rk2

May 28, 2022

0.1 №2

0.1.1 :

0.1.2 . . 5-65 -19

:

```
[ ]: import pandas as pd
     import numpy as np
     import seaborn as sns
     import matplotlib.pyplot as plt

     from sklearn import preprocessing
     from sklearn.impute import SimpleImputer
     from sklearn.preprocessing import LabelEncoder
     from sklearn.model_selection import train_test_split
     from sklearn import svm
     from sklearn.metrics import accuracy_score, balanced_accuracy_score
     from sklearn.metrics import precision_score, recall_score, f1_score,␣
      ↪classification_report

     from sklearn.ensemble import AdaBoostClassifier
```

```
[ ]: data = pd.read_csv('./investments_VC.csv', encoding='latin1', sep=",")
     target_col = 'status'
```

```
[ ]: data.head()
```

```
[ ]:                          permalink                 name  \
     0            /organization/waywire             #waywire
     1  /organization/tv-communications  &TV Communications
     2    /organization/rock-your-paper   'Rock' Your Paper
     3   /organization/in-touch-network   (In)Touch Network
     4   /organization/r-ranch-and-mine  -R- Ranch and Mine

                      homepage_url  \
     0         http://www.waywire.com
```

```
1          http://enjoyandtv.com
2   http://www.rockyourpaper.org
3  http://www.InTouchNetwork.com
4                            NaN

                                       category_list       market   \
0          |Entertainment|Politics|Social Media|News|         News
1                                            |Games|         Games
2                              |Publishing|Education|    Publishing
3  |Electronics|Guides|Coffee|Restaurants|Music|i…   Electronics
4                       |Tourism|Entertainment|Games|       Tourism

   funding_total_usd      status country_code state_code         region  …  \
0          17,50,000    acquired          USA         NY  New York City  …
1          40,00,000   operating          USA         CA    Los Angeles  …
2             40,000   operating          EST        NaN        Tallinn  …
3          15,00,000   operating          GBR        NaN         London  …
4             60,000   operating          USA         TX         Dallas  …

  secondary_market  product_crowdfunding round_A round_B round_C  round_D  \
0              0.0                   0.0     0.0     0.0     0.0      0.0
1              0.0                   0.0     0.0     0.0     0.0      0.0
2              0.0                   0.0     0.0     0.0     0.0      0.0
3              0.0                   0.0     0.0     0.0     0.0      0.0
4              0.0                   0.0     0.0     0.0     0.0      0.0

  round_E round_F  round_G  round_H
0     0.0     0.0      0.0      0.0
1     0.0     0.0      0.0      0.0
2     0.0     0.0      0.0      0.0
3     0.0     0.0      0.0      0.0
4     0.0     0.0      0.0      0.0

[5 rows x 39 columns]
```

```
[ ]: data.shape
```

```
[ ]: (54294, 39)
```

```
[ ]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 54294 entries, 0 to 54293
Data columns (total 39 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   permalink             49438 non-null  object
 1   name                  49437 non-null  object
 2   homepage_url          45989 non-null  object
 3   category_list         45477 non-null  object
 4    market               45470 non-null  object
 5    funding_total_usd    49438 non-null  object
 6   status                48124 non-null  object
 7   country_code          44165 non-null  object
 8   state_code            30161 non-null  object
 9   region                44165 non-null  object
 10  city                  43322 non-null  object
 11  funding_rounds        49438 non-null  float64
 12  founded_at            38554 non-null  object
 13  founded_month         38482 non-null  object
 14  founded_quarter       38482 non-null  object
 15  founded_year          38482 non-null  float64
 16  first_funding_at      49438 non-null  object
 17  last_funding_at       49438 non-null  object
 18  seed                  49438 non-null  float64
 19  venture               49438 non-null  float64
 20  equity_crowdfunding   49438 non-null  float64
 21  undisclosed           49438 non-null  float64
 22  convertible_note      49438 non-null  float64
 23  debt_financing        49438 non-null  float64
 24  angel                 49438 non-null  float64
 25  grant                 49438 non-null  float64
 26  private_equity        49438 non-null  float64
 27  post_ipo_equity       49438 non-null  float64
 28  post_ipo_debt         49438 non-null  float64
 29  secondary_market      49438 non-null  float64
 30  product_crowdfunding  49438 non-null  float64
 31  round_A               49438 non-null  float64
 32  round_B               49438 non-null  float64
 33  round_C               49438 non-null  float64
 34  round_D               49438 non-null  float64
 35  round_E               49438 non-null  float64
 36  round_F               49438 non-null  float64
 37  round_G               49438 non-null  float64
 38  round_H               49438 non-null  float64
dtypes: float64(23), object(16)
memory usage: 16.2+ MB
```

0.1.3

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[ ]:
```
data.isnull().mean()
```

[ ]:

```
permalink                0.089439
name                     0.089457
homepage_url             0.152963
category_list            0.162394
 market                  0.162523
 funding_total_usd       0.089439
status                   0.113641
country_code             0.186558
state_code               0.444487
region                   0.186558
city                     0.202085
funding_rounds           0.089439
founded_at               0.289903
founded_month            0.291229
founded_quarter          0.291229
founded_year             0.291229
first_funding_at         0.089439
last_funding_at          0.089439
seed                     0.089439
venture                  0.089439
equity_crowdfunding      0.089439
undisclosed              0.089439
convertible_note         0.089439
debt_financing           0.089439
angel                    0.089439
grant                    0.089439
private_equity           0.089439
post_ipo_equity          0.089439
post_ipo_debt            0.089439
secondary_market         0.089439
product_crowdfunding     0.089439
round_A                  0.089439
round_B                  0.089439
round_C                  0.089439
round_D                  0.089439
round_E                  0.089439
round_F                  0.089439
round_G                  0.089439
round_H                  0.089439
dtype: float64
```

[ ]:

```python
data=data.drop(['permalink','category_list','founded_at', 'founded_month',
       'founded_quarter',
       'first_funding_at', 'last_funding_at'],axis=1)
```

. , 4856,
. .

```
[ ]: data.isnull().sum()
```

```
[ ]: name                     4857
     homepage_url             8305
      market                  8824
      funding_total_usd       4856
     status                   6170
     country_code            10129
     state_code              24133
     region                  10129
     city                    10972
     funding_rounds           4856
     founded_year            15812
     seed                     4856
     venture                  4856
     equity_crowdfunding      4856
     undisclosed              4856
     convertible_note         4856
     debt_financing           4856
     angel                    4856
     grant                    4856
     private_equity           4856
     post_ipo_equity          4856
     post_ipo_debt            4856
     secondary_market         4856
     product_crowdfunding     4856
     round_A                  4856
     round_B                  4856
     round_C                  4856
     round_D                  4856
     round_E                  4856
     round_F                  4856
     round_G                  4856
     round_H                  4856
     dtype: int64
```

```
[ ]: data=data.dropna(how="all")
```

0.1.4 SimpleImputer

SimpleImputer

```
[ ]: imp = SimpleImputer(missing_values=np.nan, strategy='most_frequent')

     imputed = {}

     for col in data:
```

```
    contains_nan = data[col].isnull().sum() != 0
    if contains_nan:
        data_imp = data[[col]]
        data_imp = imp.fit_transform(data_imp)
        imputed[col] = data_imp

for col_name in imputed:
    df = pd.DataFrame({col_name:imputed[col_name].T[0]})
    data[col_name] = df.copy()

data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 49438 entries, 0 to 49437
Data columns (total 32 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   name                  49438 non-null  object
 1   homepage_url          49438 non-null  object
 2    market               49438 non-null  object
 3    funding_total_usd    49438 non-null  object
 4   status                49438 non-null  object
 5   country_code          49438 non-null  object
 6   state_code            49438 non-null  object
 7   region                49438 non-null  object
 8   city                  49438 non-null  object
 9   funding_rounds        49438 non-null  float64
 10  founded_year          49438 non-null  float64
 11  seed                  49438 non-null  float64
 12  venture               49438 non-null  float64
 13  equity_crowdfunding   49438 non-null  float64
 14  undisclosed           49438 non-null  float64
 15  convertible_note      49438 non-null  float64
 16  debt_financing        49438 non-null  float64
 17  angel                 49438 non-null  float64
 18  grant                 49438 non-null  float64
 19  private_equity        49438 non-null  float64
 20  post_ipo_equity       49438 non-null  float64
 21  post_ipo_debt         49438 non-null  float64
 22  secondary_market      49438 non-null  float64
 23  product_crowdfunding  49438 non-null  float64
 24  round_A               49438 non-null  float64
 25  round_B               49438 non-null  float64
 26  round_C               49438 non-null  float64
 27  round_D               49438 non-null  float64
 28  round_E               49438 non-null  float64
 29  round_F               49438 non-null  float64
 30   round_G               49438 non-null  float64
 31   round_H               49438 non-null  float64
dtypes: float64(23), object(9)
memory usage: 12.4+ MB
```

, funding_total_usd 11,11,231

```
[ ]: data.columns=data.columns.str.strip()

     data['funding_total_usd']=data['funding_total_usd'].str.replace(",","")
     data["funding_total_usd"]=pd.
      ↪to_numeric(data["funding_total_usd"],errors="coerce").convert_dtypes()
     funding_mode=data['funding_total_usd'].mode()[0]
     data['funding_total_usd']=data["funding_total_usd"].fillna(funding_mode)
```

```
[ ]: data.head()
```

```
[ ]:                    name                     homepage_url        market  \
     0              #waywire         http://www.waywire.com          News
     1  &TV Communications            http://enjoyandtv.com         Games
     2    'Rock' Your Paper    http://www.rockyourpaper.org    Publishing
     3    (In)Touch Network  http://www.InTouchNetwork.com   Electronics
     4  -R- Ranch and Mine             http://app.thotz.co/       Tourism

        funding_total_usd     status country_code state_code         region  \
     0            1750000   acquired          USA         NY  New York City
     1            4000000  operating          USA         CA    Los Angeles
     2              40000  operating          EST         CA        Tallinn
     3            1500000  operating          GBR         CA         London
     4              60000  operating          USA         TX         Dallas

               city  funding_rounds  …  secondary_market  product_crowdfunding  \
     0     New York             1.0  …               0.0                   0.0
     1  Los Angeles             2.0  …               0.0                   0.0
     2      Tallinn             1.0  …               0.0                   0.0
     3       London             1.0  …               0.0                   0.0
     4   Fort Worth             2.0  …               0.0                   0.0

        round_A  round_B  round_C  round_D  round_E  round_F  round_G  round_H
     0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     1      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     2      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     3      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     4      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0

     [5 rows x 32 columns]
```

```
[ ]: data.shape
```

[ ]:
```
(49438, 32)
```

[ ]:
```
data.dtypes
```

[ ]:
```
name                        object
homepage_url                object
market                      object
funding_total_usd            Int64
status                      object
country_code                object
state_code                  object
region                      object
city                        object
funding_rounds             float64
founded_year               float64
seed                       float64
venture                    float64
equity_crowdfunding        float64
undisclosed                float64
convertible_note           float64
debt_financing             float64
angel                      float64
grant                      float64
private_equity             float64
post_ipo_equity            float64
post_ipo_debt              float64
secondary_market           float64
product_crowdfunding       float64
round_A                    float64
round_B                    float64
round_C                    float64
round_D                    float64
round_E                    float64
round_F                    float64
round_G                    float64
round_H                    float64
dtype: object
```

[ ]:
```
data.select_dtypes('O').describe()
```

0.1.5 LabelEncoding

LabelEncoder

[ ]:
```
encoder_name=LabelEncoder()
encoder_market=LabelEncoder()
encoder_country_code=LabelEncoder()
```

```
encoder_homepage_url=LabelEncoder()
encoder_status=LabelEncoder()
encoder_state_code=LabelEncoder()
encoder_city=LabelEncoder()
encoder_region=LabelEncoder()
```

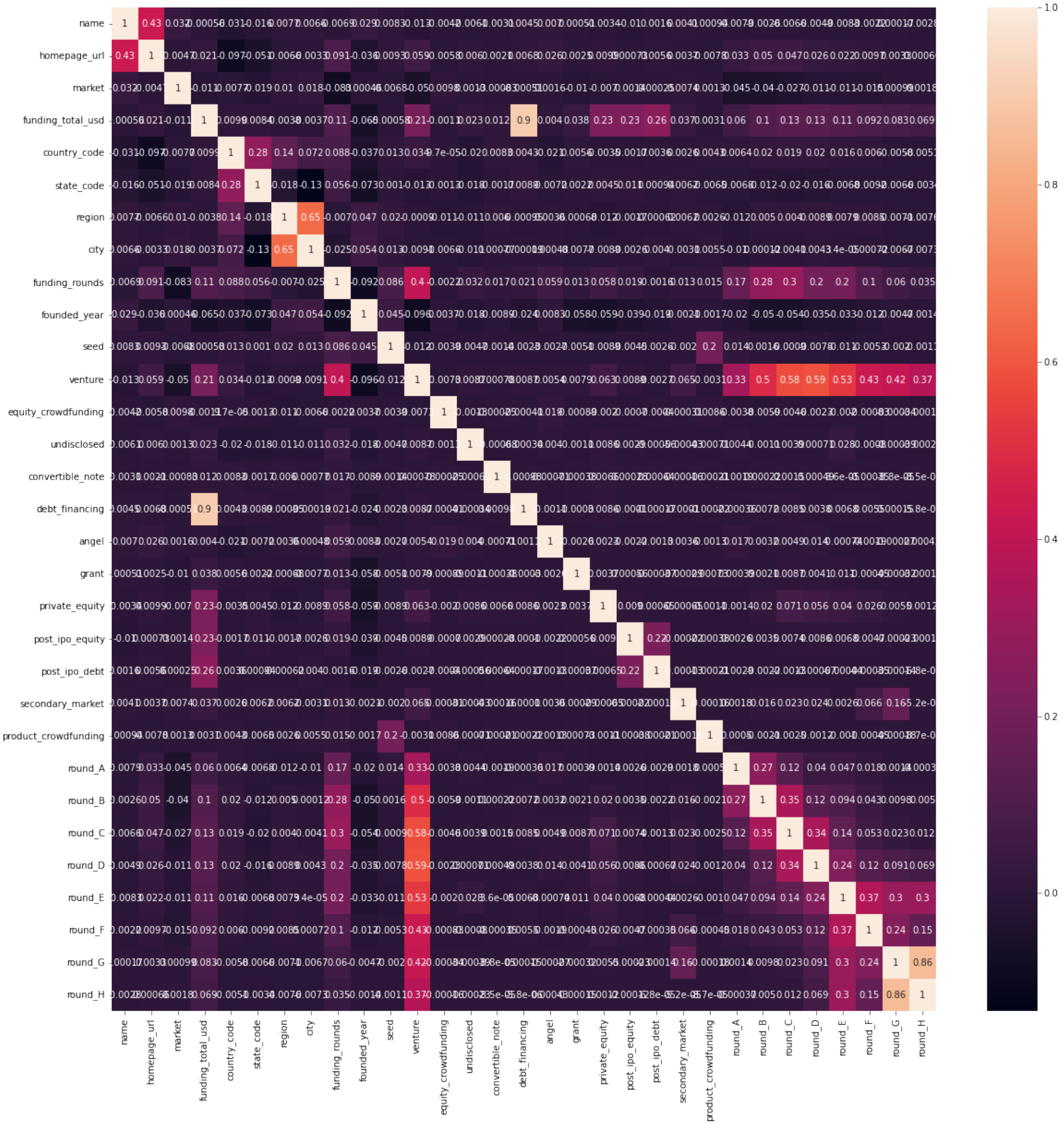
[ ]:
```
data['name']=encoder_name.fit_transform(data['name'])
data['market']=encoder_market.fit_transform(data['market'])
data['country_code']=encoder_country_code.fit_transform(data['country_code'])
data['status']=encoder_homepage_url.fit_transform(data['status'])
data['homepage_url']=encoder_homepage_url.fit_transform(data['homepage_url'])
data['state_code']=encoder_state_code.fit_transform(data['state_code'])
data['city']=encoder_city.fit_transform(data['city'])
data['region']=encoder_region.fit_transform(data['region'])
```

[ ]:
```
data.head()
```

[ ]:
```
   name  homepage_url  market  funding_total_usd  status  country_code  \
0     0         43610     465            1750000       0           110
1     1          4422     277            4000000       2           110
2     2         37197     543              40000       2            35
3     3         15435     211            1500000       2            38
4     4          1124     683              60000       2           110

   state_code  region  city  funding_rounds  …  secondary_market  \
0          40     699  2547             1.0  …               0.0
1           6     570  2098             2.0  …               0.0
2           6     956  3645             1.0  …               0.0
3           6     568  2085             1.0  …               0.0
4          53     251  1234             2.0  …               0.0

   product_crowdfunding  round_A  round_B  round_C  round_D  round_E  round_F  \
0                   0.0      0.0      0.0      0.0      0.0      0.0      0.0
1                   0.0      0.0      0.0      0.0      0.0      0.0      0.0
2                   0.0      0.0      0.0      0.0      0.0      0.0      0.0
3                   0.0      0.0      0.0      0.0      0.0      0.0      0.0
4                   0.0      0.0      0.0      0.0      0.0      0.0      0.0

   round_G  round_H
0      0.0      0.0
1      0.0      0.0
2      0.0      0.0
3      0.0      0.0
4      0.0      0.0

[5 rows x 32 columns]
```

, .

```
[ ]: data_corr=data.drop("status",axis=1).corr()
     plt.figure(figsize=(20,20))
     sns.heatmap(data_corr,annot=True)
     plt.show()
```



```
[ ]: threshold=0.5
     def correlation_fun(ds,threshold):
         corr_col=set()
         corr_mat=ds.corr()
```

```
    for i in range(len(corr_mat.columns)):
        for j in range(i):
            if abs(corr_mat.iloc[i,j])>threshold:
                colname=corr_mat.columns[i]
                corr_col.add(colname)
    return corr_col
```

```
[ ]: correlation_fun(data.drop("status",axis=1),threshold)
```

```
[ ]: {'city', 'debt_financing', 'round_C', 'round_D', 'round_E', 'round_H'}
```

```
[ ]: data=data.drop(['city', 'round_C', 'round_D', 'round_E', 'round_H'],axis=1)
```

0.1.6

```
[ ]: target = data[target_col]
     data_X_train, data_X_test, data_y_train, data_y_test = train_test_split(data,␣
      ↪target, test_size=0.2, random_state=1)
```

```
[ ]: data_X_train.shape
```

```
[ ]: (39550, 27)
```

```
[ ]: data_X_test.shape
```

```
[ ]: (9888, 27)
```

```
[ ]: np.unique(target)
```

```
[ ]: array([0, 1, 2])
```

0.1.7

```
[ ]: svr_1 = svm.LinearSVC()
     svr_1.fit(data_X_train, data_y_train)
```

```
/home/artyom/.local/lib/python3.8/site-packages/sklearn/svm/_base.py:1206:
ConvergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  warnings.warn(
```

```
[ ]: LinearSVC()
```

```
[ ]: data_y_pred_1 = svr_1.predict(data_X_test)
     accuracy_score(data_y_test, data_y_pred_1)
```

```
[ ]: 0.8080501618122977
[ ]: f1_score(data_y_test, data_y_pred_1, average='micro')
```

```
[ ]: 0.8080501618122977
```

```
[ ]: f1_score(data_y_test, data_y_pred_1, average='macro')
```

```
[ ]: 0.3295056626437861
```

```
[ ]: f1_score(data_y_test, data_y_pred_1, average='weighted')
```

```
[ ]: 0.7868994820528529
```

```
[ ]: svr_2 = svm.LinearSVC(C=1.0, max_iter=10000)
     svr_2.fit(data_X_train, data_y_train)
```

```
/home/artyom/.local/lib/python3.8/site-packages/sklearn/svm/_base.py:1206:
ConvergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  warnings.warn(
```

```
[ ]: LinearSVC(max_iter=10000)
```

```
[ ]: data_y_pred_2 = svr_2.predict(data_X_test)
     accuracy_score(data_y_test, data_y_pred_2)
```

```
[ ]: 0.6844660194174758
```

```
[ ]: f1_score(data_y_test, data_y_pred_2, average='micro')
```

```
[ ]: 0.6844660194174758
```

```
[ ]: f1_score(data_y_test, data_y_pred_2, average='macro')
```

```
[ ]: 0.35340656910368473
```

```
[ ]: f1_score(data_y_test, data_y_pred_2, average='weighted')
```

```
[ ]: 0.7253240978043891
```

```
[ ]: svr_3 = svm.LinearSVC(C=1.0, penalty='l1', dual=False, max_iter=10000)
     svr_3.fit(data_X_train, data_y_train)
```

```
/home/artyom/.local/lib/python3.8/site-packages/sklearn/svm/_base.py:1206:
ConvergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  warnings.warn(
```

```
[ ]: LinearSVC(dual=False, max_iter=10000, penalty='l1')
[ ]: data_y_pred_3_0 = svr_3.predict(data_X_train)
     accuracy_score(data_y_train, data_y_pred_3_0)
```

```
[ ]: 0.9997218710493047
```

```
[ ]: data_y_pred_3 = svr_3.predict(data_X_test)
     accuracy_score(data_y_test, data_y_pred_3)
```

```
[ ]: 0.9998988673139159
```

```
[ ]: f1_score(data_y_test, data_y_pred_3, average='micro')
```

```
[ ]: 0.9998988673139159
```

```
[ ]: f1_score(data_y_test, data_y_pred_3, average='weighted')
```

```
[ ]: 0.9998988213894379
```

0.1.8

```
[ ]: ab1 = AdaBoostClassifier()
     ab1.fit(data_X_train, data_y_train)
     data_y_pred_1 = ab1.predict(data_X_test)
     data_y_pred_1_0 = ab1.predict(data_X_train)
     accuracy_score(data_y_train, data_y_pred_1_0)
```

```
[ ]: 1.0
```

```
[ ]: accuracy_score(data_y_test, data_y_pred_1)
```

```
[ ]: 1.0
```

```
[ ]: f1_score(data_y_test, data_y_pred_1, average='micro')
```

```
[ ]: 1.0
```

```
[ ]: f1_score(data_y_test, data_y_pred_1, average='macro')
```

```
[ ]: 1.0
```

```
[ ]: f1_score(data_y_test, data_y_pred_1, average='weighted')
```

```
[ ]: 1.0
```

0.1.9

100% .
: svr_3 = svm.LinearSVC(C=1.0, penalty=‘l1’, dual=False, max_iter=10000)

100% . ,
, , .
, .

, , .