

# Mapping\_code

June 3, 2020

```
In [150]: #@title Python imports
          # A bit of imports
          import numpy as np
          import pandas as pd
          import warnings
          warnings.filterwarnings('ignore')

          import numpy as np
          import pandas as pd
          import ipywidgets as widgets
          from ipywidgets import interact, interact_manual
          from matplotlib import pyplot as plt
          import seaborn as sns
          import warnings
          warnings.filterwarnings("ignore")
          from scipy import stats
          import geopandas as gpd
          from shapely.geometry import Point, Polygon
          %matplotlib inline
          sns.set(color_codes=True)
          from sklearn import linear_model
          from matplotlib.colors import LinearSegmentedColormap
          from matplotlib_scalebar.scalebar import ScaleBar
          import statsmodels.api as statm

          import libpysal as ps
          from mgwr.gwr import GWR
          from mgwr.gwr import MGWR
          from mgwr.sel_bw import Sel_BW
          from spglm.family import Gaussian, Binomial, Poisson
          import multiprocessing as mp
          pool = mp.Pool()
          import io

In [151]: census = pd.read_csv("MGWR_session_results.csv")

In [152]: census.columns
```

```
Out[152]: Index(['Unnamed: 0', 'Unnamed: 0.1', 'Unnamed: 0.1.1', 'Unnamed: 0.1.1.1',
                'Unnamed: 0.1.1.1.1', 'ind', 'x_coor', 'y_coor', 'y', 'ols_residual',
                'mgwr_yhat', 'mgwr_residual', 'localR2', 'beta_Intercept',
                'beta_avg_age', 'beta_avg_basement', 'beta_avg_sqft',
                'beta_avg_water_dist', 'beta_avg_unemp', 'beta_avg_tech',
                'beta_avg_index', 'se_Intercept', 'se_avg_age', 'se_avg_basement',
                'se_avg_sqft', 'se_avg_water_dist', 'se_avg_unemp', 'se_avg_tech',
                'se_avg_index', 't_Intercept', 't_avg_age', 't_avg_basement',
                't_avg_sqft', 't_avg_water_dist', 't_avg_unemp', 't_avg_tech',
                't_avg_index', 'p_Intercept', 'p_avg_age', 'p_avg_basement',
                'p_avg_sqft', 'p_avg_water_dist', 'p_avg_unemp', 'p_avg_tech',
                'p_avg_index', 'sumW_Intercept', 'sumW_avg_age', 'sumW_avg_basement',
                'sumW_avg_sqft', 'sumW_avg_water_dist', 'sumW_avg_unemp',
                'sumW_avg_tech', 'sumW_avg_index', 'w_43', 'w_164', 'w_226', 'w_81',
                'w_354'],
                dtype='object')
```

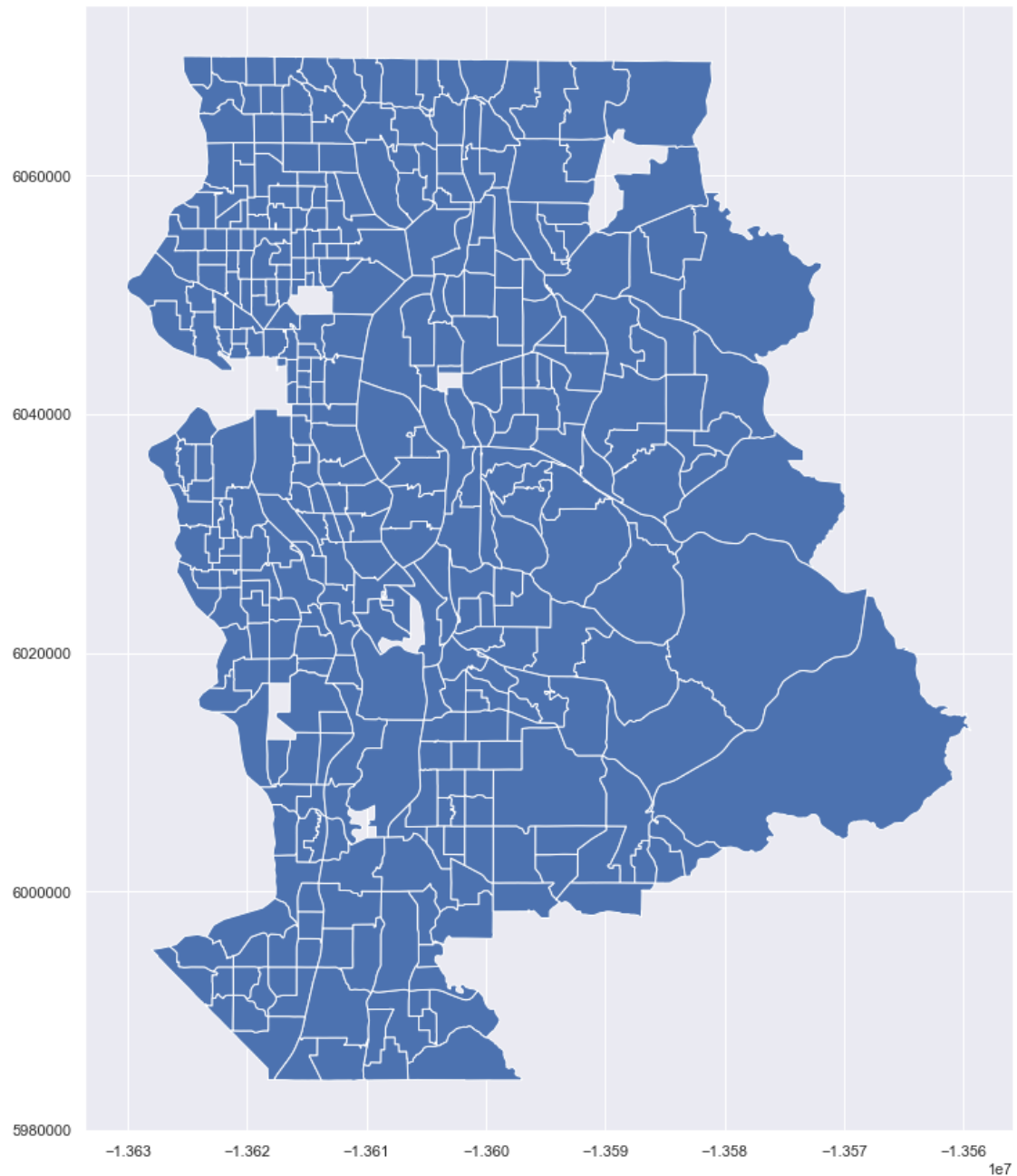
```
In [153]: b_cols = ['beta_Intercept', 'beta_avg_age', 'beta_avg_water_dist', 'beta_avg_sqft', 'beta_avg_index',
                    'beta_avg_tech', 'beta_avg_basement']
          bt_cols = ['bt_constant', 'bt_age', 'bt_water_dist', 'bt_sqft', 'bt_round_basement', 'bt_avg_index',
                    'bt_avg_tech', 'bt_avg_basement']
          t_cols = ['t_Intercept', 't_avg_age', 't_avg_water_dist', 't_avg_sqft', 't_avg_basement',
                    't_avg_index', 't_avg_tech']
          t_crit = [2.92, 2.94, 2.67, 2.99, 3.01, 2.14, 2.20, 2.41]
```

```
In [154]: for i in range(8):
          census.loc[census[t_cols[i]] >= t_crit[i], bt_cols[i]] = census[b_cols[i]]
          census.loc[census[t_cols[i]] <= -t_crit[i], bt_cols[i]] = census[b_cols[i]]
```

```
In [155]: tr = pd.read_csv("census_tracts/census_tracts.csv")
```

```
In [156]: c = 'census_tracts/census_tracts.shp'
          crs = {'EPSG': '4326'}
          geo = gpd.read_file(c, crs=crs)[['geometry', 'objectid']]
          fig, ax = plt.subplots(figsize=(20, 15))
          geo.plot(ax=ax)
```

```
Out[156]: <matplotlib.axes._subplots.AxesSubplot at 0x25763abaeb8>
```



```
In [157]: geo.crs
```

```
Out[157]: {'init': 'epsg:3857'}
```

```
In [158]: coords = np.array(list(zip(census['x_coor'], census['y_coor'])))
geom_points = [Point(xy) for xy in coords]
geo_df = gpd.GeoDataFrame(census, crs={'init': 'epsg:4326'}, geometry=geom_points)
geo_df = geo_df.rename(columns={'OBJECTID': 'index'})
```

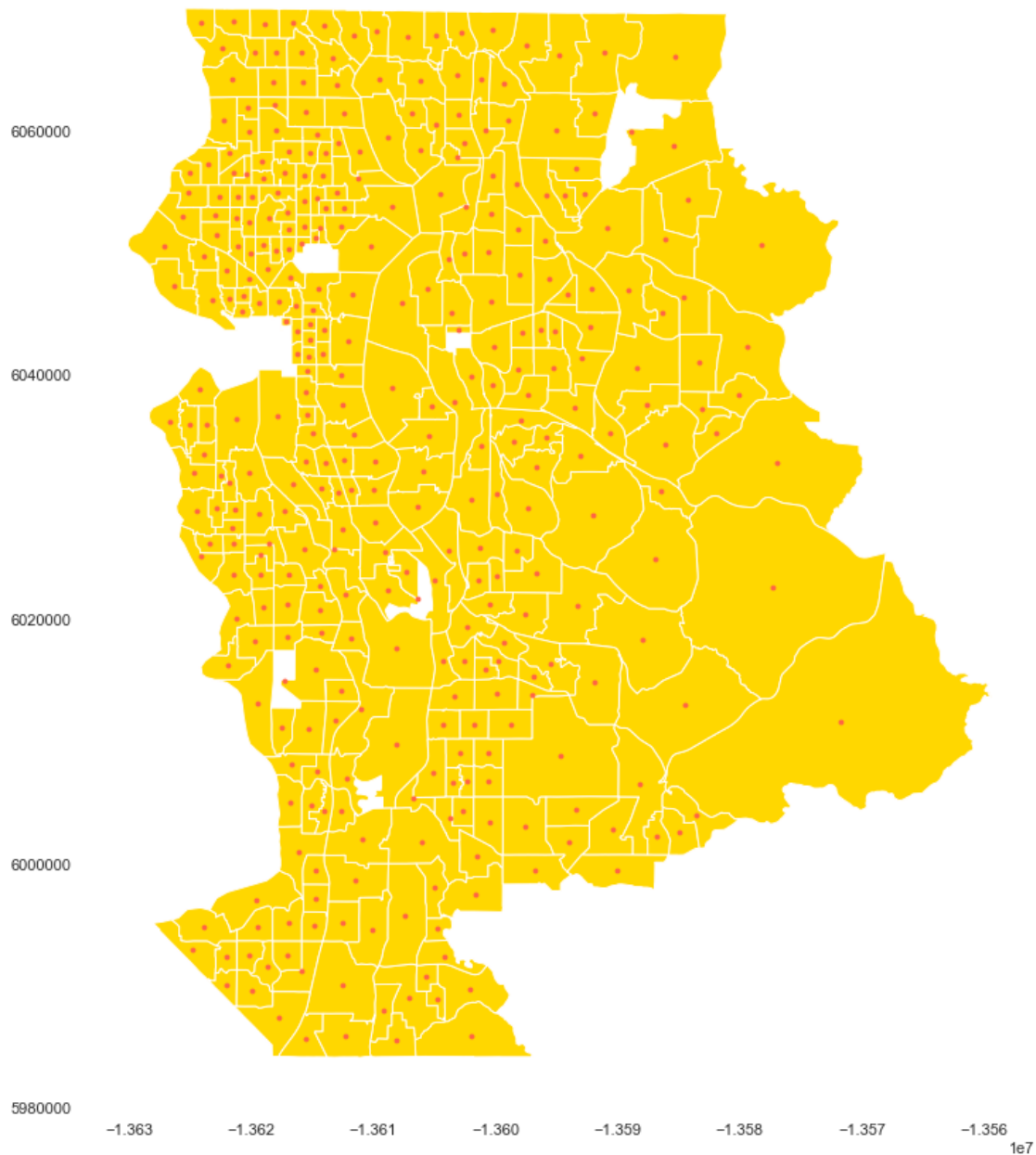
```

geo_df = geo_df.to_crs(epsg=3857)
final_geo = gpd.sjoin(geo, geo_df, how='inner',op='contains',lsuffix='left',rsuffix=

fig,ax = plt.subplots(figsize=(20,15))
ax.set_facecolor('white')
final_geo.plot(ax=ax, color='gold')
geo_df.plot(ax=ax, markersize=8,alpha=1,color='tomato',marker="o")

```

Out[158]: <matplotlib.axes.\_subplots.AxesSubplot at 0x257655d8278>



```

In [159]: import scipy as sp
import shapefile as shp

import matplotlib as mpl
import matplotlib.pyplot as plt
class MidpointNormalize(mpl.colors.Normalize):
    def __init__(self, vmin, vmax, midpoint=0, clip=False):
        self.midpoint = midpoint
        mpl.colors.Normalize.__init__(self, vmin, vmax, clip)

    def __call__(self, value, clip=None):
        normalized_min = max(0, 1 / 2 * (1 - abs((self.midpoint - self.vmin) / (self
        normalized_max = min(1, 1 / 2 * (1 + abs((self.vmax - self.midpoint) / (self
        normalized_mid = 0.5
        x, y = [self.vmin, self.midpoint, self.vmax], [normalized_min, normalized_mi
        return sp.ma.masked_array(sp.interp(value, x, y))

```

```

In [160]: label = gpd.read_file("more_labels_new/more_labels_new.shp")

```

```

In [161]: label=label.to_crs(epsg=3857)
label=label.drop(label.index[3])
label=label.reset_index()
label=label.drop(label.index[5])
label=label.reset_index()
label

```

```

Out[161]:
   level_0  index  FID_  Field1  latitude  longitude \
0         0      0     0       0  47.600000  -122.3000
1         1      1     1       1  47.610100  -122.2015
2         2      2     2       2  47.674000  -122.1215
3         3      4     4       4  47.627740  -122.2420
4         4      5     5       5  47.655548  -122.2950
5         6      7     7       7  47.488300  -121.9467
6         7      8     8       8  47.479700  -122.2079
7         8      9     9       9  47.380900  -122.2348
8         9     10    10      10  47.322300  -122.3126
9        10     11    11      11  47.680000  -122.2290
10       11     12    12      12  47.608500  -122.0878
11       12     13    13      13  47.450200  -122.3088
12       13     14    14      14  47.585900  -122.4014
13       14     15    15      15  47.625300  -122.3222
14       15     16    16      16  47.679200  -122.3860
15       16     17    17      17  47.657300  -122.4055
16       17     18    18      18  47.756000  -122.3457
17       18     19    19      19  47.758400  -122.2497
18       19     20    20      20  47.528300  -122.0997

```

names

geometry

```

0           Seattle POINT (-13614373.72401736 6040565.208625006)
1           Bellevue POINT (-13603408.75417422 6042232.762266758)
2           Redmond POINT (-13594503.19491076 6052790.400185969)
3           Bill Gates' House POINT (-13607917.19355135 6045145.975053936)
4           University of Washington POINT (-13613817.12656339 6049740.411229585)
5           Tiger Mountain State Forest POINT (-13575044.54792009 6022144.481821851)
6           Renton POINT (-13604121.1989153 6020727.859753064)
7           Kent POINT (-13607115.69321764 6004469.784188417)
8           Federal Way POINT (-13615776.34960135 5994841.227999952)
9           Lake Washington POINT (-13606470.04017103 6053782.391355693)
10          Lake Sammamish POINT (-13590751.72807102 6041968.573888839)
11          SeaTac Airport POINT (-13615353.33553634 6015870.277732232)
12          Alki Beach Park POINT (-13625661.5203838 6038237.776014488)
13          Capitol Hill POINT (-13616845.01671297 6044742.955066294)
14          Ballard POINT (-13623947.20022558 6053650.119275319)
15          Discovery Park POINT (-13626117.93029605 6050029.958486892)
16          Shoreline POINT (-13619461.02474661 6066357.500503332)
17          Kenmore POINT (-13608774.35363046 6066754.908203133)
18          Cougar Mountain Park POINT (-13592076.43001146 6028736.472030034)

```

```

In [176]: def mapp(col,name,color,filename,normal=False):
           vmi=min(col[name])
           vma=max(col[name])
           figsize=(14,10)
           colors = 10
           norm = MidpointNormalize(vmin=vmi, vmax=vma, midpoint=0)
           colors = 6
           fig, ax = plt.subplots(1, figsize=(14, 14))

           if normal==True:
               col.plot(column=name, ax=ax,cmap=color,figsize=figsize,k=colors, linewidth=0)
           else:
               col.plot(column=name, ax=ax,cmap=color,figsize=figsize,k=colors, linewidth=0)

           ax.axis("off")

           Scalebar = ScaleBar(100000,location='lower left') # 1 pixel = 0.2 meter
           scatter = ax.collections[-1]

           plt.colorbar(scatter, ax=ax, extend='min',orientation='horizontal',fraction=0.04)
           col.boundary.plot(ax=ax,color='grey',alpha=0.2)

           texts = []
           for x, y, lab in zip(label.geometry.x, label.geometry.y, label["names"]):
               texts.append(plt.text(x-1500, y-700, lab, fontsize = 8,horizontalalignment='left'))
           label.plot(ax=ax,alpha=1,color='black',linewidth=0.4)

```

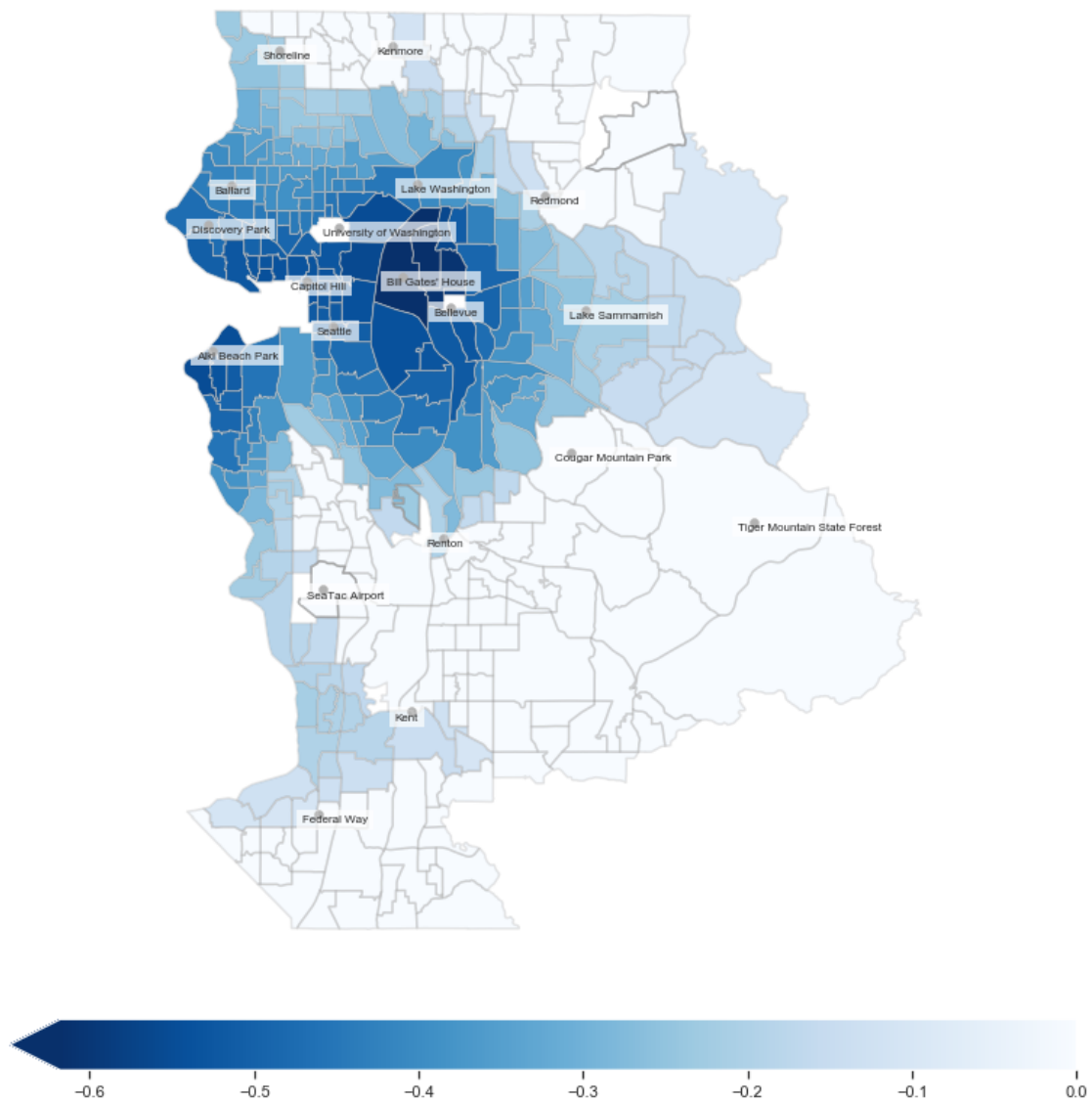
```
plt.savefig("../images/"+filename)
```

```
In [169]: final_geo.columns
```

```
Out[169]: Index(['geometry', 'objectid', 'index_right', 'Unnamed: 0', 'Unnamed: 0.1',  
                'Unnamed: 0.1.1', 'Unnamed: 0.1.1.1', 'Unnamed: 0.1.1.1.1', 'ind',  
                'x_coor', 'y_coor', 'y', 'ols_residual', 'mgwr_yhat', 'mgwr_residual',  
                'localR2', 'beta_Intercept', 'beta_avg_age', 'beta_avg_basement',  
                'beta_avg_sqft', 'beta_avg_water_dist', 'beta_avg_unemp',  
                'beta_avg_tech', 'beta_avg_index', 'se_Intercept', 'se_avg_age',  
                'se_avg_basement', 'se_avg_sqft', 'se_avg_water_dist', 'se_avg_unemp',  
                'se_avg_tech', 'se_avg_index', 't_Intercept', 't_avg_age',  
                't_avg_basement', 't_avg_sqft', 't_avg_water_dist', 't_avg_unemp',  
                't_avg_tech', 't_avg_index', 'p_Intercept', 'p_avg_age',  
                'p_avg_basement', 'p_avg_sqft', 'p_avg_water_dist', 'p_avg_unemp',  
                'p_avg_tech', 'p_avg_index', 'sumW_Intercept', 'sumW_avg_age',  
                'sumW_avg_basement', 'sumW_avg_sqft', 'sumW_avg_water_dist',  
                'sumW_avg_unemp', 'sumW_avg_tech', 'sumW_avg_index', 'w_43', 'w_164',  
                'w_226', 'w_81', 'w_354', 'bt_constant', 'bt_age', 'bt_water_dist',  
                'bt_sqft', 'bt_round_basement', 'bt_index', 'bt_unemp', 'bt_tech'],  
                dtype='object')
```

```
In [188]: final_geo['btn_water']=final_geo['bt_water_dist'].fillna(0.0)
```

```
In [190]: mapp(col=final_geo,name='btn_water',color='Blues_r',filename="trial",normal=False)
```



```
In [183]: final_geo['bt_age']
```

```
Out[183]: 0      NaN
          1      NaN
          2      0.099947
          3      NaN
          4      NaN
          ...
          352     NaN
          353     NaN
          354     NaN
          355     NaN
```



```
356          NaN
      Name: bt_age, Length: 363, dtype: float64
```

```
In [ ]:
```