Method 2

Changes in normalized DSM/VIIRS Nighttime Light

### Spatial Autocorrelation Comparison

(Global Moran's I vs. Getis-Ord Gi)

#### Method 3

ACS Total Population

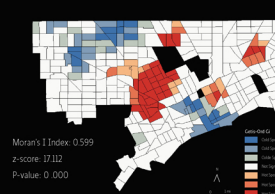
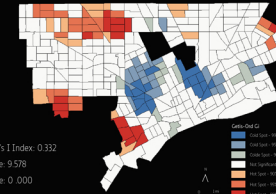
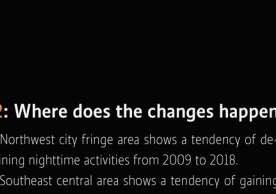
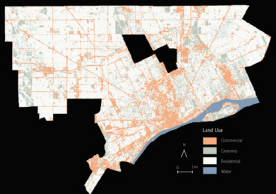
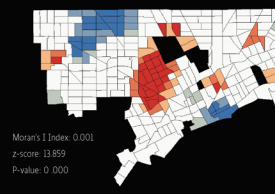
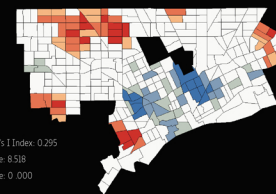
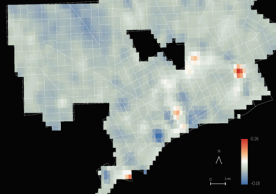
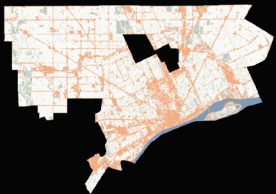
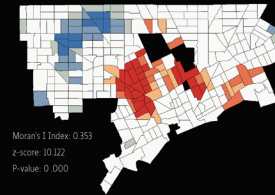
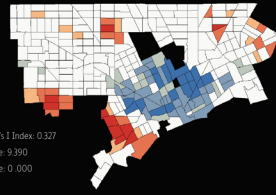
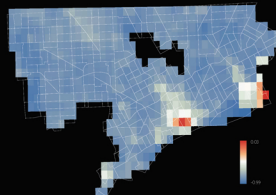
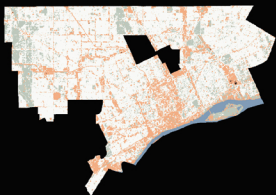
#### Method 4

ACS Owner-occupied Housing Vacancy

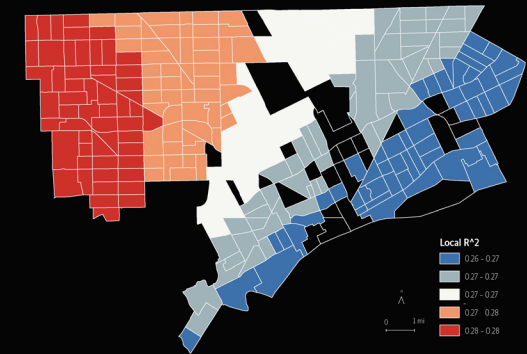
2009

2013

2018



### GWR Model Result



### Q1: Is Detroit growing or shrinking?

- Area of greenery shrank from 2009 to 2013, while bounced back from 2013 to 2018.
- Area of commercial use sprawls from 2009 to 2013, and keep steady from 2013 to 2018.
- Supervised learning has been conducted by reference to historic image and building footprint map, where the model is sampled and trained by our self.
- The accuracy and veracity of the result can not be guaranteed due to the subjectivity in the process of supervised learning process.

### Q2: Where does the changes happen?

- Northwest city fringe area shows a tendency of declining nighttime activities from 2009 to 2018.
- Southeast central area shows a tendency of gaining nighttime activities from 2009 to 2018, as well as the Conner Creek area.
- Nighttime data underwent a major update in 2012, which makes difficult and pointless to compare years after 2012 with years before.

### Population or Vacancy?

Global Moran I provides an estimates of the cluterness of population and housing vacancy of the city as a whole, however, it lacks the local condition. According to both Global Moran I and Cetus-Ord Gi's results of population and vacancy, this study determined that vacancy may be a better indicator for reflecting urban changes in Detroit.

### Q3: What are the potential driving factors?

The ordinary least squares (OLS) regression model result shows a multiple R-squared of 0.268, which indicates a low model fit. But it could still provide insights of the spatial relationship between the change of vacancy rate and various socio-economic factors from 2013 to 2018. It is shown that the percent change of African American population and population density for each census tract both have negative significant influences over the change of vacancy rates. Based on the result, we could conclude that when the census tract has an increasing trend of vacancy rate, it is always accompanied with a decrease of African American population and population density. However, it's hard for conclude that changes of housing value, employment rate and median housing income have a strong influence on vacancy rates.

From the GWR model result, it's clear from the low R<sup>2</sup> that the local model is not performing well. The best prediction is in the west portion of the city. This could imply that besides the five demographic indicators considered in this study, there are also other factors that influencing urban changes in Detroit.

In general, the comparisons conducted in this study shows that global measurements, such as Global Moran's I and OLS regression model allows for dispersion measurement at a large scale of a landscape. In contrast, local measurements, such as Hotspot Analysis and GWR regression model, help to identify the relationship of different variables in a finer scale. Thus, using a mixed method will allow us to see more insights of the spatial patterns both in smaller and larger scales, providing better understanding on complex urban problems. However, sometimes it might also cause erroneous assumptions and results due to differences in boundaries.