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Project Name: Artificial Characters

Artificial Characters Dataset

This database describes the structure of the capital letters A, C, D, E, F, G, H, L, P, R, indicated by a number 1-10, in that order (A=1,C=2,...). Each letter's structure is described by a set of segments (lines) which resemble the way an automatic program would segment an image. The dataset consists of 600 such descriptions per letter.

Originally, each 'instance' (letter) was stored in a separate file, each consisting of between 1 and 7 segments, numbered 0,1,2,3,... Here they are merged. That means that the first 5 instances describe the first 5 segments of the first segmentation of the first letter (A). Also, the training set (100 examples) and test set (the rest) are merged. The next 7 instances describe another segmentation (also of the letter A) and so on.

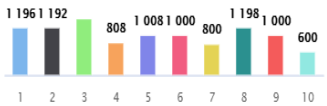
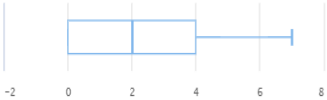
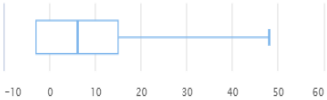
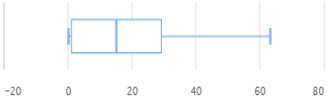
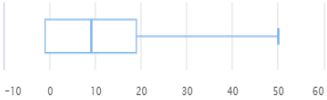
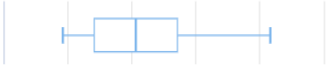
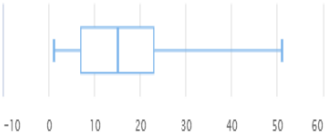
Attribute Information

V1: object number, the number of the segment (0,1,2,..,7)

* V2-V5: the initial and final coordinates of a segment in a cartesian plane (XX1,YY1,XX2,YY2). * V6: size, this is the length of a segment computed by using the geometric distance between two points A(X1,Y1) and B(X2,Y2).

* V7: diagonal, this is the length of the diagonal of the smallest rectangle which includes the picture of the character. The value of this attribute is the same in each object.

8 Features

Class **(target)**	nominal	10 unique values 0 missing	
V1	numeric	8 unique values 0 missing	
V2	numeric	45 unique values 0 missing	
V3	numeric	63 unique values 0 missing	
V4	numeric	48 unique values 0 missing	
V5	numeric	66 unique values 0 missing	
V6	numeric	333 unique values 0 missing	
V7	numeric	511 unique values 0 missing	

Sample Data Set

V1	V2	V3	V4	V5	V6	V7	Class
0	0	0	0	20	20	46.1	1
1	19	0	19	8	8	46.1	1
2	0	20	19	8	22.47	46.1	1
3	0	20	8	42	23.41	46.1	1
4	19	8	8	42	35.74	46.1	1
0	0	0	0	12	12	37.66	1
1	7	0	7	7	7	37.66	1
2	0	12	7	7	8.6	37.66	1
3	0	12	1	35	23.02	37.66	1
4	7	7	5	30	23.09	37.66	1
5	1	35	2	37	2.24	37.66	1
6	2	37	5	30	7.62	37.66	1
0	0	0	0	20	20	43.05	1
1	19	0	20	11	11.05	43.05	1
2	0	20	20	11	21.93	43.05	1
3	0	20	0	37	17	43.05	1
4	20	11	22	22	11.18	43.05	1
5	0	37	22	22	26.63	43.05	1
0	0	0	0	7	7	25	1
1	6	0	6	7	7	25	1
2	0	7	6	7	6	25	1
3	0	7	1	24	17.03	25	1
4	6	7	7	24	17.03	25	1
5	1	24	2	24	1	25	1
6	2	24	7	24	5	25	1
0	0	0	0	7	7	40	1
1	21	0	22	11	11.05	40	1
2	0	7	22	11	22.36	40	1
3	0	7	2	15	8.25	40	1
4	22	11	24	32	21.1	40	1
5	2	15	24	32	27.8	40	1
0	0	0	0	6	6	26	1
1	10	0	10	7	7	26	1
2	0	6	10	7	10.05	26	1
3	0	6	1	13	7.07	26	1
4	10	7	9	24	17.03	26	1
5	1	13	5	22	9.85	26	1
6	5	22	9	24	4.47	26	1
0	0	0	0	22	22	41.59	1
1	18	0	19	11	11.05	41.59	1
2	0	22	19	11	21.95	41.59	1
3	0	22	1	37	15.03	41.59	1
4	19	11	17	30	19.1	41.59	1
5	1	37	17	30	17.46	41.59	1
0	0	0	0	24	24	49.74	1
1	24	0	25	17	17.03	49.74	1
2	0	24	25	17	25.96	49.74	1
3	0	24	2	34	10.2	49.74	1
4	25	17	24	40	23.02	49.74	1
5	2	34	9	43	11.4	49.74	1
6	9	43	24	40	15.3	49.74	1
0	0	0	0	10	10	32.53	1
1	23	0	23	14	14	32.53	1
2	0	10	23	14	23.35	32.53	1
3	0	10	13	23	18.38	32.53	1
4	23	14	13	23	13.45	32.53	1
0	0	0	0	15	15	37.48	1
1	25	0	27	9	9.22	37.48	1
2	0	15	27	9	27.66	37.48	1

Basic Libraries for the Data And Exploring the Data

```
[1] import pandas as pd
    import numpy as np
    from google.colab import files
    ex=files.upload()
```

	0	1	2	3	4	5	6	7
0	V1	V2	V3	V4	V5	V6	V7	Class
1	0	0	0	0	20	20	46.1	1
2	1	19	0	19	8	8	46.1	1
3	2	0	20	19	8	22.47	46.1	1
4	3	0	20	8	42	23.41	46.1	1

Understanding the Data

```
[28] df.dtypes
```

```
0    int64
1    int64
2    int64
3    int64
4    int64
5    int64
6    int64
7    int64
dtype: object
```

```
df.shape
```

```
(10219, 8)
```

```
df.isnull().sum()
```

```
0    0
1    0
2    0
3    0
4    0
5    0
6    0
7    0
dtype: int64
```

```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10219 entries, 0 to 10218
Data columns (total 8 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   0       10219 non-null  object
 1   1       10219 non-null  object
 2   2       10219 non-null  object
 3   3       10219 non-null  object
 4   4       10219 non-null  object
 5   5       10219 non-null  object
 6   6       10219 non-null  object
 7   7       10219 non-null  object
dtypes: object(8)
memory usage: 638.8+ KB
```

```
[7] from sklearn.preprocessing import LabelEncoder
    le=LabelEncoder()
    for i in df:
      df[i]=le.fit_transform(df[i])
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10219 entries, 0 to 10218
Data columns (total 8 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   0       10219 non-null  int64
 1   1       10219 non-null  int64
 2   2       10219 non-null  int64
 3   3       10219 non-null  int64
 4   4       10219 non-null  int64
 5   5       10219 non-null  int64
 6   6       10219 non-null  int64
 7   7       10219 non-null  int64
dtypes: int64(8)
memory usage: 638.8 KB
```

Importing LabelEncoder

Prepared Data

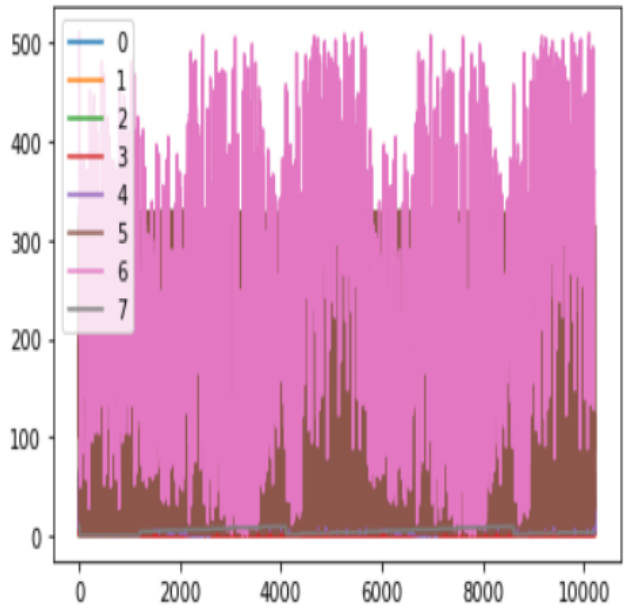
```
data.head()
```

	0	1	2	3	4	5	6
0	8	45	63	48	66	333	511
1	0	0	0	0	15	101	325
2	1	11	0	11	64	319	325
3	2	0	12	11	64	129	325
4	3	0	12	46	39	141	325

Data Visualization

```
df.plot()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f3389f2fa10>
```



Scaling Data

```
[15] from sklearn.model_selection import train_test_split
     x_train, x_test, y_train, y_test=train_test_split(data, target, test_size=0.3,random_state=42)
```

```
[16] from sklearn.preprocessing import StandardScaler
     sc=StandardScaler()
     x_train_sc=sc.fit_transform(x_train)
     x_test_sc=sc.fit_transform(x_test)
```

```
[17] x_train_sc=pd.DataFrame(x_train_sc)
     x_test_sc=pd.DataFrame(x_test_sc)
```

```
[18] x_train_sc.describe().round(2)
```

	0	1	2	3	4	5	6
count	7153.00	7153.00	7153.00	7153.00	7153.00	7153.00	7153.00
mean	-0.00	0.00	-0.00	-0.00	0.00	-0.00	-0.00
std	1.00	1.00	1.00	1.00	1.00	1.00	1.00
min	-1.29	-0.60	-0.88	-0.79	-1.37	-1.28	-1.77
25%	-0.71	-0.60	-0.88	-0.79	-0.77	-0.92	-0.83
50%	-0.13	-0.60	-0.36	-0.36	-0.23	-0.28	-0.07

Importing SVC and Predicting

```
from sklearn.svm import SVC
svc=SVC()
svc.fit(x_train, y_train)
```

```
SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='scale', kernel='rbf',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

+ Code + Text

```
[20] pred_train=svc.predict(x_train)
```

```
[21] from sklearn.metrics import accuracy_score
     print(accuracy_score(pred_train, y_train))
```

```
0.3124563120369076
```

```
[22] pred_test=svc.predict(x_test)
     print(accuracy_score(pred_test, y_test))
```

```
0.2762557077625571
```

Importing Accuracy_score and Accurating the Data

[21]
```
from sklearn.metrics import accuracy_score
print(accuracy_score(pred_train, y_train))
```

```
0.3124563120369076
```

[22]
```
pred_test=svc.predict(x_test)
print(accuracy_score(pred_test, y_test))
```

```
0.2762557077625571
```

[23]
```
from sklearn.naive_bayes import GaussianNB
nb=GaussianNB()
nb.fit(x_train, y_train)
pred_train=nb.predict(x_train)
pred_test=nb.predict(x_test)
from sklearn.metrics import accuracy_score
print(accuracy_score(pred_train, y_train))
print(accuracy_score(pred_test, y_test))
```

```
0.21277785544526773
0.2146118721461187
```

Decision Tree Classifier

```
from sklearn.tree import DecisionTreeClassifier
dt=DecisionTreeClassifier(criterion='entropy', max_depth=7)
dt.fit(x_train, y_train)
pred_train_dt=dt.predict(x_train)
pred_test_dt=dt.predict(x_test)
print(accuracy_score(pred_train_dt, y_train))
print(accuracy_score(pred_test_dt, y_test))
```

```
0.5362784845519363
0.5068493150684932
```

Bagging Classifier

```python
from sklearn.ensemble import BaggingClassifier
bag=BaggingClassifier(n_estimators=10)
bag.fit(x_train_sc, y_train)
print(accuracy_score(bag.predict(x_train_sc), y_train))
print(accuracy_score(bag.predict(x_test_sc), y_test))
```

```
0.986579057738012
0.8118069145466406
```

Random Forest Classifier

```
[26] from sklearn.ensemble import RandomForestClassifier
     rfc=RandomForestClassifier(n_estimators=10)
     rfc.fit(x_train_sc, y_train)
     print(accuracy_score(rfc.predict(x_train_sc), y_train))
     print(accuracy_score(rfc.predict(x_test_sc), y_test))
```

```
0.9893750873759262
0.8255055446836269
```

```
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier(n_estimators=10)
rfc.fit(x_train_sc, y_train)
print(accuracy_score(rfc.predict(x_train_sc), y_train))
print(accuracy_score(rfc.predict(x_test_sc), y_test))
```

```
0.9886760799664477
0.8398564905414221
```