8D

March 11, 2022

[1]:
```
%matplotlib inline
import warnings
warnings.filterwarnings("ignore")
import pandas as pd
import numpy as np
from sklearn.datasets import load_iris
from sklearn.linear_model import SGDClassifier
from sklearn.model_selection import GridSearchCV
import seaborn as sns
import matplotlib.pyplot as plt
```

[2]:
```
data = pd.read_csv('task_d.csv')
```

[3]:
```
X = data.drop(['target'], axis=1).values
Y = data['target'].values
data.head()
```

[3]:
```
          x         y         z       x*x       2*y  2*z+3*x*x         w  \
0 -0.581066  0.841837 -1.012978 -0.604025  0.841837  -0.665927 -0.536277
1 -0.894309 -0.207835 -1.012978 -0.883052 -0.207835  -0.917054 -0.522364
2 -1.207552  0.212034 -1.082312 -1.150918  0.212034  -1.166507  0.205738
3 -1.364174  0.002099 -0.943643 -1.280666  0.002099  -1.266540 -0.665720
4 -0.737687  1.051772 -1.012978 -0.744934  1.051772  -0.792746 -0.735054

   target
0       0
1       0
2       0
3       0
4       0
```

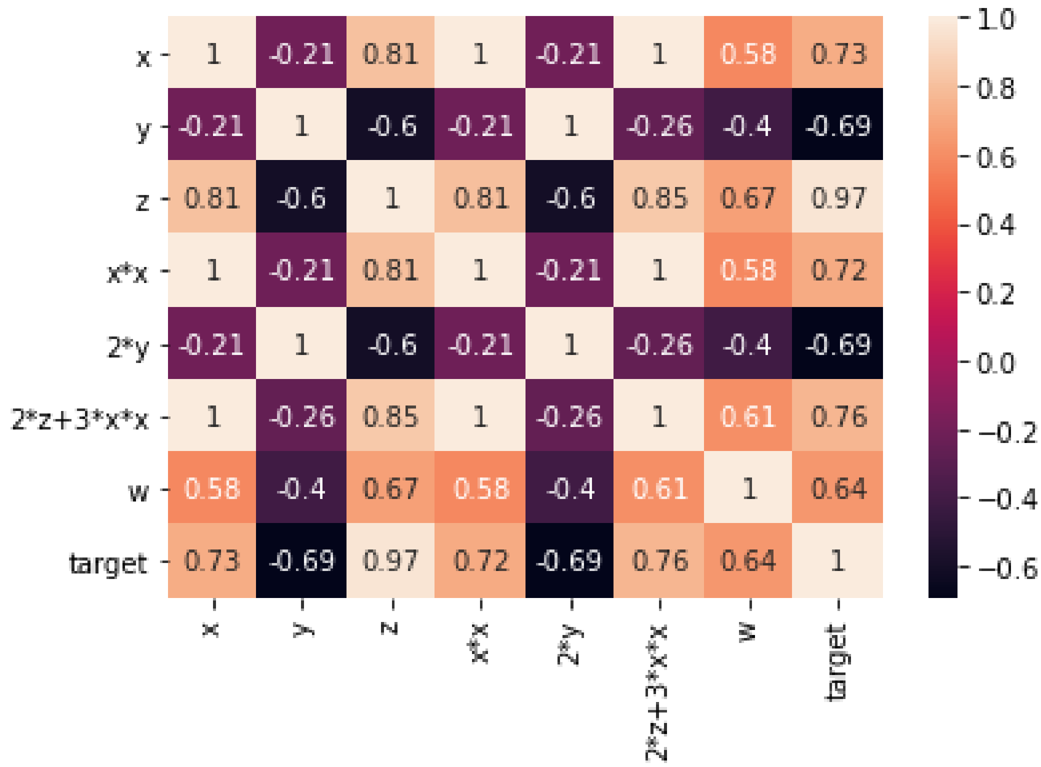
0.1 step 1 Finding the Correlation between the features

[4]:
```
import seaborn as sn

corr_df=data.corr()
corr=np.array(corr_df)
label=list(data)                                          #ylabel from data heading
```

```
sn.heatmap(data=corr,annot=True,xticklabels=label,yticklabels=label)
```

[4]: <AxesSubplot:>



0.2 step 2 Finding the best model for the given data

[19]:
```
from sklearn.model_selection import GridSearchCV
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import RepeatedStratifiedKFold
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split

X_train,X_test,y_train,y_test=train_test_split(X,Y,random_state =␣
 ↪42,test_size=0.2)

parameters = {'C':(np.logspace(-5,8,10))}

cv = RepeatedStratifiedKFold(n_splits=10, n_repeats=3, random_state=1)
#https://machinelearningmastery.com/
 ↪hyperparameter-optimization-with-random-search-and-grid-search/

log_reg=LogisticRegression()
```

```
log_reg_cv = GridSearchCV(log_reg,␣
↪parameters,n_jobs=-1,return_train_score=True,cv=cv)
log_reg_cv.fit(X, Y)                                    # fitting on whole␣
↪data for find out best hyperparameter




print("best parameter = ",log_reg_cv.best_params_)
print("best score = ",log_reg_cv.best_score_)
print("best estimator = ",log_reg_cv.best_estimator_)
```

```
best parameter =  {'C': 1e-05}
best score =  1.0
best estimator =  LogisticRegression(C=1e-05)
```

0.3 step 3 Getting the weights with the original data

[6]:
```
# step 3
best_model=LogisticRegression(C=1e-05)
best_model.fit(X_train,y_train)                 #fitting training data on␣
↪best_hyperparameter_model
y_pred=best_model.predict(X_test)
best_model_accuracy=accuracy_score(y_test, y_pred)  #getting the accuracy

weight=best_model.coef_
print("coef :-",weight)
print("accuracy = ",best_model_accuracy)
```

```
coef :- [[ 0.00029657 -0.00026116  0.00037896  0.00029181 -0.00026116
0.00030838
   0.0002199 ]]
accuracy =  0.4
```

0.4 step 4 Modifying original data

[7]:
```
import random
#print(X)
X_=[]
for i in range(len(X)):
    emp=[]
    for j in range(7):
        emp.append(X[i][j]+random.uniform(0.01, 0.09))
    X_.append(emp)
X_=np.array(X_)
for i in range(len(X_)):
    print(X_[i],X[i])
```

```
[-0.56308153  0.88729785 -0.94071359 -0.57249938  0.8626915  -0.59763304
```

```
 -0.50720968] [-0.5810659   0.84183714 -1.01297765 -0.60402468  0.84183714
-0.66592679
 -0.53627703]
[-0.84493012 -0.13708502 -0.9554204  -0.80189682 -0.13057475 -0.87882336
 -0.48102725] [-0.89430898 -0.2078351  -1.01297765 -0.88305213 -0.2078351
-0.91705408
 -0.52236404]
[-1.14536554  0.29387023 -1.05458741 -1.08129731  0.22349997 -1.14660813
  0.21646736] [-1.20755205  0.21203379 -1.08231219 -1.15091848  0.21203379
-1.16650718
  0.20573767]
[-1.35279836  0.05689629 -0.93251717 -1.20801791  0.07158822 -1.21451326
 -0.61551656] [-1.36417359  0.00209934 -0.94364311 -1.28066624  0.00209934
-1.26653955
 -0.66571996]
[-0.72315843  1.06469864 -0.93773941 -0.65832404  1.08344587 -0.76958451
 -0.67936387] [-0.73768744  1.05177159 -1.01297765 -0.74493354  1.05177159
-0.79274607
 -0.73505412]
[-0.0451491   1.74533538 -0.73402599 -0.09443888  1.72478588 -0.20419299
  0.55104383] [-0.11120129  1.68157493 -0.80497402 -0.16455644  1.68157493
-0.24528858
  0.48991585]
[-1.32708256  0.71454005 -0.95502462 -1.23016274  0.70845424 -1.21568549
  0.45421276] [-1.36417359  0.63190269 -1.01297765 -1.28066624  0.63190269
-1.27491046
  0.3681559 ]
[-0.70936446  0.66745228 -0.92747947 -0.69759219  0.69044126 -0.71733753
 -1.81471361] [-0.73768744  0.63190269 -0.94364311 -0.74493354  0.63190269
-0.78437516
 -1.8752551 ]
[-1.64321024 -0.33304802 -0.97261872 -1.44382557 -0.38874883 -1.47140645
  0.1786023 ] [-1.67741667 -0.41776955 -1.01297765 -1.53179095 -0.41776955
-1.50092502
  0.16383818]
[-0.83728043  0.02347682 -0.8978218  -0.83086435  0.08513132 -0.84783967
  0.29078737] [-0.89430898  0.00209934 -0.94364311 -0.88305213  0.00209934
-0.90868317
  0.25601337]
[-0.05399008  1.29010013 -0.92194731 -0.08532863  1.34626905 -0.17559543
 -0.33152721] [-0.11120129  1.26170604 -0.94364311 -0.16455644  1.26170604
-0.2620304
 -0.36363171]
[-0.99736846  0.7020083  -0.82830251 -0.9375929   0.67271744 -0.95353287
 -1.64694617] [-1.05093052  0.63190269 -0.87430856 -1.01838044  0.63190269
-1.02210899
 -1.67303624]
[-1.00449865 -0.12125952 -0.99110616 -0.97752357 -0.18197306 -0.98589561
```

```
 -1.60955332] [-1.05093052 -0.2078351  -1.01297765 -1.01838044 -0.2078351
-1.03885081
 -1.66480188]
[-1.75149142 -0.13690652 -1.18134543 -1.6087446  -0.19646329 -1.55127244
 -1.28248586] [-1.8340382  -0.2078351  -1.22098127 -1.65316789 -0.2078351
-1.63527812
 -1.37191487]
[ 0.60258931  1.96663199 -1.09369485  0.49416615  1.9224579   0.29996505
 -0.77935163] [ 0.51528486  1.89150938 -1.15164673  0.46046505  1.89150938
0.275382
 -0.83675616]
[ 0.40734413  2.81380725 -0.89989076  0.32585515  2.75769572  0.17131368
 -0.06796314] [ 0.35866332  2.73124718 -0.94364311  0.30002427  2.73124718
0.15609654
 -0.14465006]
[-0.09408534  1.71939955 -1.0260633  -0.09281852  1.72019238 -0.20239741
 -0.21934886] [-0.11120129  1.68157493 -1.08231219 -0.16455644  1.68157493
-0.27877222
 -0.25971271]
[-0.55472858  0.8952652  -0.98997835 -0.52075523  0.86227019 -0.64669105
 -0.31887964] [-0.5810659   0.84183714 -1.01297765 -0.60402468  0.84183714
-0.66592679
 -0.40651976]
[ 0.44365938  1.52829818 -0.77364677  0.38842662  1.49369917  0.19787937
  0.07619109] [ 0.35866332  1.47164049 -0.80497402  0.30002427  1.47164049
0.17283836
  0.00270811]
[-0.49648968  1.55715146 -0.87037962 -0.5572958   1.55759376 -0.62977611
  0.45762789] [-0.5810659   1.47164049 -0.94364311 -0.60402468  1.47164049
-0.65755588
  0.3952297 ]
[-0.05724821  0.70740857 -0.78606368 -0.14212203  0.66008062 -0.17480619
 -1.54554385] [-0.11120129  0.63190269 -0.80497402 -0.16455644  0.63190269
-0.24528858
 -1.61253425]
[-0.55416474  1.28597513 -0.87783208 -0.51825254  1.31888124 -0.64074803
 -1.11243807] [-0.5810659   1.26170604 -0.94364311 -0.60402468  1.26170604
-0.65755588
 -1.18216914]
[-1.30449378  1.0698985  -1.23522514 -1.24895166  1.10732398 -1.25261413
 -1.43645345] [-1.36417359  1.05177159 -1.29031581 -1.28066624  1.05177159
-1.3083941
 -1.51203058]
[-0.52193355  0.45720301 -0.75589906 -0.52895958  0.43763671 -0.61836109
 -0.02245361] [-0.5810659   0.42196824 -0.80497402 -0.60402468  0.42196824
-0.64081406
 -0.09799583]
[-1.03616621  0.68098324 -0.62393112 -0.98188181  0.68264619 -0.91554322
```

```
  0.38101716] [-1.05093052  0.63190269 -0.66630494 -1.01838044  0.63190269
-0.99699626
  0.34077829]
[-0.67829908 -0.14664932 -0.84598393 -0.73132795 -0.16630079 -0.71109064
 -0.75186735] [-0.73768744 -0.2078351  -0.87430856 -0.74493354 -0.2078351
-0.77600425
 -0.779964  ]
[-0.65913979  0.67149669 -0.82864323 -0.70675267  0.64936504 -0.73354299
 -0.9643856 ] [-0.73768744  0.63190269 -0.87430856 -0.74493354  0.63190269
-0.77600425
 -1.04470299]
[-0.33840606  0.86264657 -0.87098917 -0.39049248  0.89698441 -0.51079356
 -0.39532861] [-0.42444437  0.84183714 -0.94364311 -0.46032554  0.84183714
-0.52822532
 -0.44449216]
[-0.39527242  0.7082741  -0.99170323 -0.44422722  0.66399521 -0.49999611
 -1.06875333] [-0.42444437  0.63190269 -1.01297765 -0.46032554  0.63190269
-0.53659623
 -1.10420653]
[-1.15448748  0.29879125 -0.7954467  -1.09171281  0.2813276  -1.06836412
 -1.8589516 ] [-1.20755205  0.21203379 -0.87430856 -1.15091848  0.21203379
-1.14139445
 -1.9312688 ]
[-1.04006776  0.02378159 -0.85209551 -0.9916384   0.06101729 -0.96126613
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-1.02210899
 -0.98334579]
[-0.04023446  0.71403654 -0.89210505 -0.11332194  0.72144795 -0.22532828
  0.56940956] [-0.11120129  0.63190269 -0.94364311 -0.16455644  0.63190269
-0.2620304
  0.5033349 ]
[-0.3845843   2.12873629 -0.9142218  -0.40079146  2.17699131 -0.46232569
  0.35437254] [-0.42444437  2.10144383 -0.94364311 -0.46032554  2.10144383
-0.52822532
  0.27889566]
[ 0.11632037  2.39418049 -0.99164357  0.04631101  2.3588098  -0.09030984
 -0.64282447] [ 0.04542025  2.31137828 -1.01297765 -0.01248648  2.31137828
-0.13353694
 -0.68404641]
[-0.82056173  0.03325968 -0.90479459 -0.84603438  0.02722633 -0.84040176
 -0.05407314] [-0.89430898  0.00209934 -0.94364311 -0.88305213  0.00209934
-0.90868317
 -0.11431202]
[-0.65762003  0.24512999 -1.13048237 -0.71305387  0.28937894 -0.7398527
 -0.99304572] [-0.73768744  0.21203379 -1.15164673 -0.74493354  0.21203379
-0.80948789
 -1.03823234]
[ 0.05857169  0.88661478 -1.02333697  0.05049143  0.86888533 -0.12843135
```

```
 -0.15658571] [ 0.04542025  0.84183714 -1.08231219 -0.01248648  0.84183714
-0.14190785
 -0.24485643]
[-0.88143903  1.12591615 -0.9367708  -0.83902345  1.11514557 -0.87208163
 -1.01216244] [-0.89430898  1.05177159 -1.01297765 -0.88305213  1.05177159
-0.91705408
 -1.0870547 ]
[-1.66581642e+00 -1.35960792e-01 -1.00698543e+00 -1.44747745e+00
 -1.19998019e-01 -1.44347541e+00  1.48183102e-03] [-1.67741667 -0.2078351
-1.08231219 -1.53179095 -0.2078351  -1.50929593
 -0.04728291]
[-0.49354343  0.68535299 -0.88610657 -0.52054715  0.69169746 -0.56919076
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 -1.89048402]
[-0.67298067  0.8997091  -1.06943028 -0.70558032  0.86308775 -0.78290988
 -1.17073542] [-0.73768744  0.84183714 -1.08231219 -0.74493354  0.84183714
-0.80111698
 -1.20189106]
[-1.49550027 -1.62569192 -1.02259721 -1.36760993 -1.60959697 -1.38470339
  0.48497928] [-1.52079513 -1.67737625 -1.08231219 -1.40762373 -1.67737625
-1.39754429
  0.43992693]
[-1.66381789  0.24659089 -1.05482677 -1.50429478  0.27616886 -1.47098899
 -1.90861602] [-1.67741667  0.21203379 -1.08231219 -1.53179095  0.21203379
-1.50929593
 -1.93008723]
[-0.65833915  0.86482056 -0.78696541 -0.70168784  0.91201511 -0.76313679
 -0.46729775] [-0.73768744  0.84183714 -0.87430856 -0.74493354  0.84183714
-0.77600425
 -0.49462875]
[-0.50452367  1.52211695 -0.5981321  -0.55929602  1.54549452 -0.55731532
 -1.30829337] [-0.5810659   1.47164049 -0.66630494 -0.60402468  1.47164049
-0.62407224
 -1.3930365 ]
[-0.98884917 -0.18695155 -0.97497864 -0.96140386 -0.13828927 -0.99566931
 -1.41325215] [-1.05093052 -0.2078351  -1.01297765 -1.01838044 -0.2078351
-1.03885081
 -1.43304574]
[-0.52271192  1.54189747 -0.85130815 -0.5494861   1.48247043 -0.5664225
 -0.99386061] [-0.5810659   1.47164049 -0.87430856 -0.60402468  1.47164049
-0.64918497
 -1.06009817]
[-1.28754011  0.22677142 -0.95769106 -1.19984173  0.24058854 -1.25756266
  0.16429569] [-1.36417359  0.21203379 -1.01297765 -1.28066624  0.21203379
-1.27491046
  0.07875195]
[-0.24308271  1.31166664 -0.87399573 -0.25865131  1.27425652 -0.38334983
```

```
 -1.31171213] [-0.26782283  1.26170604 -0.94364311 -0.31383613  1.26170604
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 -1.35689221]
[-0.68275738  0.48450577 -0.94966921 -0.7025592   0.47052349 -0.74841404
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-0.79274607
  0.11354893]
[2.45841065 0.24403403 1.30205301 2.6508833  0.22977334 2.54426518
 1.62885336] [2.39474331 0.21203379 1.27506221 2.60339588 0.21203379 2.49702141
 1.57480018]
[1.54279959 0.29789044 1.19303521 1.55943207 0.24815082 1.48702734
 1.17855595] [1.45501408 0.21203379 1.13639313 1.48170552 0.21203379 1.47074789
 1.09369365]
[2.25919635 0.07787423 1.4894489  2.43187397 0.01706279 2.40777044
 1.75221641] [2.23812177e+00 2.09934449e-03 1.41373130e+00 2.40947180e+00
 2.09934449e-03 2.33922977e+00 1.67479348e+00]
[ 0.05706528 -1.60291825  0.87862397  0.00651441 -1.59928695  0.15328336
  1.110595  ] [ 0.04542025 -1.67737625  0.78972042 -0.01248648 -1.67737625
0.08410671
  1.08052043]
[ 1.66864354 -0.56366873  1.21839281  1.73314215 -0.57890254  1.72031084
 -0.66644974] [ 1.61163562 -0.627704    1.20572767  1.66167823 -0.627704
1.6410959
 -0.70031188]
[ 0.3845847  -0.60087341  1.18025735  0.36267182 -0.55206609  0.45733109
 -0.03084652] [ 0.35866332 -0.627704    1.13639313  0.30002427 -0.627704
0.40722383
 -0.0505433 ]
[1.38686788 0.50128422 1.34332007 1.3663624  0.4780426  1.3643565
 1.28235581] [1.29839254 0.42196824 1.27506221 1.30452309 0.42196824 1.32802388
 1.24065846]
[-0.81699235 -1.42822285  0.38885276 -0.83742773 -1.38426365 -0.69734983
  1.08669411] [-0.89430898 -1.4674418   0.30437864 -0.88305213 -1.4674418
-0.75800679
  1.01070437]
[ 1.8126475  -0.39378062  1.24831819  1.89191174 -0.35766041  1.87016005
  1.13862351] [ 1.76825716 -0.41776955  1.20572767  1.84444121 -0.41776955
1.80558428
  1.08190246]
[-0.41410559 -0.76599836  0.76190704 -0.39930758 -0.82027786 -0.31017012
 -0.61837624] [-0.42444437 -0.83763845  0.72038588 -0.46032554 -0.83763845
-0.32732349
 -0.65530013]
[-0.65212148 -2.23963867  0.47256947 -0.70318633 -2.22124628 -0.55331603
 -0.42478595] [-0.73768744 -2.30717959  0.44304772 -0.74493354 -2.30717959
-0.61695697
 -0.45821479]
[ 0.68285073 -0.13025699  0.99866516  0.66663088 -0.19064003  0.73991757
```

```
  0.16063194] [ 0.6719064  -0.2078351   0.92838951  0.62369611 -0.2078351
0.67341875
  0.08994834]
[ 0.86114731 -1.81404456  0.81757895  0.84649602 -1.81925498  0.85025964
  1.60672773] [ 0.82852793 -1.88731069  0.78972042  0.78971744 -1.88731069
0.80609767
  1.56285055]
[ 1.00039427 -0.36243639  1.31289977  1.02862215 -0.33676262  1.09742136
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1.01662605
 -0.2933458 ]
[ 0.2188688  -0.33431729  0.55238504  0.19000603 -0.40230707  0.25098723
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0.18999872
 -0.34731407]
[1.99072712 0.08663784 1.1357054  2.04827459 0.07919356 1.96847118
 1.11043745] [1.92487869 0.00209934 1.06705859 2.02999446 0.00209934 1.95584211
 1.0413574 ]
[ 0.24213233 -0.17188958  1.18511328  0.19458248 -0.13935021  0.32671693
  1.08012196] [ 0.20204178 -0.2078351   1.13639313  0.14237376 -0.2078351
0.26533691
  1.04153762]
[ 0.57930991 -0.77231601  0.94189046  0.52611319 -0.81224774  0.60671268
  0.75903336] [ 0.51528486 -0.83763845  0.85905497  0.46046505 -0.83763845
0.51813838
  0.73404616]
[ 1.23103638 -1.8126028   1.20453605  1.1641663  -1.80020302  1.16999447
  0.63365092] [ 1.14177101 -1.88731069  1.13639313  1.13013093 -1.88731069
1.15432751
  0.56100144]
[ 0.23617693 -1.1725886   0.74617576  0.1537876  -1.20736707  0.30028728
 -0.14101169] [ 0.20204178 -1.25750735  0.72038588  0.14237376 -1.25750735
0.21511145
 -0.15653725]
[0.73973205 0.28961052 1.36498751 0.64010755 0.23943725 0.75167167
 0.5519498 ] [0.6719064  0.21203379 1.34439675 0.62369611 0.21203379 0.72364421
 0.5131026 ]
[ 1.00580728 -0.61204774  0.82726455  1.00671635 -0.59174155  0.96863549
 -0.14884357] [ 0.98514947 -0.627704    0.78972042  0.95852905 -0.627704
0.95802968
 -0.20345648]
[ 1.34935132 -1.21337827  1.43037726  1.32882942 -1.20726855  1.40780192
  1.91324526] [ 1.29839254 -1.25750735  1.4137313   1.30452309 -1.25750735
1.3447657
  1.88555113]
[ 1.01549272 -0.59970929  1.29369894  0.9931277  -0.55549151  1.0620855
  2.29350979] [ 0.98514947 -0.627704    1.27506221  0.95852905 -0.627704
1.01662605
```

```
  2.24724411]
[ 1.53506199 -0.38699311  1.07878519  1.507425   -0.40499235  1.50459707
  0.16185049] [ 1.45501408 -0.41776955  0.99772405  1.48170552 -0.41776955
1.45400607
  0.09493325]
[ 1.84911951 -0.13558177  1.12955974  1.86169453 -0.18219286  1.87781741
  0.17330375] [ 1.76825716 -0.2078351   1.06705859  1.84444121 -0.2078351
1.78884246
  0.11498483]
[ 2.10619635 -0.59172882  1.37029428  2.26101798 -0.54083973  2.20373993
  1.97684716] [ 2.08150023 -0.627704    1.34439675  2.21833799 -0.627704
2.15883666
  1.94105101]
[ 1.97920742 -0.12101248  1.52255149  2.04390707 -0.13176701  2.09590556
  1.41317927] [ 1.92487869 -0.2078351   1.48306584  2.02999446 -0.2078351
2.00606756
  1.36780975]
[ 0.87133255 -0.38277353  1.19770899  0.81830178 -0.39584756  0.92450219
  0.8884285 ] [ 0.82852793 -0.41776955  1.13639313  0.78971744 -0.41776955
0.84795222
  0.87421373]
[ 0.38362636 -1.00196258  0.50236199  0.38316808 -0.97142085  0.3985113
 -0.50543822] [ 0.35866332 -1.0475729   0.44304772  0.30002427 -1.0475729
0.32351473
 -0.5474978 ]
[ 0.12703394 -1.45529809  0.67606752  0.04993048 -1.42556741  0.09910731
 -0.30699105] [ 0.04542025 -1.4674418   0.65105134 -0.01248648 -1.4674418
0.0673649
 -0.3302076 ]
[ 0.12092223 -1.45516826  0.62481365  0.03501553 -1.38555935  0.07048835
  0.16984455] [ 0.04542025 -1.4674418   0.5817168  -0.01248648 -1.4674418
0.05899399
  0.13804358]
[ 0.54711221 -0.74980026  0.76782589  0.48938316 -0.80676705  0.57075441
  1.3432073 ] [ 0.51528486 -0.83763845  0.72038588  0.46046505 -0.83763845
0.50139656
  1.28012377]
[ 0.85005126 -0.76262747  1.622674    0.85399935 -0.8134911   0.93396845
  1.98538169] [ 0.82852793 -0.83763845  1.55240038  0.78971744 -0.83763845
0.89817767
  1.94454083]
[-0.02827715 -0.17045256  1.15157978 -0.14588926 -0.12905301  0.04236614
  0.12123408] [-0.11120129 -0.2078351   1.13639313 -0.16455644 -0.2078351
-0.01090311
  0.07381134]
[0.87581368 0.64861579 1.1475828  0.86991184 0.66857927 0.92244965
 1.06879168] [0.82852793 0.63190269 1.13639313 0.78971744 0.63190269 0.84795222
 1.02133893]
```

```
[ 1.93670547  0.05431544  1.28556218  2.07671852  0.02503867  2.06193804
 -0.06396527] [ 1.92487869  0.00209934  1.27506221  2.02999446  0.00209934
1.98095483
 -0.09909819]
[ 1.38374966 -1.59354384  1.13695798  1.34019838 -1.64833912  1.32861527
  0.99953446] [ 1.29839254 -1.67737625  1.06705859  1.30452309 -1.67737625
1.30291115
  0.9307629 ]
[ 0.25482837 -0.15513792  0.90766017  0.21700519 -0.18612263  0.24366338
  0.06881416] [ 0.20204178 -0.2078351   0.85905497  0.14237376 -0.2078351
0.23185327
 -0.01875666]
[ 0.12275932 -1.18107654  0.86447194  0.04327025 -1.2297115   0.10692258
 -0.25258491] [ 0.04542025 -1.25750735  0.78972042 -0.01248648 -1.25750735
0.08410671
 -0.31966474]
[ 0.06781951 -1.00482833  1.10734951  0.02833693 -1.03276811  0.15007155
  0.66834688] [ 0.04542025 -1.0475729   1.06705859 -0.01248648 -1.0475729
0.11759035
  0.63341909]
[ 1.01864628 -0.14834385  1.23117853  0.97072466 -0.1929102   1.03268431
  0.4858471 ] [ 0.98514947 -0.2078351   1.20572767  0.95852905 -0.2078351
1.00825514
  0.47544708]
[ 0.5373169  -1.02401988  0.82007292  0.49628739 -1.0339105   0.5977304
  0.26944368] [ 0.51528486 -1.0475729   0.78972042  0.46046505 -1.0475729
0.50976747
  0.20230709]
[-0.6762473  -1.62447585  0.38138623 -0.66314888 -1.6245395  -0.5981955
  1.38821349] [-0.73768744 -1.67737625  0.30437864 -0.74493354 -1.67737625
-0.63369879
  1.3635154 ]
[ 0.25282051 -0.79031325  1.01042478  0.20206487 -0.75514288  0.32554294
  1.3262981 ] [ 0.20204178 -0.83763845  0.92838951  0.14237376 -0.83763845
0.24022418
  1.2549275 ]
[ 0.40583303 -0.18581259  0.98702791  0.34605366 -0.17694149  0.43545722
  1.74803285] [ 0.35866332 -0.2078351   0.92838951  0.30002427 -0.2078351
0.3821111
  1.71647571]
[ 0.42248867 -0.33382809  0.96236021  0.32771642 -0.39443268  0.39377218
  1.85354436] [ 0.35866332 -0.41776955  0.92838951  0.30002427 -0.41776955
0.3821111
  1.84126905]
[ 1.1841147  -0.35583456  1.01284878  1.18091773 -0.3385647   1.21221649
  0.09694254] [ 1.14177101 -0.41776955  0.99772405  1.13013093 -0.41776955
1.13758569
  0.01985967]
```

```
[-0.54714892 -1.23298173  0.13256532 -0.54957579 -1.17580039 -0.49113233
  0.63383262] [-0.5810659  -1.25750735  0.09637501 -0.60402468 -1.25750735
-0.53199223
  0.5905822 ]
[ 0.40172687 -0.57828017  0.90534251  0.3670125  -0.61256391  0.42501028
 -0.01692131] [ 0.35866332 -0.627704    0.85905497  0.30002427 -0.627704
0.37374019
 -0.04536372]
```

[8]:
```
X_train_,X_test_,y_train,y_test=train_test_split(X_,Y,random_state =␣
↪42,test_size=0.2)  #adding error

best_model.fit(X_train_,y_train)
y_pred_=best_model.predict(X_test_)
best_model_accuracy_edited=accuracy_score(y_test, y_pred_)
print("best_model_accuracy_edited = ",best_model_accuracy_edited)
weight_1=best_model.coef_
print("coef :-",weight_1)
```

```
best_model_accuracy_edited =  0.4
coef :- [[ 0.00029688 -0.00026124  0.00037905  0.00029056 -0.00026117
0.00031002
   0.00021826]]
```

[9]:
```
print("different in accuracy = ",best_model_accuracy_edited-best_model_accuracy)
```

```
different in accuracy =  0.0
```

0.5 step 5 Checking deviations in metric and weights

[11]:
```
change=weight-weight_1
print("Absolute change in weight = ",change)

per_chan=[]
for i in range(7):
    per_chan.append(abs(change[:,i]/weight[:,i])*100)

print(per_chan)

top=[]
idx=[]
top_fe=[]
fe= label.copy()
for i in range(4):
    idx.append(per_chan.index(max(per_chan)))
    top.append(max(per_chan))
    per_chan.pop(idx[i])
    top_fe.append(fe[idx[i]])
```

```
    fe.pop(idx[i])


print("Top features are = ",top_fe)
print("with change in weight with percentage =",list(top))
```

```
Absolute change in weight =  [[-3.07476576e-07  8.20232349e-08 -8.99509811e-08
1.24712284e-06
   1.15782681e-08 -1.64045231e-06  1.64688780e-06]]
[array([0.10367701]), array([0.03140726]), array([0.02373631]),
array([0.42737671]), array([0.0044334]), array([0.53195253]),
array([0.74891423])]
Top features are =  ['w', '2*z+3*x*x', 'x*x', 'x']
with change in weight with percentage = [array([0.74891423]),
array([0.53195253]), array([0.42737671]), array([0.10367701])]
```

0.6 According to logistic regression 'w', '2z+3xx', 'xx', 'x" are the most important features by weight of that features.

1 Here we start LinearSVC

1.1 step 2

[32]:
```
from sklearn.svm import SVC

parameters = {'C':(np.logspace(-5,8,10))}

cv = RepeatedStratifiedKFold(n_splits=10, n_repeats=3, random_state=42)

lr_svc=SVC(kernel='linear')
lr_svc_cv = GridSearchCV(lr_svc, parameters,n_jobs=-1,cv=cv)
lr_svc_cv.fit(X, Y)                                                   # fitting␣
 ↪on whole data for find out best hyperparameter



print("best parameter = ",lr_svc_cv.best_params_)
print("best score = ",lr_svc_cv.best_score_)
print("best estimator = ",lr_svc_cv.best_estimator_)
```

```
best parameter =  {'C': 0.007742636826811269}
best score =  1.0
best estimator =  SVC(C=0.007742636826811269, kernel='linear')
```

1.2 step 3

[37]:
```
best_model_1=SVC(kernel='linear',C=0.007742636826811269)

best_model_1.fit(X_train,y_train)               #fitting training data on␣
 ↪best_hyperparameter_model
y_pred_0=best_model_1.predict(X_test)
best_model_accuracy_1=accuracy_score(y_test, y_pred_0)

w_01=best_model_1.coef_
print("coef :-",w_01)
print("accuracy = ",best_model_accuracy_1)
```

```
coef :- [[ 0.16128427 -0.20643167  0.30599434  0.15069928 -0.20643167  0.1725741
   0.12110967]]
accuracy =  1.0
```

[36]:
```
best_model_1.fit(X_train_,y_train)
y_pred_1=best_model_1.predict(X_test_)
best_model_accuracy_edited_1=accuracy_score(y_test, y_pred_1)
print("best_model_accuracy_edited = ",best_model_accuracy_edited_1)
w_12=best_model_1.coef_
print("coef :-",w_12)
```

```
best_model_accuracy_edited =  1.0
coef :- [[ 0.16009975 -0.20690403  0.3050217   0.15015462 -0.20592693
0.17426045
   0.12377358]]
```

[38]:
```
print("different in accuracy =␣
 ↪",best_model_accuracy_edited_1-best_model_accuracy_1)
```

```
different in accuracy =  0.0
```

1.3 step 5 Checking deviations in metric and weights with updated data set.

[39]:
```
ch=[]

ch=abs(w_01-w_12)



print("Absolute change in weight = ",ch)

per_chan=[]
for i in range(7):
    per_chan.append(abs(ch[:,i]/w_01[:,i])*100)

print(per_chan)
```

```python
top=[]
idx=[]
top_fe=[]
fe1=label.copy()
for i in range(4):
    idx.append(per_chan.index(max(per_chan)))
    top.append(max(per_chan))
    per_chan.pop(idx[i])
    top_fe.append(fe1[idx[i]])
    fe1.pop(idx[i])

print("Top features are = ",top_fe)
print("with change in weight with percentage =",list(top))
```

```
Absolute change in weight =  [[0.00118452 0.00047236 0.00097264 0.00054465
0.00050473 0.00168635
  0.00266391]]
[array([0.7344298]), array([0.22882139]), array([0.3178629]),
array([0.3614178]), array([0.24450327]), array([0.97717166]),
array([2.19958674])]
Top features are =  ['w', '2*z+3*x*x', 'x', 'x*x']
with change in weight with percentage = [array([2.19958674]),
array([0.97717166]), array([0.7344298]), array([0.3614178])]
```

1.3.1 1.According to Linear SVM ‘w’, ‘2*z+3*x*x*’, ’*x*’, ’*x*x’ are the most important features by weights.

1.3.2 2.After pertubation test there is not much change in accuracy and weight of feature of the both model in linear SVM and Logistic Regression.

1.3.3 3.Some freature are highly correlated to each other in correlation matrix.

[ ]: