Indian_Agriculture_Analysis

December 11, 2019

[ ]:
```
from __future__ import division, print_function, unicode_literals
from numpy import *
import numpy as np
import matplotlib.pyplot as mplot
import matplotlib.pylab as plt
import matplotlib.cm as cm
import matplotlib as mpl
import pandas as pd
import seaborn as sns #Need to install
import scipy.stats as stats
import pylab
import warnings
warnings.filterwarnings('ignore')
from itertools import cycle
from sklearn.cluster import KMeans as km
from sklearn.linear_model import LinearRegression as LR
from sklearn.linear_model import Lasso as LS
from sklearn.linear_model import Ridge as RG
from sklearn.tree import DecisionTreeRegressor as scart
from sklearn.manifold import TSNE
%matplotlib inline
```

Loading CSV to dataframes Production of crop

[2]:
```
crop_prod=pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/sum_prod.
 ↪csv',delimiter=',')
crop_prod=crop_prod.fillna(0)
# print(crop_prod.dtypes)
```

[4]:
```
crop_prod.sort_values(by=crop_prod.columns[0])
STATENAM = sorted(set(crop_prod.iloc[:,0].values))
crop_prod.head()
```

[4]:

	STATENAM	YEAR	sum(QWHEAT)	sum(QRICE)	sum(QMAIZE)	sum(QJOWAR)	\
0	BIHAR	1956	184.533000	3795.153000	378.284	0.000	
1	HARYANA	1956	641.940000	82.846000	103.637	38.711	
2	WEST_BENGAL	1956	27.198262	4801.670153	40.515	0.000	
3	MADHYA_PRADESH	1956	1730.200000	3316.400000	188.900	1099.600	
4	KARNATAKA	1956	65.400000	1068.700000	8.400	851.000	

```
   sum(QBAJRA)  sum(QSUGAR)  sum(QPOTATO)  sum(QGNUT)  ...   sum(QGRAM)  \
0        0.000   372.916000        291.570       0.000  ...   145.682000
1      179.028   253.698000         35.561       5.962  ...  1108.206000
2        0.000   117.712172        313.612       0.000  ...   120.312223
3       91.100   169.800000        337.668     201.100  ...  1007.100000
4      112.600   344.550000          0.000     657.050  ...    40.970000

   sum(QTUR)  sum(QRAGI)  sum(QSESAMUM)  sum(QRMSEED)  sum(QCOTTON)  \
0     48.938      74.265          6.748     12.182000       0.00000
1     27.958       0.000          0.784     56.899000      30.44538
2      0.000       0.000          0.000     25.046186       0.00000
3    417.363       0.000         67.400      0.000000     101.22000
4    181.318       0.000          0.000      0.000000      71.14000

   sum(QOPULS)  sum(QSOY)  sum(QSUNFLWR)  sum(QJUTE)
0        0.000        0.0            0.0   225.40752
1       37.391        0.0            0.0     0.00000
2        0.000        0.0            0.0   243.97758
3      436.530        0.0            0.0     0.00000
4       79.560        0.0            0.0     0.00000

[5 rows x 22 columns]
```

[6]:
```
crop_price=pd.read_csv("/Users/pranitaeugena/Desktop/agri_data/price_avg.
 ↪csv",delimiter=',')
for i in range(1,crop_price.shape[1]):
    crop_price.iloc[:,i]=pd.to_numeric(crop_price.iloc[:,i],errors='coerce')
    crop_price.iloc[:,i]=crop_price.iloc[:,i].fillna(0)
crop_price.head()
```

[6]:
```
         STATENAM  YEAR  avg(PJOWAR)  avg(PMAIZE)  avg(PWHEAT)  avg(PSUGAR)  \
0           BIHAR  1956     0.000000    29.885588    49.465294    41.099412
1         HARYANA  1956    27.611667    30.828667    39.260000    29.198577
2    WEST_BENGAL  1956     0.000000    27.967157    40.333238    41.578080
3  MADHYA_PRADESH  1956    35.146512    24.500000    43.913953    36.691395
4       KARNATAKA  1956    31.831579    27.757895    51.610526    32.278947

   avg(PPOTATO)  avg(PGNUT)  avg(PRICE)  avg(PBAJRA)  ...  avg(PTOBAC)  \
0     28.259765   36.620000   48.061176     0.000000  ...   196.132588
1     28.707825   40.249539   31.051667    34.910000  ...   134.408667
2     24.780750    0.000000   51.761852     0.000000  ...   164.131440
3     28.560710   34.370930   42.751163    40.348837  ...   301.959302
4     38.688244   40.758421   67.215789    29.078947  ...   217.828421

   avg(PBARLEY)  avg(PGRAM)  avg(PSESAMUM)  avg(PRMSEED)  avg(PCOTTON)  \
0     34.117471   40.171471      70.066706     73.758824      0.000000
1     30.355833   31.949833      80.240000     72.116333     70.634165
```

```
2     30.733488   30.810286       0.000000     71.472148      0.000000
3     33.222590   33.322326      67.640465     60.122173     57.483488
4     48.226340   43.191579      49.941055     62.801414     82.564737

   avg(POPULS)  avg(PSOY)  avg(PSUNFLWR)  avg(PJUTE)
0    34.860412        0.0            0.0   40.333529
1    31.949833        0.0            0.0    0.000000
2     0.000000        0.0            0.0   66.223333
3    37.528128        0.0            0.0    0.000000
4    37.220526        0.0            0.0    0.000000

[5 rows x 22 columns]
```

Area of cultivation

[7]:
```
area_cult=pd.read_csv("/Users/pranitaeugena/Desktop/agri_data/sum_area.
 ↪csv",delimiter=',')
# print(sum(area_cult.isna()))
area_cult.head()
```

[7]:
```
         STATENAM  YEAR  sum(AWHEAT)  sum(ARICE)  sum(AMAIZE)  sum(AJOWAR)  \
0           BIHAR  1956   761.655000  4982.91100      612.143         0.00
1         HARYANA  1956   540.789000    98.26900       81.466       238.47
2     WEST_BENGAL  1956    84.763967  4445.18468       56.100         0.00
3  MADHYA_PRADESH  1956  3240.300000  3889.40000      430.100      1644.70
4       KARNATAKA  1956   309.800000   942.60000       10.000      2597.40

   sum(ABAJRA)  sum(ASUGAR)  sum(APOTATO)  sum(AGNUT)  ...   sum(AGRAM)  \
0        0.000   162.511000     49.842000       0.000  ...   496.049000
1      791.602    90.217000      2.294000       9.018  ...  1346.922000
2        0.000    24.170931     47.924049       0.000  ...   194.129557
3      172.000    52.910000     28.759000     346.080  ...  1543.300000
4      534.500    54.420000      0.000000     938.500  ...   159.150000

   sum(ATUR)  sum(ARAGI)  sum(ASESAMUM)  sum(ARMSEED)  sum(ACOTTON)  \
0    128.039     143.704         25.902     57.170000         0.000
1     27.914       0.000          3.172    161.470000       117.813
2      0.000       0.000          0.000     72.692308         0.000
3    486.501       0.000        321.030      0.000000       767.410
4    401.276       0.000          0.000      0.000000      1183.150

   sum(AOPULS)  sum(ASOY)  sum(ASUNFLWR)  sum(AJUTE)
0        0.000        0.0            0.0     249.785
1      147.602        0.0            0.0       0.000
2        0.000        0.0            0.0     271.827
3     1026.790        0.0            0.0       0.000
4      291.170        0.0            0.0       0.000

[5 rows x 22 columns]
```

Price of the crop

[50]:
```
crop_price.head()
```

[50]:
```
         STATENAM  YEAR  avg(PJOWAR)  avg(PMAIZE)  avg(PWHEAT)  avg(PSUGAR)  \
0           BIHAR  1956     0.000000    29.885588    49.465294    41.099412
1         HARYANA  1956    27.611667    30.828667    39.260000    29.198577
2    WEST_BENGAL  1956     0.000000    27.967157    40.333238    41.578080
3  MADHYA_PRADESH  1956    35.146512    24.500000    43.913953    36.691395
4       KARNATAKA  1956    31.831579    27.757895    51.610526    32.278947

   avg(PPOTATO)  avg(PGNUT)  avg(PRICE)  avg(PBAJRA)  ...  avg(PTOBAC)  \
0     28.259765   36.620000   48.061176     0.000000  ...   196.132588
1     28.707825   40.249539   31.051667    34.910000  ...   134.408667
2     24.780750    0.000000   51.761852     0.000000  ...   164.131440
3     28.560710   34.370930   42.751163    40.348837  ...   301.959302
4     38.688244   40.758421   67.215789    29.078947  ...   217.828421

   avg(PBARLEY)  avg(PGRAM)  avg(PSESAMUM)  avg(PRMSEED)  avg(PCOTTON)  \
0     34.117471   40.171471      70.066706     73.758824      0.000000
1     30.355833   31.949833      80.240000     72.116333     70.634165
2     30.733488   30.810286       0.000000     71.472148      0.000000
3     33.222590   33.322326      67.640465     60.122173     57.483488
4     48.226340   43.191579      49.941055     62.801414     82.564737

   avg(POPULS)  avg(PSOY)  avg(PSUNFLWR)  avg(PJUTE)
0    34.860412        0.0            0.0   40.333529
1    31.949833        0.0            0.0    0.000000
2     0.000000        0.0            0.0   66.223333
3    37.528128        0.0            0.0    0.000000
4    37.220526        0.0            0.0    0.000000

[5 rows x 22 columns]
```

Average Price of the crop Yearwise

[78]:
```
crop_price_year=pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/price_year.
 ↪csv',delimiter=',')
crop_price_year=crop_price_year.fillna(0)
```

[79]:
```
crop_price_year.head()
```

[79]:
```
   YEAR      WHEAT       RICE      MAIZE      JOWAR      BAJRA      SUGAR  \
0  1956  43.187258  41.190087  28.484940  26.356545  27.769277  37.426100
1  1957  42.979839  43.562016  30.040616  24.083642  26.280011  39.113553
2  1958  48.813222  43.926039  32.844178  26.744115  29.063172  47.341284
3  1959  46.862000  44.066294  30.495578  27.666089  28.522844  49.530732
4  1960  45.090633  43.425872  31.000470  27.557708  29.708605  43.186069

      POTATO       GNUT     BARLEY  ...       GRAM        TUR       RAGI  \
0  28.402587  39.285801  29.471242  ...  35.462950  32.734899  29.450375
```

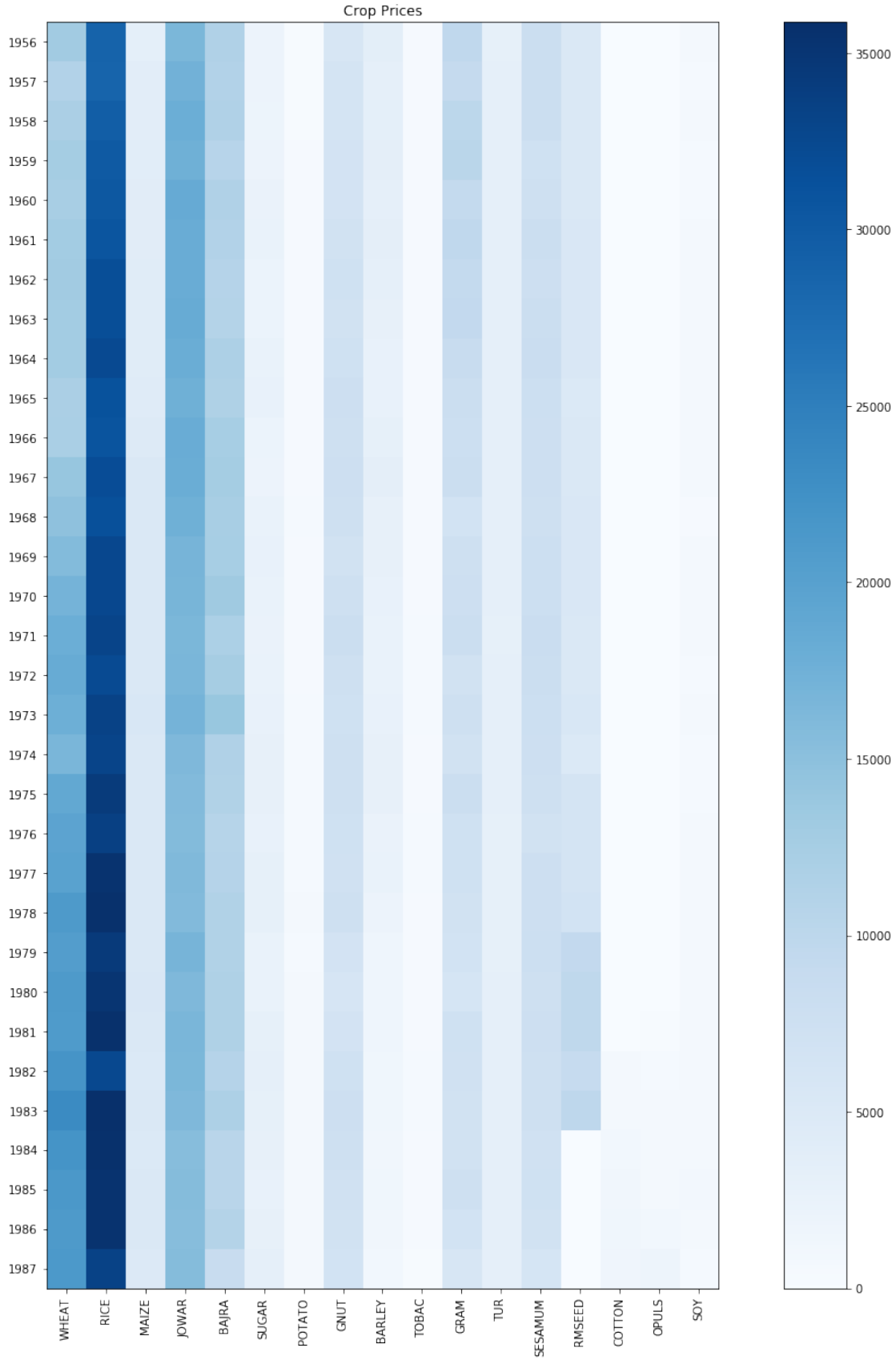
```
1  28.623609  41.796386  26.906162  ...  34.193125  31.540664  28.856264
2  28.608965  43.134198  32.809844  ...  43.004186  39.672414  31.825891
3  29.562451  46.290822  27.782508  ...  38.707483  36.135408  30.530407
4  28.711125  50.377390  27.367883  ...  39.547193  36.645273  31.438156

     SESAMUM     RMSEED     COTTON      OPULS  SOY  SUNFLWR       JUTE
0  67.710816  64.721887  63.907390  31.900534  0.0      0.0  17.741169
1  70.519070  64.756141  70.327843  35.020101  0.0      0.0  17.149851
2  71.077195  65.799562  74.871588  41.072037  0.0      0.0  16.706689
3  69.959613  66.181269  74.052776  39.225863  0.0      0.0  15.250956
4  83.893891  76.462328  89.697121  39.581415  0.0      0.0  31.098163

[5 rows x 21 columns]
```

Visualization of the Crop Price data

[80]:
```
mat1 = np.matrix(crop_price_year.values[:,1:],dtype='float')
# print(mat2.shape)
mat2=np.delete(mat2,12,1)
# print(mat2.shape)
fig = plt.figure(num=1,figsize=(20,20))
ax = fig.add_subplot(1,1,1)
# ax.set_aspect('equal')
ax.set_xticks(np.arange(len(np.delete(crop_price_year.columns[1:],12))))
ax.set_yticks(np.arange(len(crop_price_year.iloc[:,0])))
ax.set_xticklabels(np.delete(crop_price_year.columns[1:
 ↪],12),rotation='vertical')
ax.set_yticklabels(area_cult_year.iloc[:,0])
plt.imshow(mat2, cmap='Blues')
plt.colorbar()
plt.title('Crop Prices')
plt.show()
```


Crop Prices
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
WHEAT
RICE
MAIZE
JOWAR
BAJRA
SUGAR
POTATO
GNUT
BARLEY
TOBAC
GRAM
TUR
SESAMUM
RMSEED
COTTON
OPULS
SOY
35000
30000
25000
20000
15000
10000
5000
0

Area under Cultivation Yearly

[81]:
```
area_cult_year=pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/area_year.
 ↪csv',delimiter=',')
area_cult_year=area_cult_year.fillna(0)
```

[82]:
```
area_cult_year.head()
```

[82]:
```
   YEAR        WHEAT         RICE     MAIZE      JOWAR      BAJRA  \
0  1956  12951.36897  28783.21868  3352.050  16496.839  11386.333
1  1957  11124.86045  28693.36952  3679.540  17247.415  11107.748
2  1958  11964.39013  29432.29205  3782.756  17895.009  11357.569
3  1959  12724.82640  30077.45306  3881.671  17645.206  10645.070
4  1960  12259.01078  30315.49543  3925.277  18411.868  11482.312

         SUGAR      POTATO      GNUT       BARLEY  ...          GRAM  \
0  2021.141931  231.402049  5674.862  3520.938514  ...   9655.280557
1  2021.018879  258.429187  6414.056  3169.552666  ...   9100.404669
2  1907.863530  271.796749  6240.430  3343.798489  ...  10071.397620
3  2078.814530  290.731068  6449.811  3393.273385  ...  10336.769820
4  2353.335932  291.139436  6449.220  3220.483023  ...   9229.449101

        TUR     RAGI   SESAMUM      RMSEED    COTTON     OPULS  SOY  SUNFLWR  \
0  3064.431  210.719  1643.351  880.358308  7944.251  5086.020  0.0      0.0
1  3100.436  234.834  1587.144  994.199430  7932.753  5169.518  0.0      0.0
2  3143.685  263.433  1731.856  966.217271  7866.980  5185.647  0.0      0.0
3  3140.471  269.401  1657.272  845.306753  7220.447  5203.516  0.0      0.0
4  3122.379  277.621  1455.727  840.690470  7536.802  5155.862  0.0      0.0

      JUTE
0  580.983
1  547.372
2  561.731
3  497.293
4  489.865

[5 rows x 21 columns]
```

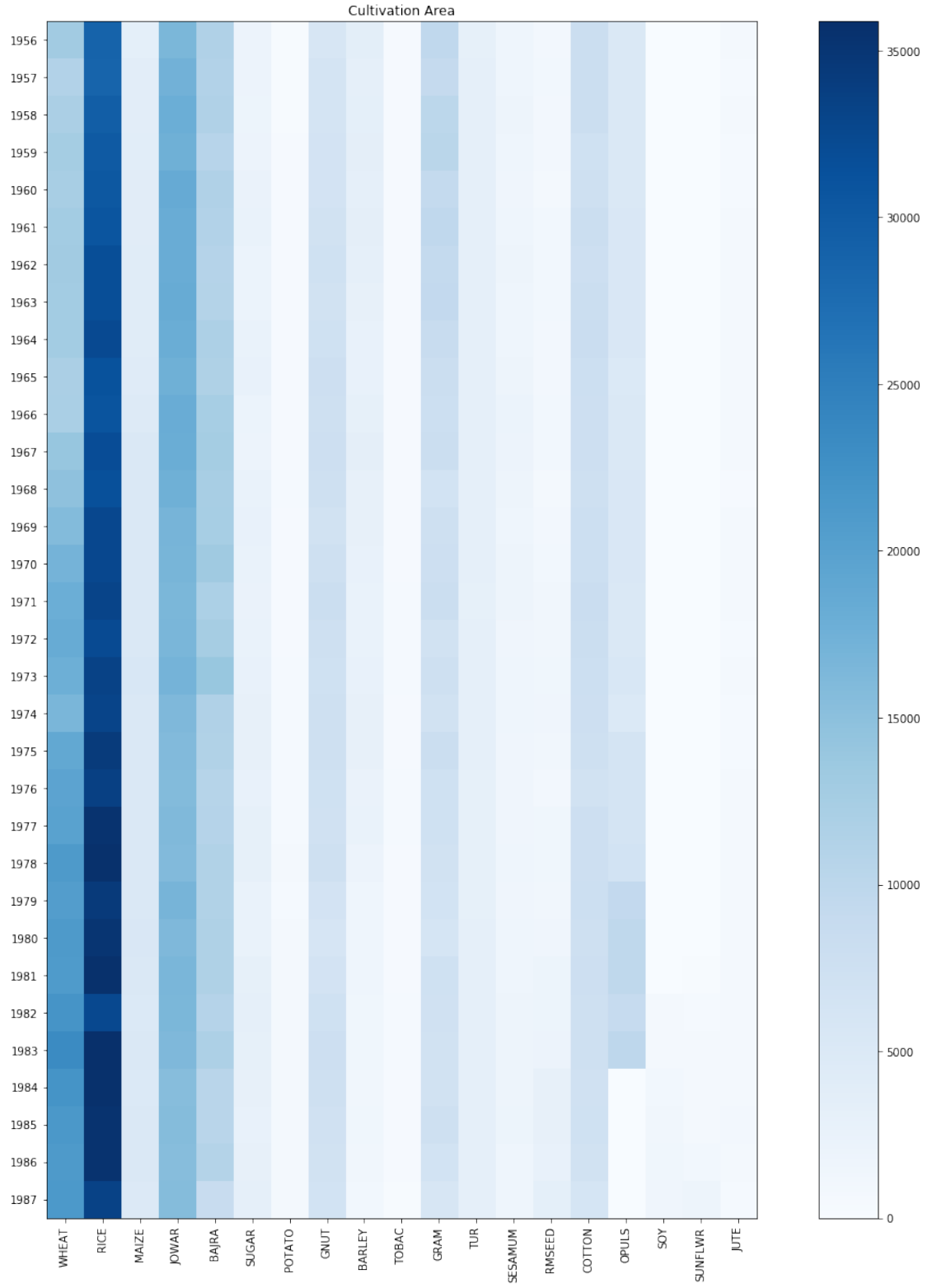
[ ]:
```

```

Visualization of the Area under cultivation data

[83]:
```
mat2 = np.matrix(area_cult_year.values[:,1:],dtype='float')
# print(mat2.shape)
mat2=np.delete(mat2,12,1)
# print(mat2.shape)
fig = plt.figure(num=2,figsize=(20,20))
ax = fig.add_subplot(1,1,1)
# ax.set_aspect('equal')
```

```
ax.set_xticks(np.arange(len(np.delete(area_cult_year.columns[1:],12))))
ax.set_yticks(np.arange(len(area_cult_year.iloc[:,0])))
ax.set_xticklabels(np.delete(area_cult_year.columns[1:],12),rotation='vertical')
ax.set_yticklabels(area_cult_year.iloc[:,0])
plt.imshow(mat2, cmap='Blues')
plt.colorbar()
plt.title('Cultivation Area')
plt.show()
```



Production of the crop

[85]:
```
crop_prod_year=pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/prod_year.
 ↪csv',delimiter=',')
crop_prod_year=crop_prod_year.fillna(0)
```

[86]:
```
crop_prod_year.head()
```

[86]:

	YEAR	WHEAT	RICE	MAIZE	JOWAR	BAJRA	\
0	1956	8994.794262	25509.26915	2710.378	7631.323	2886.312	
1	1957	7343.911870	21604.97523	2802.579	8597.357	3616.600	
2	1958	9413.368621	27008.66144	2992.087	8984.954	3838.561	
3	1959	9789.582790	27687.38011	3602.979	8516.071	3465.496	
4	1960	10528.610090	30394.82344	3594.961	9834.699	3254.185	

	SUGAR	POTATO	GNUT	BARLEY	...	GRAM	\
0	7013.055172	1672.284000	4566.565	2973.464745	...	6212.494223	
1	6901.704800	1875.045115	4673.989	2456.824085	...	4913.056160	
2	7096.408200	2150.681824	5144.230	2780.001367	...	7018.333270	
3	7670.902600	2516.961578	4529.749	2799.343293	...	5621.398290	
4	10798.259200	2462.428590	4727.999	2905.219627	...	6284.399685	

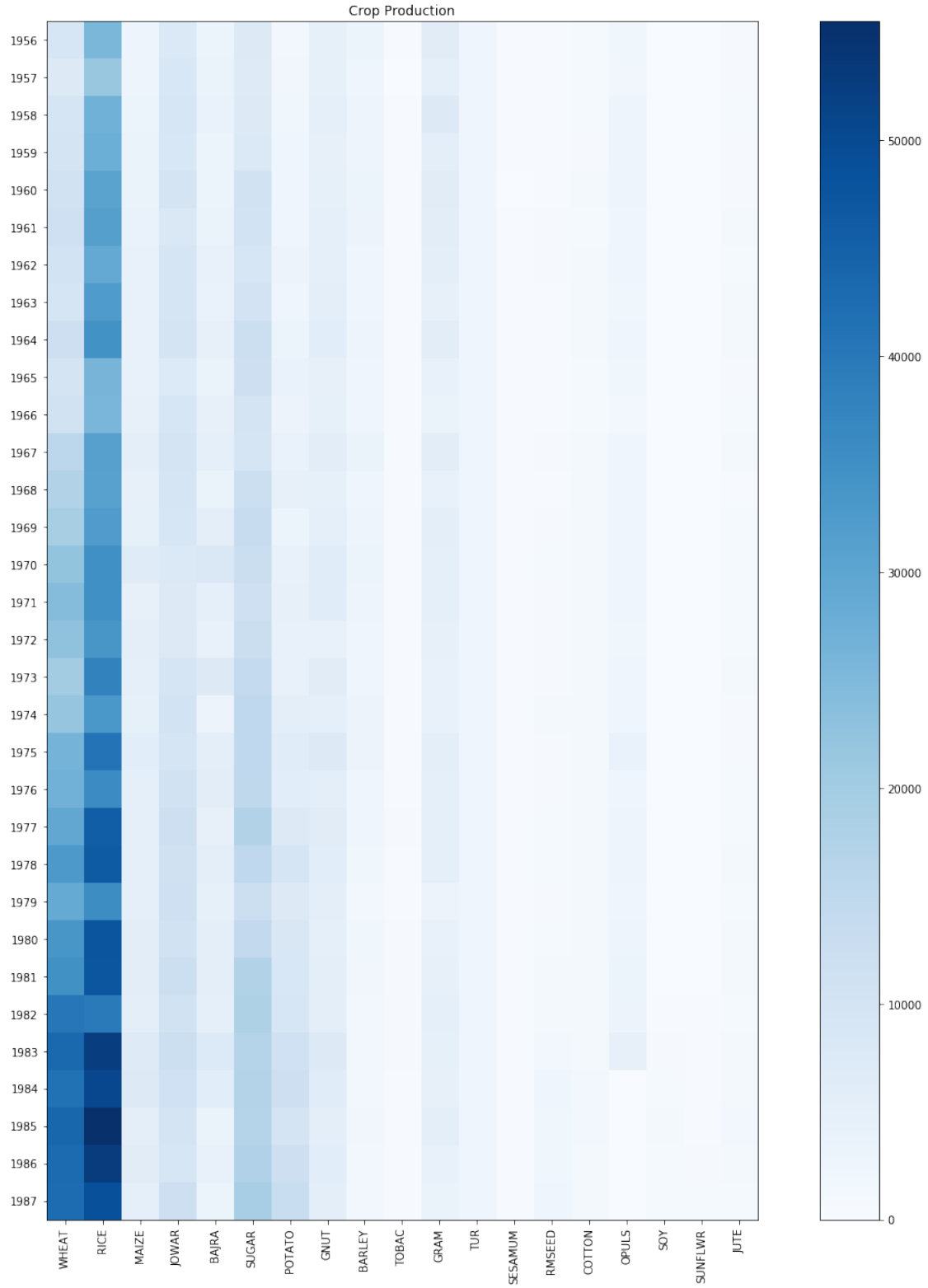
	TUR	RAGI	SESAMUM	RMSEED	COTTON	OPULS	SOY	SUNFLWR	\
0	2277.251	101.561	335.712	355.080186	816.32676	1990.496	0.0	0.0	
1	2310.780	103.601	263.962	368.882894	818.12932	1925.913	0.0	0.0	
2	2357.383	127.347	387.458	380.403559	822.39198	2739.836	0.0	0.0	
3	2337.247	153.424	271.376	291.225574	611.17560	2661.684	0.0	0.0	
4	2336.095	133.415	186.139	364.405310	926.04960	2673.806	0.0	0.0	

	JUTE
0	530.96454
1	504.95670
2	700.33716
3	556.20468
4	565.71696

[5 rows x 21 columns]

[87]:
```
mat3 = np.matrix(crop_prod_year.values[:,1:],dtype='float')
# print(mat3.shape)
mat3=np.delete(mat3,12,1)
# print(mat3.shape)
fig = plt.figure(num=3,figsize=(20,20))
ax = fig.add_subplot(1,1,1)
# ax.set_aspect('equal')
ax.set_xticks(np.arange(len(np.delete(crop_prod_year.columns[1:],12))))
ax.set_yticks(np.arange(len(crop_prod_year.iloc[:,0])))
ax.set_xticklabels(np.delete(crop_prod_year.columns[1:],12),rotation='vertical')
ax.set_yticklabels(crop_prod_year.iloc[:,0])
plt.imshow(mat3, cmap='Blues')
```

```
plt.colorbar()
plt.title('Crop Production')
plt.show()
```



[88]:
```
crop_yield_year=pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/yield_year.
 ↪csv',delimiter=',')
crop_yield_year=crop_yield_year.fillna(0)
crop_yield_year.head()
```

[88]:

	YEAR	WHEAT	RICE	MAIZE	JOWAR	BAJRA	\
0	1956	142.139663	218.379154	154.830737	96.688463	74.567994	
1	1957	139.862257	194.720165	142.682246	113.721145	82.210835	
2	1958	165.875684	230.494105	167.739962	123.213744	88.798229	
3	1959	162.037833	229.635559	168.982956	117.295837	85.409247	
4	1960	177.034342	232.637265	176.061540	117.248091	86.372075	

	SUGAR	POTATO	GNUT	BARLEY	...	GRAM	\
0	932.039639	1277.152929	218.874660	141.521991	...	129.680089	
1	946.250554	1246.345073	217.885092	139.974844	...	110.575844	
2	976.526417	1320.211813	242.891415	149.543476	...	137.875324	
3	979.687464	1325.044479	250.922041	142.864689	...	122.222772	
4	1089.761573	1342.382784	189.897089	154.604827	...	134.372115	

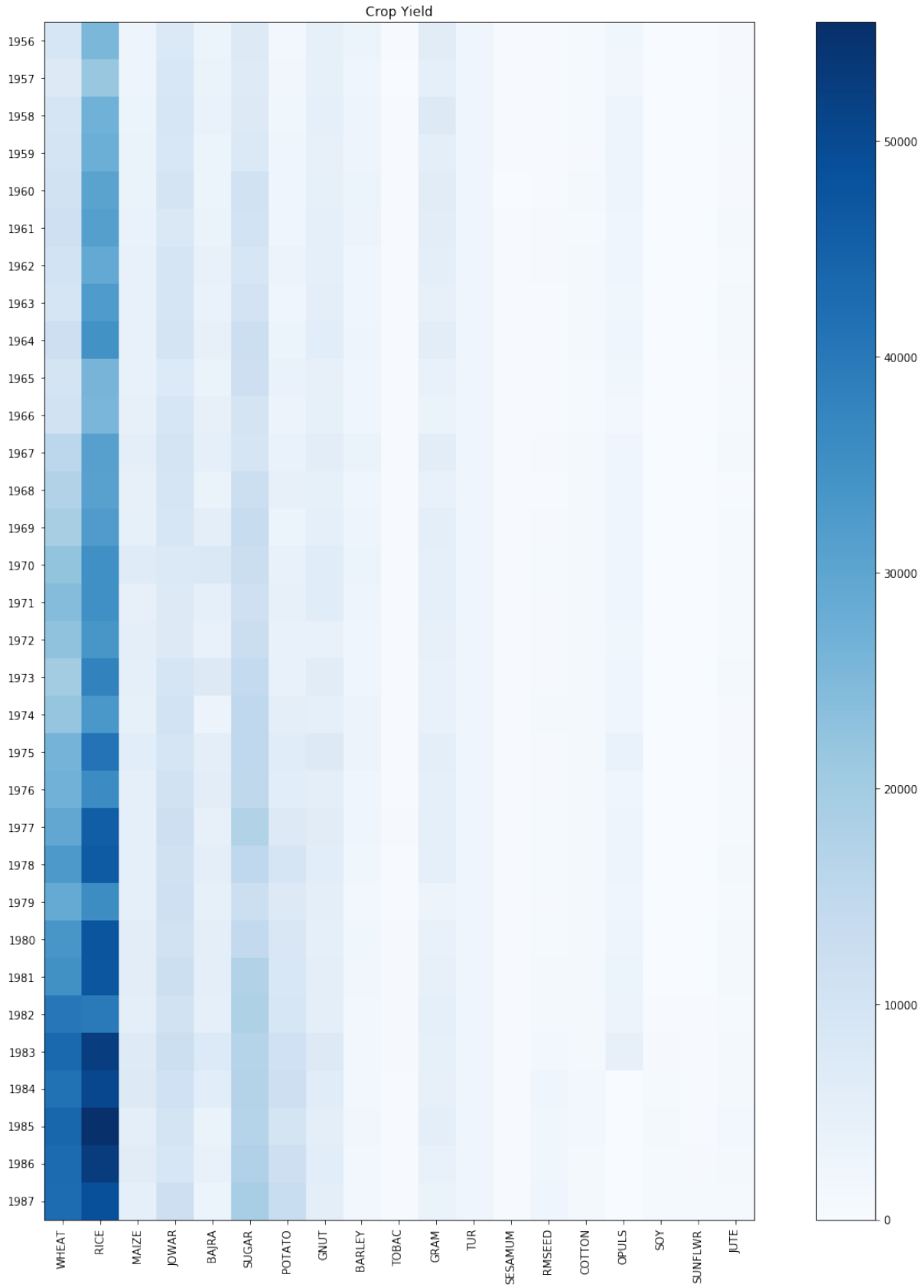
	TUR	RAGI	SESAMUM	RMSEED	COTTON	OPULS	SOY	\
0	184.054121	13.587052	53.543472	55.100672	19.275587	85.766453	0.0	
1	184.840416	11.859708	50.255022	55.880623	18.768086	80.682155	0.0	
2	185.804497	13.132560	59.552844	67.812583	18.392946	110.787131	0.0	
3	183.805294	14.488696	48.317224	46.815507	17.765593	106.054610	0.0	
4	185.009440	12.806572	43.608872	51.638454	23.710441	108.738404	0.0	

	SUNFLWR	JUTE
0	0.0	83.337570
1	0.0	73.241272
2	0.0	83.143390
3	0.0	82.817122
4	0.0	82.321341

[5 rows x 21 columns]

[89]:
```
mat4 = np.matrix(crop_prod_year.values[:,1:],dtype='float')
# print(mat3.shape)
mat4=np.delete(mat4,12,1)
# print(mat3.shape)
fig = plt.figure(num=4,figsize=(20,20))
ax = fig.add_subplot(1,1,1)
# ax.set_aspect('equal')
ax.set_xticks(np.arange(len(np.delete(crop_yield_year.columns[1:],12))))
ax.set_yticks(np.arange(len(crop_yield_year.iloc[:,0])))
ax.set_xticklabels(np.delete(crop_yield_year.columns[1:
 ↪],12),rotation='vertical')
```

```
ax.set_yticklabels(crop_yield_year.iloc[:,0])
plt.imshow(mat3, cmap='Blues')
plt.colorbar()
plt.title('Crop Yield')
plt.show()
```



Annual Rainfall

[65]:
```
rainfall =  pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/
 ↪rainfall_no_missing.csv',delimiter=',')
rainfall.head()
```

[65]:

	State	YEAR	RNJAN	RNFEB	RNMAR	RNAPR	RNMAY	RNJUN	RNJUL	\
0	PUNJAB	1956	21.60	6.80	45.30	5.10	0.70	53.5	236.50	
1	BIHAR	1956	19.20	4.60	9.60	5.30	74.90	319.0	2.70	
2	HARYANA	1956	16.80	3.00	24.80	0.80	2.20	5.7	23.30	
3	MADHYA_PRADESH	1956	8.00	3.15	5.05	1.05	37.50	150.0	468.35	
4	WEST_BENGAL	1956	9.65	17.65	24.15	95.25	92.25	545.6	362.65	

	RNAUG	RNSEP	RNOCT	RNNOV	RNDEC	Annual
0	28.70	26.70	14.10	0.20	5.30	444.50
1	286.40	36.00	169.00	35.90	8.20	970.80
2	161.60	21.50	132.40	4.80	0.60	397.50
3	325.35	156.35	84.55	33.25	13.75	1286.35
4	391.10	338.15	186.70	7.90	3.75	2074.80

[66]:
```
rainfall1=rainfall.copy()
rainfall1 = rainfall1.groupby(['State','YEAR'],as_index=True).mean()
```

[71]:
```
rainfall1.head()
```

[71]:

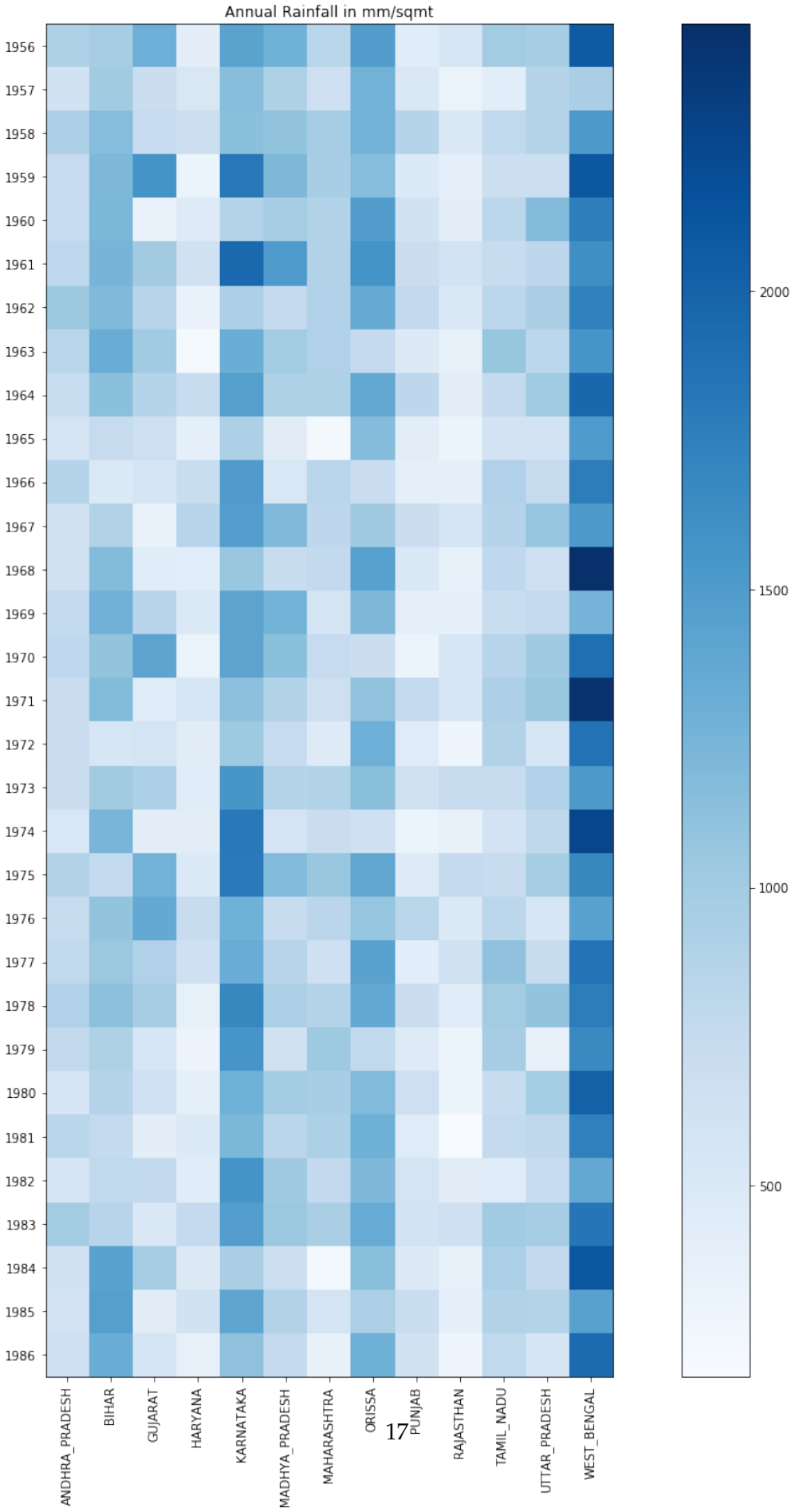
		RNJAN	RNFEB	RNMAR	RNAPR	RNMAY	\
State	YEAR						
ANDHRA_PRADESH	1956	3.233333	1.900000	4.452492	32.266667	42.233333	
	1957	4.074852	2.366667	14.100000	15.566667	31.766667	
	1958	3.333333	4.333333	6.566667	22.666667	33.200000	
	1959	1.766667	6.766667	7.971650	14.533333	10.666667	
	1960	0.766667	7.517040	17.733333	4.433333	30.366667	

		RNJUN	RNJUL	RNAUG	RNSEP	\
State	YEAR					
ANDHRA_PRADESH	1956	95.566667	147.366667	118.333333	170.000000	
	1957	104.000000	15.200000	202.433333	81.600000	
	1958	28.033333	207.566667	237.500000	110.833333	
	1959	109.566667	217.300000	98.666667	147.200000	
	1960	104.200000	142.966667	57.300000	242.600000	

		RNOCT	RNNOV	RNDEC	Annual
State	YEAR				
ANDHRA_PRADESH	1956	191.033333	85.000000	21.233333	912.619158
	1957	89.466667	56.111050	4.666352	621.352254
	1958	159.833333	91.866667	11.566352	917.299686
	1959	110.366667	14.066667	6.433333	745.304983
	1960	24.233333	103.766667	7.966667	743.850373

[68]:
```
mat5 = np.matrix(rainfall1.iloc[:,12].unstack(level=-1).reset_index().values[:
 ↪,1:],dtype='float').T
```

```
fig = plt.figure(num=5,figsize=(20,20))
ax = fig.add_subplot(1,1,1)
ax.set_yticks(np.arange(len(rainfall1.iloc[:,12].unstack(level=-1).
 ↪reset_index().columns[1:])))
ax.set_xticks(np.arange(len(rainfall1.iloc[:,12].unstack(level=-1).
 ↪reset_index().values[:,0])))
ax.set_yticklabels(rainfall1.iloc[:,12].unstack(level=-1).reset_index().
 ↪columns[1:])
ax.set_xticklabels(rainfall1.iloc[:,12].unstack(level=-1).reset_index().values[:
 ↪,0],rotation='vertical')
plt.imshow(mat5, cmap='Blues')
plt.colorbar()
plt.title('Annual Rainfall in mm/sqmt')
plt.show()
```


Annual Rainfall in mm/sqmt
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
ANDHRA_PRADESH
BIHAR
GUJARAT
HARYANA
KARNATAKA
MADHYA_PRADESH
MAHARASHTRA
ORISSA
PUNJAB
RAJASTHAN
TAMIL_NADU
UTTAR_PRADESH
WEST_BENGAL
2000
1500
1000
500

[97]:
```
price=crop_price_year.transpose()
price.head()
```

[97]:
```
                0            1            2            3            4   \
YEAR   1956.000000  1957.000000  1958.000000  1959.000000  1960.000000
WHEAT    43.187258    42.979839    48.813222    46.862000    45.090633
RICE     41.190087    43.562016    43.926039    44.066294    43.425872
MAIZE    28.484940    30.040616    32.844178    30.495578    31.000470
JOWAR    26.356545    24.083642    26.744115    27.666089    27.557708

                5            6            7            8            9   ...  \
YEAR   1961.000000  1962.000000  1963.000000  1964.000000  1965.000000  ...
WHEAT    46.742005    47.420532    57.210559    70.005913    87.460120  ...
RICE     44.147218    49.547925    56.937961    68.734669    87.185401  ...
MAIZE    30.426459    31.551339    35.089808    50.369200    60.508726  ...
JOWAR    28.333015    29.113625    34.083852    44.804735    49.987318  ...

               22           23           24           25           26  \
YEAR   1978.000000  1979.000000  1980.000000  1981.000000  1982.000000
WHEAT   134.060697   149.230603   176.943972   185.619414   211.000164
RICE    140.295255   142.689989   153.199296   168.825363   191.570996
MAIZE    99.086459   111.593353   121.604203   136.507035   148.391233
JOWAR    85.010203    90.841008   108.343647   117.330879   124.293654

               27           28           29           30           31
YEAR   1983.000000  1984.000000  1985.000000  1986.000000  1987.000000
WHEAT   195.560545   182.584921   203.533868   212.144970   215.174556
RICE    207.124072   178.561991   193.439612   200.422899   228.521716
MAIZE   149.120853   142.639323   167.793713   179.183432   184.292899
JOWAR   130.322686   134.098402   145.943373   149.399408   153.585799

[5 rows x 32 columns]
```

[104]:
```
price.to_csv(r'price.csv')
```

[108]:
```
crop_prod2= crop_prod.
 ↪melt(id_vars=["STATENAM","YEAR"],var_name="CROP",value_name="PROD")
crop_prod2.head()
```

[108]:
```
         STATENAM  YEAR         CROP         PROD
0           BIHAR  1956  sum(QWHEAT)   184.533000
1         HARYANA  1956  sum(QWHEAT)   641.940000
2     WEST_BENGAL  1956  sum(QWHEAT)    27.198262
3  MADHYA_PRADESH  1956  sum(QWHEAT)  1730.200000
4       KARNATAKA  1956  sum(QWHEAT)    65.400000
```

[109]:
```
crop_prod2.to_csv(r'new_prod.csv')
```

[110]:
```
area_cult2= area_cult.
 ↪melt(id_vars=["STATENAM","YEAR"],var_name="CROP",value_name="AREA")
area_cult2.head()
```

[110]:

	STATENAM	YEAR	CROP	AREA
0	BIHAR	1956	sum(AWHEAT)	761.655000
1	HARYANA	1956	sum(AWHEAT)	540.789000
2	WEST_BENGAL	1956	sum(AWHEAT)	84.763967
3	MADHYA_PRADESH	1956	sum(AWHEAT)	3240.300000
4	KARNATAKA	1956	sum(AWHEAT)	309.800000

[111]:
```
area_cult2.to_csv(r'new_area.csv')
```

[114]:
```
crop_yield=pd.read_csv('/Users/pranitaeugena/Desktop/agri_data/sum_yield.
 ↪csv',delimiter=',')
crop_yield=crop_yield.fillna(0)
# print(crop_prod.dtypes)
```

[115]:
```
crop_yield2= area_cult.
 ↪melt(id_vars=["STATENAM","YEAR"],var_name="CROP",value_name="YIELD")
crop_yield2.head()
```

[115]:

	STATENAM	YEAR	CROP	YIELD
0	BIHAR	1956	sum(AWHEAT)	761.655000
1	HARYANA	1956	sum(AWHEAT)	540.789000
2	WEST_BENGAL	1956	sum(AWHEAT)	84.763967
3	MADHYA_PRADESH	1956	sum(AWHEAT)	3240.300000
4	KARNATAKA	1956	sum(AWHEAT)	309.800000

[116]:
```
crop_yield2.to_csv(r'new_yield.csv')
```

[ ]:
```

```