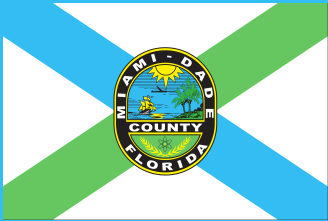


# An Emerging Hot Spot Analysis study on the property sales of subdivisions in Miami-Dade County

Nicolas Alberto Tobon | University of Florida | GIS 3043



The median listing home price in Miami, Florida was \$590,000, signifying a 28.3% increase in prices year-over-year for properties in Miami. In 2021, Miami’s property market achieved 39,394 total homes sales signifying a new record of total home sales in the market’s history. In an effort to promote the accessibility of public records, the government of Miami-Dade developed the Miami-Dade Open Data Hub in collaboration with ArcGIS to view, access, and source domain-prevalent data such as property sales, noise level measurements, to nuclear powerplant boundaries, and demographic distributions. The study conducts an Emerging Hot Spot Analysis using geospatial data sourced from the city of Miami to identify new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating, and historical hot/cold spots county subdivisions.

## Introduction

The city of Miami has achieved significant overall growth in the past several years, achieving record numbers in several facets such as population growth, total home sales, and other economic metrics. The growth of urban development due to these underlying factors, is represented by the notable activity occurring in the Miami-Dade real estate market. The study seeks to understand the urban development and market activity of properties in relevant neighborhoods such as El Portal, Doral, and Miami Shores

## Data

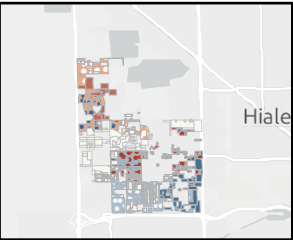
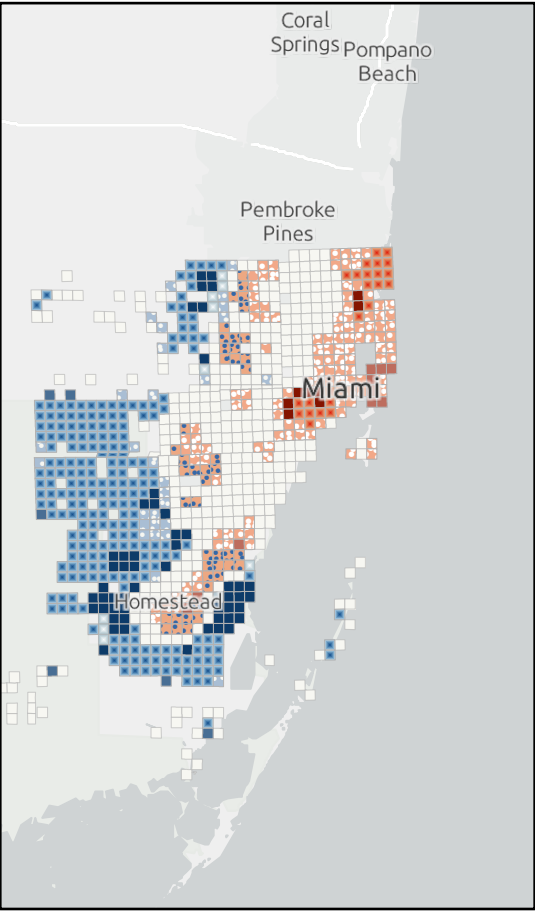
The dataset used for the study is the Property Point View (PPV), Subdivision Boundary (SB) and the Public Sales Extract (PSE) provided by the Miami-Dade Open Data Hub and the Miami-Dade Property Appraiser, respectively. The datasets were ingested as CSV’s and pre-processed to data-tables using the Pandas package in Python. The data engineering operations ensured that the PSV was joined with adjacent sales data from PSE and necessary data validation practices were taken (null records, selecting unique identifiers, field engineering). The dataset’s FOLIO number was declared to be the unique property identifier, as the FOLIO encodes the municipality, township, range, section, subdivision, and parcel identifier. Along with that, a group by operation was done on a monthly frequency and aggregate fields were calculated (FOLIO: count, price: mean, price\_per\_building\_actual\_area: mean). The dataset was then merged to geospatial boundaries using a merge operation in pandas. The pandas dataframe was transformed to a geopandas geodataframe, and the geodataframe was written to a shapefile.

## Metrics

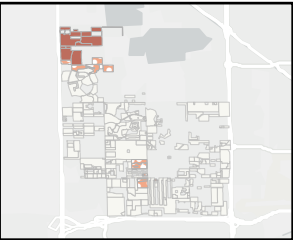
The Space-Time Cube requires a numeric metric of aggregation to model the relationships in the EHSA. The metric used to model the relationship is the number of sales. Every EHSA was modeled with a Space-Time Cube pre-defined over the determined area.

## Methods

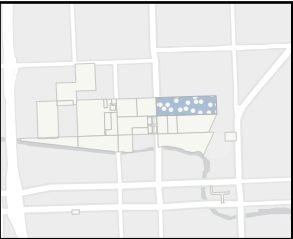
The Emerging Hot Spot Analysis (EHSA) can detect eight specific hot or cold spot trends: new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating, and historical. The EHSA takes as input a Space Time Cube, which was created using the defined boundary locations. The EHSA uses a space-time implementation of the Getis-Ord Gi\* statistic, which considers the value for each bin within the context of the values for neighboring bins. The EHSA uses a conceptualization of spatial relationships and neighboring time periods, which we modeled with K Nearest Neighbors (8 neighbors) and Fixed Distance (3 kilometers) to determine neighboring bins that will be used in each analysis neighborhood. The EHSA also uses a time-step, which we modeled using an interval of 3 years (time step of 2), that determines the aggregation of time in the analysis.



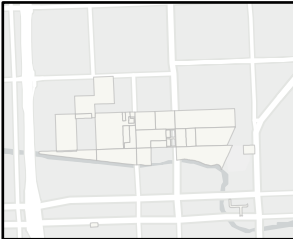
Fixed Distance | 3km  
Neighborhood Time Step | 2



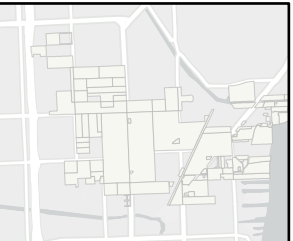
K Nearest Neighbors | 8  
Neighborhood Time Step | 2



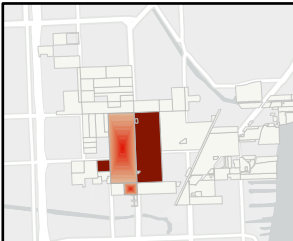
Fixed Distance | 3km  
Neighborhood Time Step | 2



K Nearest Neighbors | 8  
Neighborhood Time Step | 2



Fixed Distance | 3km  
Neighborhood Time Step | 2



K Nearest Neighbors | 8  
Neighborhood Time Step | 2

- |                      |                       |                      |                        |                       |                       |
|----------------------|-----------------------|----------------------|------------------------|-----------------------|-----------------------|
| <b>PATTERN</b>       | Intensifying Hot Spot | Sporadic Hot Spot    | New Cold Spot          | Persistent Cold Spot  | Oscillating Cold Spot |
| New Hot Spot         | Persistent Hot Spot   | Oscillating Hot Spot | Consecutive Cold Spot  | Diminishing Cold Spot | Historical Cold Spot  |
| Consecutive Hot Spot | Diminishing Hot Spot  | Historical Hot Spot  | Intensifying Cold Spot | Sporadic Cold Spot    | No Pattern Detected   |

References: Miami-Dade County, FDEP, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

## Results

The Emerging Hot Spot Analysis was computed to understand the spatial relationships between sections in Miami-Dade County, and spatial relationships within municipality zones of El Portal, Doral, and Miami Shores using subdivisions.

## Miami Section

The section-based EHSA produced a wide array of zones which are characterized by the presence of neighboring hot/cold spots. The cold zones seem particularly prevalent near the South and West region of Miami, which is particularly expected. The South and West regions of Miami border the Everglades, and are composed of regions such as Homestead, composed primarily of faming plots of land. The most prominent red zones occur closest in geographical proximity to US-1 --a national highway that runs diagonal through Miami--, which includes zones such as Kendall, Pinecrest, and Coral Gables. Along with that, several zones nearby Downtown, including Miami Beach can also be characterized as hot zones.

## Miami Municipalities

The subdivision-based EHSA on municipalities produced generally non-significant results. The EHSA displayed results in Doral under the parameters of fixed distance and neighborhood time step. The Doral municipality seems to have a high activity of property sales in the northern region, and conversely low activity in the southern region. In the municipality of Miami Shores, a collection of subdivisions were particularly hot while the rest yielded no patterns. In the region of El Portal, no patterns were detected.

## Discussion

The Emerging Hot Spot Analysis was computed to understand the property sale activity in Miami-Dade County, and analyze the geographical significance of spatial relationships for property sale activity.

In conclusion, the EHSA should be further developed to understand the effect of the spatial relationships on price and development. The parameterization included in the EHSA, produced key insights into the conceptualization of spatial relationships and can be altered to model a variety of polygon arrangements and zone interactions. Additionally, price metrics such as price per square foot can be collected, and property types can be segmented to thoroughly understand the effects of land use on economic development in urban zones.