3 - Data Project – Team Winrate - Descriptive Regression - Summer 2019

May 31, 2020

[1]:

```
import numpy as np
import pandas as pd
pd.options.display.max_columns=100
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.preprocessing import StandardScaler as SSc
from sklearn.decomposition import PCA
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
import graphviz as gviz
%matplotlib inline

#set width of window to preference
from IPython.core.display import display, HTML
display(HTML("<style>.container { width:90% !important; }</style>"))
```

```
<IPython.core.display.HTML object>
```

[2]:

```
#year = "2019"                                                   #choose year␣
 ↪to get data from
#split = "summer"                                                #choose split␣
 ↪to get data from(spring, summer, worlds)
#infile = r"C:\Users\Triplea657\000 MSCS-335 2020\Datasets\League_"#path
#inf = "-Wrangled.csv"                                           #file to read
#filein = infile+year+"\\"+year+'-'+split+'-'+inf
#data = pd.read_csv(filein,low_memory=False)
#data.head(10)

#changed for submission version
data = pd.read_csv("Datasets/League_2019/2019-summer-Wrangled.csv", index_col=0,␣
 ↪low_memory=False)
data.head()
```

[2]:

```
   league_CBLoL  league_LCK  league_LCS  league_LEC  league_LMS  gamelength  \
0           0.0         0.0         1.0         0.0         0.0   35.500000
1           0.0         0.0         1.0         0.0         0.0   35.500000
```

```
2          0.0         0.0         1.0         0.0         0.0   29.700000
3          0.0         0.0         1.0         0.0         0.0   29.700000
4          0.0         0.0         1.0         0.0         0.0   31.983333

   result     k     d     a   fb       kpm      okpm      ckpm   fd  \
0     1.0  21.0  14.0  52.0  0.0  0.591549  0.394366  0.985915  0.0   
1     0.0  14.0  21.0  32.0  1.0  0.394366  0.591549  0.985915  1.0   
2     1.0  11.0   4.0  25.0  1.0  0.370370  0.134680  0.505051  1.0   
3     0.0   4.0  11.0  10.0  0.0  0.134680  0.370370  0.505051  0.0   
4     1.0  12.0   3.0  26.0  1.0  0.375195  0.093799  0.468994  0.0   

      fdtime  teamdragkills  oppdragkills  elementals  oppelementals  \
0  12.556633            2.0           2.0         2.0            2.0   
1  12.556633            2.0           2.0         2.0            2.0   
2  12.306967            2.0           1.0         2.0            1.0   
3  12.306967            1.0           2.0         1.0            2.0   
4  10.158933            3.0           1.0         3.0            1.0   

   firedrakes  waterdrakes  earthdrakes  airdrakes  elders  oppelders  herald  \
0         2.0          0.0          0.0        0.0     0.0        0.0     1.0   
1         1.0          0.0          0.0        1.0     0.0        0.0     0.0   
2         0.0          0.0          1.0        1.0     0.0        0.0     0.0   
3         0.0          1.0          0.0        0.0     0.0        0.0     1.0   
4         1.0          0.0          0.0        2.0     0.0        0.0     0.0   

   heraldtime   ft     fttime  firstmidouter  firsttothreetowers  \
0   13.369417  1.0  15.162683            1.0                 0.0   
1   13.369417  0.0  15.162683            0.0                 1.0   
2   12.377433  1.0  12.791600            1.0                 1.0   
3   12.377433  0.0  12.791600            0.0                 0.0   
4   12.242783  0.0  14.386333            1.0                 1.0   

   teambaronkills  oppbaronkills  dmgtochamps  dmgtochampsperminute  wards  \
0             1.0            0.0      70545.0           1987.183099  109.0   
1             0.0            1.0      71736.0           2020.732394  108.0   
2             1.0            0.0      51538.0           1735.286195   96.0   
3             0.0            1.0      38185.0           1285.690236   93.0   
4             1.0            0.0      49421.0           1545.211047  143.0   

        wpm  wardkills      wcpm  totalgold    earnedgpm  goldspent      gspd  \
0  3.070423       51.0  1.436620    69022.0  1293.464789    65108.0  0.110966   
1  3.042254       37.0  1.042254    61541.0  1082.732394    58263.0 -0.110966   
2  3.232323       44.0  1.481481    59081.0  1330.861953    50910.0  0.135867   
3  3.131313       41.0  1.380471    45794.0   883.488215    44433.0 -0.135867   
4  4.471079       44.0  1.375717    61326.0  1262.351225    54340.0  0.158169   

   monsterkillsownjungle  monsterkillsenemyjungle       cspm  goldat10  \
0                  151.0                     24.0  31.802817   16118.0
1                  155.0                      4.0  32.985915   15436.0
2                  102.0                     56.0  35.656566   16270.0
3                   82.0                      0.0  33.265993   14985.0
4                  128.0                     18.0  34.299114   16157.0

   oppgoldat10  gdat10  goldat15  oppgoldat15  gdat15   xpat10  oppxpat10  \
0      15436.0   682.0   24287.0      23616.0   671.0  19260.0    18621.0
1      16118.0  -682.0   23616.0      24287.0  -671.0  18621.0    19260.0
2      14985.0  1285.0   27399.0      23026.0  4373.0  19015.0    18226.0
3      16270.0 -1285.0   23026.0      27399.0 -4373.0  18226.0    19015.0
4      14365.0  1792.0   26339.0      22782.0  3557.0  19284.0    18656.0

   xpdat10  csat10  oppcsat10  csdat10  csat15  oppcsat15  csdat15
0    639.0   334.0      316.0     18.0   548.0      535.0     13.0
1   -639.0   316.0      334.0    -18.0   535.0      548.0    -13.0
2    789.0   316.0      335.0    -19.0   509.0      506.0      3.0
3   -789.0   335.0      316.0     19.0   506.0      509.0     -3.0
4    628.0   322.0      305.0     17.0   512.0      470.0     42.0
```

[3]:
```
mean = data.mean()
print(mean)
```

```
league_CBLoL      0.132964
league_LCK        0.337950
league_LCS        0.182825
league_LEC        0.173130
league_LMS        0.173130
                   ...
oppcsat10       318.845568
csdat10           0.000000
csat15          503.474377
oppcsat15       503.474377
csdat15           0.000000
Length: 62, dtype: float64
```

PCA without data standardization

[4]:
```
pca = PCA(n_components=12)
pca.fit(data)
#print("PCA components:               "+str(pca.components_))
print("\nPCA explained variance ratio: "+str(pca.explained_variance_ratio_))
print("\nPCA singular values:          "+str(pca.singular_values_))

X = pd.DataFrame(pca.transform(data))
pd.plotting.scatter_matrix(X,figsize=(12,12));
```

```
PCA explained variance ratio: [8.67627130e-01 1.01407391e-01 1.95668660e-02
4.99782276e-03
 3.15962230e-03 1.48517238e-03 9.23823613e-04 4.94639370e-04
 2.96124762e-04 3.27582717e-05 2.77884748e-06 2.47570114e-06]

PCA singular values:          [937142.1768778  320386.14434339 140734.17063465
71126.15758824
  56553.11189101  38772.81689976  30579.71627688  22376.04168278
  17313.15770017   5758.36795488   1677.14757112   1583.0259366 ]
```

```
C:\Users\Triplea657\anaconda3\lib\site-
packages\pandas\plotting\_matplotlib\tools.py:298: MatplotlibDeprecationWarning:
The rowNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().rowspan.start instead.
  layout[ax.rowNum, ax.colNum] = ax.get_visible()
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  if not layout[ax.rowNum + 1, ax.colNum]:
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minor releases later. Use ax.get_subplotspec().colspan.start instead.
  if not layout[ax.rowNum + 1, ax.colNum]:
```

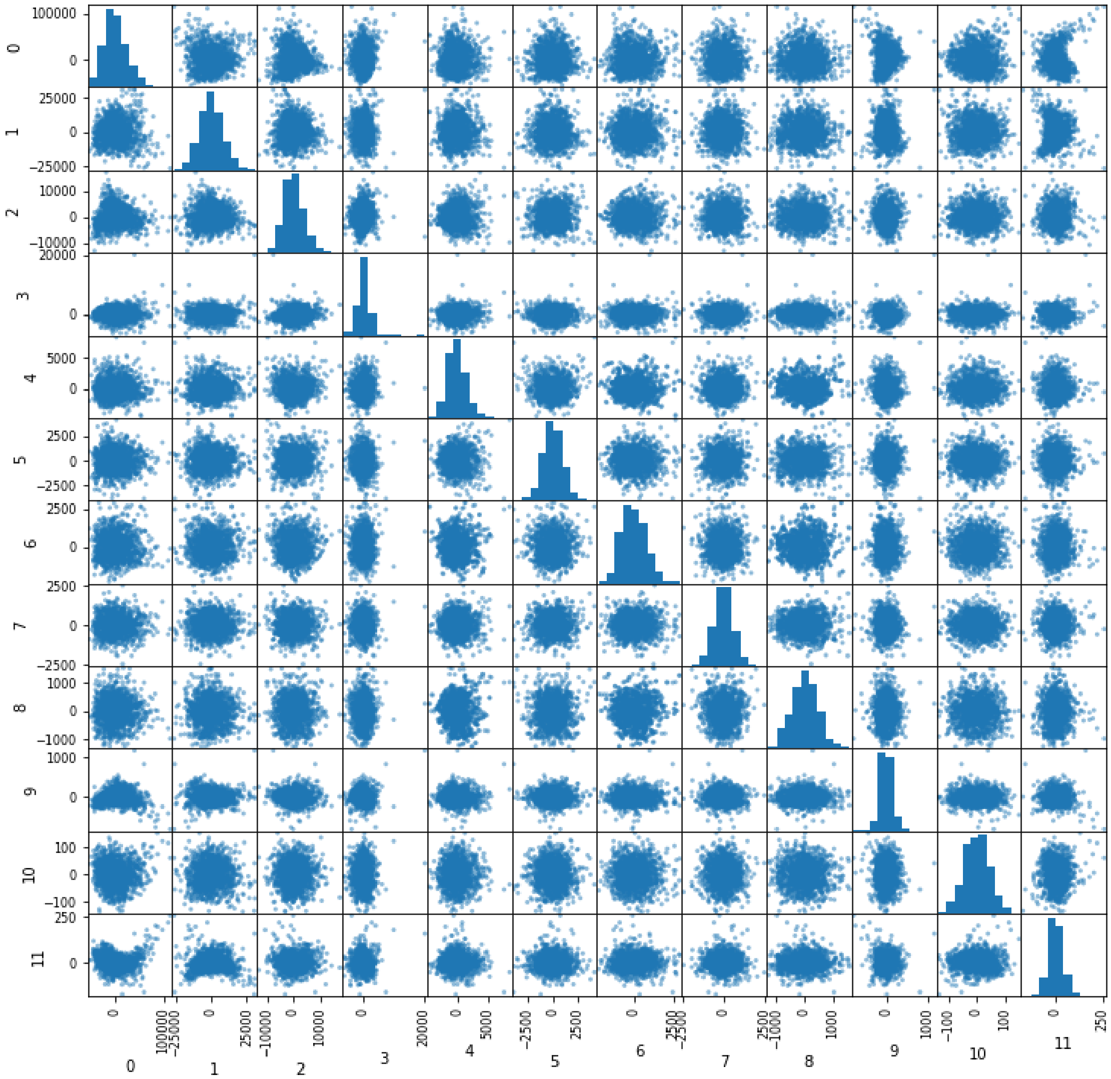

PCA with data standardization

[5]:
```
pca = PCA(n_components=12)
pca.fit(X)
#print("PCA components:                 "+str(pca.components_))
print("\nPCA explained variance ratio: "+str(pca.explained_variance_ratio_))
print("\nPCA singular values:          "+str(pca.singular_values_))

ssc = SSc()
X = pd.DataFrame(ssc.fit_transform(X))

X = pd.DataFrame(pca.transform(X))
pd.plotting.scatter_matrix(X,figsize=(12,12));
```

```
PCA explained variance ratio: [8.67630076e-01 1.01407735e-01 1.95669325e-02
4.99783973e-03
 3.15963303e-03 1.48517742e-03 9.23826750e-04 4.94641049e-04
 2.96125768e-04 3.27583829e-05 2.77885691e-06 2.47570954e-06]

PCA singular values:          [937142.1768778  320386.14434339 140734.17063465
71126.15758824
  56553.11189101  38772.81689976  30579.71627688  22376.04168278
  17313.15770017   5758.36795488   1677.14757112   1583.0259366 ]
```

```
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packages\pandas\plotting\_matplotlib\tools.py:298: MatplotlibDeprecationWarning:
The rowNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().rowspan.start instead.
  layout[ax.rowNum, ax.colNum] = ax.get_visible()
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  layout[ax.rowNum, ax.colNum] = ax.get_visible()
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The rowNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().rowspan.start instead.
  if not layout[ax.rowNum + 1, ax.colNum]:
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packages\pandas\plotting\_matplotlib\tools.py:304: MatplotlibDeprecationWarning:
The colNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().colspan.start instead.
  if not layout[ax.rowNum + 1, ax.colNum]:
```
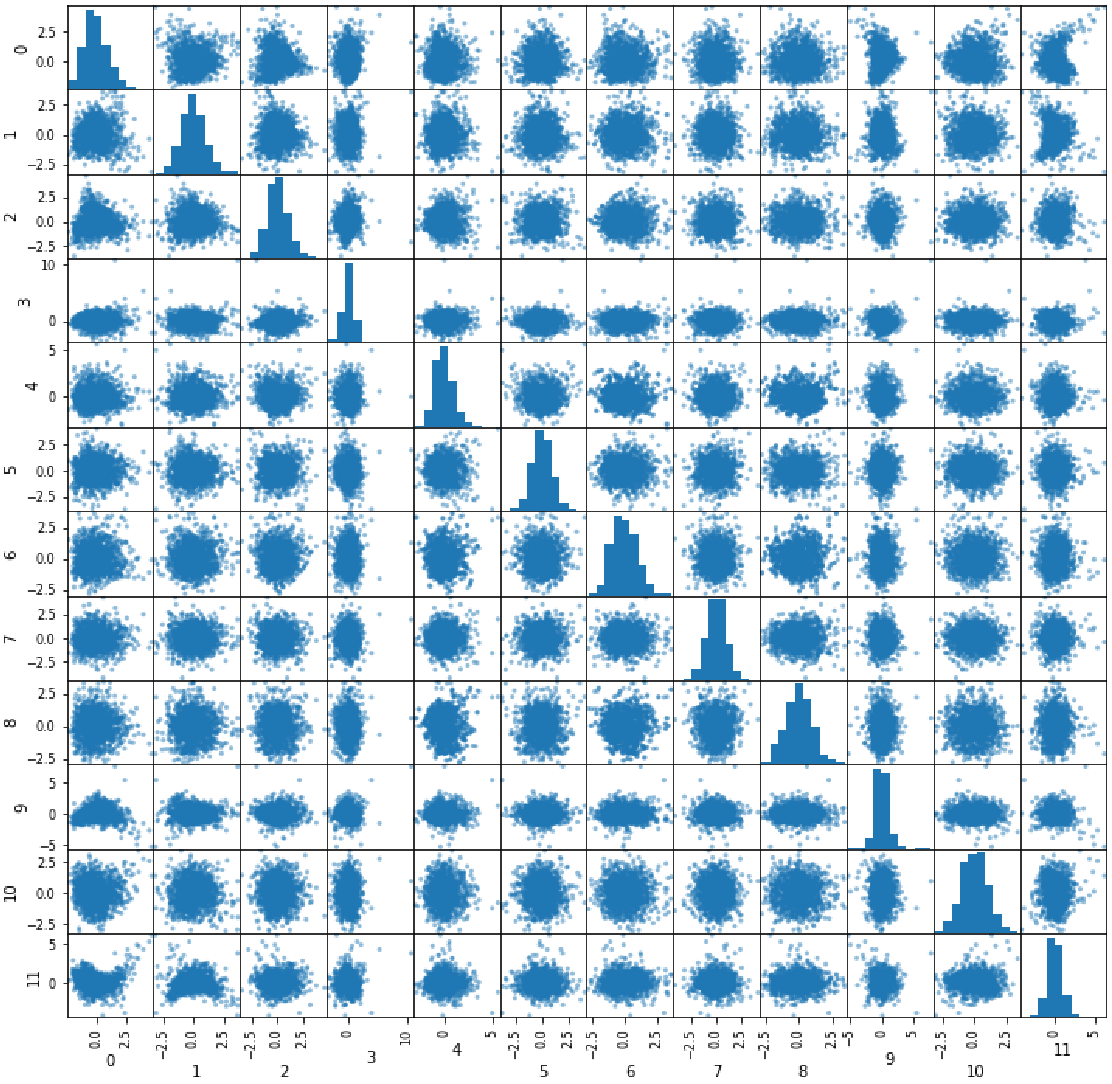



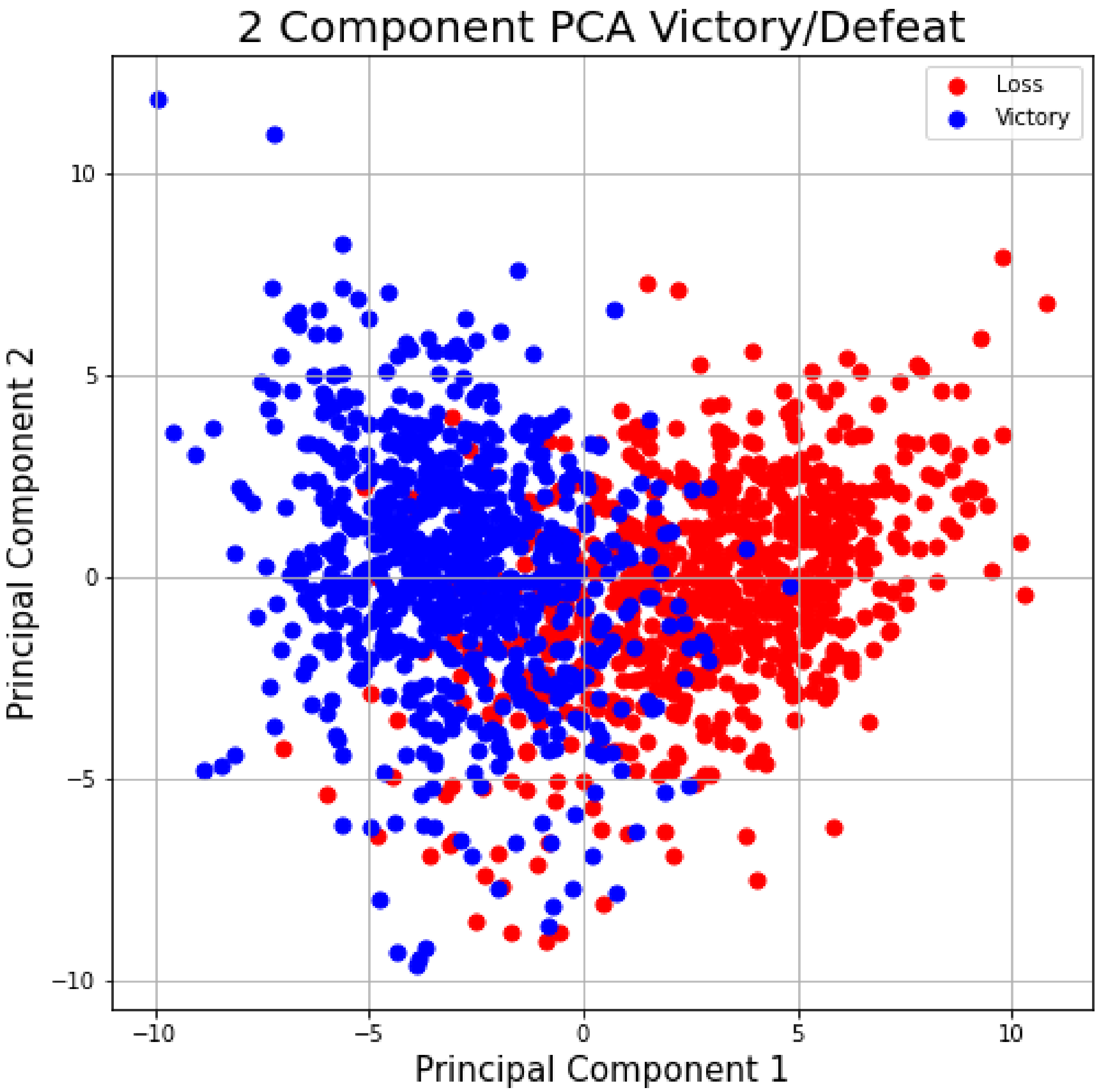
PCA analysis of victory/defeat (2 components)

[6]:
```
def pcaout(pca, n_ftrs, col_nms):
    print("Principal components:")
    idx = ['PC-1','PC-2','PC-3','PC-4','PC-5','PC-6']
    return pd.DataFrame(pca.components_, columns=col_nms, index = idx[:n_ftrs])
```

[7]:
```
X = data.iloc[:,data.columns != 'result']
Xcol = X.columns
Y = data.iloc[:,data.columns == 'result']
#transform input data (normalize)
ssc = SSc()
Xft = ssc.fit_transform(X)
X = pd.DataFrame(Xft)
```

```
pca = PCA(n_components=2)
components = pca.fit_transform(X)
componentDf = pd.DataFrame(data=components, columns=['principal component 1',␣
 ↪'principal component 2'])

pltDF = pd.concat([componentDf, Y], axis = 1)
print("PCA explained variance ratio:  {}".format(pca.explained_variance_ratio_))
print("Portion of variance explained: {}".format(pca.explained_variance_ratio_/
 ↪sum(pca.explained_variance_ratio_)))


#plot
fig = plt.figure(figsize = (8,8))
ax = fig.add_subplot(1,1,1)
ax.set_xlabel('Principal Component 1', fontsize = 15)
ax.set_ylabel('Principal Component 2', fontsize = 15)
ax.set_title('2 Component PCA Victory/Defeat', fontsize = 20)


results = [0.0, 1.0]
colors = ['r', 'b']
for result, color in zip(results,colors):
    indicesToKeep = (pltDF['result'] == result)
    ax.scatter(pltDF.loc[indicesToKeep, 'principal component 1']
               , pltDF.loc[indicesToKeep, 'principal component 2']
               , c = color
               , s = 50)
ax.legend(['Loss','Victory'])
ax.grid()
```

```
PCA explained variance ratio:  [0.25647711 0.12592736]
Portion of variance explained: [0.67069589 0.32930411]
```



```
[8]: df = pcaout(pca, 2, Xcol)
     df
```

```
Principal components:
```

```
[8]:       league_CBLoL  league_LCK  league_LCS  league_LEC  league_LMS  \
     PC-1      0.003958   -0.008343    0.000866    0.005484    0.000509
     PC-2      0.046823   -0.115762    0.012782    0.101831   -0.012185

           gamelength         k         d         a        fb       kpm      okpm  \
     PC-1   -0.050080 -0.166795  0.139952 -0.158998 -0.086159 -0.156447  0.161371
     PC-2   -0.298563  0.064694  0.004309  0.031856  0.033971  0.155790  0.089599
```

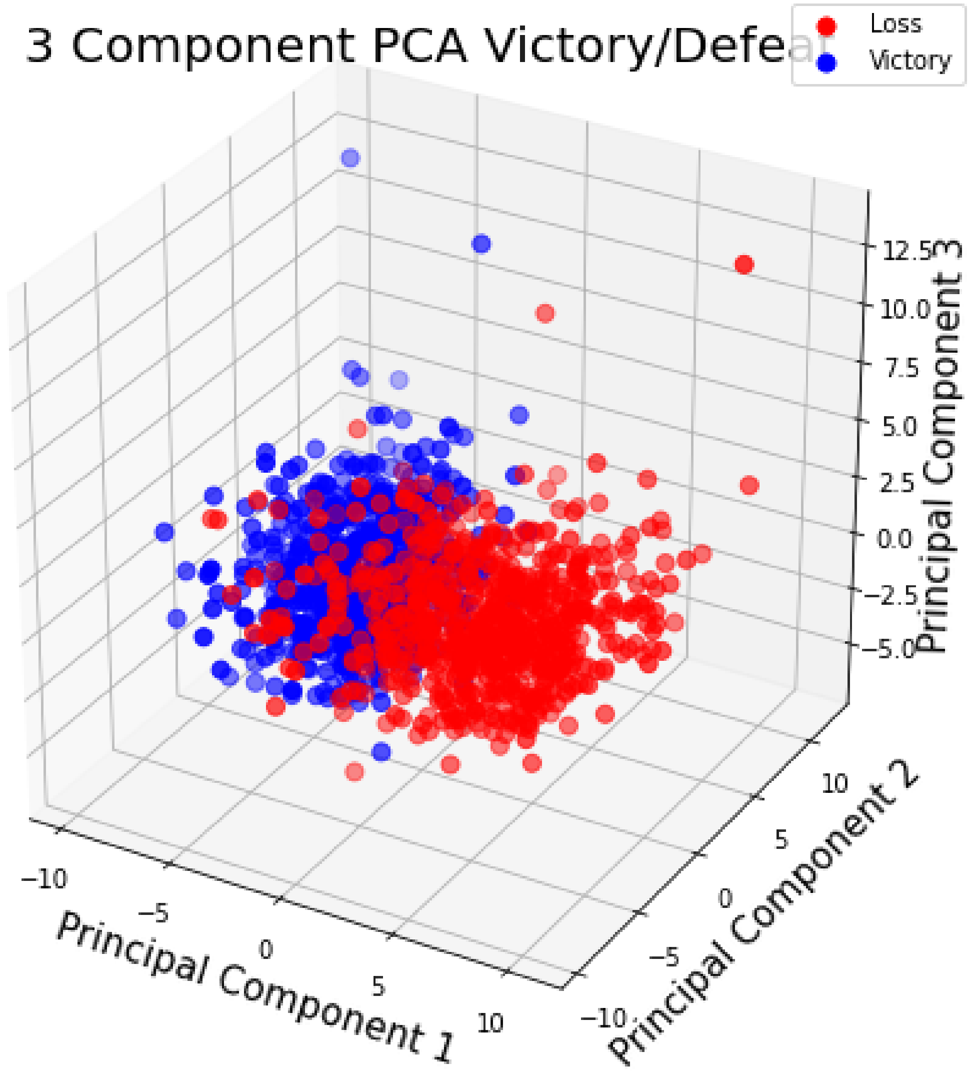
```
          ckpm        fd    fdtime  teamdragkills  oppdragkills  elementals  \
PC-1  0.003948 -0.115469  0.003115      -0.202534      0.167631   -0.202371
PC-2  0.196758  0.035238  0.022261      -0.063025     -0.151020   -0.030192

      oppelementals  firedrakes  waterdrakes  earthdrakes  airdrakes  \
PC-1       0.177836   -0.108573    -0.092821    -0.085696  -0.097351
PC-2      -0.121844   -0.004087    -0.023802    -0.007486  -0.021806

        elders  oppelders    herald  heraldtime        ft    fttime  \
PC-1 -0.047086  -0.008447 -0.074291    0.000345 -0.143544 -0.006874
PC-2 -0.164998  -0.168354  0.026337    0.003719  0.046607 -0.084438

      firstmidouter  firsttothreetowers  teambaronkills  oppbaronkills  \
PC-1      -0.170376           -0.187454       -0.156228       0.121386
PC-2       0.044149            0.047430       -0.067670      -0.115831

      dmgtochamps  dmgtochampsperminute     wards       wpm  wardkills  \
PC-1    -0.110854             -0.123607 -0.056646 -0.047123  -0.082411
PC-2    -0.141347              0.021892 -0.304310 -0.206338  -0.290090

          wcpm  totalgold  earnedgpm  goldspent      gspd  \
PC-1 -0.089111  -0.147279  -0.217007  -0.116267 -0.218768
PC-2 -0.216231  -0.233344   0.048704  -0.254233  0.046821

      monsterkillsownjungle  monsterkillsenemyjungle      cspm  goldat10  \
PC-1              -0.054776                -0.170127 -0.111433 -0.146216
PC-2              -0.287850                -0.016775 -0.083955  0.092978

      oppgoldat10    gdat10  goldat15  oppgoldat15    gdat15    xpat10  \
PC-1     0.145150 -0.185977 -0.173139     0.177246 -0.215511 -0.118877
PC-2    -0.013079  0.067696  0.125517     0.018078  0.066082 -0.058053

      oppxpat10   xpdat10    csat10  oppcsat10   csdat10    csat15  oppcsat15  \
PC-1   0.107176 -0.175705 -0.093568   0.073709 -0.144339 -0.105367   0.079592
PC-2  -0.136850  0.061247 -0.124232  -0.185095  0.052517 -0.140902  -0.197828

      csdat15
PC-1 -0.16317
PC-2  0.05022
```

PCA analysis of victory/defeat (3 components)

[9]:
```python
X = data.iloc[:,data.columns != 'result']
Y = data.iloc[:,data.columns == 'result']
#transform input data (normalize)
ssc = SSc()
Xft = ssc.fit_transform(X)
```

```
X = pd.DataFrame(Xft)

pca = PCA(n_components=3)
components = pca.fit_transform(X)
componentDf = pd.DataFrame(data=components, columns=['principal component 1',␣
 ↪'principal component 2', 'principal component 3'])

pltDF = pd.concat([componentDf, Y], axis = 1)
print("PCA explained variance ratio:  {}".format(pca.explained_variance_ratio_))
print("Portion of variance explained: {}".format(pca.explained_variance_ratio_/
 ↪sum(pca.explained_variance_ratio_)))


#plot
fig = plt.figure(figsize = (8,8))
ax = fig.add_subplot(1,1,1,projection='3d')
ax.set_xlabel('Principal Component 1', fontsize = 15)
ax.set_ylabel('Principal Component 2', fontsize = 15)
ax.set_zlabel('Principal Component 3', fontsize = 15)
ax.set_title('3 Component PCA Victory/Defeat', fontsize = 20)


results = [0.0, 1.0]
colors = ['r', 'b']
for result, color in zip(results,colors):
    indicesToKeep = (pltDF['result'] == result)
    ax.scatter(pltDF.loc[indicesToKeep, 'principal component 1']
               , pltDF.loc[indicesToKeep, 'principal component 2']
               , pltDF.loc[indicesToKeep, 'principal component 3']
               , c = color
               , s = 50)
ax.legend(['Loss','Victory'])
ax.grid()
```

```
PCA explained variance ratio:  [0.25647711 0.12592736 0.08840393]
Portion of variance explained: [0.54475899 0.26747051 0.1877705 ]
```



PCA analysis of victory/defeat (6 components)

[10]:
```
X = data.iloc[:,data.columns != 'result']
Y = data.iloc[:,data.columns == 'result']
#transform input data (normalize)
ssc = SSc()
Xft = ssc.fit_transform(X)
X = pd.DataFrame(Xft)

pca = PCA(n_components=6)
components = pca.fit_transform(X)
componentDf = pd.DataFrame(data=components, columns=['component 1', 'component␣
 ↪2', 'component 3',
                                                'component 4', 'component␣
 ↪5', 'component 6'])

pltDF = pd.concat([componentDf, Y], axis = 1)
print("PCA explained variance ratio:  {}".format(pca.explained_variance_ratio_))
print("Portion of variance explained: {}".format(pca.explained_variance_ratio_/
 ↪sum(pca.explained_variance_ratio_)))

colors = ['r', 'b']
pd.plotting.scatter_matrix(pltDF,figsize=(12,12),c=pltDF.result.apply(lambda x:
 ↪colors[int(x)]))
print("\n\n\t6-component PCA")
plt.legend(['Loss','Victory'])
plt.show()
```

```
PCA explained variance ratio:  [0.25647711 0.12592736 0.08840393 0.05106679
0.03655437 0.03350323]
Portion of variance explained: [0.43328755 0.21273929 0.14934791 0.08627126
0.06175427 0.05659972]
```

```
C:\Users\Triplea657\anaconda3\lib\site-
packages\pandas\plotting\_matplotlib\tools.py:298: MatplotlibDeprecationWarning:
The rowNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().rowspan.start instead.
  layout[ax.rowNum, ax.colNum] = ax.get_visible()
C:\Users\Triplea657\anaconda3\lib\site-
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packages\pandas\plotting\_matplotlib\tools.py:304: MatplotlibDeprecationWarning:
The rowNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().rowspan.start instead.
  if not layout[ax.rowNum + 1, ax.colNum]:
C:\Users\Triplea657\anaconda3\lib\site-
packages\pandas\plotting\_matplotlib\tools.py:304: MatplotlibDeprecationWarning:
The colNum attribute was deprecated in Matplotlib 3.2 and will be removed two
minor releases later. Use ax.get_subplotspec().colspan.start instead.
  if not layout[ax.rowNum + 1, ax.colNum]:
```
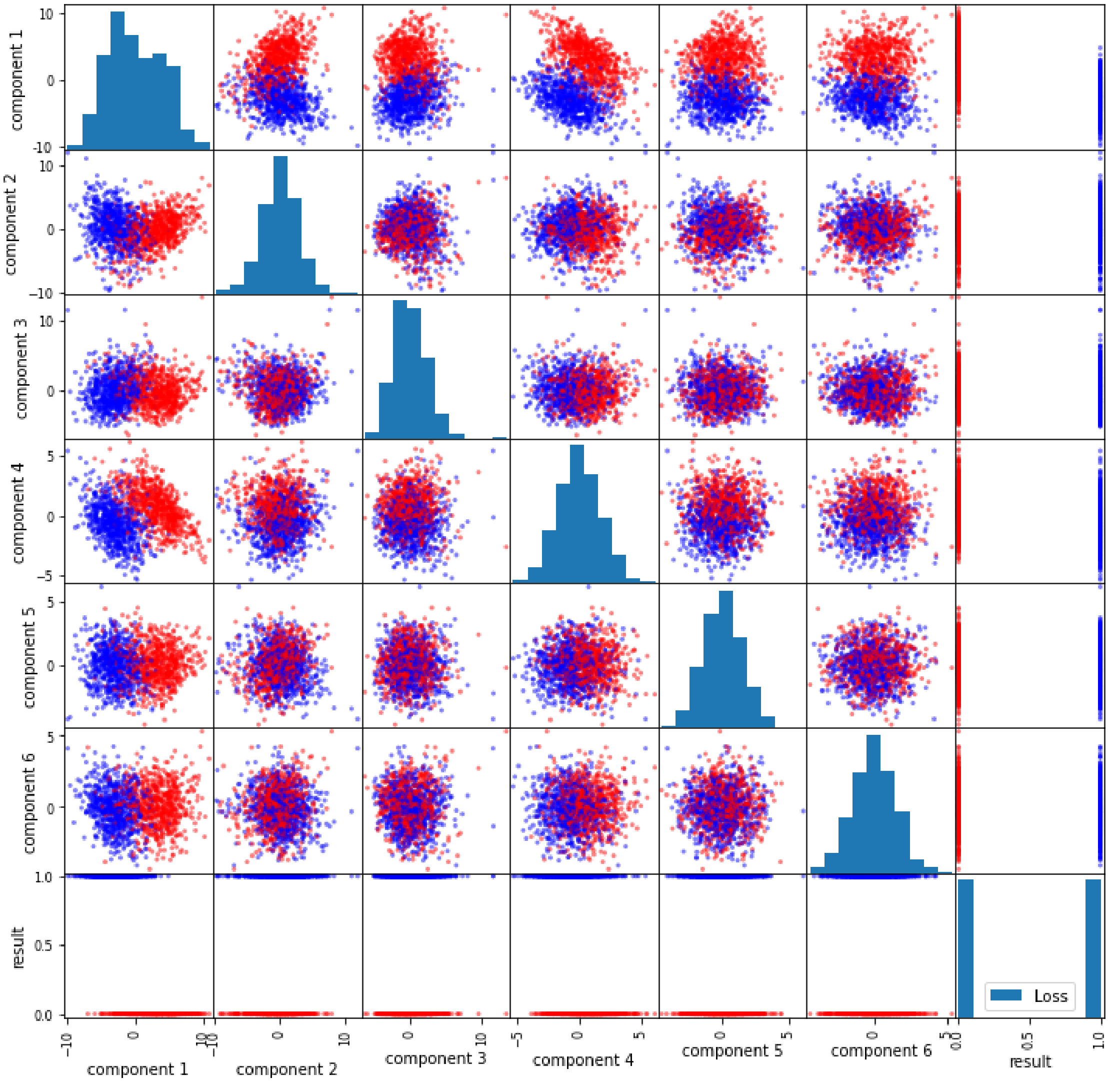

```


        6-component PCA
```



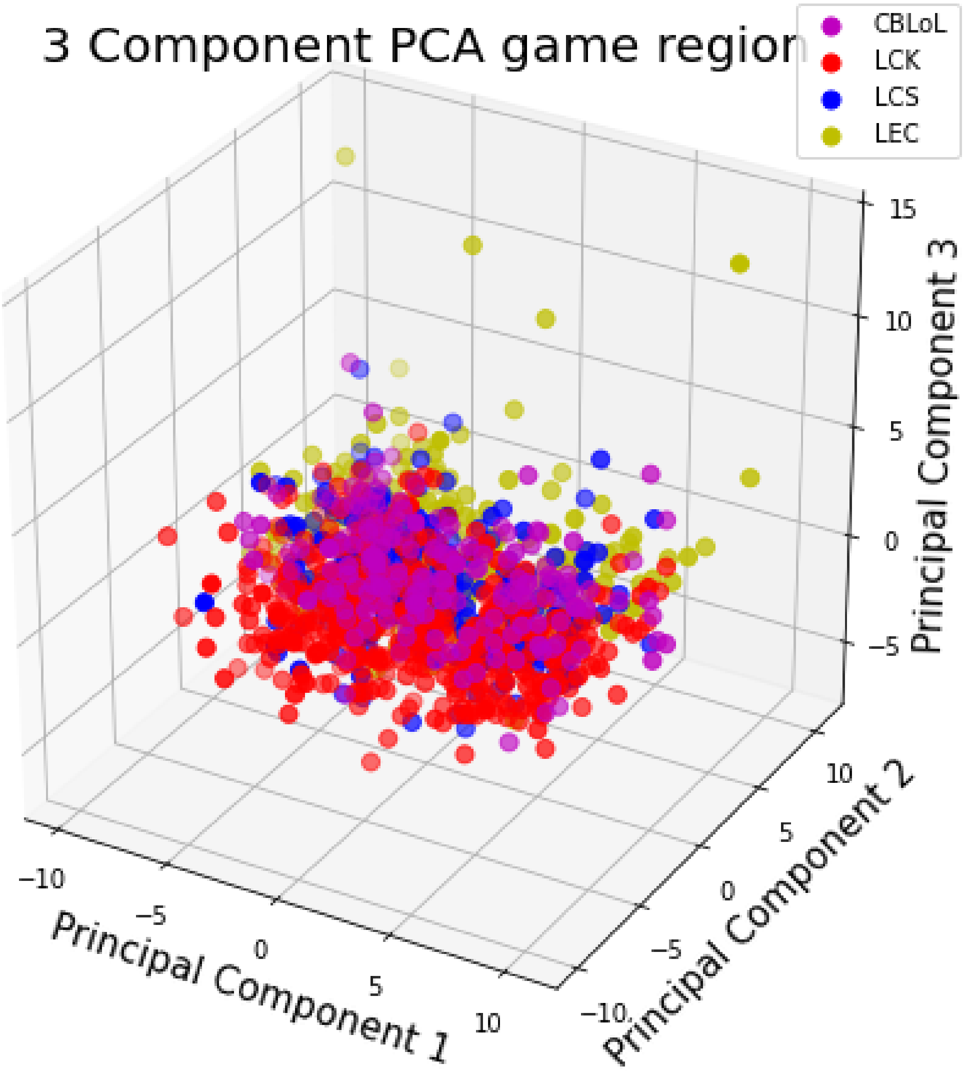
PCA analysis of region played

[11]:

```
#filein = inpath+year+"\\"+year+'-'+split+"-"+"WrangledNotHot.csv"
#changed for submission version
filein = "Datasets/League_2019/2019-summer-WrangledNotHot.csv"
data2 = pd.read_csv(filein,low_memory=False,index_col=0)

X = data2.iloc[:,1:]
Y = data2.iloc[:,:1]
#transform input data (normalize)
ssc = SSc()
Xft = ssc.fit_transform(X)
X = pd.DataFrame(Xft)
```

```
pca = PCA(n_components=3)
components = pca.fit_transform(X)
componentDf = pd.DataFrame(data=components, columns=['principal component 1', 'principal component 2', 'principal component 3'])

pltDF = pd.concat([componentDf, Y], axis = 1)
print("PCA of regions")
print("PCA explained variance ratio:  {}".format(pca.explained_variance_ratio_))
print("Portion of variance explained: {}".format(pca.explained_variance_ratio_/sum(pca.explained_variance_ratio_)))


#plot
fig = plt.figure(figsize = (8,8))
ax = fig.add_subplot(1,1,1,projection='3d')
ax.set_xlabel('Principal Component 1', fontsize = 15)
ax.set_ylabel('Principal Component 2', fontsize = 15)
ax.set_zlabel('Principal Component 3', fontsize = 15)
ax.set_title('3 Component PCA game region', fontsize = 20)


regions = ['CBLoL', 'LCK', 'LCS', 'LEC']
colors = ['m', 'r', 'b', 'y']
for region, color in zip(regions,colors):
    indicesToKeep = (pltDF['league'] == region)
    ax.scatter(pltDF.loc[indicesToKeep, 'principal component 1']
               , pltDF.loc[indicesToKeep, 'principal component 2']
               , pltDF.loc[indicesToKeep, 'principal component 3']
               , c = color
               , s = 50)
ax.legend(regions)
ax.grid()
```

```
PCA of regions
PCA explained variance ratio:  [0.28470343 0.13203852 0.09198295]
Portion of variance explained: [0.55964123 0.25954798 0.18081079]
```


3 Component PCA game region
CBLoL
LCK
LCS
LEC
Principal Component 1
Principal Component 2
Principal Component 3
−10
−5
0
5
10
−10
−5
0
5
10
−5
0
5
10
15