Chapter 8 - Comparison of taxa and qualitative classification

November 10, 2020

[1]:
```
import pandas as pd
import geopandas as gpd
import seaborn as sns
import matplotlib.pyplot as plt
import husl
from legendgram import legendgram
import mapclassify
from matplotlib_scalebar.scalebar import ScaleBar
from matplotlib.colors import ListedColormap
from random import shuffle
from tqdm import tqdm
```

[2]:
```
clusters = pd.read_csv('/Users/martin/Dropbox/Academia/Data/Geo/Prague/
↪Clustering/complete data/200218_clusters_complete_n20.csv', index_col=0)
```

[3]:
```
file = '/Users/martin/Dropbox/Academia/Contracts/UAP Prague/2020.01_Zakázka MF/
↪01_data/202004_Zakazka MF_predana data/20200421_ZakazkaMF_data_validacni.gdb'
```

[4]:
```
import fiona
fiona.listlayers(file)
```

[4]:
```
['URK_LokalityStav_p', 'URK_SS_VyuzitiZakl_p', 'VyvojZastavby_p']
```

[5]:
```
qual = gpd.read_file(file, layer='URK_LokalityStav_p')
```

[6]:
```
buildings = gpd.read_file('/Users/martin/Dropbox/Academia/Data/Geo/Prague/
↪Clustering/geometry.gpkg', layer='buildings')
```

[7]:
```
buildings['cent'] = buildings.centroid
buildings = buildings.set_geometry('cent')
```

[8]:
```
buildings = buildings.to_crs(qual.crs)
```

[9]:
```
joined = gpd.sjoin(buildings, qual, how='left')
```

[10]:
```
joined = joined.merge(clusters, how='left', on='uID')
```

[11]:
```
joined.head(2)
```

[11]:
```
   uID                                              geometry  \
0    0  POLYGON ((-749844.585 -1052277.805, -749844.41…
1    1  POLYGON ((-744449.580 -1042702.590, -744447.15…

                              cent  index_right     ID CISLO_TXT  \
0  POINT (-749841.681 -1052279.951)          233  16170       617
1  POINT (-744432.289 -1042699.409)          702  10080       008

           NAZEV_STAV  ZASTAVENOST  VYUZITI_STAV  STRUKTURA_STAV  \
0  Cementárna Radotín            1             2               8
1         Malá Strana            1             1               1

   MIRA_STABILITY_STAV  TYP_MESTA  KRAJINA  Shape_Length     Shape_Area  \
0                    5        1.0        1   2815.203269  239855.665606
1                    4        1.0        1   5419.046731  692062.403477

   cluster
0      1.0
1     11.0
```

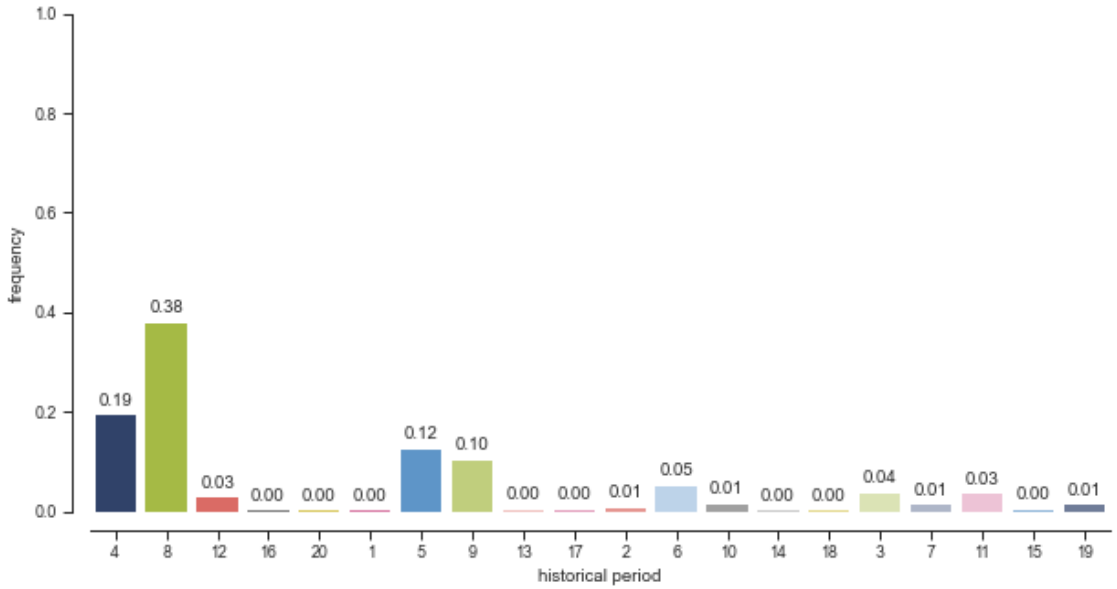
[11]:
```
joined = joined.set_geometry('geometry')
```

0.1 analyse

[14]:
```
import numpy as np

def show_values_on_bars(axs):
    def _show_on_single_plot(ax):
        for p in ax.patches:
            _x = p.get_x() + p.get_width() / 2
            _y = p.get_y() + p.get_height() + 0.02
            value = '{:.2f}'.format(p.get_height())
            ax.text(_x, _y, value, ha="center")

    if isinstance(axs, np.ndarray):
        for idx, ax in np.ndenumerate(axs):
            _show_on_single_plot(ax)
    else:
        _show_on_single_plot(axs)

pal = cols
```

[53]:
```
data = joined.loc[joined['cluster'].isin()]['STRUKTURA_STAV'].
↪value_counts(sort=False, normalize=True)
```

```
sns.set(context="paper", style="ticks", rc={'patch.force_edgecolor': False})
fig, ax = plt.subplots(figsize=(10, 5))
sns.barplot(ax=ax, x=data.index, y=data, order=data.index, palette=pal)
sns.despine(offset=10)
plt.ylabel('frequency')
plt.xlabel('historical period')
plt.ylim(0, 1)
show_values_on_bars(ax)
```



[14]:
```
sample = joined.loc[joined['STRUKTURA_STAV'].isin([1, 2, 5, 6, 7, 8, 9])]
```

[ ]:
```
data = sample.loc[sample['cluster'].isin([11])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)

labels = ['organic', 'perimeter block', 'village', 'garden city', 'modernism',␣
 ↪'production', 'services']
sns.set(context="paper", style="ticks", rc={'patch.force_edgecolor': False})
fig, ax = plt.subplots(figsize=(10, 5))
sns.barplot(ax=ax, x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
plt.ylabel('frequency')
plt.xlabel('qualitative typology')
plt.ylim(0, 1)
ax.set_xticklabels(labels)
show_values_on_bars(ax)
```

[ ]:
```
# save all clusters
for cl in range(20):
    data = sample.loc[sample['cluster'].isin([cl])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)

    fig, ax = plt.subplots(figsize=(10, 5))
    sns.barplot(ax=ax, x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
    sns.despine(offset=10)
    plt.ylabel('frequency')
    plt.xlabel('qualitative typology')
    plt.ylim(0, 1)
    ax.set_xticklabels(labels)
    show_values_on_bars(ax)
    for ext in ['pdf', 'png']:
        plt.savefig('figures/PRG_cluster_' + str(cl) + '_structure.' + ext,␣
 ↪bbox_inches='tight')
    plt.close()
```

[ ]:
```
fig, ax = plt.subplots(2, 2, figsize=(14, 10))

data = sample.loc[sample['cluster'].isin([11])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)

sns.barplot(ax=ax[0, 0], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[0,0].set_ylabel('frequency')
ax[0,0].set_xlabel('qualitative typology')
ax[0,0].set_title('cluster 11')
ax[0,0].set_ylim(0, 1)
ax[0,0].set_xticklabels(labels)
show_values_on_bars(ax[0, 0])

data = sample.loc[sample['cluster'].isin([5])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)
sns.barplot(ax=ax[0, 1], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[0,1].set_ylabel('frequency')
ax[0,1].set_xlabel('qualitative typology')
ax[0,1].set_title('cluster 5')
ax[0,1].set_ylim(0, 1)
ax[0,1].set_xticklabels(labels)
show_values_on_bars(ax[0, 1])
```

```
data = sample.loc[sample['cluster'].isin([12])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)
sns.barplot(ax=ax[1, 0], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[1,0].set_ylabel('frequency')
ax[1,0].set_xlabel('qualitative typology')
ax[1,0].set_title('cluster 12')
ax[1,0].set_ylim(0, 1)
ax[1,0].set_xticklabels(labels)
show_values_on_bars(ax[1, 0])

data = sample.loc[sample['cluster'].isin([13])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)
sns.barplot(ax=ax[1, 1], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[1,1].set_ylabel('frequency')
ax[1,1].set_xlabel('qualitative typology')
ax[1,1].set_title('cluster 13')
ax[1,1].set_ylim(0, 1)
ax[1,1].set_xticklabels(labels)
show_values_on_bars(ax[1, 1])

plt.tight_layout()
plt.savefig('figures/PRG_cluster_structure_subplot.pdf')
```

[ ]:
```
fig, ax = plt.subplots(2, 2, figsize=(14, 10))

data = sample.loc[sample['cluster'].isin([11, 15, 5])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)

sns.barplot(ax=ax[0, 0], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[0,0].set_ylabel('frequency')
ax[0,0].set_xlabel('qualitative typology')
ax[0,0].set_title('compact city')
ax[0,0].set_ylim(0, 1)
ax[0,0].set_xticklabels(labels)
show_values_on_bars(ax[0, 0])

data = sample.loc[sample['cluster'].isin([3, 0, 8, 9, 13,␣
 ↪17])]['STRUKTURA_STAV'].value_counts(sort=False, normalize=True)
sns.barplot(ax=ax[0, 1], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
```

```
sns.despine(offset=10)
ax[0,1].set_ylabel('frequency')
ax[0,1].set_xlabel('qualitative typology')
ax[0,1].set_title('low-rise city')
ax[0,1].set_ylim(0, 1)
ax[0,1].set_xticklabels(labels)
show_values_on_bars(ax[0, 1])

data = sample.loc[sample['cluster'].isin([1, 19])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)
sns.barplot(ax=ax[1, 0], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[1,0].set_ylabel('frequency')
ax[1,0].set_xlabel('qualitative typology')
ax[1,0].set_title('industrial city')
ax[1,0].set_ylim(0, 1)
ax[1,0].set_xticklabels(labels)
show_values_on_bars(ax[1, 0])

data = sample.loc[sample['cluster'].isin([12, 14, 2, 10])]['STRUKTURA_STAV'].
 ↪value_counts(sort=False, normalize=True)
sns.barplot(ax=ax[1, 1], x=data.index, y=data, order=[1, 2, 5, 6, 7, 8, 9],␣
 ↪palette=pal)
sns.despine(offset=10)
ax[1,1].set_ylabel('frequency')
ax[1,1].set_xlabel('qualitative typology')
ax[1,1].set_title('heterogenous dense city branch')
ax[1,1].set_ylim(0, 1)
ax[1,1].set_xticklabels(labels)
show_values_on_bars(ax[1, 1])

plt.tight_layout()
plt.savefig('figures/PRG_branch_structure_subplot.pdf')
```

[12]:
```
import scipy.stats as ss
import numpy as np

def cramers_v(x, y):
    confusion_matrix = pd.crosstab(x,y)
    chi2 = ss.chi2_contingency(confusion_matrix)[0]
    n = confusion_matrix.sum().sum()
    phi2 = chi2/n
    r,k = confusion_matrix.shape
    phi2corr = max(0, phi2-((k-1)*(r-1))/(n-1))
    rcorr = r-((r-1)**2)/(n-1)
    kcorr = k-((k-1)**2)/(n-1)
```

```
    return np.sqrt(phi2corr/min((kcorr-1),(rcorr-1)))
```

[15]:
```
cramers_v(sample.cluster, sample.STRUKTURA_STAV)
```

[15]: 0.6741832153043661

[16]:
```
confusion_matrix = pd.crosstab(sample.cluster, sample.STRUKTURA_STAV)
chi, p, dof, exp = ss.chi2_contingency(confusion_matrix)
```

[20]:
```
p
```

[20]: 0.0

[21]:
```
dof
```

[21]: 114

[22]:
```
chi
```

[22]: 325595.1995642433