Defining Informal Settlements: Cairo, Egypt as a Case Study

DSI Chicago, February 2020

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Problem Statement

Satellite imagery is commonly used to identify Informal Settlement locations; however, we were tasked to determine the feasibility of using real estate data and population densities to attempt to locate Informal Settlements.

Hypothesis

- Use Web-scraped real estate data to identify informal settlements by mapping high versus low price points.
- Using gridded population estimates (from Facebook), create a ratio of real estate adverts to population density.
- Test this ratio as an input to machine learning models for mapping informal settlements.

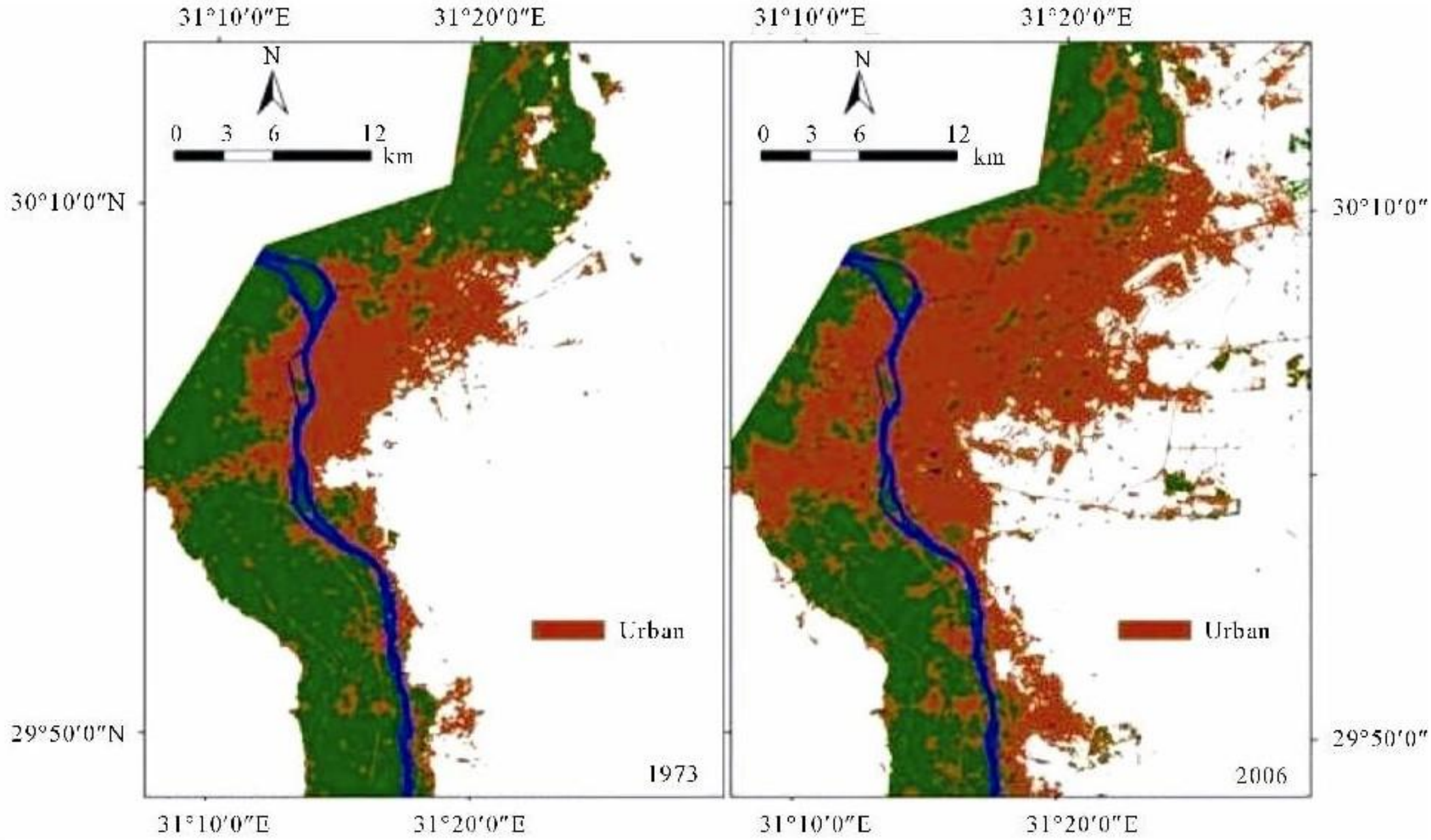


Figure 3. The land cover maps of Cairo in 1973 and 2003.

Defining “Informal Settlement”

- No legal claim to their land/homes
- Not compliant with codes/regulations
- Lack of services and infrastructure

National

City

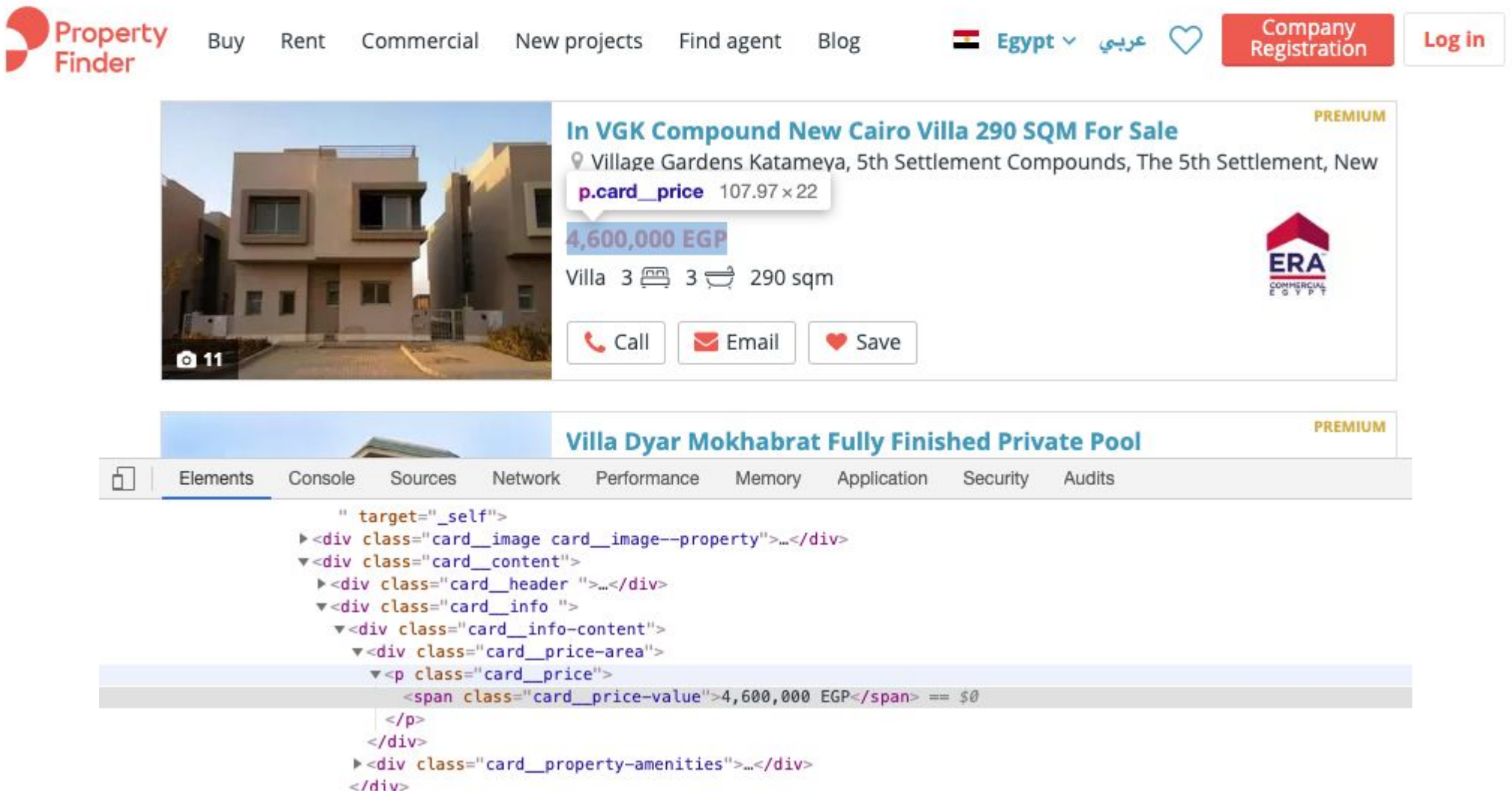
Neighborhood

Informal Settlement

MORPHOLOGY OF SLUMS – FROM SPACE

Features	Slums	Planned areas
Size	• Small building sizes	• Generally larger building sizes
Density	• High densities (roof coverage) • Lack of public (green) spaces	• Low – moderate density areas • Provision of public (green spaces)
Pattern	• Organic layout structure	• Regular layout pattern
Site Characteristics	• Hazardous locations • Access to livelihood opportunities • Etc…	• Formal development with services and infrastructure provision

Real Estate Data: Collection Process



Difficulties Gathering Data

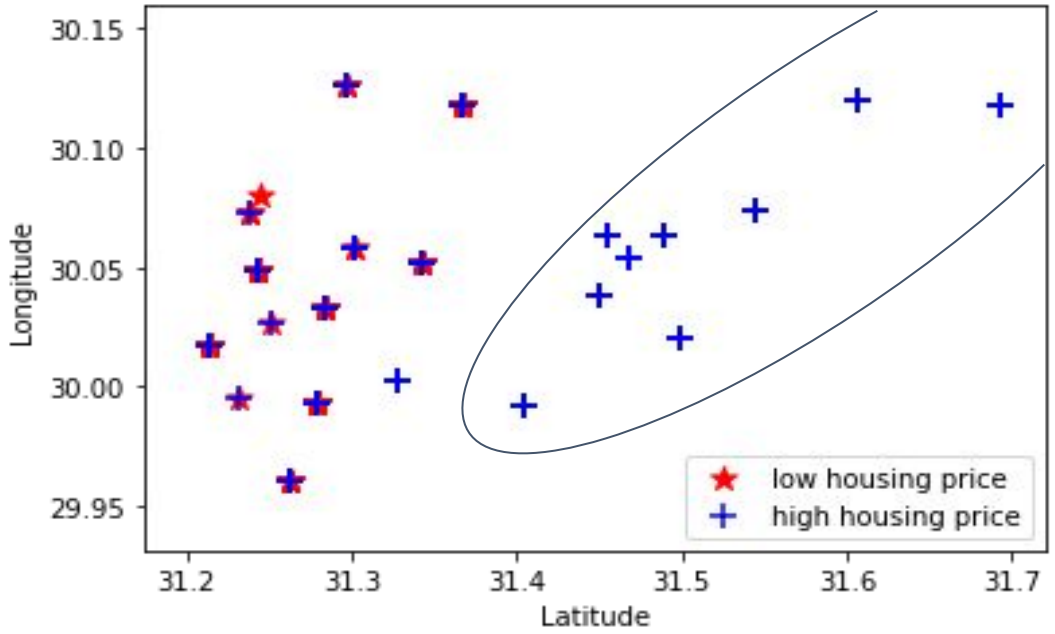
Difficulties Gathering Data

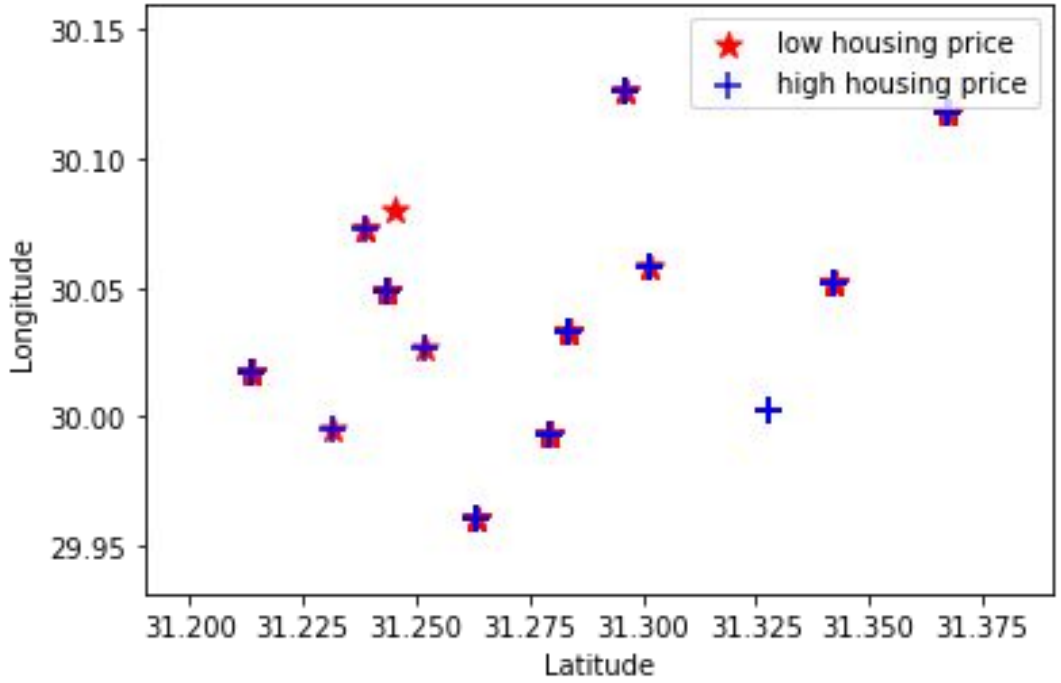
- Missing Data
  - Paywalls for past data
  - Email local realtors - non-responsive

- Web scraping
  - Time Consuming
  - Wrote function to automate the pulling of real estate data

- Finding Latitude and Longitude
  - “Address” data wasn’t as accurate as it could be
  - Geocoder was fed inaccurate locations so data points got lumped together
  - Even more time consuming because now it's working for each row of data and the pause has to be even longer.

Location	Square Meter	base_price	city	country	page	price_usd	property_type	sub_div	lat	lon
Hyde Park, 5th Settlement Compounds, The 5th S...	236	2250000	Cairo	Egypt	buy	143038.779402	Apartment	New Cairo City	30.063579	31.447190

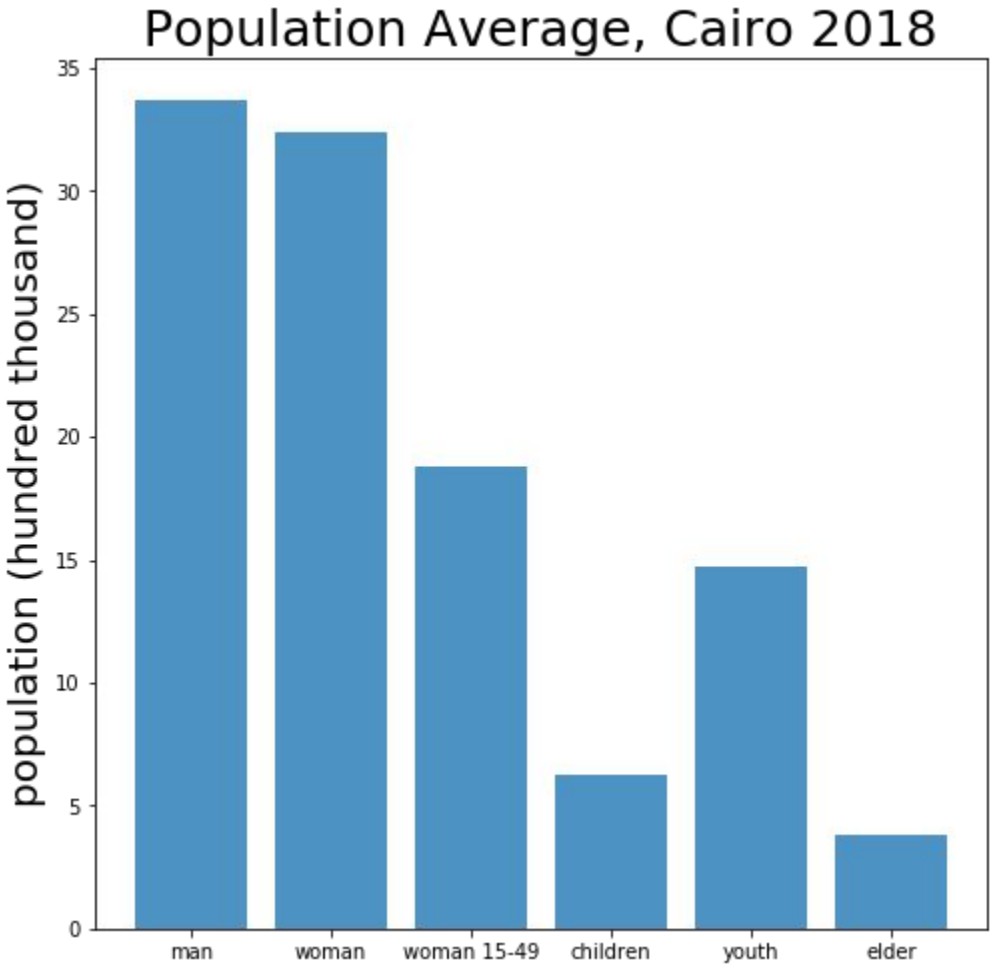




Real Estate Price Mapping

- Low housing price is within the 25th percentile
- Severe overlapping is observed
- ~ 3,300 data points were removed to concentrate on the city of Cairo

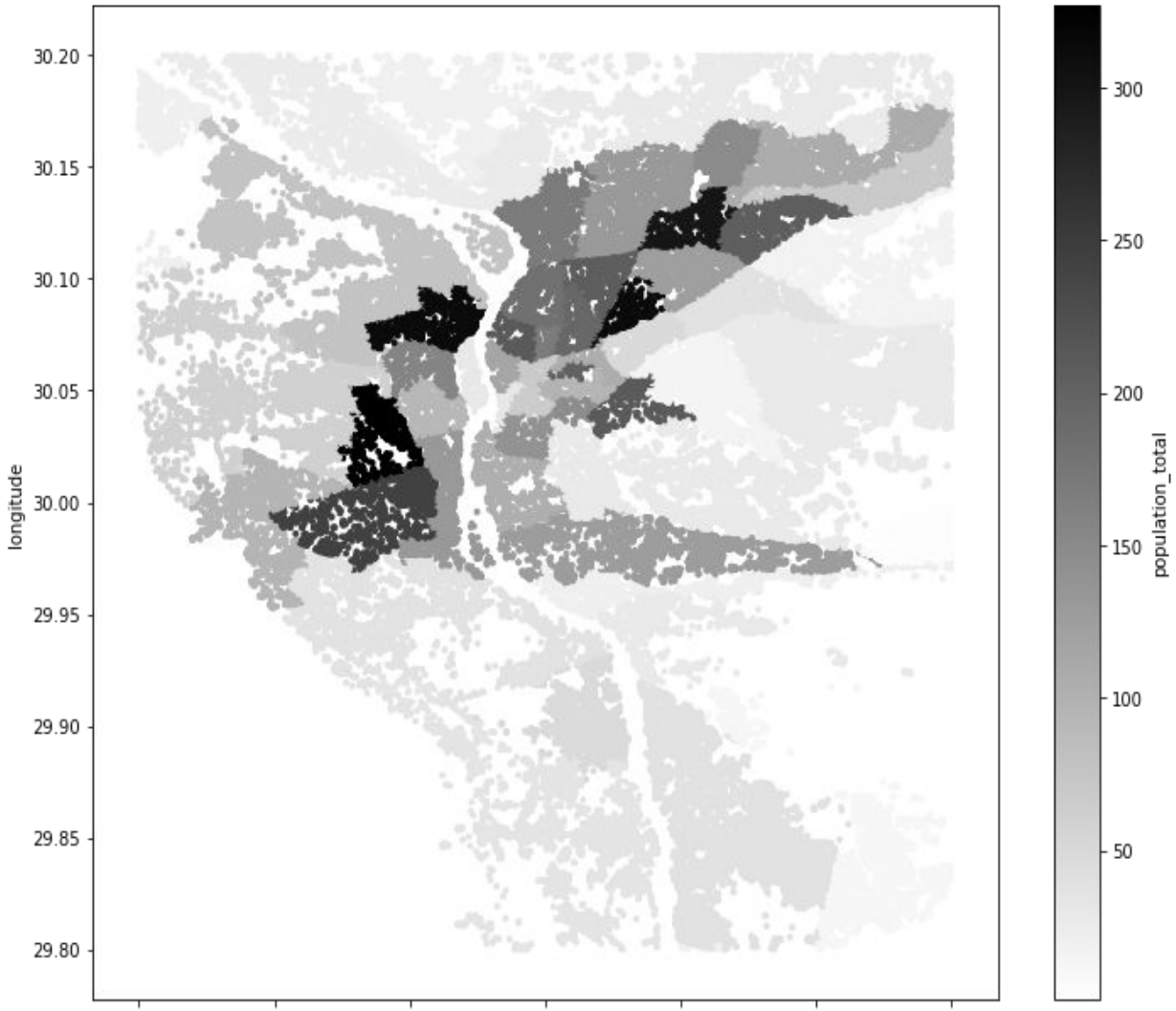
Population Demographics of Facebook Users



- Gender ratio is relatively well balanced
- About 2/3 of the women's population are within age 15 to 49
- There are more children (under 5) and youth (15 -24) than elders (above 60)

(data source: facebook data for good)

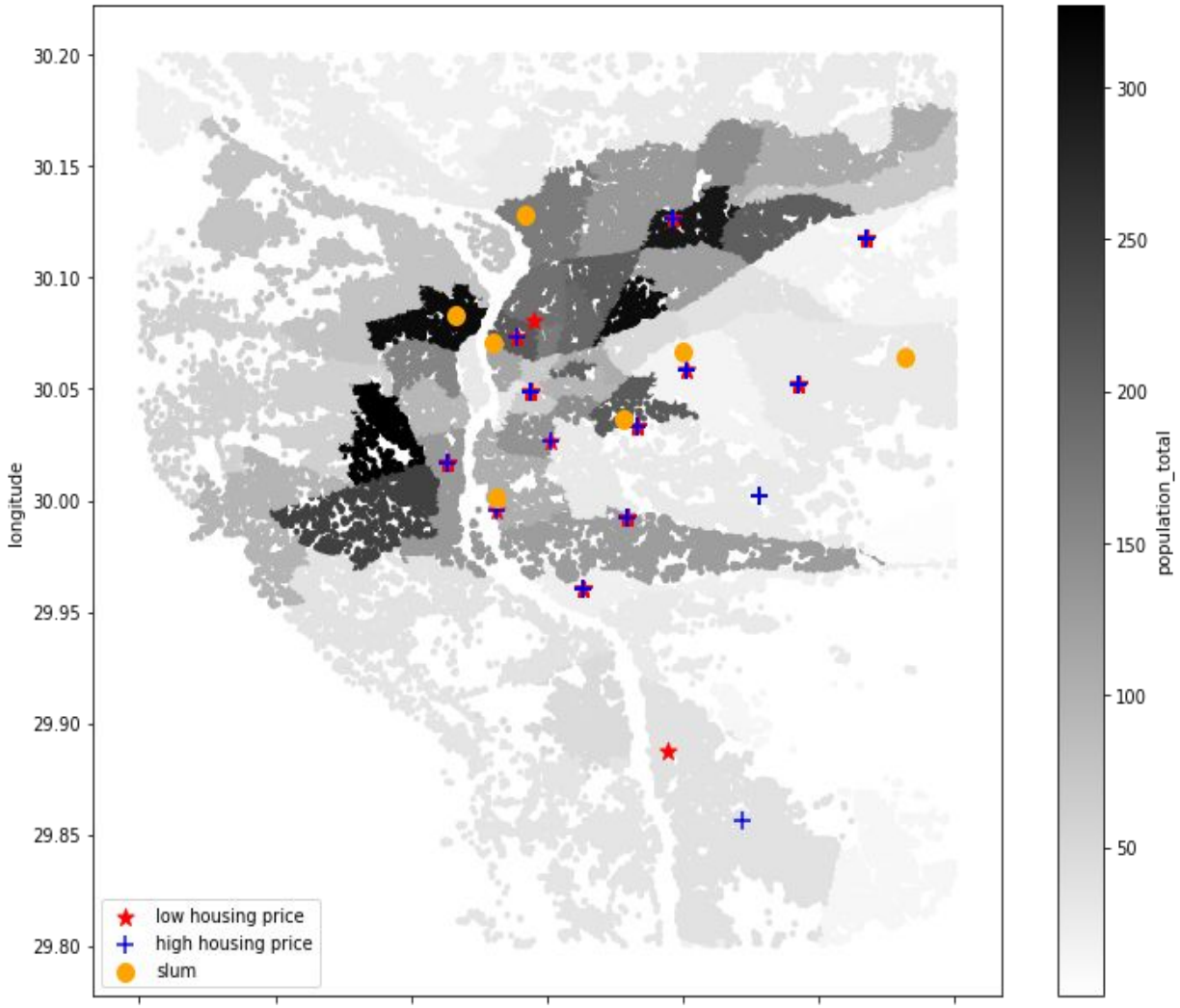
Facebook User Density Mapping



- Area with darker color shows higher population density
- Population is more concentrated in center area close to the river
- Graphs of separate population demographic shows similar traits

(data source: [facebook data for good](#))

Combined Real Estate & Population

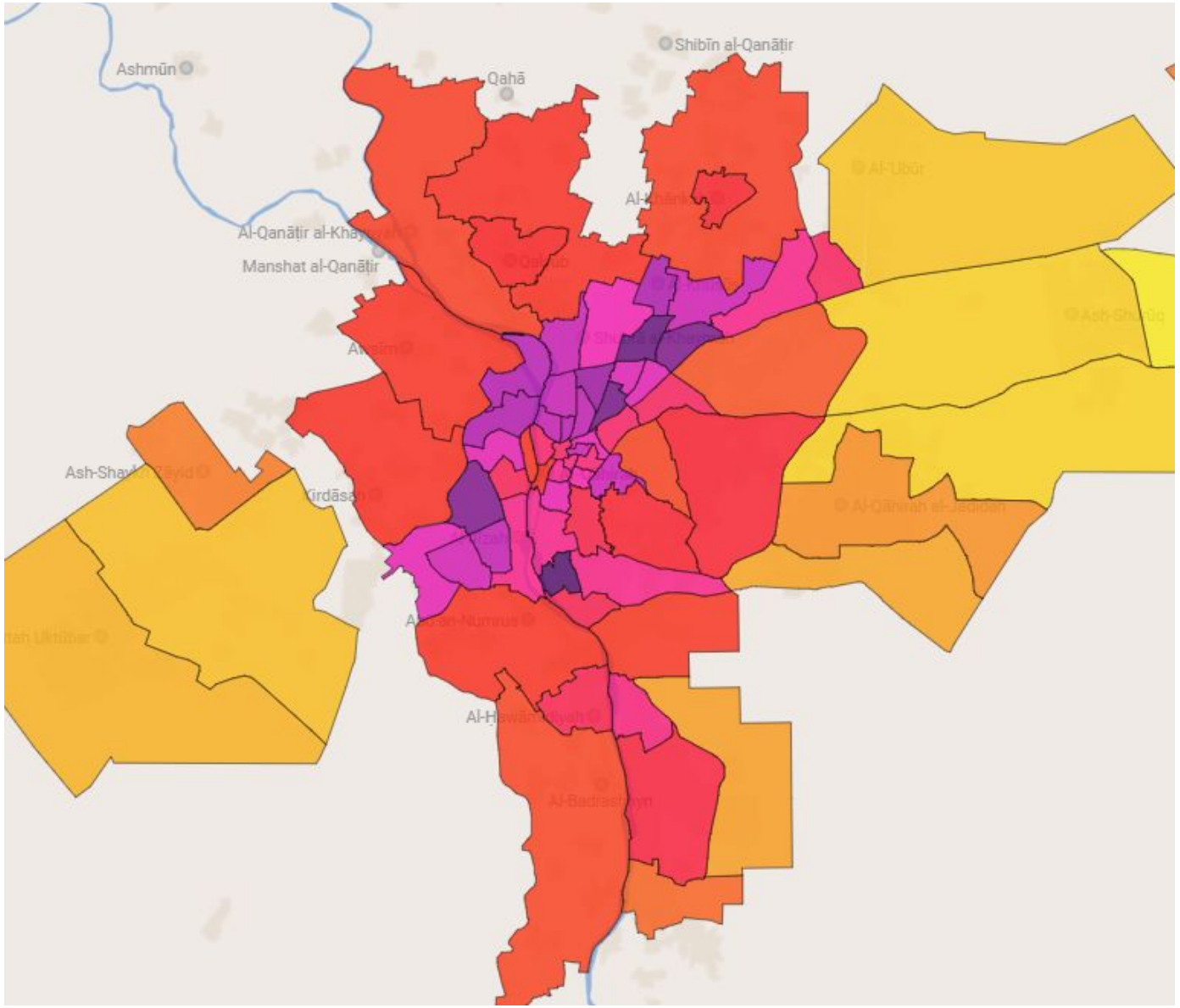


- Housing coordinates overlap in some center areas
- Housing prices don't seem to correlate with population density
- Slum areas do not correlate with population density

(data source: [facebook data for good](#))

Districts & Density of Cairo

- 65 Districts found (varying sources have different counts)
- Scraped density for each district to build ratio
- Pulled multiple names to attempt to match up to housing data



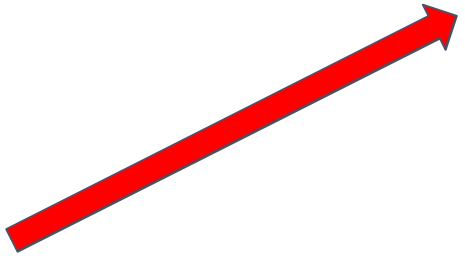
Source: *City Population*

Known Slums of Egypt

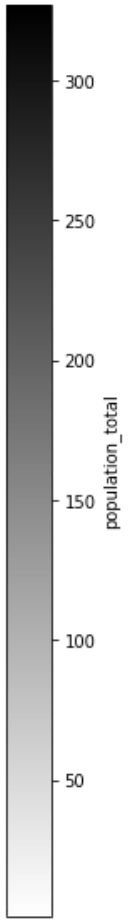
- Manshiyet Nasr
- Nasr City
- Imbaba
- Ezbet Khayrallah
- Ramlet Boulak
- Ezbet Abu Qarn
- Ezbet El Haggana
- Shubra Al Kheima

Density Issues & Data Issues

Population Density	Advertisment Count	District	Ratio
895.49	3139	New Cairo	3.505343
11928.47	647	Hay El Maadi	0.05424
5588.98	196	Zamalek	0.035069
8081.54	101	Mokattam	0.012498
7727.07	**63**	**Nasr City**	**0.008153**
3527.28	62	El Nozha	0.017577
514.47	11	Shorouk City	0.021381
5767.72	9	Garden City	0.00156
14753.15	8	New Heliopolis	0.000542
10980.07	2	El Khalifa	0.000182
16013.22	1	Bulaq Abo El Ela	0.000062
55996.46	1	Hay Shobra	0.000018
5235.77	1	Hay Torah	0.000191



Known Slums	Density
Manshiyet Nasr	47301.45
Nasr City	**7727.07**
Imbaba	59380.56
Ezbet Khayrallah	NaN
Ramlet Boulak	NaN
Ezbet Abu Qarn	NaN
Ezbet El Haggana	NaN
Shubra Al Kheima	NaN



Conclusion

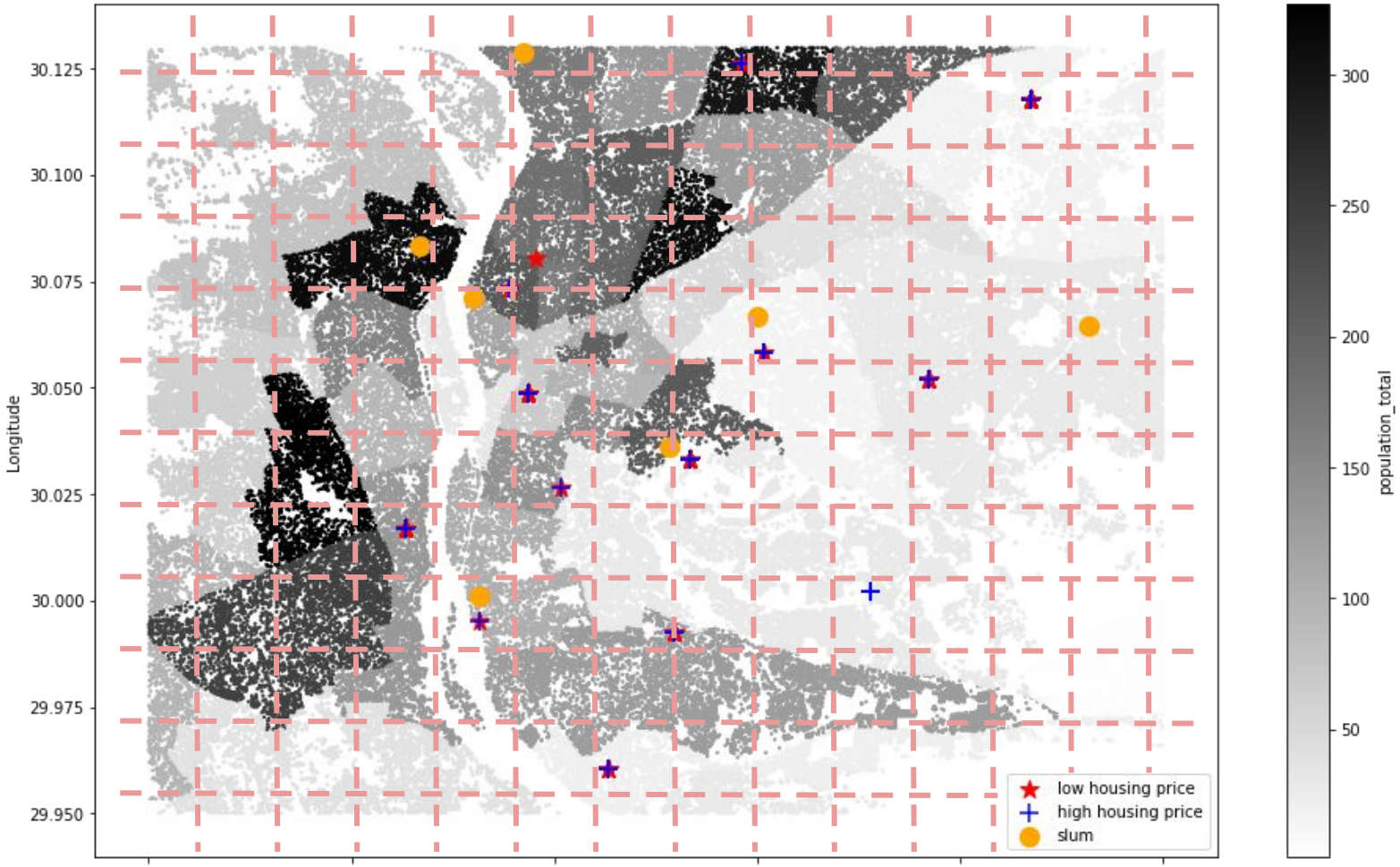
- Responses on inquiries
- Limited Advertisement Counts
- Data Wants
  - Coordinate Information
  - Neighborhood Affluence
  - Lots more data!!!

Next Steps

- Property Finder Web Scraper
  - Applicable to other cities
  - Location data may still overlap
- Moving to new cities require a new web scraper & location data may be even more limited
- Gather information on utilities & and other available/descriptive features for each district

propertyfinder.eg

Next Steps: Building a Classifier



- Applying a grid to distinguish sections of a map.
- Utilize features to determine the probability of an Informal Settlement residing within each section.

Questions?