

# Summary of Urban Heat Island (UHI) Index Modeling - Team Shuanggao

## The model

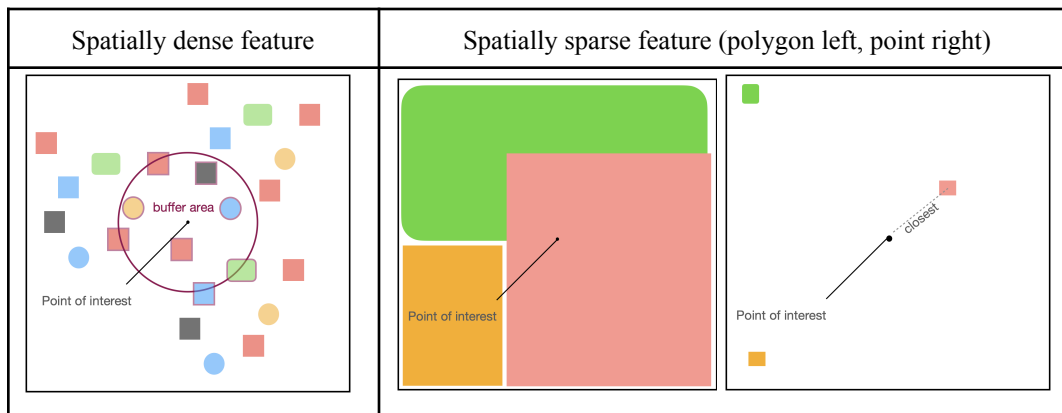
We use ExtraTreesRegressor from scikit-learn for training.

## Spatial feature deviation

We consider two types of feature construction based on the property of spatial features at hand

- **Spatially dense features (SD)**: we construct buffer size within point of interest (lon, lat) and compute the statistics. For buffer-based methods, we may construct multiple buffer sizes to better understand the feature.

- **Spatially sparse feature (SP)**: we perform data assignment, i.e., for each point of interest, we assign the feature based on the (1) which polygon it lies in (if the feature is polygon); (2) which point it is closest to (if the feature is a point).



## Utilized features

We list the data used in the following table. For each data, we will specify data source, explanation, method (SD / SP), used statistics and other details if possible. **(More details can be found in the jupyter notebook!)**

**POI**: point of interest (lon,lat)

Building footprint	<b>Explanation:</b> Building footprint of the Bronx and Manhattan regions (the provided .kml file) <b>Method:</b> SD (polygon) <b>Statistics:</b> total area of the building within the buffer, counts of building overlapped with the buffer <b>Other details:</b> buffer size is in [0.06, 0.07, 0.08, 0.09, 0.1] for building count, [0.0005, 0.001, 0.002, 0.003, 0.004, 0.005, 0.006, 0.007, 0.008, 0.009, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1] for building area. All under projection 4326.
Weather	<b>Explanation:</b> The weather data from 2 weather stations (Bronx and Manhattan) <b>Method:</b> SP (point) <b>Statistics:</b> Weather characteristics (temperature, rainfall, humidity, etc.) in the region the POI belongs to. <b>Other details:</b> N/A
Building elevation	<b>Explanation:</b> The elevation of the building (not building height) <b>Source:</b> <a href="https://data.cityofnewyork.us/City-Government/Building-Elevation-and-Subgrade-BES-bsi-n-59hv/about_data">https://data.cityofnewyork.us/City-Government/Building-Elevation-and-Subgrade-BES-bsi-n-59hv/about_data</a> <b>Method:</b> SD (polygon)

	<p><b>Statistics:</b> Mean value of all building overlapped with the buffer</p> <p><b>Other details:</b> buffer size is in [0.005, 0.01] under projection 4326</p>
Building height	<p><b>Explanation:</b> The height of the building</p> <p><b>Source:</b> <a href="https://data.cityofnewyork.us/City-Government/Building-Footprints/5zhs-2jue/about_data">https://data.cityofnewyork.us/City-Government/Building-Footprints/5zhs-2jue/about_data</a></p> <p><b>Method:</b> SD (polygon)</p> <p><b>Statistics:</b> Mean “Floor Area Ratio (FAR)” of all building overlapped with the buffer</p> <p><b>Other details:</b> buffer size is in [500 meters] under projection 3857</p>
Building energy	<p><b>Explanation:</b> The energy consumption of the building</p> <p><b>Source:</b> <a href="https://energy.cusp.nyu.edu/#/">https://energy.cusp.nyu.edu/#/</a></p> <p><b>Method:</b> SD (point)</p> <p><b>Statistics:</b> Mean “Energy Use Intensity (EUI)” of all building overlapped with the buffer</p> <p><b>Other details:</b> buffer size is in [0.005, 0.01, 0.15] under projection 4326</p>
Population data	<p><b>Explanation:</b> Regional population data</p> <p><b>Source:</b> <a href="https://www.kaggle.com/datasets/muonneutrino/new-york-city-census-data">https://www.kaggle.com/datasets/muonneutrino/new-york-city-census-data</a></p> <p><b>Method:</b> SP (point)</p> <p><b>Statistics:</b> Total population of the region the POI belongs to.</p> <p><b>Other details:</b> N/A</p>
Mapping Inequality	<p><b>Explanation:</b> Region type (by income as well as functionality)</p> <p><b>Source:</b> <a href="https://dsl.richmond.edu/panorama/redlining/data/NY-Manhattan/">https://dsl.richmond.edu/panorama/redlining/data/NY-Manhattan/</a>, <a href="https://dsl.richmond.edu/panorama/redlining/data/NY-Bronx">https://dsl.richmond.edu/panorama/redlining/data/NY-Bronx</a></p> <p><b>Method:</b> SP (polygon)</p> <p><b>Statistics:</b> Income grade(1~10) / Area / Functionality(residential/commercial/industrial) of the region the POI belongs to.</p> <p><b>Other details:</b> N/A</p>
Commute data	<p><b>Explanation:</b> Commute type (car/walk/public/bike) of each region</p> <p><b>Source:</b> <a href="https://a816-dohbsp.nyc.gov/IndicatorPublic/data-explorer/walking-driving-and-cycling/?id=2415#display=summary">https://a816-dohbsp.nyc.gov/IndicatorPublic/data-explorer/walking-driving-and-cycling/?id=2415#display=summary</a></p> <p><b>Method:</b> SP (polygon)</p> <p><b>Statistics:</b> #people who prefer public transportation in the region the POI belongs to.</p> <p><b>Other details:</b> N/A</p>
Air Quality	<p><b>Explanation:</b> Regional PM2.5 index</p> <p><b>Source:</b> <a href="https://a816-dohbsp.nyc.gov/IndicatorPublic/data-explorer/air-quality/?id=2023#display=summary">https://a816-dohbsp.nyc.gov/IndicatorPublic/data-explorer/air-quality/?id=2023#display=summary</a></p> <p><b>Method:</b> SP (point)</p> <p><b>Statistics:</b> PM2.5 value in the region the POI belongs to.</p> <p><b>Other details:</b> N/A</p>
Facilities	<p><b>Explanation:</b> Facilities geometry data</p> <p><b>Source:</b> <a href="https://data.cityofnewyork.us/City-Government/Facilities-Database/ji82-xba5/about_data">https://data.cityofnewyork.us/City-Government/Facilities-Database/ji82-xba5/about_data</a></p> <p><b>Method:</b> SD (polygon)</p> <p><b>Statistics:</b> number of “park and plaza” overlapped with the buffer</p> <p><b>Other details:</b> buffer size is in [0.01] under projection 4326</p>