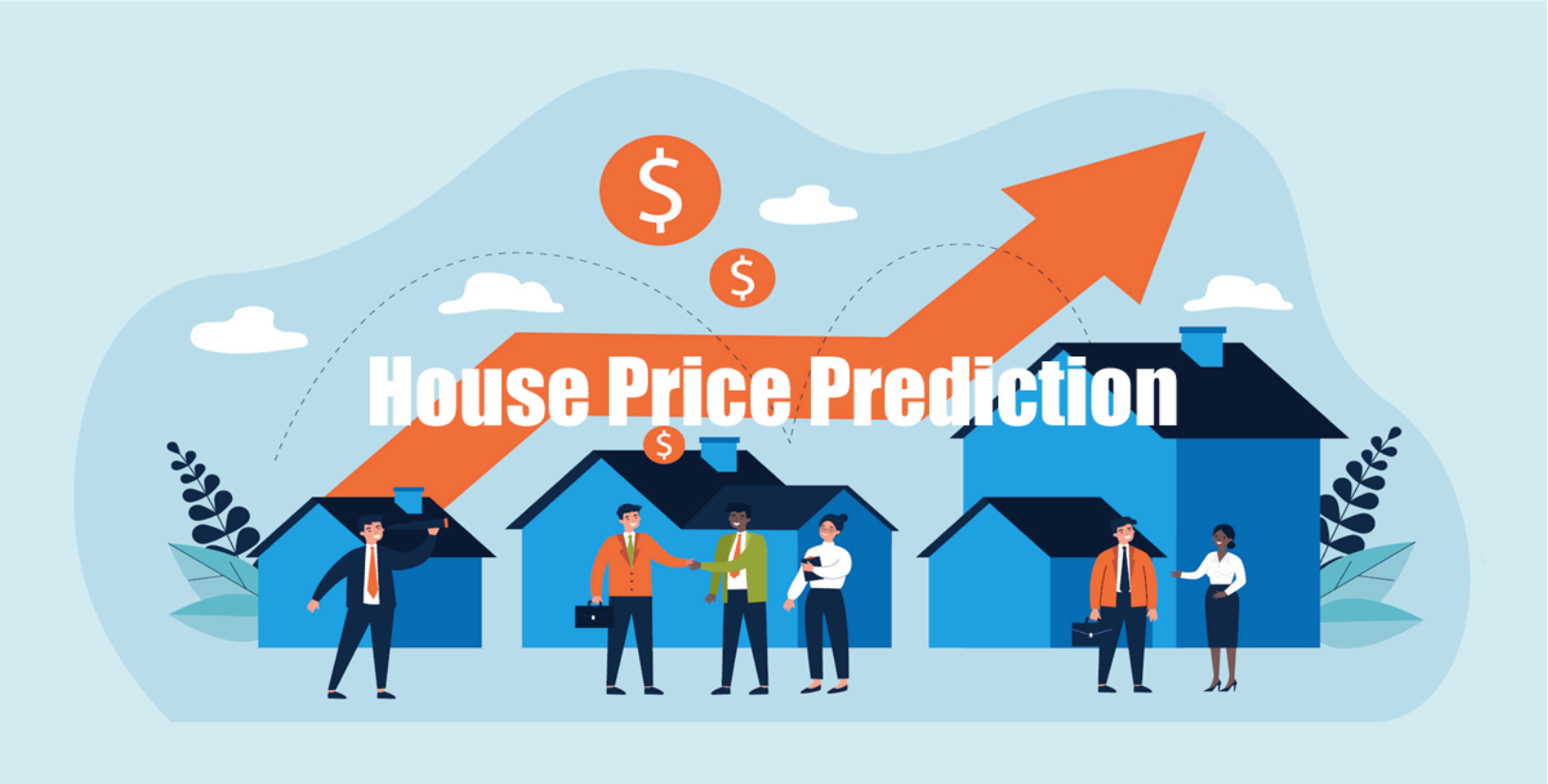
Machine Learning with SVM: House Price Prediction & Digit Classification

SVM (support vector machine)

- Regression problem
- classification problem
  - Binary
  - multiclass

In [ ]:
```
# Designed By  : ALTAF HUSAIN DATA ANALYST
```

Housing Price Prdiction : Regression Problem (SVR)



step 1 : modules import

In [80]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC,SVR
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import confusion_matrix,classification_report,mean_absolute_error,mean_squared_error,root_mean_squ
from sklearn.datasets import load_digits,fetch_california_housing
import warnings
```

```
warnings.filterwarnings('ignore')
print("All modules loaded succesfully")
```

```
All modules loaded succesfully
```

In [81]:
```
house = fetch_california_housing()
df = pd.DataFrame(house.data,columns= house.feature_names)
df[house.target_names[0]] = house.target
```

In [82]:
```
df.sample()
```

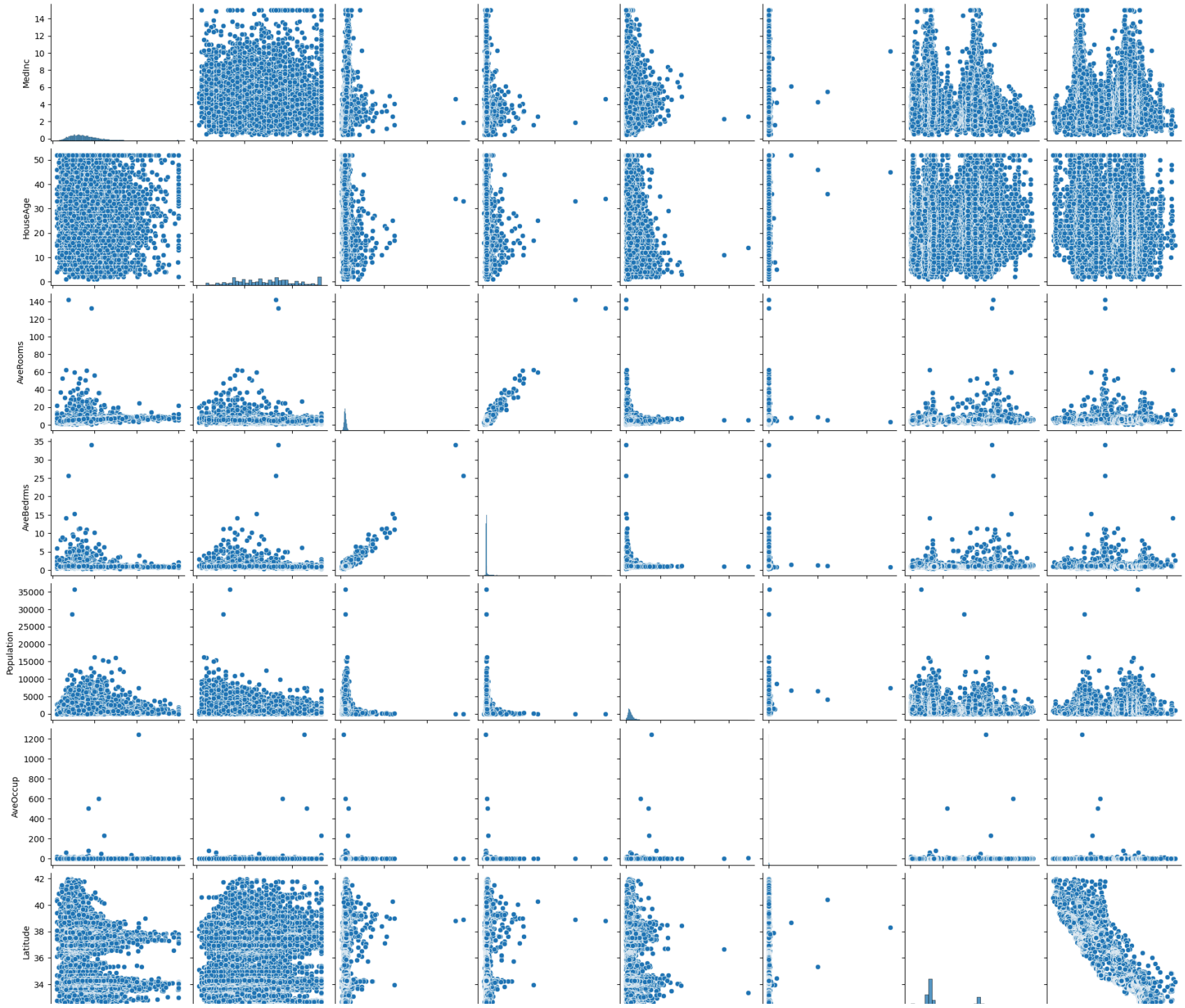
Out[82]:

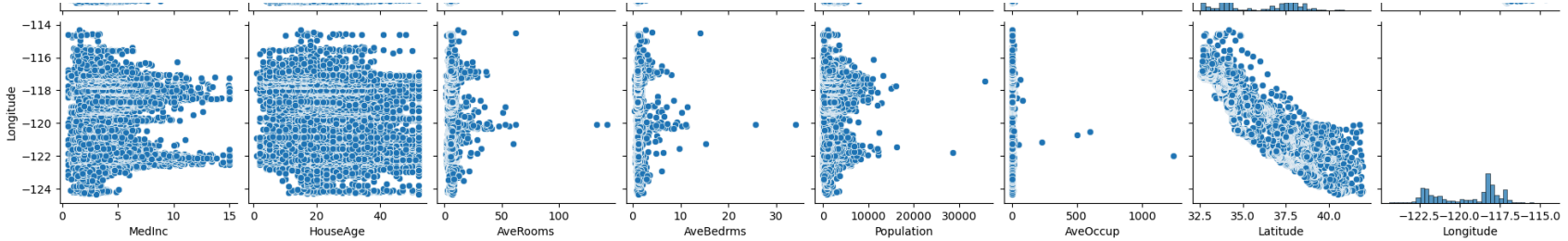
	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	Longitude	MedHouseVal
13444	2.1189	13.0	4.47792	1.164868	2475.0	2.428852	34.08	-117.43	1.217

In [83]:
```
# print(house['DESCR'])
```

In [84]:
```
X = df.iloc[:,:-1]
y = df['MedHouseVal']
```

In [85]:
```
sns.pairplot(X)
plt.show()
```


MedInc
HouseAge
AveRooms
AveBedrms
Population
AveOccup
Latitude



In [86]:
```
X.sample()
```

Out[86]:

	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	Longitude
853	4.6786	16.0	5.350061	1.088127	2530.0	3.096695	37.59	-122.03

MIN_MAX SCALER

In [87]:
```
scaler = MinMaxScaler()  # scale to 0 and 1
```

In [88]:
```
X_scaled = scaler.fit_transform(X)
```

In [89]:
```
X.describe()
```

Out[89]:

	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	Longitude
count	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000
mean	3.870671	28.639486	5.429000	1.096675	1425.476744	3.070655	35.631861	-119.569704
std	1.899822	12.585558	2.474173	0.473911	1132.462122	10.386050	2.135952	2.003532
min	0.499900	1.000000	0.846154	0.333333	3.000000	0.692308	32.540000	-124.350000
25%	2.563400	18.000000	4.440716	1.006079	787.000000	2.429741	33.930000	-121.800000
50%	3.534800	29.000000	5.229129	1.048780	1166.000000	2.818116	34.260000	-118.490000
75%	4.743250	37.000000	6.052381	1.099526	1725.000000	3.282261	37.710000	-118.010000
max	15.000100	52.000000	141.909091	34.066667	35682.000000	1243.333333	41.950000	-114.310000

In [90]:
```
pd.DataFrame(X_scaled).describe()
```

Out[90]:

	0	1	2	3	4	5	6	7
count	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000	20640.000000
mean	0.232464	0.541951	0.032488	0.022629	0.039869	0.001914	0.328572	0.476125
std	0.131020	0.246776	0.017539	0.014049	0.031740	0.008358	0.226988	0.199555
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	0.142308	0.333333	0.025482	0.019943	0.021974	0.001398	0.147715	0.253984
50%	0.209301	0.549020	0.031071	0.021209	0.032596	0.001711	0.182784	0.583665
75%	0.292641	0.705882	0.036907	0.022713	0.048264	0.002084	0.549416	0.631474
max	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Train-test part

In [91]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size = 0.2 ,random_state=42)
```

In [92]:
```
X_train.shape
```

Out[92]: (16512, 8)

In [93]:
```
X_test.shape
```

Out[93]: (4128, 8)

In [94]:
```
y_train.shape
```

Out[94]: (16512,)

In [95]:
```
y_test.shape
```

Out[95]: (4128,)

Model Building

In [96]:
```
model_reg = SVR()
```

In [97]:
```
model_reg.fit(X_train,y_train)
```

Out[97]:
SVR

SVR()

In [98]:
```
y_pred = model_reg.predict(X_test)
```

In [99]:
```
mae = mean_absolute_error(y_test,y_pred)
print("Mae : ",mae)
```

```
Mae :  0.8599506583445776
```

In [100]:
```
mse = mean_squared_error(y_test,y_pred)
print("Mse : ",mse)
```

```
Mse :  1.3320115421348788
```

In [101]:
```
rmse = root_mean_squared_error(y_test,y_pred)
print("RMse : ",rmse)
```

```
RMse :  1.1541280440812791
```

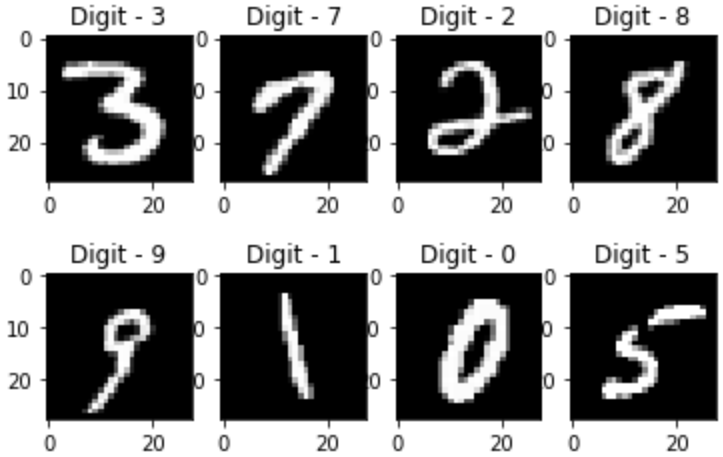
In [102]:
```
model_reg.score(X_test,y_test)
```

Out[102]:
```
-0.01648536010717705
```

In [103]:
```
sample_data = pd.DataFrame(X_scaled,columns = house.feature_names).sample()
price =  round(model_reg.predict(sample_data)[0]* 100000,2)
print(f'MedHouseVal : ${price}')
```

```
MedHouseVal : $140943.73
```

Digits classification : multiclass Classification problem (SVC)



In [104]:
```
digits = load_digits()
```

In [105]:
```
df = pd.DataFrame(digits.data,columns= digits.feature_names)
df['target'] = digits.target
```

In [106]:
```
df.sample()
```

Out[106]:

	pixel_0_0	pixel_0_1	pixel_0_2	pixel_0_3	pixel_0_4	pixel_0_5	pixel_0_6	pixel_0_7	pixel_1_0	pixel_1_1	...	pixel_6_7	pixel
1222	0.0	0.0	0.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0	...	1.0	

1 rows × 65 columns

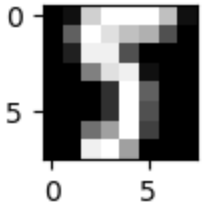
In [107]:
```
df.shape
```

Out[107]:
```
(1797, 65)
```

In [108]:
```
X = df.iloc[:,:-1]
```

In [109]:
```
y = df['target']
```

In [110]:
```
image_digit = X.sample().to_numpy().reshape(8,8)
plt.figure(figsize=(1,1 ))
plt.gray()
plt.imshow(image_digit)
plt.show()
```



In [111]:
```
df['target'].unique()
```

Out[111]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [112]:
```
image_digit
```

Out[112]:
```
array([[ 0.,  1., 13., 16., 16., 16., 12.,  1.],
       [ 0.,  6., 16., 14., 12., 11.,  5.,  0.],
       [ 0.,  2., 15., 15.,  5.,  0.,  0.,  0.],
       [ 0.,  0.,  8., 14., 15.,  1.,  0.,  0.],
       [ 0.,  0.,  0.,  3., 16.,  6.,  0.,  0.],
       [ 0.,  0.,  0.,  3., 16.,  5.,  0.,  0.],
       [ 0.,  0.,  7., 10., 16.,  4.,  0.,  0.],
       [ 0.,  0., 15., 16., 10.,  0.,  0.,  0.]])
```

In [113]:
```
# image : 0 - 255
```

In [114]:
```
scaler = MinMaxScaler()
```

In [115]:
```
X_scaled = scaler.fit_transform(X)
```

In [116]:
```
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42)
```

In [117]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(1437, 64)
(360, 64)
(1437,)
(360,)
```

In [118]:
```
model_cl = SVC()
```

In [119]:
```
model_cl.fit(X_train,y_train)
```

Out[119]:
```
SVC()
```

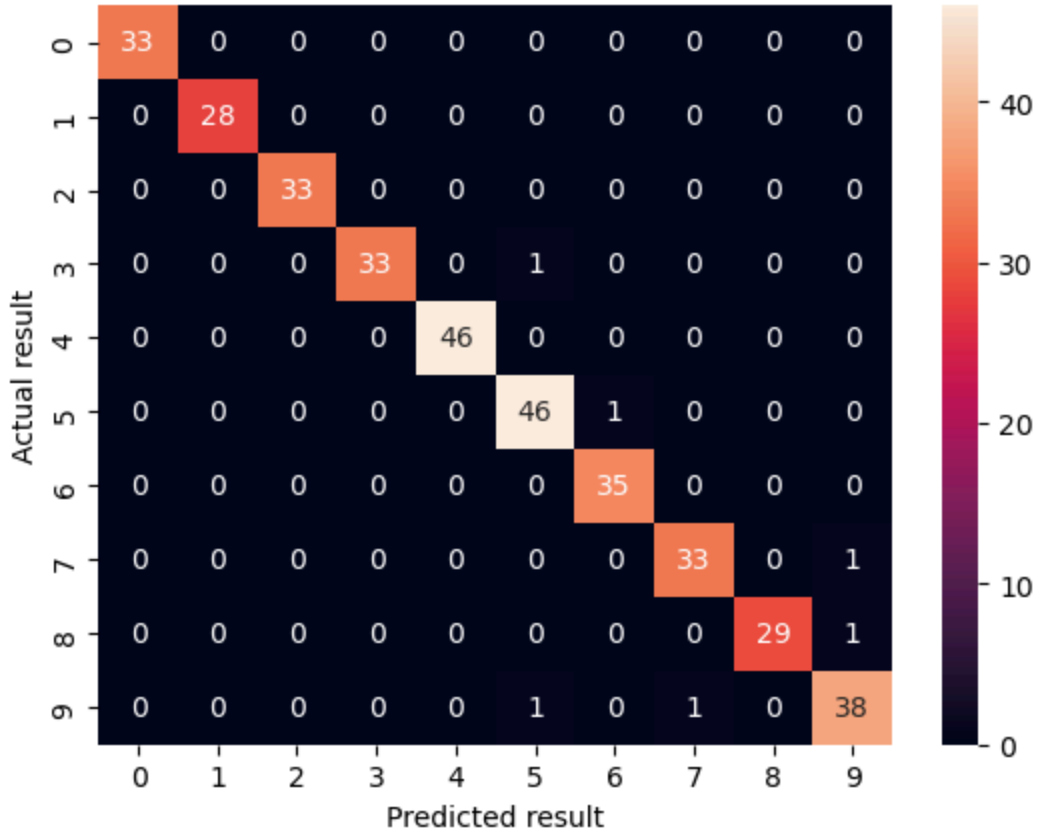
In [120]:
```
y_pred = model_cl.predict(X_test)
```

In [121]:
```
temp_df = pd.DataFrame({'Actual class':y_test,'Predicted class':y_pred})
```

In [122]:
```
cm =confusion_matrix(y_test,y_pred)
cm
```

Out[122]:
```
array([[33,  0,  0,  0,  0,  0,  0,  0,  0,  0],
       [ 0, 28,  0,  0,  0,  0,  0,  0,  0,  0],
       [ 0,  0, 33,  0,  0,  0,  0,  0,  0,  0],
       [ 0,  0,  0, 33,  0,  1,  0,  0,  0,  0],
       [ 0,  0,  0,  0, 46,  0,  0,  0,  0,  0],
       [ 0,  0,  0,  0,  0, 46,  1,  0,  0,  0],
       [ 0,  0,  0,  0,  0,  0, 35,  0,  0,  0],
       [ 0,  0,  0,  0,  0,  0,  0, 33,  0,  1],
       [ 0,  0,  0,  0,  0,  0,  0,  0, 29,  1],
       [ 0,  0,  0,  0,  0,  1,  0,  1,  0, 38]])
```

In [123]:
```
sns.heatmap(cm,annot =True)
plt.xlabel('Predicted result')
plt.ylabel('Actual result')
plt.show()
```



In [124]:
```
model_score = model_cl.score(X_test,y_test)
```

In [125]:
```
print(f'Model score is :{round(model_score *100,2)}%')
```

```
Model score is :98.33%
```

In [126]:
```
print(classification_report(y_test,y_pred))
```

	precision	recall	f1-score	support
0	1.00	1.00	1.00	33
1	1.00	1.00	1.00	28
2	1.00	1.00	1.00	33
3	1.00	0.97	0.99	34
4	1.00	1.00	1.00	46
5	0.96	0.98	0.97	47
6	0.97	1.00	0.99	35
7	0.97	0.97	0.97	34
8	1.00	0.97	0.98	30
9	0.95	0.95	0.95	40
accuracy			0.98	360
macro avg	0.99	0.98	0.98	360
weighted avg	0.98	0.98	0.98	360

In [127]:
```
sample_data = pd.DataFrame(X_scaled).sample()
ans = model_cl.predict(sample_data)[0]

plt.figure(figsize=(1,1))
plt.gray()
plt.title(f'Predicted digit is : {ans}')
plt.imshow(sample_data.to_numpy().reshape(8,8))
plt.show()
```

Giving image to predict

In [130]:
```
arr = plt.imread("C:\\Users\\SK COMPUTER\\Downloads\\img.jpg")
```

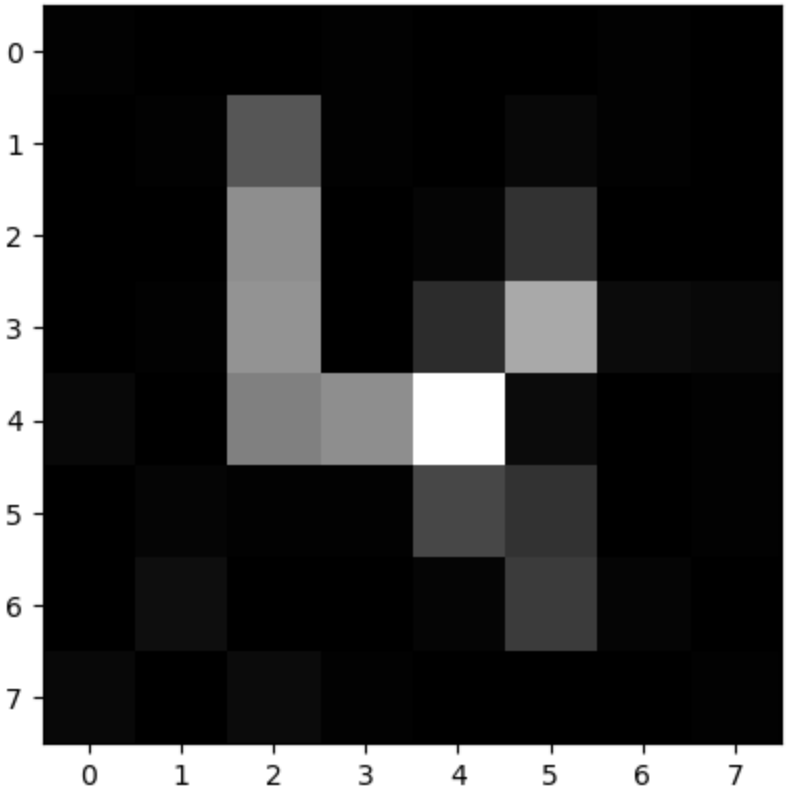
In [131]:
```
img_arr = arr.copy()
```

In [132]:
```
img_arr.shape
```

Out[132]: (8, 8, 3)

In [133]:
```
plt.imshow(img_arr[:,:,0])
```

Out[133]: <matplotlib.image.AxesImage at 0x2814e394e10>



In [134]:
```
img_arr = img_arr[:, :, 0] if img_arr.ndim == 3 else img_arr
```

In [135]:
```
from skimage.transform import resize
img_arr = resize(img_arr, (8, 8), anti_aliasing=True)
```

In [136]:
```
sample_data =  np.expand_dims(img_arr.flatten(),axis = 0)
```

In [137]:
```
sample_scaled_data = scaler.transform(sample_data)
```

In [138]:
```
ans = model_cl.predict(sample_scaled_data)[0]
print("Predicted digit is:", ans)
```

```
Predicted digit is: 4
```

In [ ]:
```
# Designed By  : ALTAF HUSAIN DATA ANALYST
```