```
In [1]: import numpy as np
    import pandas as pd
    import matplotlib.pyplot as plt
    import seaborn as sns
    import warnings
    warnings.filterwarnings('ignore')
    loan = pd.read_csv("loan.csv", sep=",")
In [2]: # summarising number of missing values in each column
    pd.set_option('display.max_columns', None)
    pd.set_option('display.max_rows', None)
    #pd.set_option('display.max_columns', None)
    loan.isnull().sum()
```

Out[2]:	id	0
	member_id loan_amnt	0
	funded_amnt	0
	funded_amnt_inv	0
	term	0
	int_rate	0
	installment	0
	grade sub_grade	0
	emp title	2459
	emp_length	1075
	home_ownership	0
	annual_inc	0
	verification_status	0
	issue_d	0
	loan_status pymnt_plan	0
	url	0
	desc	12940
	purpose	0
	title	11
	zip_code	0
	addr_state dti	0
	delinq_2yrs	0
	earliest_cr_line	0
	inq_last_6mths	0
	mths_since_last_delinq	25682
	mths_since_last_record	36931
	open_acc	0
	<pre>pub_rec revol_bal</pre>	0
	revol_util	50
	total_acc	0
	initial_list_status	0
	out_prncp	0
	out_prncp_inv	0
	<pre>total_pymnt total_pymnt_inv</pre>	0
	total_rec_prncp	0
	total_rec_int	0
	total_rec_late_fee	0
	recoveries	0
	collection_recovery_fee	0
	<pre>last_pymnt_d last_pymnt_amnt</pre>	71
	next_pymnt_d	0 38577
	last_credit_pull_d	2
	collections_12_mths_ex_med	56
	<pre>mths_since_last_major_derog</pre>	39717
	policy_code	0
	application_type	20717
	<pre>annual_inc_joint dti_joint</pre>	39717 39717
	verification_status_joint	39717
	acc_now_delinq	0
	tot_coll_amt	39717
	tot_cur_bal	39717
	open_acc_6m	39717
	open_il_6m open_il_12m	39717 39717
	open_il_12m open il 24m	39717
	mths since rcnt il	39717
	_ '- '- '- '- '-	=

```
total_bal_il
                                    39717
                                    39717
il_util
open_rv_12m
                                   39717
open_rv_24m
                                   39717
max bal bc
                                   39717
all_util
                                    39717
total_rev_hi_lim
                                   39717
inq_fi
                                   39717
total_cu_tl
                                   39717
inq_last_12m
                                   39717
acc_open_past_24mths
                                   39717
avg_cur_bal
                                   39717
bc_open_to_buy
                                   39717
bc util
                                   39717
chargeoff_within_12_mths
                                      56
                                       0
delinq_amnt
mo_sin_old_il_acct
                                    39717
                                    39717
mo_sin_old_rev_tl_op
mo_sin_rcnt_rev_tl_op
                                   39717
mo_sin_rcnt_tl
                                   39717
mort_acc
                                   39717
mths_since_recent_bc
                                   39717
mths_since_recent_bc_dlq
                                   39717
mths_since_recent_inq
                                   39717
mths_since_recent_revol_delinq
                                   39717
num_accts_ever_120_pd
                                   39717
num_actv_bc_tl
                                   39717
num_actv_rev_tl
                                    39717
num_bc_sats
                                    39717
num_bc_tl
                                   39717
num il tl
                                   39717
num_op_rev_tl
                                   39717
num_rev_accts
                                   39717
num_rev_tl_bal_gt_0
                                   39717
num_sats
                                   39717
num\_tl\_120dpd\_2m
                                   39717
num_tl_30dpd
                                   39717
num_tl_90g_dpd_24m
                                   39717
num_tl_op_past_12m
                                   39717
pct_tl_nvr_dlq
                                   39717
percent_bc_gt_75
                                   39717
pub_rec_bankruptcies
                                     697
tax liens
                                      39
tot_hi_cred_lim
                                   39717
total_bal_ex_mort
                                   39717
total_bc_limit
                                    39717
total_il_high_credit_limit
                                   39717
dtype: int64
```

```
In [3]: # removing the columns having more than 90% missing values
    missing_columns = loan.columns[100*(loan.isnull().sum()/len(loan.index)) > 90]
    print(missing columns)
```

```
'annual_inc_joint', 'dti_joint', 'verification_status_joint',
                  'tot_coll_amt', 'tot_cur_bal', 'open_acc_6m', 'open_il_6m',
'open_il_12m', 'open_il_24m', 'mths_since_rcnt_il', 'total_bal_il',
                  'il_util', 'open_rv_12m', 'open_rv_24m', 'max_bal_bc', 'all_util',
                  'total_rev_hi_lim', 'inq_fi', 'total_cu_tl', 'inq_last_12m',
                  'acc_open_past_24mths', 'avg_cur_bal', 'bc_open_to_buy', 'bc_util',
                  'mo_sin_old_il_acct', 'mo_sin_old_rev_tl_op', 'mo_sin_rcnt_rev_tl_op',
                  'mo_sin_rcnt_tl', 'mort_acc', 'mths_since_recent_bc',
'mths_since_recent_bc_dlq', 'mths_since_recent_inq',
                  'mths_since_recent_revol_delinq', 'num_accts_ever_120_pd',
                  'num_actv_bc_tl', 'num_actv_rev_tl', 'num_bc_sats', 'num_bc_tl',
                  'num_il_tl', 'num_op_rev_tl', 'num_rev_accts', 'num_rev_tl_bal_gt_0',
                  'num_sats', 'num_tl_120dpd_2m', 'num_tl_30dpd', 'num_tl_90g_dpd_24m',
                  'num_tl_op_past_12m', 'pct_tl_nvr_dlq', 'percent_bc_gt_75',
'tot_hi_cred_lim', 'total_bal_ex_mort', 'total_bc_limit',
                  'total_il_high_credit_limit'],
                 dtype='object')
In [4]:
          loan = loan.drop(missing_columns, axis=1)
          print(loan.shape)
          (39717, 55)
In [5]:
          loan.head()
Out[5]:
                  id member_id loan_amnt funded_amnt funded_amnt_inv
                                                                                 term int_rate installment
          0 1077501
                         1296599
                                        5000
                                                      5000
                                                                       4975.0
                                                                                        10.65%
                                                                                                     162.87
                                                                              months
          1 1077430
                         1314167
                                        2500
                                                      2500
                                                                       2500.0
                                                                                        15.27%
                                                                                                      59.83
                                                                              months
          2 1077175
                         1313524
                                        2400
                                                      2400
                                                                       2400.0
                                                                                        15.96%
                                                                                                      84.33
          3 1076863
                         1277178
                                       10000
                                                     10000
                                                                      10000.0
                                                                                        13.49%
                                                                                                     339.31
                                                                               months
          4 1075358 1311748
                                        3000
                                                      3000
                                                                       3000.0
                                                                                        12.69%
                                                                                                      67.79
                                                                              months
```

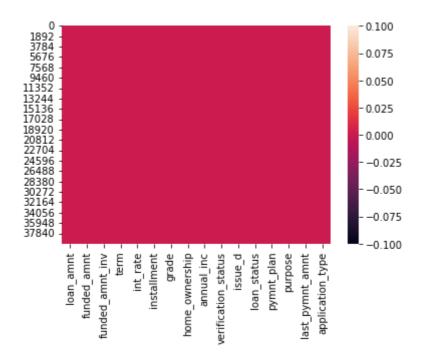
Index(['mths_since_last_record', 'next_pymnt_d', 'mths_since_last_major_derog',

```
loan.isnull().sum()/loan.shape[0]*100
In [6]:
                                         0.000000
Out[6]:
         member_id
                                         0.000000
         loan_amnt
                                         0.000000
         funded_amnt
                                         0.000000
         funded_amnt_inv
                                         0.000000
                                         0.000000
         term
         int rate
                                         0.000000
         installment
                                         0.000000
         grade
                                         0.000000
                                         0.000000
         sub_grade
         emp_title
                                         6.191303
         emp_length
                                         2.706650
         home_ownership
                                         0.000000
         annual_inc
                                         0.000000
         verification_status
                                         0.000000
         issue d
                                         0.000000
         loan_status
                                         0.000000
         pymnt_plan
                                         0.000000
         url
                                         0.000000
         desc
                                        32.580507
         purpose
                                         0.000000
         title
                                         0.027696
         zip_code
                                         0.000000
         addr_state
                                         0.000000
         dti
                                         0.000000
         delinq_2yrs
                                         0.000000
         earliest_cr_line
                                         0.000000
         inq_last_6mths
                                         0.000000
         mths_since_last_delinq
                                        64.662487
                                         0.000000
         open_acc
                                         0.000000
         pub_rec
         revol_bal
                                         0.000000
         revol_util
                                         0.125891
         total_acc
                                         0.000000
         initial_list_status
                                         0.000000
                                         0.000000
         out_prncp
                                         0.000000
         out_prncp_inv
         total_pymnt
                                         0.000000
         total_pymnt_inv
                                         0.000000
                                         0.000000
         total_rec_prncp
         total_rec_int
                                         0.000000
         total_rec_late_fee
                                         0.000000
         recoveries
                                         0.000000
         collection recovery fee
                                         0.000000
         last_pymnt_d
                                         0.178765
         last_pymnt_amnt
                                         0.000000
         last_credit_pull_d
                                         0.005036
         collections_12_mths_ex_med
                                         0.140998
                                         0.000000
         policy_code
         application_type
                                         0.000000
         acc_now_deling
                                         0.000000
         chargeoff_within_12_mths
                                         0.140998
         deling amnt
                                         0.000000
         pub_rec_bankruptcies
                                         1.754916
                                         0.098195
         tax_liens
         dtype: float64
         m=loan['emp_length'].mode()
         loan['emp_length'].fillna(m,inplace=True)
In [8]:
         loan.isnull().sum()
```

```
0
        id
Out[8]:
                                            0
        member_id
        loan_amnt
                                            0
        funded_amnt
                                            0
        funded amnt inv
                                            0
                                            0
        term
                                            0
        int_rate
        installment
                                            0
        grade
                                            0
                                            0
        sub_grade
        emp_title
                                         2459
        emp_length
                                         1075
        home_ownership
                                            0
        annual inc
                                            0
        verification_status
                                            0
                                            0
         issue_d
        loan_status
                                            0
        pymnt_plan
                                            0
        url
                                            0
        desc
                                        12940
                                            0
        purpose
        title
                                           11
        zip_code
                                            0
                                            0
        addr_state
                                            0
        dti
                                            0
        delinq_2yrs
        earliest_cr_line
                                            0
         inq_last_6mths
                                            0
        mths_since_last_delinq
                                        25682
                                            0
        open_acc
        pub rec
                                            0
        revol bal
                                            0
        revol_util
                                           50
        total_acc
                                            0
        initial_list_status
                                            0
                                            0
        out_prncp
        out_prncp_inv
                                            0
                                            0
        total_pymnt
        total_pymnt_inv
                                            0
        total_rec_prncp
                                            0
                                            0
        total_rec_int
                                            0
        total_rec_late_fee
                                            0
        recoveries
                                            0
        collection_recovery_fee
         last_pymnt_d
                                           71
        last_pymnt_amnt
                                            0
        last_credit_pull_d
                                            2
         collections 12 mths ex med
                                           56
                                            0
        policy code
                                            0
        application_type
        acc now deling
                                            0
         chargeoff_within_12_mths
                                           56
                                            0
        delinq_amnt
        pub_rec_bankruptcies
                                          697
        tax_liens
                                           39
        dtype: int64
         #as above these columns are not getting filled with mode despite having less
In [9]:
         #percent of null values so directly dropping the columns
         loan.drop('id',axis=1,inplace=True)
         loan.drop('member_id',axis=1,inplace=True)
         loan.drop('sub_grade',axis=1,inplace=True)
         loan.drop('url',axis=1,inplace=True)
```

loan.drop('desc',axis=1,inplace=True)

```
loan.drop('title',axis=1,inplace=True)
         loan.drop('zip_code',axis=1,inplace=True)
         loan.drop('addr_state',axis=1,inplace=True)
         loan.drop('dti',axis=1,inplace=True)
         loan.drop('delinq_2yrs',axis=1,inplace=True)
         loan.drop('earliest_cr_line',axis=1,inplace=True)
         loan.drop('inq_last_6mths',axis=1,inplace=True)
         loan.drop('mths_since_last_deling',axis=1,inplace=True)
         loan.drop('open_acc',axis=1,inplace=True)
         loan.drop('pub_rec',axis=1,inplace=True)
         loan.drop('revol_bal',axis=1,inplace=True)
         loan.drop('revol_util',axis=1,inplace=True)
         loan.drop('total_acc',axis=1,inplace=True)
         loan.drop('initial_list_status',axis=1,inplace=True)
         loan.drop('out_prncp',axis=1,inplace=True)
         loan.drop('out_prncp_inv',axis=1,inplace=True)
         loan.drop('total_pymnt',axis=1,inplace=True)
         loan.drop('total_pymnt_inv',axis=1,inplace=True)
         loan.drop('total_rec_prncp',axis=1,inplace=True)
         loan.drop('total_rec_int',axis=1,inplace=True)
         loan.drop('total_rec_late_fee',axis=1,inplace=True)
         loan.drop('recoveries',axis=1,inplace=True)
         loan.drop('collection_recovery_fee',axis=1,inplace=True)
         loan.drop('collections_12_mths_ex_med',axis=1,inplace=True)
         loan.drop('policy_code',axis=1,inplace=True)
         loan.drop('acc_now_deling',axis=1,inplace=True)
         loan.drop('chargeoff_within_12_mths',axis=1,inplace=True)
         loan.drop('delinq_amnt',axis=1,inplace=True)
         loan.drop('pub_rec_bankruptcies',axis=1,inplace=True)
         loan.drop('tax_liens',axis=1,inplace=True)
         loan.drop('emp title',axis=1,inplace=True)
         loan.drop('emp_length',axis=1,inplace=True)
         loan.drop('last_pymnt_d',axis=1,inplace=True)
         loan.drop('last_credit_pull_d',axis=1,inplace=True)
         loan.isnull().sum()
In [10]:
         loan_amnt
                                0
Out[10]:
         funded amnt
                                0
         funded amnt inv
                                0
         term
                                0
         int rate
                                0
         installment
                                0
         grade
                                0
         home_ownership
                                0
                                0
         annual_inc
         verification status
         issue d
         loan_status
                                0
         pymnt plan
                                0
         purpose
                                 0
         last_pymnt_amnt
                                0
         application_type
         dtype: int64
         sns.heatmap(loan.isnull())
In [11]:
         plt.show()
```



In	[12]	:	<pre>loan.head()</pre>
----	------	---	------------------------

Out[12]:		loan_amnt	funded_amnt	funded_amnt_inv	term	int_rate	installment	grade	home_owners
	0	5000	5000	4975.0	36 months	10.65%	162.87	В	RI
	1	2500	2500	2500.0	60 months	15.27%	59.83	С	RI
	2	2400	2400	2400.0	36 months	15.96%	84.33	С	RI
	3	10000	10000	10000.0	36 months	13.49%	339.31	С	RI
	4	3000	3000	3000.0	60 months	12.69%	67.79	В	RI

In [13]: #checking that if we have duplcates
loan.duplicated().sum()

Out[13]:

In [14]: #as we need single datatype so converting the dataset by applying #LabelEncoder before that checking which types of datatypes we have loan.dtypes

```
int64
          loan_amnt
Out[14]:
          funded_amnt
                                    int64
                                  float64
          funded_amnt_inv
                                   object
          term
          int rate
                                   object
          installment
                                  float64
          grade
                                   object
          home_ownership
                                   object
          annual_inc
                                  float64
          verification_status
                                   object
          issue d
                                   object
          loan_status
                                   object
          pymnt_plan
                                   object
          purpose
                                   object
          last_pymnt_amnt
                                  float64
                                   object
          application_type
          dtype: object
In [15]:
          #we diffrent type of data we first bifurcate it and then apply label encoder
          loan_cat=loan.select_dtypes(object)
          loan_cat.dtypes
          term
                                  object
Out[15]:
          int_rate
                                  object
          grade
                                  object
          home_ownership
                                  object
          verification_status
                                  object
                                  object
          issue_d
          loan_status
                                  object
                                  object
          pymnt_plan
          purpose
                                  object
          application_type
                                  object
          dtype: object
          loan_num=loan.select_dtypes(['int64','float64'])
In [16]:
          loan_num.dtypes
          loan_amnt
                                int64
Out[16]:
          funded_amnt
                                int64
          funded_amnt_inv
                              float64
          installment
                              float64
          annual inc
                              float64
          last_pymnt_amnt
                              float64
          dtype: object
          from sklearn.preprocessing import LabelEncoder
In [17]:
          for col in loan_cat:
              le=LabelEncoder()
              loan_cat[col]=le.fit_transform(loan_cat[col])
          loan_cat.head()
In [18]:
Out[18]:
            term int_rate grade home_ownership
                                                 verification_status issue_d loan_status pymnt_plan
          0
                0
                       17
                              1
                                               4
                                                                2
                                                                       13
                                                                                   2
                                                                                              0
          1
                               2
                                                                                   0
                                                                                              0
                      158
                                               4
                                                                       13
          2
                0
                      175
                               2
                                               4
                                                                0
                                                                                   2
                                                                                              0
                                                                       13
          3
                0
                       99
                               2
                                               4
                                                                       13
                                                                                   2
                       74
                               1
                                                                                   1
                                                                                              0
          4
                1
                                               4
                                                                1
                                                                       13
```

```
loan_new=pd.concat([loan_cat,loan_num],axis=1)
In [19]:
          loan_new.head()
In [20]:
Out[20]:
                  int_rate grade home_ownership verification_status issue_d loan_status pymnt_plan p
          0
                0
                       17
                               1
                                                4
                                                                  2
                                                                                     2
                                                                                                 0
                                                                        13
                                                                                     0
          1
                1
                       158
                               2
                                                4
                                                                  1
                                                                        13
                                                                                                 0
          2
                               2
                                                                                     2
                0
                       175
                                                4
                                                                  0
                                                                        13
                                                                                                 0
                       99
                               2
                                                                                     2
          3
                0
                                                4
                                                                        13
                                                                                                 0
                                                                                                 0
                                                                  1
                                                                                     1
          4
                1
                       74
                               1
                                                4
                                                                        13
                                                                                                  •
          f=loan['loan_status'].value_counts()
In [21]:
          sns.countplot(data=loan,x='loan_status')
          plt.yticks(f)
          plt.show()
          print(f)
             32950
              5627
              1140
                       Fully Paid
                                        Charged Off
                                                          Current
                                        loan_status
          Fully Paid
                          32950
          Charged Off
                           5627
          Current
                           1140
          Name: loan_status, dtype: int64
          #now bifurcating the data in input and output
In [22]:
          X=loan_new.drop('loan_status',axis=1)
          Y=loan_new['loan_status']
          #this is the data having in column X
In [23]:
          X.head()
```

```
Out[23]:
            term int_rate grade home_ownership verification_status issue_d pymnt_plan purpose app
          0
               0
                       17
                                                                     13
          1
               1
                              2
                                                                                 0
                                                                                          0
                      158
                                                              1
                                                                     13
                                              4
          2
               0
                     175
                              2
                                              4
                                                              0
                                                                     13
                                                                                 0
                                                                                         11
               0
                      99
                              2
                                                                                          9
          3
                                                                     13
                                                                                 0
          4
               1
                      74
                              1
                                              4
                                                              1
                                                                     13
                                                                                 0
                                                                                          9
          #these are the headed columns for y columns as we dropped it from X
In [24]:
               2
Out[24]:
               0
          1
          2
               2
          3
               2
          4
               1
         Name: loan_status, dtype: int32
In [25]:
          #now apply train_test_split
          from sklearn.model_selection import train_test_split
          X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=0.3,random_state=1)
In [26]: X_train.shape,X_test.shape
          ((27801, 15), (11916, 15))
Out[26]:
          #here in output we have unbalanced counts of output that too our data has
In [27]:
          #three output class so we will apply smote function now
          Y_train.value_counts()
               23067
          2
Out[27]:
                3946
                 788
          Name: loan_status, dtype: int64
          #importing the smote function to make balance data
In [28]:
          from imblearn.over_sampling import SMOTE
In [29]:
          #applying the smote for training data
          X_train1,Y_train1=SMOTE().fit_resample(X_train,Y_train)
          Y_train1.value_counts()
In [30]:
          2
               23067
Out[30]:
               23067
          1
               23067
          Name: loan_status, dtype: int64
          #applying the smote for test data
In [31]:
          X_test1,Y_test1=SMOTE().fit_resample(X_test,Y_test)
          #now data seems to be balanced
In [32]:
          Y_test1.value_counts()
```

```
9883
              9883
         Name: loan_status, dtype: int64
          #apply Stabdard Scaler on Training input X_train1 and testing input
In [33]:
          #X test1
          from sklearn.preprocessing import StandardScaler
          ss=StandardScaler()
          X_train1=ss.fit_transform(X_train1)
          X_test1=ss.transform(X_test1)
In [34]: X_train1
Out[34]: array([[-0.99115199, 1.67483228, -1.41788272, ..., -0.94237819,
                 0.45564172, 1.00383959],
[-0.99115199, 1.39653694, -1.41788272, ..., -0.51486645,
                   0.36679455, 0.34177372],
                 [\ 1.008927\ ,\ 1.08842425,\ 2.53555955,\ \ldots,\ -0.48177513,
                   0.132238 , -0.34143678],
                 . . . ,
                 [1.008927, 0.52189446, 0.95418264, ..., -0.18334582,
                  -0.25513568, -0.32058425],
                 [ 1.008927 , 0.10445145, 0.16349418, ..., -0.9678556 ,
                   0.0556337 , -0.3754013 ],
                 [1.008927, 0.26347736, -0.62719427, ..., -1.26446506,
                  -0.34398286, -0.39612667]])
In [35]:
         #applying standard scaler for the reason to get data into same scale
          #creating the class for not applyning agian and again
In [36]:
          def create_model(model):
              model.fit(X_train1,Y_train1)
              Y_pred=model.predict(X_test1)
              print(classification_report(Y_test1,Y_pred))
              print(confusion_matrix(Y_test1,Y_pred))
              return model
In [37]: #importing the two essential class
          from sklearn.metrics import classification_report,confusion_matrix
In [38]:
         #first model perfromance checking with loisticRegression
          from sklearn.linear_model import LogisticRegression
In [39]:
         #creating the object
          lr=LogisticRegression()
          create_model(lr)
                        precision
                                     recall f1-score
                                                         support
                     0
                                       0.64
                             0.70
                                                 0.67
                                                            9883
                     1
                             0.77
                                       0.99
                                                 0.87
                                                            9883
                     2
                                       0.70
                                                 0.76
                                                            9883
                             0.85
                                                 0.77
                                                           29649
             accuracy
                             0.78
                                       0.77
                                                 0.77
                                                           29649
            macro avg
                                                 0.77
                                       0.77
         weighted avg
                             0.78
                                                           29649
          [[6316 2327 1240]
          [ 143 9740
                         0]
          [2502 511 6870]]
```

9883

2

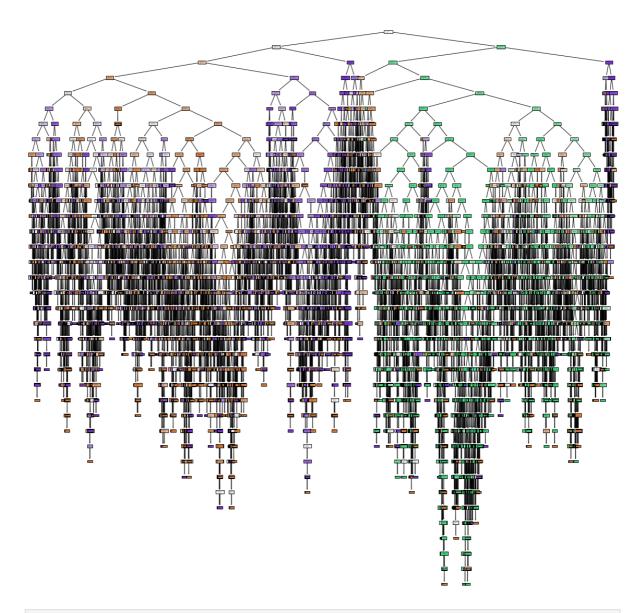
Out[32]:

```
Out[39]: LogisticRegression()
In [40]: # as we can see above we had multiclass data so we will look for F1 score
         #and accuracy of the dataset
         #we got a quite good accuracy but applying diffrent algo may result in more
         #good score.
In [41]:
         #second algo applying is Decision tree Classifier
         from sklearn.tree import DecisionTreeClassifier
         #creating the object for decisiontree classifier
In [42]:
         dt=DecisionTreeClassifier()
In [43]: create_model(dt)
                       precision recall f1-score
                                                      support
                    0
                            0.65
                                    0.71
                                               0.68
                                                         9883
                            0.88
                                     0.70
                                               0.78
                                                         9883
                    1
                    2
                            0.77
                                     0.86
                                               0.81
                                                         9883
             accuracy
                                               0.76
                                                        29649
                           0.77
                                    0.76
                                               0.76
                                                        29649
            macro avg
                                    0.76
                                               0.76
                                                        29649
         weighted avg
                           0.77
         [[7013 838 2032]
          [2500 6876 507]
          [1273
                 74 8536]]
         DecisionTreeClassifier()
Out[43]:
In [44]:
         # we got less accuracy score in decisiontreeClassifier it seems that
         #data is overfit
         #show the information gain of all input features
In [45]:
         IG=dt.feature_importances_
         print("information gain:",IG)
         information gain: [0.25539767 0.11085004 0.02499277 0.02242697 0.01152655 0.045814
         79
                     0.02437303 0.
                                          0.02885724 0.03082064 0.04272952
          0.
          0.0487285 0.06423061 0.28925168]
In [46]: dict={'input':X.columns,'IG':IG}
         df1=pd.DataFrame(dict)
         df1.sort_values('IG',ascending=False)
         #descending order according to IG
```

Out[46]:		input	IG
	14	last_pymnt_amnt	0.289252
	0	term	0.255398
	1	int_rate	0.110850
	13	annual_inc	0.064231
	12	installment	0.048728
	5	issue_d	0.045815
	11	funded_amnt_inv	0.042730
	10	funded_amnt	0.030821
	9	loan_amnt	0.028857
	2	grade	0.024993
	7	purpose	0.024373
	3	home_ownership	0.022427
	4	verification_status	0.011527
	6	pymnt_plan	0.000000
	8	application_type	0.000000

```
In [47]: #create the tree
```

```
from sklearn import tree
features=X.columns#input features
fig=plt.figure(figsize=(20,20))
#_=tree.plot_tree(dt,feature_names=features,filled=True)
```



```
In [48]: # our data is overfit in Decsion tree we apply pruning if our data is overfit
In [49]: #for applying pruning first we will do hit and trial method

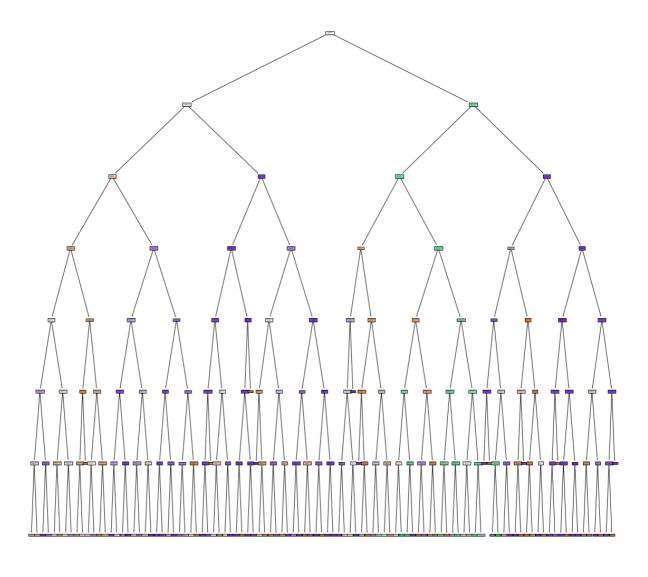
In [50]: for i in range(1,9):
    dt1=DecisionTreeClassifier(max_depth=i,random_state=1)
    print('max_depth:',i)
    dt1=create model(dt1)
```

max_depth: 1				
max_acpen: 1	precision	recall	f1-score	support
0	0.00	0.00	0.00	9883
1	0.68	1.00	0.81	9883
2	0.52	0.79	0.63	9883
accuracy			0.60	29649
macro avg	0.40	0.60	0.48	29649
weighted avg	0.40	0.60	0.48	29649
[[0 2621 7 [0 9883 [0 2072 7 max_depth: 2	0] '811]]			
	precision	recall	f1-score	support
0	0.62	0.72	0.67	9883
1	0.76	1.00	0.86	9883
2	0.97	0.49	0.66	9883
accuracy			0.74	29649
macro avg	0.78	0.74	0.73	29649
weighted avg	0.78	0.74	0.73	29649
[[7158 2582 [0 9881 [4426 573 4 max_depth: 3			£1	
	precision	recall	f1-score	support
0	0.71	0.67	0.69	9883
1	0.77	1.00	0.87	9883
2	0.89	0.68	0.77	9883
accuracy			0.78	29649
macro avg	0.79	0.78	0.77	29649
weighted avg	0.79			
[[6586 2444 [27 9854 [2719 481 6 max_depth: 4	2] 6683]]			
	precision	recall	f1-score	support
0	0.77	0.59	0.67	9883
1	0.78	1.00	0.88	9883
2	0.81	0.78	0.79	9883
accuracy			0.79	29649
macro avg	0.79	0.79	0.78	
weighted avg	0.79	0.79	0.78	29649
[[5825 2292 1 [10 9849 [1757 436 7 max_depth: 5	24]			
	precision	recall	f1-score	support
0	0.74	0.65	0.69	9883
1	0.78	1.00	0.88	9883
2	0.86	0.73	0.79	9883
accuracy			0.79	29649

macro avg weighted avg	0.79 0.79	0.79 0.79	0.79 0.79	29649 29649
[[6442 2299 13 [5 9854 [2253 438 73 max_depth: 6	24]			
	precision	recall	f1-score	support
0 1 2	0.75 0.78 0.86	0.64 1.00 0.75	0.69 0.88 0.80	9883 9883 9883
_	0.00	0.75		
accuracy macro avg weighted avg	0.80 0.80	0.80 0.80	0.80 0.79 0.79	29649 29649 29649
[[6344 2292 12 [29 9849 [2036 436 74 max_depth: 7	5]			
	precision	recall	f1-score	support
0 1 2	0.74 0.81 0.87	0.69 0.98 0.75	0.72 0.88 0.81	9883 9883 9883
accuracy macro avg weighted avg	0.81 0.81	0.81 0.81	0.81 0.80 0.80	29649 29649 29649
[[6864 1953 16 [241 9637 [2181 317 73 max_depth: 8	5]			
	precision	recall	f1-score	support
0 1 2	0.76 0.82 0.86	0.69 0.97 0.78	0.72 0.89 0.82	9883 9883 9883
accuracy macro avg weighted avg [[6836 1827 12 [290 9567	0.81 0.81 220]	0.81 0.81	0.81 0.81 0.81	29649 29649 29649
[1879 252 7]	-			

In [51]: #above we got the good accuracy score at 8 Loop
 dt1=DecisionTreeClassifier(max_depth=7,random_state=1)
 dt1=create_model(dt1)

```
precision recall f1-score
                                                          support
                                        0.69
                     0
                             0.74
                                                   0.72
                                                             9883
                     1
                             0.81
                                        0.98
                                                   0.88
                                                             9883
                     2
                                        0.75
                              0.87
                                                   0.81
                                                             9883
                                                   0.81
                                                            29649
              accuracy
                             0.81
                                        0.81
                                                   0.80
                                                            29649
             macro avg
         weighted avg
                             0.81
                                        0.81
                                                   0.80
                                                            29649
          [[6864 1953 1066]
           [ 241 9637
                         5]
           [2181 317 7385]]
In [52]: #again coming back to the information gain
          IG=dt1.feature_importances_
          print('information gain:',IG)
          information gain: [4.27091568e-01 1.11849857e-01 2.57293287e-02 1.10001470e-02
           1.55017219e-03 1.95533160e-02 0.00000000e+00 3.21620220e-04
           0.00000000e+00 3.77093643e-03 9.70983957e-03 2.83250811e-03
           2.65893011e-02 2.25797348e-03 3.57743432e-01]
In [53]:
         dict={'input':X.columns,'IG':IG}
          df1=pd.DataFrame(dict)
          df1.sort_values('IG',ascending=False)
Out[53]:
                                  IG
                       input
           0
                        term 0.427092
          14
              last_pymnt_amnt 0.357743
           1
                      int_rate 0.111850
          12
                   installment 0.026589
           2
                       grade 0.025729
           5
                      issue d 0.019553
           3
              home_ownership 0.011000
          10
                 funded_amnt 0.009710
           9
                   loan_amnt 0.003771
          11
              funded_amnt_inv 0.002833
          13
                   annual_inc 0.002258
             verification_status 0.001550
           7
                     purpose 0.000322
           6
                  pymnt_plan 0.000000
           8
               application_type 0.000000
          #create the tree
In [58]:
          #decison tree max depth pruning technique
          from sklearn import tree
          features=X.columns#input features
          fig=plt.figure(figsize=(20,20))
          #_=tree.plot_tree(dt1,feature_names=features,filled=True)
```



```
In [57]: for i in range(45,101):
    dt2=DecisionTreeClassifier(min_samples_leaf=i,random_state=1)
    print('min samples:',i)
    dt2=create_model(dt2)
```

min samples:	45			
'	precision	recall	f1-score	support
0	0.71	0.71	0.71	9883
1	0.85	0.85	0.85	9883
2	0.84	0.84	0.84	9883
accuracy	0.90	0.80	0.80 0.80	29649
macro avg weighted avg	0.80 0.80	0.80	0.80	29649 29649
weighted avg	0.00	0.00	0.00	25045
[[7058 1276 1 [1468 8384 [1363 191 8 min samples:	31] 3329]]			
	precision	recall	f1-score	support
0	0.71	0.71	0.71	9883
1	0.85	0.85	0.85	9883
2	0.84	0.84	0.84	9883
				20540
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
weighted avg	0.80	0.80	0.80	29649
[[7065 1288 1 [1451 8388 [1385 191 8 min samples:	44] 3307]] 47			
	precision	recall	f1-score	support
0	0.72	0.71	0.71	9883
1	0.85	0.85	0.85	9883
2	0.84	0.84	0.84	9883
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
weighted avg	0.80	0.80	0.80	29649
[[7019 1302 1 [1392 8447 [1368 188 8 min samples:	44] 3327]]			
'	precision	recall	f1-score	support
0	0.72	0.71	0.72	9883
1	0.85	0.86	0.85	9883
2	0.84	0.84	0.84	9883
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
weighted avg	0.80	0.80	0.80	29649
[[7046 1298 1 [1386 8453 [1379 188 8 min samples:	.539] 44] 3316]]	0.00	0.00	250.15
	precision	recall	f1-score	support
0	0.72	0.71	0.72	9883
1	0.85	0.86	0.86	9883
2	0.84	0.84	0.84	9883
accuracy			0.80	29649

macro avg weighted avg	0.80 0.80	0.80 0.80	0.80 0.80	29649 29649
[[7032 1313 1538] [1312 8527 44] [1387 195 8301] min samples: 50]			
•	ecision	recall	f1-score	support
0	0.73	0.71	0.72	9883
1	0.85	0.87	0.86	9883
2	0.84	0.84	0.84	9883
accuracy			0.81	29649
macro avg	0.81	0.81	0.81	29649
weighted avg	0.81	0.81	0.81	29649
[[7014 1337 1532] [1254 8585 44] [1373 198 8312] min samples: 51]			
pre	ecision	recall	f1-score	support
0	0.72	0.72	0.72	9883
1	0.85	0.85	0.85	9883
2	0.84	0.84	0.84	9883
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
weighted avg	0.80	0.80	0.80	29649
[[7075 1290 1518] [1426 8413 44] [1377 197 8309]]			
min samples: 52 pre	ecision	recall	f1-score	support
0	0.72	0.72	0.72	9883
1	0.85	0.85		9883
2	0.85	0.84	0.84	9883
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
weighted avg	0.80	0.80	0.80	29649
[[7134 1290 1459] [1422 8417 44] [1416 198 8269] min samples: 53]	recall	f1-score	support
0	0.72	0.72	0.72	0003
0 1	0.72 0.85	0.72 0.86	0.72 0.85	9883 9883
2	0.85	0.84	0.84	9883
			0.00	20640
accuracy macro avg	0.80	0.80	0.80 0.80	29649 29649
weighted avg	0.80	0.80	0.80	29649
[[7139 1289 1455] [1388 8452 43] [1421 198 8264] min samples: 54 pre]	recall	f1-score	support

0	0.72	0.72	0.72	9883
1	0.85	0.86	0.85	9883
2	0.85	0.84	0.84	9883
accuracy			0.81	29649
macro avg	0.81	0.81	0.81	29649
weighted avg	0.81	0.81	0.81	29649
[[7081 1346 145	6]			
-	1]			
[1398 203 828				
min samples: 55	recision	recall	f1-score	support
Р	1 CC131011	rccarr	11 30010	зиррог с
0	0.72	0.71	0.72	9883
1	0.85	0.86	0.85	9883
2	0.84	0.84	0.84	9883
accuracy	0.00	0.00	0.80	29649
macro avg weighted avg	0.80 0.80	0.80 0.80	0.80 0.80	29649 29649
weighted avg	0.00	0.00	0.00	25045
[[7055 1346 148	21			
	1]			
[1385 203 829	5]]			
min samples: 56				
р	recision	recall	f1-score	support
0	0.72	0.71	0.72	9883
1	0.85	0.86	0.86	9883
2	0.84	0.84	0.84	9883
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
-	0.80 0.80	0.80 0.80		
macro avg weighted avg	0.80		0.80	29649
macro avg weighted avg [[7026 1354 150	0.80		0.80	29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1]		0.80	29649
macro avg weighted avg [[7026 1354 150 [1296 8546 4	0.80 3] 1]		0.80	29649
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57	0.80 3] 1]	0.80	0.80	29649
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57	0.80 3] 1] 3]] recision	0.80	0.80 0.80	29649 29649 support
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57 p	0.80 3] 1] 3]] recision 0.72	0.80 recall 0.71	0.80 0.80 f1-score 0.72	29649 29649 support 9883
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57 p	0.80 3] 1] 3]] recision 0.72 0.85	0.80 recall 0.71 0.86	0.80 0.80 f1-score 0.72 0.85	29649 29649 support 9883 9883
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57 p	0.80 3] 1] 3]] recision 0.72	0.80 recall 0.71	0.80 0.80 f1-score 0.72	29649 29649 support 9883
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57 p	0.80 3] 1] 3]] recision 0.72 0.85	0.80 recall 0.71 0.86	0.80 0.80 f1-score 0.72 0.85	29649 29649 support 9883 9883
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57 p	0.80 3] 1] 3]] recision 0.72 0.85	0.80 recall 0.71 0.86	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7026 1354 150 [1296 8546 4 [1385 205 829 min samples: 57 p	0.80 3] 1] 3]] recision 0.72 0.85 0.84	0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80	0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4]	0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4]	0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]]	0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]]	0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision	0.80 recall 0.71 0.86 0.84 0.80 0.80	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision 0.72	0.80 recall 0.71 0.86 0.84 0.80 0.80	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision 0.72 0.85	0.80 recall 0.71 0.86 0.80 0.80 recall 0.71 0.86	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 29649 support 9883 9883
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision 0.72	0.80 recall 0.71 0.86 0.84 0.80 0.80	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision 0.72 0.85	0.80 recall 0.71 0.86 0.80 0.80 recall 0.71 0.86	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 29649 support 9883 9883
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision 0.72 0.85	0.80 recall 0.71 0.86 0.80 0.80 recall 0.71 0.86	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 29649 support 9883 9883 9883
macro avg weighted avg [[7026 1354 150	0.80 3] 1] 3]] recision 0.72 0.85 0.84 0.80 0.80 4] 0] 6]] recision 0.72 0.85 0.84	0.80 recall 0.71 0.86 0.84 0.80 recall 0.71 0.86 0.84	0.80 0.80 f1-score 0.72 0.85 0.84 0.80 0.80	29649 29649 support 9883 9883 9883 29649 29649 support 9883 9883 9883

[1371 201 831 min samples: 59	1] 1]]	recall	f1-score	support
a	0.72	0 71	0.72	0000
0 1	0.73 0.85	0.71 0.87	0.72 0.86	9883 9883
2	0.83	0.84	0.84	9883
4	0.04	0.04	0.04	5005
accuracy			0.81	29649
macro avg	0.80	0.81	0.81	29649
weighted avg	0.80	0.81	0.81	29649
8	0.00	0.00	0.02	
[[6988 1342 155 [1277 8575 3 [1345 206 833 min samples: 60	1] 2]]			
p	recision	recall	f1-score	support
0	0.72	0.71	0.72	9883
1	0.85	0.86	0.86	9883
2	0.84	0.84	0.84	9883
accuracy			0.80	29649
macro avg	0.80	0.80	0.80	29649
weighted avg	0.80	0.80	0.80	29649
[[7018 1324 154 [1327 8525 3 [1360 202 832 min samples: 61	1] 1]]			
	recision	recall	f1-score	support
0	0.73	0.71	0.72	9883
1	0.85	0.87	0.86	9883
2	0.84	0.84	0.84	9883
accuracy			0.81	29649
macro avg	0.81	0.81	0.81	29649
weighted avg	0.81	0.81	0.81	29649
[[7058 1303 152 [1221 8638 2 [1386 203 829	2] 4]			
min samples: 62	4]]		64	
min samples: 62	4]]	recall	f1-score	support
min samples: 62	4]]	recall 0.71	f1-score 0.73	support 9883
min samples: 62	4]] recision			
min samples: 62	4]] recision 0.74	0.71	0.73	9883
min samples: 62 p 0 1	4]] recision 0.74 0.85	0.71 0.89	0.73 0.87	9883 9883
min samples: 62 p 0 1	4]] recision 0.74 0.85	0.71 0.89	0.73 0.87	9883 9883
min samples: 62 p 0 1 2 accuracy macro avg	4]] recision 0.74 0.85 0.84	0.71 0.89 0.84	0.73 0.87 0.84 0.81	9883 9883 9883 29649 29649
min samples: 62 p 0 1 2 accuracy	4]] recision 0.74 0.85 0.84	0.71 0.89 0.84	0.73 0.87 0.84 0.81	9883 9883 9883 29649
min samples: 62 0 1 2 accuracy macro avg weighted avg [[7043 1321 151	4]] recision	0.71 0.89 0.84	0.73 0.87 0.84 0.81	9883 9883 9883 29649 29649
min samples: 62 p 0 1 2 accuracy macro avg weighted avg [[7043 1321 151 [1074 8785 2 [1391 209 828 min samples: 63	4]] recision	0.71 0.89 0.84 0.81	0.73 0.87 0.84 0.81	9883 9883 9883 29649 29649

1 2	0.85 0.84	0.90 0.84	0.87 0.84	9883 9883
accuracy macro avg weighted avg	0.81 0.81	0.82 0.82	0.82 0.81 0.81	29649 29649 29649
[[6993 1361 1 [966 8893 [1356 212 8 min samples:	24] 315]]			
·	precision	recall	f1-score	support
0 1 2	0.75 0.85 0.84	0.71 0.90 0.84	0.73 0.87 0.84	9883 9883 9883
accuracy macro avg weighted avg	0.81 0.81	0.82 0.82	0.82 0.82 0.82	29649 29649 29649
[[6996 1357 1 [970 8889 [1346 211 8 min samples:	24] 326]]			
·	precision	recall	f1-score	support
0	0.76 0.85	0.71 0.90	0.73 0.88	9883 9883
2	0.84	0.84	0.84	9883
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82 0.82	29649 29649 29649
[[6979 1351 1 [926 8933 [1333 212 8 min samples:	24] 338]]			
Jap	precision	recall	f1-score	support
0 1 2	0.76 0.85 0.84	0.71 0.90 0.84	0.73 0.88 0.84	9883 9883 9883
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82 0.82	29649 29649 29649
[[7005 1351 1 [919 8940 [1354 212 8 min samples:	24] 317]]			
,	precision	recall	f1-score	support
0 1 2	0.75 0.85 0.84		0.73 0.88 0.84	9883 9883 9883
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82 0.82	29649 29649 29649

[942 8917 24] [1355 214 8314]] min samples: 68 precision recall f1-score support 0 0.76 0.71 0.73 9883 0.91 1 0.85 0.88 9883 2 0.84 0.84 0.84 9883 0.82 29649 accuracy macro avg 0.82 0.82 0.82 29649 0.82 weighted avg 0.82 0.82 29649 [[7029 1358 1496] [883 8976 24] [1380 221 8282]] min samples: 69 precision recall f1-score support 0.75 0.72 0.73 9883 1 0.85 0.91 0.88 9883 2 0.85 0.83 9883 0.84 0.82 29649 accuracy 0.82 0.82 0.82 29649 macro avg weighted avg 0.82 0.82 0.82 29649 [[7072 1358 1453] [886 8973 24] [1426 221 8236]] min samples: 70 precision recall f1-score support 0 0.75 0.72 0.73 9883 1 0.85 0.91 0.88 9883 2 0.85 0.83 0.84 9883 accuracy 0.82 29649 0.82 0.82 0.82 0.82 macro avg 0.82 29649 weighted avg 0.82 29649 [[7085 1346 1452] [907 8952 24] [1437 218 8228]] min samples: 71 precision recall f1-score support 0 0.75 0.72 0.74 9883 1 0.85 0.91 0.88 9883 0.85 0.83 0.84 9883 0.82 29649 accuracy 0.82 0.82 29649 0.82 macro avg weighted avg 0.82 0.82 0.82 29649 [[7107 1345 1431] [904 8955 24] [1444 217 8222]] min samples: 72 precision recall f1-score support 0 0.75 0.72 0.74 9883 1 0.85 0.91 0.88 9883 0.83 9883 0.85 0.84

accuracy macro avg	0.82	0.82	0.82 0.82	29649 29649
weighted avg	0.82	0.82	0.82	29649
[1448 217 82] min samples: 7	24] 18]] 3			
	precision	recall	f1-score	support
0	0.75	0.71	0.73	9883
1	0.85	0.91	0.88	9883
2	0.85	0.83	0.84	9883
accuracy			0.82	29649
macro avg	0.82	0.82		29649
weighted avg	0.82	0.82	0.82	29649
[[7066 1348 14 [895 8964 [1416 218 82 min samples: 7	24] 49]]			
	precision	recall	f1-score	support
0	0.75	0.71	0.73	9883
1	0.85	0.91	0.88	9883
2	0.85	0.83	0.84	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.82	29649
weighted avg	0.82	0.82	0.82	29649
[1420 217 820 min samples: 7	24] 46]]	recall	f1-score	support
	0.75	0 74	0 = 0	0000
0 1	0.75 0.85	0.71 0.91	0.73 0.88	9883
2	0.85	0.83	0.84	9883 9883
_	0.00	0,00		2003
accuracy			0.82	29649
macro avg	0.82	0.82	0.82	29649
weighted avg	0.82	0.82	0.82	29649
[1418 217 824 min samples: 7	24] 48]] 6	nocall	£1	support
	precision	recall	f1-score	support
0	0.75	0.71	0.73	9883
1 2	0.85 0.85	0.91 0.83	0.88 0.84	9883
2	0.85	0.83	0.84	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.82	29649
weighted avg	0.82	0.82	0.82	29649
[[7058 1339 14 [906 8953 [1418 217 82	24]			

min samples:	77						
min Sampies.	precision	recall	f1-score	support			
0	0.75	0.71	0.73	9883			
1	0.85	0.91	0.88	9883			
2	0.85	0.83	0.84	9883			
accuracy	0.03	0.00	0.82	29649			
macro avg	0.82	0.82	0.82	29649			
weighted avg	0.82	0.82	0.82	29649			
[[7062 1339 1482] [906 8953 24] [1439 217 8227]] min samples: 78							
	precision	recall	f1-score	support			
0	0.75	0.71	0.73	9883			
1	0.85	0.91	0.88	9883			
2	0.84	0.83	0.84	9883			
266419264			0.82	20640			
accuracy	0.00	0.82	0.82	29649 29649			
macro avg weighted avg	0.82 0.82	0.82	0.82	29649			
weighted avg	0.82	0.82	0.82	29049			
[[7063 1334 1 [886 8973 [1490 207 8 min samples:	24] 186]] 79	11	C1 				
	precision	recall	f1-score	support			
0	0.75	0.71	0.73	9883			
1	0.85	0.91	0.88	9883			
2	0.84	0.83	0.84	9883			
266419264			0 02	29649			
accuracy macro avg	0.81	0.82	0.82 0.82	29649			
weighted avg	0.81	0.82					
	0.00	0.02	0.02	200.0			
[[7014 1334 1 [885 8974 [1453 207 8 min samples:	24] 223]]						
'	precision	recall	f1-score	support			
0	0.74	0.71	0.73	9883			
1	0.85	0.91	0.88	9883			
2	0.84	0.83	0.83	9883			
266419264			0.81	29649			
accuracy macro avg	0.81	0.81	0.81	29649			
weighted avg	0.81	0.81	0.81	29649			
weighted dvg	0.01	0.01	0.01	25045			
[[7030 1334 1 [887 8972 [1521 207 8 min samples:	24] 155]]						
	precision	recall	f1-score	support			
0	0.75	0.71	0.73	9883			
1	0.85	0.91	0.88	9883			
2	0.84	0.82	0.83	9883			
accuracy			0.82	29649			
accuracy			0.02	23043			

macro avg	0.81	0.82	0.81	29649
weighted avg	0.81	0.82	0.81	29649
[[7032 1342 1509] [834 9025 24] [1542 208 8133] min samples: 82				
pre	cision	recall	f1-score	support
0	0.75	0.71	0.73	9883
1 2	0.85 0.84	0.92 0.82	0.88 0.83	9883 9883
_	0.0.	0.02		
accuracy macro avg	0.81	0.82	0.82 0.81	29649 29649
weighted avg	0.81	0.82	0.81	29649
[[7020 1360 1503] [815 9044 24] [1535 207 8141] min samples: 83				
pre	cision	recall	f1-score	support
0	0.75	0.71	0.73	9883
1 2	0.85 0.84	0.92 0.82	0.88 0.83	9883 9883
2	0.04	0.02	0.03	3003
accuracy	0.00	0 02	0.82	29649
macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82	29649 29649
[[7051 1352 1480] [785 9074 24] [1540 214 8129] min samples: 84				
	cision	recall	f1-score	support
0	0.75	0.71	0.73	9883
1 2	0.85 0.84	0.92 0.82	0.88 0.83	9883 9883
2	0.04	0.02	0.83	9883
accuracy	0.02	0.00	0.82	29649
macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82	29649 29649
[[7060 1355 1468] [789 9070 24] [1566 215 8102] min samples: 85 pre		recall	f1-score	support
0	0.75	0.71	0.73	9883
1	0.75	0.71	0.88	9883
2	0.84	0.82	0.83	9883
accuracy			0.82	29649
macro avg	0.81	0.82	0.81	29649
weighted avg	0.81	0.82	0.81	29649
[[7034 1347 1502] [817 9042 24] [1550 215 8118] min samples: 86 pre		recall	f1-score	support

0	0.75	0.71	0.73	9883				
1	0.85 0.84	0.91 0.82	0.88 0.83	9883 9883				
2	0.64	0.02	0.03	9003				
accuracy			0.81	29649				
macro avg	0.81	0.81	0.81	29649				
weighted avg	0.81	0.81	0.81	29649				
[[7016 1362 1 [831 9028 [1558 211 8 min samples:	24] 114]] 87							
	precision	recall	f1-score	support				
0	0.75	0.71	0.73	9883				
1	0.85	0.92	0.88	9883				
2	0.84	0.82	0.83	9883				
accuracy	0.01	0.00	0.82	29649				
macro avg weighted avg	0.81 0.81	0.82 0.82	0.81 0.81	29649 29649				
weighted avg	0.81	0.02	0.81	23043				
[799 9060	[1550 210 8123]]							
	precision	recall	f1-score	support				
0	0.75	0.70	0.73	9883				
1	0.85	0.92	0.89	9883				
2	0.84	0.82	0.83	9883				
2661182614			0.82	29649				
accuracy macro avg	0.81	0.82	0.82	29649				
weighted avg	0.81	0.82	0.81	29649				
Weighted avg 0.81 0.82 0.81 29649 [[6959 1385 1539] [745 9114 24] [1548 212 8123]] min samples: 89								
	precision	recall	f1-score	support				
0	0.75	0.71	0.73	9883				
1	0.85	0.92	0.89	9883				
2	0.84	0.82	0.83	9883				
accuracy			0.82	29649				
accuracy macro avg	0.81	0.82	0.82	29649				
weighted avg	0.81	0.82	0.81	29649				
[[6970 1385 1 [745 9114 [1556 213 8	F201							
min samples:	24] 114]] 90	recall	f1-score	sunnort				
-	24] 114]]	recall	f1-score	support				
-	24] 114]] 90 precision 0.75	0.71	0.73	support 9883				
min samples: 0 1	24] 114]] 90 precision 0.75 0.85	0.71 0.92	0.73 0.89	9883 9883				
min samples:	24] 114]] 90 precision 0.75	0.71	0.73	9883				
min samples: 0 1 2	24] 114]] 90 precision 0.75 0.85	0.71 0.92	0.73 0.89	9883 9883				
min samples: 0 1	24] 114]] 90 precision 0.75 0.85	0.71 0.92	0.73 0.89 0.83	9883 9883 9883				
min samples: 0 1 2 accuracy	24] 114]] 90 precision 0.75 0.85 0.84	0.71 0.92 0.82	0.73 0.89 0.83	9883 9883 9883 29649				

[[6974 1404 1505] [723 9136						
0 1 2	0.75 0.85 0.84	0.71 0.92 0.82	0.73 0.89 0.83	9883 9883 9883		
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82 0.82	29649 29649 29649		
[[7013 1377 149] [720 9139 2] [1578 207 809] min samples: 92	24] 98]]					
•	orecision	recall	f1-score	support		
0 1 2	0.75 0.85 0.84	0.71 0.92 0.82	0.73 0.89 0.83	9883 9883 9883		
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82 0.82	29649 29649 29649		
[[7013 1372 1498] [720 9139						
min samples: 93	orecision	recall	f1-score	support		
		0.71 0.93 0.82	f1-score 0.73 0.89 0.83	9883 9883 9883		
0 1	0.75 0.85	0.71 0.93	0.73 0.89 0.83	9883 9883		
0 1 2 accuracy macro avg weighted avg [[6987 1372 153 [717 9142 23 [1565 187 813	0.75 0.85 0.84 0.82 0.82	0.71 0.93 0.82	0.73 0.89 0.83 0.82 0.82	9883 9883 9883 29649 29649		
0 1 2 accuracy macro avg weighted avg [[6987 1372 15: [717 9142 2: [1565 187 81: min samples: 94	0.75 0.85 0.84 0.82 0.82	0.71 0.93 0.82 0.82 0.82	0.73 0.89 0.83 0.82 0.82	9883 9883 9883 29649 29649		
0 1 2 accuracy macro avg weighted avg [[6987 1372 15: [717 9142 2: [1565 187 81: min samples: 94	0.75 0.85 0.84 0.82 0.82 24] 24]	0.71 0.93 0.82 0.82 0.82	0.73 0.89 0.83 0.82 0.82	9883 9883 9883 29649 29649 29649		
0 1 2 accuracy macro avg weighted avg [[6987 1372 153 [717 9142 2 [1565 187 813 min samples: 94	0.75 0.85 0.84 0.82 0.82 24] 24] 31]] 4 precision 0.75 0.85	0.71 0.93 0.82 0.82 0.82 recall 0.71 0.92	0.73 0.89 0.83 0.82 0.82 0.82	9883 9883 9883 29649 29649 29649 support 9883 9883		
accuracy macro avg weighted avg [[6987 1372 157] [717 9142 27] [1565 187 813] min samples: 94 0 1 2 accuracy macro avg weighted avg [[7004 1371 150] [723 9136 27] [1557 188 813	0.75 0.85 0.84 0.82 0.82 0.82 24] 24] 31]] 4 precision 0.75 0.85 0.84 0.82 0.82	0.71 0.93 0.82 0.82 0.82 recall 0.71 0.92 0.82	0.73 0.89 0.83 0.82 0.82 0.82 f1-score 0.73 0.89 0.83 0.82 0.82	9883 9883 9883 29649 29649 29649 support 9883 9883 9883 29649 29649		
accuracy macro avg weighted avg [[6987 1372 157] [717 9142 27] [1565 187 813] min samples: 94 0 1 2 accuracy macro avg weighted avg [[7004 1371 156] [723 9136 27] [1557 188 813] min samples: 95	0.75 0.85 0.84 0.82 0.82 0.82 24] 24] 31]] 4 precision 0.75 0.85 0.84 0.82 0.82	0.71 0.93 0.82 0.82 0.82 recall 0.71 0.92 0.82	0.73 0.89 0.83 0.82 0.82 0.82 f1-score 0.73 0.89 0.83 0.82 0.82	9883 9883 9883 29649 29649 29649 support 9883 9883 9883 29649 29649		

1 2	0.85 0.84	0.92 0.83	0.89 0.83	9883 9883			
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.82 0.82	29649 29649 29649			
[[6969 1371 1 [723 9136 [1513 187 8 min samples:	24] 183]]	recall	f1-score	support			
	precision	recarr	11-30016	заррог с			
0	0.75	0.71	0.73	9883			
1	0.85	0.92	0.89	9883			
2	0.84	0.82	0.83	9883			
accuracy			0.82	29649			
macro avg	0.82	0.82	0.82	29649			
weighted avg	0.82	0.82	0.82	29649			
[[6989 1366 1 [731 9128 [1544 188 8 min samples:	24]						
·	precision	recall	f1-score	support			
0	0.75	0.70	0.73	9883			
1	0.86	0.92	0.89	9883			
2	0.84	0.82	0.83	9883			
accuracy			0.82	29649			
macro avg	0.82	0.82	0.82	29649			
weighted avg	0.82	0.82	0.82	29649			
[[6965 1363 1555] [721 9136							
	precision		f1-score	support			
0	0.75	0.71	0.73	9883			
1	0.86	0.92	0.89	9883			
2	0.84	0.82	0.83	9883			
accuracy			0.82	29649			
macro avg	0.82	0.82	0.82	29649			
weighted avg	0.82	0.82	0.82	29649			
[[6999 1363 1521] [721 9136							
min samples:	precision	recall	f1-score	support			
0	0.75	0.71	0.73	9883			
1	0.85	0.92	0.89	9883			
2	0.84	0.82	0.83	9883			
266112261			a 02	20640			
accuracy macro avg	0.81	0.82	0.82 0.81	29649 29649			
weighted avg	0.81	0.82	0.81	29649			
5 3							

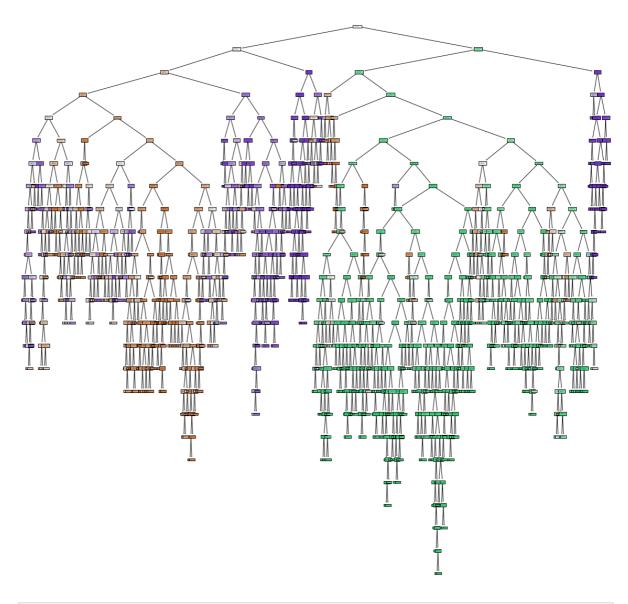
[[6969 1386 1528]

```
[ 717 9140
          [1588 195 8100]]
         min samples: 100
                      precision recall f1-score
                                                     support
                   0
                           0.75
                                   0.70
                                               0.73
                                                        9883
                   1
                           0.85
                                    0.92
                                               0.89
                                                        9883
                    2
                           0.84
                                     0.82
                                               0.83
                                                        9883
                                               0.82
                                                        29649
            accuracy
            macro avg
                           0.81
                                     0.82
                                               0.81
                                                        29649
         weighted avg
                           0.81
                                     0.82
                                               0.81
                                                        29649
         [[6933 1385 1565]
          [ 717 9140
                      26]
          [1541 194 8148]]
         dt2=DecisionTreeClassifier(min_samples_leaf=63,random_state=1)
In [59]:
         dt2=create_model(dt2)
                       precision recall f1-score
                                                      support
                   0
                           0.75
                                   0.71
                                               0.73
                                                        9883
                   1
                           0.85
                                    0.90
                                               0.87
                                                        9883
                   2
                           0.84
                                     0.84
                                               0.84
                                                        9883
                                               0.82
            accuracy
                                                        29649
                                    0.82
                                               0.81
                                                        29649
            macro avg
                           0.81
                                     0.82
                                               0.81
                                                        29649
         weighted avg
                           0.81
         [[6993 1361 1529]
          [ 966 8893
                      24]
          [1356 212 8315]]
In [60]:
         #in min_samples_leaf we got bit good accuracy but yet we have remaining
         #more algos that if we apply we might get good score
         IG=dt2.feature_importances_
In [61]:
         print('information gain:',IG)
         information gain: [0.36286826 0.11654338 0.02985772 0.01957757 0.00397664 0.024542
         53
                    0.00387262 0.
                                          0.01280442 0.01800513 0.01255553
          0.
          0.03374593 0.02531025 0.33634002]
In [62]: dict={'Input':X.columns,'IG':IG}
         df1=pd.DataFrame(dict)
         df1.sort_values('IG',ascending=False)#descending order according to IG
```

26]

Out[62]:		Input	IG
	0	term	0.362868
	14	last_pymnt_amnt	0.336340
	1	int_rate	0.116543
	12	installment	0.033746
	2	grade	0.029858
	13	annual_inc	0.025310
	5	issue_d	0.024543
	3	home_ownership	0.019578
	10	funded_amnt	0.018005
	9	loan_amnt	0.012804
	11	funded_amnt_inv	0.012556
	4	verification_status	0.003977
	7	purpose	0.003873
	6	pymnt_plan	0.000000
	8	application_type	0.000000

```
In [63]: #making tree with the help of min_samples_leaf
           \textbf{from} \text{ sklearn } \textbf{import} \text{ tree}
           features=X.columns#input features
           fig=plt.figure(figsize=(20,20))
           #_=tree.plot_tree(dt2,feature_names=features,filled=True)
```



max_depth: 1				
aaep ev _	precision	recall	f1-score	support
0	0.00	0.00	0.00	9883
1	0.68	1.00	0.81	9883
2	0.52	0.79	0.63	9883
accuracy			0.60	29649
macro avg	0.40	0.60	0.48	29649
weighted avg	0.40	0.60	0.48	29649
[[0 2621 7 [0 9883 [0 2072 7 max_depth: 2	0]			
	precision	recall	f1-score	support
0	0.61	0.73	0.66	9883
1	0.76	1.00	0.86	9883
2	0.98	0.47	0.63	9883
accuracy			0.73	29649
macro avg	0.78	0.73	0.72	29649
weighted avg	0.78	0.73	0.72	29649
[[7202 2593 [0 9883 [4663 588 4 max_depth: 3			C1 	
	precision	recall	f1-score	support
0	0.70	0.67	0.68	9883
1	0.77	1.00	0.87	9883
2	0.89	0.66	0.76	9883
accuracy			0.78	29649
macro avg	0.79	0.78	0.77	29649
weighted avg	0.79	0.78	0.77	29649
[[6627 2455 [27 9856 [2876 492 6 max_depth: 4	0]			
	precision	recall	f1-score	support
0	0.70	0.68	0.69	9883
1	0.78	1.00	0.88	9883
2	0.89	0.66	0.76	9883
accuracy			0.78	29649
macro avg	0.79	0.78	0.77	
weighted avg	0.79	0.78	0.77	29649
[[6762 2305 [8 9851 [2918 448 6 max_depth: 5	24]			
	precision	recall	f1-score	support
0	0.74	0.64	0.69	9883
1	0.78	1.00	0.88	9883
2	0.85	0.72	0.78	9883
accuracy			0.79	29649

	macro avg weighted avg		0.79 0.79	0.78 0.78	29649 29649	
	[[6346 2312 1 [3 9856 [2270 451 7 max_depth: 6	24] /162]]	.,	C4		
		precision	recall	f1-score	support	
	0	0.74	0.64	0.69	9883	
	1	0.78	1.00	0.88	9883	
	2	0.85	0.73	0.78	9883	
	accuracy			0.79	29649	
	macro avg	0.79	0.79		29649	
	weighted avg		0.79	0.78	29649	
	[[6333 2305 1 [3 9851 [2233 448 7 max_depth: 7	29]				
		precision	recall	f1-score	support	
	0	0.75	0.65	0.70	9883	
	1	0.81	0.98	0.88	9883	
	2	0.84	0.77	0.80	9883	
	accuracy			0.80	29649	
	macro avg	0.80	0.80	0.79		
	weighted avg		0.80	0.79	29649	
	[[6459 1982 1 [215 9639 [1963 316 7 max_depth: 8	29] 7604]]				
		precision	recall	f1-score	support	
	0	0.76	0.67	0.71	9883	
	1	0.82	0.97	0.89	9883	
	2	0.85	0.79	0.82	9883	
	accuracy			0.81	29649	
	macro avg	0.81	0.81	0.81	29649	
	weighted avg		0.81	0.81	29649	
			0.01	0.01	25045	
	[[6622 1839 1 [297 9581 [1793 270 7	5]				
In [66]:		ing the min_	samples_le	eaf accurac	y has redu	ppy our score is reducing uced from 82% to 81% max
In [67]:	#applying the from sklearn.	_		ıtaset		
In [68]:	#creating the svc=LinearSVC	-	rte=1)			
		1.7/				
In [69]:	svc=create_mc	odel(svc)				

```
precision recall f1-score
                                                       support
                    0
                            0.70
                                      0.65
                                                0.67
                                                          9883
                    1
                            0.76
                                      1.00
                                                0.86
                                                          9883
                    2
                            0.87
                                      0.66
                                                0.75
                                                          9883
                                                0.77
                                                          29649
             accuracy
                            0.78
                                      0.77
                                                0.76
                                                          29649
            macro avg
         weighted avg
                            0.78
                                      0.77
                                                0.76
                                                          29649
         [[6444 2497 942]
          [ 40 9843
                      0]
          [2734 586 6563]]
In [70]: #the score has been decreased in every aspect support vector classifier
         #of the dataset accuracy score has reduced
In [71]:
         #adding some external feature to the dataset
In [73]: svc1=LinearSVC(random_state=1,C=0.01)
         svc1=create_model(svc1)
         #no effct of external parameter score is same i.e less
         #so no change in score that means data is non linear
                       precision
                                    recall f1-score
                                                        support
                    0
                            0.70
                                      0.65
                                                0.67
                                                          9883
                                      1.00
                            0.76
                                                0.86
                                                          9883
                    1
                            0.87
                                      0.66
                                                0.75
                                                          9883
                                                0.77
                                                          29649
             accuracy
                            0.78
                                      0.77
                                                0.76
                                                          29649
            macro avg
         weighted avg
                            0.78
                                      0.77
                                                0.76
                                                          29649
         [[6421 2526 936]
          [ 49 9834
                        0]
          [2740 603 6540]]
In [74]: from sklearn.svm import SVC
         #so here given dataset to the kernel function bcoz data is non linear
In [76]:
         #for finding the optimal linearty of the data
         svc1=SVC(random_state=1,kernel='poly')
         svc1=create model(svc1)
In [77]:
         #poly has given bit good score but not the best
                       precision
                                    recall f1-score
                                                        support
                    0
                            0.79
                                      0.65
                                                0.71
                                                           9883
                    1
                            0.78
                                      0.99
                                                0.87
                                                           9883
                                      0.78
                            0.87
                                                0.82
                                                          9883
             accuracy
                                                0.81
                                                          29649
                            0.81
                                      0.81
                                                0.80
                                                          29649
            macro avg
                                      0.81
                                                0.80
                                                          29649
         weighted avg
                            0.81
         [[6453 2291 1139]
          [ 109 9771
                        3]
          [1636 530 7717]]
         #applying the second kernel function
```

In [79]:

svc2=SVC(random_state=1,kernel='rbf')

```
svc2=create_model(svc2)
#by using rbf score has been intact as of dt with min_sample_leaf technique
```

```
precision recall f1-score support
         0
                0.83
                        0.64
                                  0.72
                                          9883
         1
                0.79
                        0.98
                                  0.88
                                          9883
         2
                0.85
                        0.85
                                  0.85
                                          9883
                                  0.82
                                          29649
   accuracy
                                         29649
                0.82
                       0.82
                                 0.82
  macro avg
weighted avg
                0.82
                        0.82
                                  0.82
                                          29649
[[6303 2134 1446]
[ 201 9668
           14]
[1135 372 8376]]
```

In [80]: #using ensemble technique

 $\textbf{from} \ \, \textbf{sklearn.ensemble} \ \, \textbf{import} \ \, \textbf{RandomForestClassifier}$

```
In [81]: #using hit and trail method for rfc
for i in range(10,101):
    rfc=RandomForestClassifier(n_estimators=i,random_state=1)
    print('no. of trees:',i)
    rfc=create_model(rfc)
```

no. of trees:	10			
	precision	recall	f1-score	support
0	0.74	0.77	0.76	9883
1	0.90	0.84	0.87	9883
2	0.85	0.87	0.86	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7640 859 1 [1521 8286 [1191 109 8 no. of trees:	76] 583]] 11			
	precision	recall	f1-score	support
0	0.76	0.75	0.75	9883
1	0.89	0.85	0.87	9883
2	0.84	0.89	0.86	9883
			0.03	20640
accuracy	0.03	0.02	0.83	29649
macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83	29649 29649
weighted avg	0.05	0.05	0.83	23043
[[7366 905 1 [1378 8440 [1004 109 8 no. of trees:	65] 770]] 12	11	C.	
	precision	recall	f1-score	support
0	0.74	0.77	0.76	9883
1	0.90	0.84	0.87	9883
2	0.85	0.87	0.86	9883
accuracy			0.83	29649
accuracy macro avg	0.83	0.83	0.83	29649
weighted avg	0.83			
[[7611 856 1	76] 637]]			
	precision	recall	f1-score	support
0	0.76	0.74	0.75	9883
1	0.89	0.85	0.87	9883
2	0.84	0.89	0.86	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7348 903 1 [1375 8430 [983 105 8 no. of trees:	632] 78] 795]] 14			
	precision	recall	f1-score	support
0	0.75	0.76	0.75	9883
1	0.89	0.85	0.87	9883
2	0.85	0.88	0.86	9883
accuracy			0.83	29649
2222. 229			2.00	

macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83	29649 29649
[[7528 895 1 [1437 8366 [1096 103 8 no. of trees:	80] 684]]			
	precision	recall	f1-score	support
0 1 2	0.76 0.89 0.84	0.74 0.86 0.89	0.75 0.87 0.86	9883 9883 9883
accuracy macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83 0.83	29649 29649 29649
[[7324 917 1 [1328 8475 [954 106 8 no. of trees:	80] 823]]			
	precision	recall	f1-score	support
0 1 2	0.75 0.89 0.85	0.76 0.85 0.88	0.76 0.87 0.86	9883 9883 9883
accuracy macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83 0.83	29649 29649 29649
[[7491 907 1 [1388 8411 [1055 106 8 no. of trees:	84] 722]]			
	precision	recall	f1-score	support
0 1 2	0.77 0.89 0.84	0.74 0.86 0.89	0.75 0.88 0.87	
accuracy macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83 0.83	29649 29649 29649
[[7330 924 1 [1280 8519 [942 102 8 no. of trees:	84] 839]]	recall	f1-score	support
0	0.76	0.76	0.76	9883
1 2	0.89 0.85	0.85 0.89	0.87 0.87	9883 9883
accuracy macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83 0.83	29649 29649 29649
[[7471 918 1 [1366 8433 [1014 102 8 no. of trees:	84] 767]]	recall	f1-score	support

0	0.77	0.74	0.75	9883
1	0.89	0.86	0.88	9883
2	0.84	0.90	0.87	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7314 926 1 [1265 8533 [934 98 8 no. of trees:	85] 851]]	recall	f1-score	support
	•			• • •
0	0.76	0.75	0.76	9883
1	0.89	0.86	0.88	9883
2	0.85	0.89	0.87	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7443 915 1 [1320 8488 [1028 100 8 no. of trees:	75] 755]]			
	precision	recall	f1-score	support
0	0.77	0.74	0.76	9883
1	0.89	0.87	0.88	9883
2	0.84	0.90	0.87	9883
2661182614			0.02	20640
accuracy macro avg	0.83	0.83	0.83 0.83	29649 29649
weighted avg	0.83	0.83	0.83	29649
[[7317 921 1 [1246 8561 [932 100 8 no. of trees:	76] 851]] 22			
	precision	recall	f1-score	support
0	0.77	0.75	0.76	9883
1	0.89	0.86	0.88	9883
2	0.85	0.89	0.87	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7429 933 1 [1269 8541 [1002 101 8 no. of trees:	73] 780]]	recall	f1-score	support
	,			
0			0.76	0000
1	0.77	0.74	0.76	9883
_	0.89	0.87	0.88	9883
2				
2	0.89	0.87	0.88	9883
_	0.89	0.87	0.88 0.87	9883 9883
accuracy	0.89 0.84	0.87 0.90	0.880.870.83	9883 9883 29649

[929 103 885 no. of trees: 2		recall	f1-score	support
0	0.77	0.75	0.76	9883
1	0.89	0.87	0.88	9883
2	0.84	0.89	0.87	9883
accupacy			0.84	29649
accuracy macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
1102811000 018	0.0	0.01	0.01	230.13
[[7426 923 153 [1240 8565 7 [996 101 878 no. of trees: 2	8] 6]]			
р	recision	recall	f1-score	support
0	0.78	0.74	0.76	0000
1	0.78 0.89	0.74 0.87	0.76	9883 9883
2	0.89	0.87	0.87	9883
2	0.04	0.50	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[925 104 885 no. of trees: 2	4] 4]] 6			
р	recision	recall	f1-score	support
_				
0	0.77	0.75	0.76	9883
0 1	0.77 0.89	0.75 0.87	0.76 0.88	9883 9883
1	0.89	0.87	0.88	9883 9883
1 2 accuracy	0.89 0.85	0.87 0.89	0.880.870.84	9883 9883 29649
1 2 accuracy macro avg	0.89 0.85 0.84	0.87 0.89	0.88 0.87 0.84 0.84	9883 9883 29649 29649
1 2 accuracy	0.89 0.85	0.87 0.89	0.880.870.84	9883 9883 29649 29649
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3]	0.87 0.89 0.84 0.84	0.88 0.87 0.84 0.84	9883 9883 29649 29649 29649
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3]	0.87 0.89 0.84 0.84	0.88 0.87 0.84 0.84	9883 9883 29649 29649 29649
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision	0.87 0.89 0.84 0.84	0.88 0.87 0.84 0.84 0.84	9883 9883 29649 29649 29649 support
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78	0.87 0.89 0.84 0.84	0.88 0.87 0.84 0.84 0.84	9883 9883 29649 29649 29649 support
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision	0.87 0.89 0.84 0.84	0.88 0.87 0.84 0.84 0.84	9883 9883 29649 29649 29649 support
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2 p	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78 0.89	0.87 0.89 0.84 0.84 recall 0.74 0.87	0.88 0.87 0.84 0.84 0.84 f1-score 0.76 0.88	9883 9883 29649 29649 29649 support 9883 9883
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2 p	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78 0.89	0.87 0.89 0.84 0.84 recall 0.74 0.87	0.88 0.87 0.84 0.84 0.84 f1-score 0.76 0.88	9883 9883 29649 29649 29649 support 9883 9883
accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2 p 0 1 2 accuracy macro avg	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78 0.89 0.84	0.87 0.89 0.84 0.84 recall 0.74 0.87 0.90	0.88 0.87 0.84 0.84 0.84 0.84 0.86 0.87 0.84 0.84	9883 9883 29649 29649 29649 support 9883 9883 9883 29649 29649
1 2 accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2 p 0 1 2 accuracy	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78 0.89 0.84	0.87 0.89 0.84 0.84 recall 0.74 0.87 0.90	0.88 0.87 0.84 0.84 0.84 f1-score 0.76 0.88 0.87 0.84	9883 9883 29649 29649 29649 support 9883 9883 9883
accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78 0.89 0.84 0.84	0.87 0.89 0.84 0.84 recall 0.74 0.87 0.90	0.88 0.87 0.84 0.84 0.84 0.84 0.86 0.87 0.84 0.84	9883 9883 29649 29649 29649 support 9883 9883 9883 29649 29649
accuracy macro avg weighted avg [[7445 930 150 [1214 8596 7 [985 103 879 no. of trees: 2	0.89 0.85 0.84 0.84 8] 3] 5]] 7 recision 0.78 0.89 0.84 0.84	0.87 0.89 0.84 0.84 0.87 0.90	0.88 0.87 0.84 0.84 0.84 0.84 0.86 0.87 0.84 0.84	9883 9883 29649 29649 29649 support 9883 9883 9883 29649 29649

1 2	0.89 0.85	0.87 0.89	0.88 0.87	9883 9883
accuracy macro avg weighted avg	0.84 0.84	0.84 0.84	0.84 0.84 0.84	29649 29649 29649
[[7444 922 1 [1201 8604 [985 102 8 no. of trees:	78] 796]] 29	nocall	f1-score	cuppent
	precision	recall	11-50016	support
0 1	0.78 0.89	0.74 0.87	0.76 0.88	9883 9883
2	0.84	0.90	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7353 924 1 [1170 8637 [916 99 8 no. of trees:	76] 868]] 30			
	precision	recall	f1-score	support
0	0.78	0.75	0.76	9883
1	0.89	0.88	0.88	9883
2	0.85	0.89	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7409 940 1 [1154 8653 [955 97 8 no. of trees:	76] 831]]	recall	f1-score	support
0	0.70	0.74	0.76	0002
0 1	0.78 0.89	0.74 0.88	0.76 0.89	9883 9883
2	0.84	0.90	0.87	9883
accupacy			0.84	29649
accuracy macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7332 941 1 [1138 8673 [913 97 8 no. of trees:	610] 72] 873]] 32			
	precision	recall	f1-score	support
0	0.78	0.75	0.76	9883
1	0.89	0.88	0.88	9883
2	0.85	0.89	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649

[1158 8655 [954 96 8 no. of trees:	833]] 33	macall	£1 55000	support
	precision	recall	f1-score	support
0	0.79	0.74	0.76	9883
1	0.89	0.88	0.89	9883
2	0.84	0.90	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7340 937 1 [1100 8710 [899 101 8 no. of trees:	73] 883]]	recall	f1-score	support
	•			
0	0.78	0.75	0.77	9883
1	0.89	0.88	0.89	9883
2	0.84	0.89	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7402 931 1 [1109 8694 [953 98 8 no. of trees:	80] 832]]	recall	f1-score	support
0	0.79	0.74	0.76	9883
1	0.89	0.88	0.89	9883
2	0.84	0.90	0.87	9883
accupacy			0.84	29649
accuracy macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7341 931 1 [1079 8724 [908 98 8 no. of trees:	80] 877]]	nocall	f1-score	support
	precision	recarr	11-30016	зиррог с
0	0.79	0.75	0.77	9883
1	0.89	0.88	0.89	9883
2	0.85	0.89	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7408 935 1 [1086 8722 [942 101 8 no. of trees:	75] 840]]	recall	f1-score	support
0	0.70	0.74	0.76	0002
0 1	0.79 0.89	0.74	0.76	9883 9883
2	0.84	0.90	0.83	9883
_	- 70 .			- 300

accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7332 935 1616 [1069 8737 77 [899 105 8879 no. of trees: 38]]]			
pr	ecision	recall	f1-score	support
0	0.79	0.75	0.77	9883
1	0.89	0.88	0.89	9883
2	0.85	0.89	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7386 950 1547 [1076 8737 70 [941 102 8840 no. of trees: 39]]]			
pr	ecision	recall	f1-score	support
0	0.79	0.74	0.76	9883
1	0.89	0.89	0.89	9883
2	0.84	0.90	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7318 946 1619 [1058 8758 67 [896 100 8887 no. of trees: 40]]]	recall	f1-score	support
ρι	ECTATON	recarr	11-30016	suppor c
0	0.79	0.75	0.77	9883
1	0.89	0.89	0.89	9883
2	0.85	0.89	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7381 954 1548 [1038 8772 73 [935 104 8844 no. of trees: 41 pr]]]	recall	f1-score	support
	• = '			
0	0.79	0.74	0.77	9883
1	0.89	0.89	0.89	9883
2	0.84	0.90	0.87	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7330 942 1611 [1042 8773 68 [891 103 8889]	0.07	0.04	25045

### Precision recall f1-score support ### 0	no. of trees:	42			
1 0.89 0.89 0.89 9.89 9883 2 0.84 0.89 0.87 9883 accuracy macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 0.84 29649 [[7382 945 1556] [1041 8766 76] [935 104 8844]] no. of trees: 43			recall	f1-score	support
accuracy macro avg 0.84 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649	0	0.79	0.75	0.77	9883
accuracy	1	0.89	0.89	0.89	9883
macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7382 945 1556] [1041 8766 76] [935 104 8844]] no. of trees: 43	2	0.84	0.89	0.87	9883
weighted avg 0.84 0.84 0.84 29649 [[7382 945 1556] [1041 8766 76] [935 104 8844]] no. of trees: 43 precision recall f1-score support 0 0.79 0.74 0.77 9883 1 0.89 0.89 9.89 9883 2 0.84 0.90 0.87 9883 2 0.84 0.90 0.87 9883 2 0.84 0.90 0.87 9883 2 0.84 0.84 0.84 29649 accuracy macro avg 0.84 0.84 0.84 0.84 29649 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 0.84 29649 0.87 0.87 0.77 9883 0.89 0.89 9883 0.89 9883 0.89 0.89 9883 0.89 0.89 9883 0.89 0.89 9883 0.89 0.89 9883 0.89 0.89 0.87 9883 0.80 0.87 9883 0.80 0.87 0.80 0.87 0.80 0.87 0.80 0.80	-	0.94	0.84		
[[7382 945 1556] [1041 8766 76] [935 104 8844]] no. of trees: 43					
[1041 8766 76] [935 104 8844] no. of trees: 43	weighted avg	0.04	0.04	0.04	25045
Precision recall f1-score support	[1041 8766 [935 104 8	76] 844]]			
1 0.89 0.89 0.89 9883 2 0.84 0.90 0.87 9883 accuracy 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7324 949 1610] [1052 8757 74] [870 103 8910]] no. of trees: 44	110. 01 11 663.		recall	f1-score	support
1 0.89 0.89 0.89 9883 2 0.84 0.90 0.87 9883 accuracy 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7324 949 1610] [1052 8757 74] [870 103 8910]] no. of trees: 44	0	0.79	0.74	0.77	9883
accuracy	1				9883
macro avg	2	0.84	0.90	0.87	9883
macro avg				0.04	20640
weighted avg		0.04	0.04		
[[7324 949 1610] [1052 8757 74] [870 103 8910]] no. of trees: 44	_				
[1052 8757 74] [870 103 8910]] no. of trees: 44	weighted avg	0.04	0.04	0.04	23043
0 0.79 0.75 0.77 9883 1 0.89 0.89 0.89 9883 2 0.85 0.90 0.87 9883 accuracy 0.84 29649 macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7400 943 1540] [1046 8765 72] [915 101 8867]] no. of trees: 45	[1052 8757 [870 103 8	74] 910]] 44			
1 0.89 0.89 0.89 9883 2 0.85 0.90 0.87 9883 accuracy 0.84 29649 macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7400 943 1540] [1046 8765 72] [915 101 8867]] no. of trees: 45		precision	recall	f1-score	support
accuracy	0	0.79		0.77	9883
accuracy					
macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7400 943 1540]	2	0.85	0.90	0.87	9883
macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7400 943 1540]	accuracv			0.84	29649
weighted avg		0.84	0.84		
[1046 8765 72] [915 101 8867]] no. of trees: 45	_	0.84	0.84	0.84	29649
0 0.79 0.74 0.77 9883 1 0.89 0.89 0.89 9883 2 0.84 0.90 0.87 9883 accuracy 0.84 29649 macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7344 940 1599] [1038 8772 73] [873 101 8909]] no. of trees: 46	[1046 8765 [915 101 8	72] 867]] 45	nacall	f1_ccope	support
1 0.89 0.89 0.89 9883 2 0.84 0.90 0.87 9883 accuracy 0.84 29649 macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7344 940 1599] [1038 8772 73] [873 101 8909]] no. of trees: 46		precision	recarr	11-30016	suppor c
accuracy 0.84 0.90 0.87 9883 accuracy 0.84 29649 macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7344 940 1599] [1038 8772 73] [873 101 8909]] no. of trees: 46	0				
accuracy					
macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7344 940 1599] [1038 8772 73] [873 101 8909]] no. of trees: 46	2	0.84	0.90	0.87	9883
macro avg 0.84 0.84 0.84 29649 weighted avg 0.84 0.84 0.84 29649 [[7344 940 1599] [1038 8772 73] [873 101 8909]] no. of trees: 46	accuracv			0.84	29649
weighted avg		0.84	0.84		
[1038 8772 73] [873 101 8909]] no. of trees: 46	_			0.84	
0 0.79 0.75 0.77 9883 1 0.89 0.89 0.89 9883 2 0.85 0.90 0.87 9883	[1038 8772 [873 101 8	73] 909]] 46	recall	f1-score	support
1 0.89 0.89 0.89 9883 2 0.85 0.90 0.87 9883		p. cc151011		50010	Jappon C
2 0.85 0.90 0.87 9883	0				9883
accuracy 0.85 29649	2	0.85	0.90	0.87	9883
	accuracy			0.85	29649

macro avg	0.84 0.84	0.85 0.85		29649 29649
weighted avg [[7397 937 1988] [1033 8780] [905 101 88] no. of trees:	549] 70] 377]]	0.03	0.04	23043
	precision	recall	f1-score	support
0 1 2	0.79 0.89 0.84	0.74 0.89 0.90	0.77 0.89 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.84 0.84	0.84 0.84	0.84 0.84 0.84	29649 29649 29649
[[7334 943 16 [1026 8784 [866 102 89 no. of trees:	73] 915]]			
	precision	recall	f1-score	support
0 1 2	0.80 0.89 0.85	0.75 0.89 0.90	0.77 0.89 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.84 0.84	0.85 0.85	0.85 0.84 0.84	29649 29649 29649
[[7398 945 19	77] 384]]			
	precision	recall	f1-score	support
0 1 2	0.80 0.89 0.84	0.74 0.89 0.90	0.77 0.89 0.87	9883
accuracy macro avg weighted avg	0.84 0.84	0.85 0.85	0.85 0.84 0.84	29649 29649 29649
[[7338 948 19 [982 8821 [859 103 89 no. of trees:	80] 921]]	necall	f1-score	support
0				
0 1 2	0.80 0.89 0.85	0.75 0.89 0.90	0.77 0.89 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7399 941 19 [986 8819 [892 101 88 no. of trees:	78] 390]]	recall	f1-score	support

0	0.80	0.74	0.77	9883
1	0.89	0.89	0.89	9883
2	0.84	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.84	29649
weighted avg	0.85	0.85	0.84	29649
[[7345 947 1 [979 8819 [860 102 8 no. of trees:	85] 921]]	recall	f1-score	support
	p			
0	0.80	0.75	0.77	9883
1	0.89	0.89	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
accuracy macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
8	0.00	0.05	0.05	
[[7405 936 1 [989 8812 [896 102 8 no. of trees:	82] 885]] 53			
	precision	recall	f1-score	support
0	0.80	0.74	0.77	9883
1	0.89	0.89	0.89	9883
2	0.84	0.90	0.87	9883
			0.05	20640
accuracy	A 9F	0.05	0.85	29649
macro avg	0.85 0.85	0.85 0.85	0.85	29649
•	0.85 0.85	0.85 0.85		
macro avg	0.85 586] 82] 919]] 54	0.85	0.85 0.85	29649 29649
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8	0.85 586] 82] 919]]	0.85	0.85	29649
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8	0.85 586] 82] 919]] 54	0.85	0.85 0.85	29649 29649
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8 no. of trees:	0.85 586] 82] 919]] 54 precision 0.80 0.89	0.85 recall 0.75 0.89	0.85 0.85 f1-score 0.77 0.89	29649 29649 support
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8 no. of trees:	0.85 586] 82] 919]] 54 precision 0.80	0.85 recall 0.75	0.85 0.85 f1-score 0.77	29649 29649 support
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8 no. of trees:	0.85 586] 82] 919]] 54 precision 0.80 0.89	0.85 recall 0.75 0.89	0.85 0.85 f1-score 0.77 0.89 0.87	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8 no. of trees: 0 1 2	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85	0.85 recall 0.75 0.89 0.90	0.85 0.85 f1-score 0.77 0.89 0.87	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8 no. of trees:	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85	0.85 recall 0.75 0.89	0.85 0.85 f1-score 0.77 0.89 0.87	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7354 943 1 [985 8816 [857 107 8 no. of trees: 0 1 2	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85 0.85 532] 83] 896]]	0.85 recall 0.75 0.89 0.90	0.85 0.85 1-score 0.77 0.89 0.87 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85 0.85 0.85 532] 83] 896]]	0.85 recall 0.75 0.89 0.90	0.85 0.85 f1-score 0.77 0.89 0.87 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85 0.85 532] 83] 896]]	0.85 recall 0.75 0.89 0.90	0.85 0.85 1-score 0.77 0.89 0.87 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85 0.85 532] 83] 896]] 55 precision	0.85 recall 0.75 0.89 0.90 0.85 0.85	0.85 0.85 f1-score 0.77 0.89 0.87 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.85 0.85 0.85 532] 83] 896]] 55 precision 0.80	0.85 recall 0.75 0.89 0.90 0.85 0.85	0.85 0.85 f1-score 0.77 0.89 0.87 0.85 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.85 0.85 0.85 532] 83] 896]] 55 precision 0.80 0.89	0.85 recall 0.75 0.89 0.90 0.85 0.85	0.85 0.85 0.85 f1-score 0.77 0.85 0.85 0.85 0.85	29649 29649 support 9883 9883 29649 29649 29649 29649
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.89 0.85 0.85 532] 83] 896]] 55 precision 0.80 0.89 0.84	0.85 recall 0.75 0.89 0.90 0.85 0.85	0.85 0.85 0.85 f1-score 0.77 0.85 0.85 0.85	29649 29649 support 9883 9883 29649 29649 support 9883 9883 9883
macro avg weighted avg [[7354 943 1	0.85 586] 82] 919]] 54 precision 0.80 0.85 0.85 0.85 532] 83] 896]] 55 precision 0.80 0.89	0.85 recall 0.75 0.89 0.90 0.85 0.85	0.85 0.85 0.85 f1-score 0.77 0.85 0.85 0.85 0.85	29649 29649 support 9883 9883 29649 29649 29649 29649

[852 104 89 no. of trees:	81] 27]]	recall	f1-score	support
0 1 2	0.80 0.89 0.85	0.75 0.89 0.90	0.77 0.89 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7395 950 15 [978 8826 [881 107 88 no. of trees:	79] 95]]			
	precision	recall	f1-score	support
0 1 2	0.80 0.89 0.84	0.75 0.89 0.90	0.77 0.89 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[856 106 89 no. of trees:	76] 21]] 58			
	precision	recall	f1-score	support
0 1 2	0.80 0.89 0.85	0.75 0.89 0.90	0.77 0.89 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85	0.85 0.85	
	0.05	0.85	0.85	
[877 109 88	42] 83] 97]]	0.85	0.85	
[975 8825 [877 109 88 no. of trees:	42] 83] 97]] 59		0.85	29649
[975 8825 [877 109 88 no. of trees:	42] 83] 97]] 59		f1-score 0.77	29649
[975 8825 [877 109 88 no. of trees: 0 1	42] 83] 97]] 59 precision 0.80 0.89	recall 0.74 0.89	f1-score 0.77 0.89	29649 support 9883 9883
[975 8825 [877 109 88 no. of trees:	42] 83] 97]] 59 precision 0.80 0.89 0.84 0.85 0.85 81] 84] 30]]	recall 0.74 0.89 0.90	f1-score 0.77 0.89 0.87 0.85 0.85	29649 support 9883 9883 9883 29649 29649
[975 8825 [877 109 88 no. of trees:	42] 83] 97]] 59 precision 0.80 0.89 0.84 0.85 0.85 81] 84] 30]]	recall 0.74 0.89 0.90 0.85 0.85	f1-score 0.77 0.89 0.87 0.85 0.85 0.85	29649 support 9883 9883 9883 29649 29649

1 2	0.89 0.85	0.89 0.90	0.89 0.87	9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7410 937 1 [981 8815 [881 106 8 no. of trees:	87] 896]]	recall	f1-score	support
	precision	rccarr	11 30010	заррог с
0	0.80	0.75	0.77	9883
1	0.89	0.89	0.89	9883
2	0.84	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7369 936 1 [966 8835 [854 106 8 no. of trees:	82] 923]] 62			
	precision	recall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.89	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7403 941 1 [960 8843 [882 107 8 no. of trees:	80] 894]]	recall	f1-score	support
0	0.00	0.75	0.77	9883
1	0.80 0.89	0.73	0.89	9883
2	0.84	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
Weighted avg [[7381 942 1 [955 8851 [855 105 8 no. of trees:	77] 923]]	0.85	0.85	29649
	precision	recall	f1-score	support
0	0.80	0.75	0.78	9883
1	0.89	0.90	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
5				

[956 8850 [874 109 89 no. of trees:	65	11	Ca.	
	precision	recall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.90	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7379 945 1] [958 8851 [852 107 8] no. of trees:	74] 924]] 66			
	precision	recall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.90	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7402 951 1 [963 8848 [869 107 8 no. of trees:	72] 907]]	recall	f1-score	support
0	0.80	0.75	0.77	9883
1 2	0.89 0.85	0.90 0.90	0.89 0.87	9883 9883
_				
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7378 947 1] [955 8853 [852 104 8] no. of trees:	75] 927]] 68			
	precision	recall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.90	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7401 950 1 [959 8851 [867 106 8 no. of trees:	73] 910]] 69		£1	
	precision	Lecall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.90	0.90	9883
2	0.84	0.90	0.87	9883

accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[851 109 892] no. of trees: 70	4] 3]] 0			
р	recision	recall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.90	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[869 110 8904 no. of trees: 73	7] 4]] 1			
р	recision	recall	f1-score	support
0	0.80	0.74	0.77	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[851 108 8924 no. of trees: 73	7] 4]]	recall	f1-score	support
P	1 60131011	recarr	11-30016	зиррог с
0	0.80	0.75	0.77	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
			0.05	20640
accuracy	0.05	0.05	0.85 0.85	29649
macro avg weighted avg	0.85 0.85	0.85 0.85	0.85	29649 29649
weighted avg	0.03	0.03	0.65	23043
[867 108 8908 no. of trees: 73	2] 8]]	recall	f1-score	support
P	1 CCT2TOH	i ecall	11-2001.6	support
0	0.81	0.75	0.77	9883
1	0.89	0.90	0.90	9883
2	0.84	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7366 943 1574 [933 8879 73 [844 107 893	4] 1]	0.03	0.03	25043

no. of trees:	74			
	precision	recall	f1-score	support
0	0.80	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7401 945 1 [949 8861 [861 109 8 no. of trees:	73] 913]] 75		C1 	
	precision	recall	f1-score	support
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7375 950 1 [934 8879 [836 109 8 no. of trees:	70] 938]]	necall	f1-score	support
	precision	recarr	11-30016	suppor c
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
2661122614			0.85	20640
accuracy macro avg	0.85	0.85	0.85	29649 29649
weighted avg	0.85			
weighted dvg	0.03	0.03	0.03	25015
[[7398 952 1 [934 8877 [857 109 8 no. of trees:	72] 917]]			
	precision	recall	f1-score	support
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
			0.05	20640
accuracy	0.05	0.05	0.85	29649
macro avg	0.85 0.85	0.85 0.85	0.85 0.85	29649 29649
weighted avg	0.65	0.05	0.05	29049
[[7375 949 1 [931 8880 [835 107 8 no. of trees:	72] 941]] 78	11	C.	
	precision	recall	f1-score	support
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
accui acy			0.05	27U43

macro avg weighted avg	0.85 0.85	0.85 0.85		29649 29649
[[7404 952 1965] [935 8876	527] 72] 926]]	0.03	0.03	23043
	precision	recall	f1-score	support
0 1 2	0.81 0.89 0.85	0.75 0.90 0.90	0.78 0.90 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7378 947 19] [917 8891 [834 106 89] no. of trees:	75] 943]]			
	precision	recall	f1-score	support
0 1 2	0.81 0.89 0.85	0.75 0.90 0.90	0.78 0.90 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7396 955 1986 955 1986 955 108 8986 956 956 956 956 956 956 956 956 956 95	69] 920]]			
	precision	recall	f1-score	support
0 1 2	0.81 0.89 0.85	0.75 0.90 0.90	0.78 0.90 0.87	
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7385 947 19 [926 8887 [834 107 89 no. of trees:	70] 942]]	recall	f1-score	support
0				
0 1 2	0.81 0.89 0.85	0.75 0.90 0.90	0.78 0.90 0.88	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7406 955 19 [923 8896 [853 107 89 no. of trees:	64] 923]]	recall	f1-score	support

0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7383 950 1 [918 8897 [836 107 8	68]			
no. of trees:				
	precision	recall	f1-score	support
0	0.01	0.75	0.70	0002
0 1	0.81 0.89	0.75 0.90	0.78 0.90	9883 9883
2	0.85	0.90	0.87	9883
_	0.00	0.20	0,0,	2003
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7402 950 1 [934 8883 [852 108 8 no. of trees:	66] 923]]			
	precision	recall	f1-score	support
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
-	0.85 0.85	0.85 0.85		
macro avg	0.85 550] 65] 934]]		0.85	29649
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8	0.85 550] 65] 934]]	0.85	0.85	29649
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8	0.85 550] 65] 934]] 86	0.85	0.85 0.85	29649 29649
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees:	0.85 550] 65] 934]] 86 precision	0.85	0.85 0.85	29649 29649 support
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees:	0.85 550] 65] 934]] 86 precision 0.81	0.85 recall 0.75	0.85 0.85 f1-score 0.78	29649 29649 support
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees:	0.85 550] 65] 934]] 86 precision 0.81 0.89	0.85 recall 0.75 0.90	0.85 0.85 f1-score 0.78 0.90 0.87	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees: 0 1 2	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85	0.85 recall 0.75 0.90 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees:	0.85 550] 65] 934]] 86 precision 0.81 0.89	0.85 recall 0.75 0.90	0.85 0.85 f1-score 0.78 0.90 0.87	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees: 0 1 2	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 521] 67] 918]]	0.85 recall 0.75 0.90 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7387 946 1	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 521] 67] 918]]	0.85 recall 0.75 0.90 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7387 946 1	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 0.85 7.85 521] 67] 918]] 87 precision 0.81	0.85 recall 0.75 0.90 0.85 0.85 recall 0.75	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7387 946 1	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 521] 67] 918]] 87 precision 0.81 0.89	0.85 recall 0.75 0.90 0.85 0.85 recall 0.75 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649 support 9883 9883
macro avg weighted avg [[7387 946 1	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 0.85 7.85 521] 67] 918]] 87 precision 0.81	0.85 recall 0.75 0.90 0.85 0.85 recall 0.75	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85 0.85	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7387 946 1	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 521] 67] 918]] 87 precision 0.81 0.89	0.85 recall 0.75 0.90 0.85 0.85 recall 0.75 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85 0.85 0.85	29649 29649 support 9883 9883 29649 29649 29649 29649
macro avg weighted avg [[7387 946 1 [931 8887 [840 109 8 no. of trees:	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 521] 67] 918]] 87 precision 0.81 0.89 0.85	0.85 recall 0.75 0.90 0.90 0.85 0.85 recall 0.75 0.90 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85 0.85	29649 29649 support 9883 9883 29649 29649 support 9883 9883 9883
macro avg weighted avg [[7387 946 1	0.85 550] 65] 934]] 86 precision 0.81 0.89 0.85 0.85 521] 67] 918]] 87 precision 0.81 0.89	0.85 recall 0.75 0.90 0.85 0.85 recall 0.75 0.90	0.85 0.85 f1-score 0.78 0.90 0.87 0.85 0.85 0.85 0.85	29649 29649 support 9883 9883 29649 29649 29649 29649

[839 108 89 no. of trees:	66]	recall	f1-score	support
0 1 2	0.81 0.89 0.85	0.75 0.90 0.90	0.78 0.90 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7407 941 15 [931 8887 [854 108 89 no. of trees:	65] 21]]			
	precision	recall	f1-score	support
0 1 2	0.81 0.89 0.85	0.75 0.90 0.90	0.78 0.90 0.87	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7379 941 15 [931 8888 [835 108 89 no. of trees:	64] 40]]			
	precision	recall	f1-score	support
0 1 2		0.75 0.90 0.90	f1-score 0.78 0.90 0.87	9883 9883 9883
0 1	0.81 0.89	0.75 0.90 0.90	0.78 0.90 0.87 0.85 0.85	9883 9883 9883 29649 29649
0 1 2 accuracy macro avg weighted avg [[7411 939 15 [939 8879 [856 109 89	0.81 0.89 0.85 0.85 0.85	0.75 0.90 0.90	0.78 0.90 0.87 0.85 0.85	9883 9883 9883 29649 29649
0 1 2 accuracy macro avg weighted avg [[7411 939 15 [939 8879 [856 109 89 no. of trees:	0.81 0.89 0.85 0.85 0.85	0.75 0.90 0.90	0.78 0.90 0.87 0.85 0.85	9883 9883 9883 29649 29649 29649
0 1 2 accuracy macro avg weighted avg [[7411 939 15 [939 8879 [856 109 89 no. of trees:	0.81 0.89 0.85 0.85 0.85 33] 65] 18]]	0.75 0.90 0.90	0.78 0.90 0.87 0.85 0.85 0.85	9883 9883 9883 29649 29649 29649
0 1 2 accuracy macro avg weighted avg [[7411 939 15 [939 8879 [856 109 89 no. of trees:	0.81 0.89 0.85 0.85 0.85 33] 65] 18]] 91 precision 0.81 0.89	0.75 0.90 0.90 0.85 0.85	0.78 0.90 0.87 0.85 0.85 0.85	9883 9883 9883 29649 29649 29649 support 9883 9883
accuracy macro avg weighted avg [[7411 939 15 [939 8879 [856 109 89 no. of trees:	0.81 0.89 0.85 0.85 0.85 33] 65] 18]] 91 precision 0.81 0.89 0.85 0.85	0.75 0.90 0.90 0.85 0.85 recall 0.75 0.90 0.90	0.78 0.90 0.87 0.85 0.85 0.85 0.85	9883 9883 9883 29649 29649 29649 support 9883 9883 9883 9883
accuracy macro avg weighted avg [[7411 939 15 [939 8879 [856 109 89 no. of trees:	0.81 0.89 0.85 0.85 0.85 33] 65] 18]] 91 precision 0.81 0.89 0.85 0.85	0.75 0.90 0.90 0.85 0.85 recall 0.75 0.90 0.90	0.78 0.90 0.87 0.85 0.85 0.85 0.85 0.78 0.90 0.87 0.85 0.85	9883 9883 9883 29649 29649 29649 3883 9883 9883 29649 29649

1 2	0.89 0.85	0.90 0.90	0.90 0.87	9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85 0.85	29649 29649 29649
[[7409 938 1 [934 8880 [853 109 8 no. of trees:	69] 921]]	recall	f1-score	support
	pr cc1510		.1 500.0	зарро. с
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7382 939 1 [940 8878 [836 108 8 no. of trees:	65] 939]]			
	precision	recall	f1-score	support
0	0.81	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7411 940 1 [939 8877 [851 110 8 no. of trees:	67] 922]]	recall	f1-score	support
0	0.81	0.75	0.78	9883
1	0.89	0.73	0.78	9883
2	0.85	0.90	0.87	9883
accuracy	0.05	0.05	0.85	29649
macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.85	29649 29649
[[7379 938 1 [942 8875 [838 110 8 no. of trees:	566] 66] 935]]	0.03	0.03	25045
	precision	recall	f1-score	support
0	0.80	0.75	0.78	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649

```
[ 942 8876 65]
 [ 854 109 8920]]
no. of trees: 97
             precision recall f1-score
                                           support
                          0.75
                                      0.78
                                               9883
          0
                  0.81
          1
                  0.89
                           0.90
                                      0.90
                                               9883
          2
                  0.85
                            0.90
                                      0.87
                                               9883
                                              29649
                                      0.85
   accuracy
   macro avg
                  0.85
                            0.85
                                      0.85
                                              29649
weighted avg
                  0.85
                            0.85
                                      0.85
                                              29649
[[7380 942 1561]
[ 936 8880 67]
[ 839 110 8934]]
no. of trees: 98
             precision recall f1-score
                                            support
          0
                  0.81
                           0.75
                                      0.78
                                               9883
                  0.89
                           0.90
                                      0.90
                                               9883
          1
          2
                            0.90
                  0.85
                                      0.87
                                               9883
                                      0.85
                                              29649
   accuracy
                  0.85
                                      0.85
                                              29649
   macro avg
                            0.85
weighted avg
                  0.85
                            0.85
                                      0.85
                                              29649
[[7412 934 1537]
[ 934 8880 69]
[ 860 110 8913]]
no. of trees: 99
             precision recall f1-score
                                           support
          0
                  0.81
                           0.75
                                      0.77
                                               9883
          1
                  0.89
                            0.90
                                      0.90
                                               9883
          2
                  0.85
                            0.90
                                      0.87
                                               9883
                                      0.85
                                              29649
   accuracy
   macro avg
                  0.85
                            0.85
                                      0.85
                                              29649
weighted avg
                  0.85
                            0.85
                                      0.85
                                              29649
[[7375 942 1566]
[ 934 8881
             68]
[ 843 110 8930]]
no. of trees: 100
             precision recall f1-score
                                           support
          0
                            0.75
                                      0.78
                                               9883
                  0.81
          1
                  0.90
                            0.90
                                      0.90
                                               9883
                  0.85
                            0.90
                                      0.87
                                               9883
                                      0.85
                                              29649
   accuracy
                                              29649
                  0.85
                            0.85
                                      0.85
   macro avg
weighted avg
                  0.85
                            0.85
                                      0.85
                                              29649
[[7404 934 1545]
[ 922 8894 67]
 [ 855 109 8919]]
```

```
In [82]: rfc=RandomForestClassifier(n_estimators=48,random_state=1)
    rfc=create_model(rfc)
```

```
precision recall f1-score
                                                  support
                   0
                          0.80
                                  0.75
                                           0.77
                                                      9883
                   1
                          0.89
                                  0.89
                                             0.89
                                                      9883
                   2
                          0.85
                                   0.90
                                             0.87
                                                      9883
                                             0.85
                                                     29649
            accuracy
                                             0.84
0.84
                                  0.85
           macro avg
                        0.84
                                                     29649
                          0.84
                                  0.85
                                                     29649
        weighted avg
         [[7398 945 1540]
         [1009 8797 77]
         [ 897 102 8884]]
In [83]: #dtc=82%
         #svc=82%
         #rfc=85%
         #rfc min sample leaf=86%
         #ada boost=85%
         #xgboost=88%
In [84]: #applying the pruning for randomForestTree
         for i in range(1,9):
            rfc1=RandomForestClassifier(n_estimators=48,random_state=1,max_depth=i)
            print(i)
```

rfc1=create_model(rfc1)

precision recall f1-score support 0 0.69 0.60 0.64 9883 1 0.69 0.99 0.81 9883 2 0.79 0.55 0.65 9883 accuracy 0.72 0.71 0.70 29649 weighted avg 0.72 0.71 0.70 29649 [[5970 2603 1310] [0 9762 121] [2707 1771 5405]] 2 precision recall f1-score support 0 0.71 0.66 0.68 9883 1 0.71 0.99 0.83 9883 2 0.86 0.59 0.70 9883 accuracy 0.76 0.74 0.74 29649 weighted avg 0.76 0.74 0.74 29649 weighted avg 0.76 0.74 0.74 29649 weighted avg 0.76 0.74 0.74 29649 [[6488 2552 843] [20 9743 120] [2647 1419 5817]] 3 precision recall f1-score support 0 0.72 0.65 0.68 9883 1 0.76 1.00 0.86 9883 2 0.89 0.69 0.78 9883 accuracy 0.79 0.78 0.77 29649 weighted avg 0.79 0.78 0.77 29649 [[6449 2580 854] [4 9854 25] [2535 533 6815]] 4 precision recall f1-score support 0 0.72 0.65 0.69 9883 1 0.76 1.00 0.87 9883 2 0.89 0.70 0.78 9883 accuracy 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6449 2580 854] [4 9854 25] [2535 533 6815]] 4 precision recall f1-score support 0 0.72 0.65 0.69 9883 1 0.76 1.00 0.87 9883 accuracy 0.89 0.70 0.78 9883 accuracy 0.89 0.70 0.78 9883 [1 8 9856 9] [2439 512 6932]] 5 precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 1 0.77 1.00 0.87 9883 2 0.89 0.70 0.78 0.78 29649 [[6463 2532 888] [1 8 9856 9] [2439 512 6932]] 5 precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 1 0.77 1.00 0.87 9883 2 0.89 0.70 0.78 0.78 29649 [[6463 2532 888] [1 8 9856 9] [2439 512 6932]] 5 precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 0.79 0.78 0.79 9883 2 0.89 0.70 0.79 0.78 0.79 9883 2 0.89 0.70 0.79 0.79 0.79 0.79 0.79 0.79 0.7	1				
1		precision	recall	f1-score	support
accuracy macro avg 0.72 0.71 0.70 29649 weighted avg 0.72 0.71 0.70 29649 [[5970 2603 1310]	0	0.69	0.60	0.64	9883
accuracy macro avg 0.72 0.71 0.70 29649 weighted avg 0.72 0.71 0.70 29649 weighted avg 0.72 0.71 0.70 29649 [[5970 2603 1310]	1	0.69	0.99	0.81	9883
macro avg	2	0.79	0.55	0.65	9883
weighted avg	accuracy			0.71	29649
[[5970 2603 1310] [0 9762 121] [2707 1771 5405]] 2	•				
Precision Prec	weighted avg	0.72	0.71	0.70	29649
precision recall f1-score support	0 9762 [2707 1771 5	121]			
1 0.71 0.99 0.83 9883 2 0.86 0.59 0.70 9883 accuracy 0.74 29649 macro avg 0.76 0.74 0.74 29649 weighted avg 0.76 0.74 0.74 29649 [[6488 2552 843] [20 9743 120] [2647 1419 5817]] 3	2	precision	recall	f1-score	support
accuracy	0	0.71	0.66	0.68	9883
accuracy weighted avg 0.76 0.74 0.74 29649 weighted avg 0.76 0.74 0.74 29649 [[6488 2552 843] 20 9743 120] [2647 1419 5817]] precision recall f1-score support 0.76 1.00 0.86 9883 1 0.76 1.00 0.86 9883 2 0.89 0.69 0.78 9883 0.77 29649 weighted avg 0.79 0.78 0.77 29649 weighted avg 0.79 0.78 0.77 29649 [[6449 2580 854] 4 9854 25] [2535 533 6815]] precision recall f1-score support 0.78 0.72 0.65 0.69 9883 1 0.76 1.00 0.87 9883 2 0.89 0.70 0.78 9883 2 0.89 0.70 0.78 29649 [[6463 2532 888] 1 0.76 1.00 0.87 9883 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] 1 8.9856 9] [2439 512 6932]] precision recall f1-score support 0.78 0.78 29649 [[6463 2532 888] 1 0.76 0.78 0.78 29649 [[6463 2532 888] 1 0.76 0.78 0.78 29649 [[6463 2532 888] 1 0.79 0.78 0.78 29649 [[6463 2532 888] 1 0.79 0.78 0.78 29649 [[6463 2532 888] 1 0.77 0.00 0.87 9883 0.79 0.78 0.78 29649 [[6463 2532 888] 1 0.77 0.00 0.87 9883 0.79 0.78 0.78 29649 [[6463 2532 888] 1 0.77 0.00 0.87 9883 0.79 0.79 9883 0.79 0.79 9883 0.79 0.79 9883 0.79 0.79 9883	1	0.71		0.83	9883
macro avg	2	0.86	0.59	0.70	9883
weighted avg	accuracy			0.74	29649
[[6488 2552 843] [20 9743 120] [2647 1419 5817]] 3	-	0.76	0.74	0.74	29649
[20 9743 120] [2647 1419 5817]] 3	_	0.76	0.74	0.74	29649
precision recall f1-score support 0 0.72 0.65 0.68 9883 1 0.76 1.00 0.86 9883 2 0.89 0.69 0.78 9883 accuracy 0.79 0.78 0.77 29649 weighted avg 0.79 0.78 0.77 29649 [[6449 2580 854] [4 9854 25] [2535 533 6815]] 4 precision recall f1-score support 0 0.72 0.65 0.69 9883 1 0.76 1.00 0.87 9883 2 0.89 0.70 0.78 9883 accuracy 0.78 0.78 9883 accuracy 0.78 29649 macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] 5 precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	[20 9743 [2647 1419 5	120]			
1 0.76 1.00 0.86 9883 2 0.89 0.69 0.78 9883 accuracy 0.78 0.77 29649 weighted avg 0.79 0.78 0.77 29649 [[6449 2580 854]		precision	recall	f1-score	support
accuracy	0	0.72	0.65	0.68	9883
accuracy	1	0.76	1.00	0.86	9883
macro avg 0.79 0.78 0.77 29649 weighted avg 0.79 0.78 0.77 29649 [[6449 2580 854] [4 9854 25] [2535 533 6815]] 4	2	0.89	0.69	0.78	9883
macro avg 0.79 0.78 0.77 29649 weighted avg 0.79 0.78 0.77 29649 [[6449 2580 854] [4 9854 25] [2535 533 6815]] 4	accuracv			0.78	29649
weighted avg	-	0.79	0.78		
[4 9854 25] [2535 533 6815]] 4 precision recall f1-score support 0 0.72 0.65 0.69 9883 1 0.76 1.00 0.87 9883 2 0.89 0.70 0.78 9883 accuracy 0.78 29649 macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] 5 precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	_				
precision recall f1-score support 0 0.72 0.65 0.69 9883 1 0.76 1.00 0.87 9883 2 0.89 0.70 0.78 9883 accuracy 0.78 29649 macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	[4 9854 [2535 533 6	25]			
1 0.76 1.00 0.87 9883 2 0.89 0.70 0.78 9883 accuracy 0.78 29649 macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] 5 precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883		precision	recall	f1-score	support
2 0.89 0.70 0.78 9883 accuracy 0.78 29649 macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	0	0.72	0.65	0.69	9883
accuracy	1	0.76	1.00	0.87	9883
macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] 5	2	0.89	0.70	0.78	9883
macro avg 0.79 0.78 0.78 29649 weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] 5	accuracy			0.78	29649
<pre>weighted avg 0.79 0.78 0.78 29649 [[6463 2532 888] [18 9856 9] [2439 512 6932]] 5</pre>	-	0.79	0.78		
<pre>[18 9856 9] [2439 512 6932]] 5</pre>	_				
precision recall f1-score support 0 0.74 0.66 0.69 9883 1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	[18 9856 [2439 512 6	9]			
1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	-	precision	recall	f1-score	support
1 0.77 1.00 0.87 9883 2 0.89 0.72 0.79 9883	0	0.74	0.66	0.69	9883
2 0.89 0.72 0.79 9883					
accuracy 0.79 29649					
	accuracy			0.79	29649

```
0.79
                                                        29649
                            0.80
                                               0.79
            macro avg
                                     0.79
                                                0.79
                                                        29649
         weighted avg
                            0.80
         [[6503 2490 890]
          [ 14 9856
                      13]
          [2322 482 7079]]
         6
                       precision recall f1-score
                                                      support
                    0
                            0.74
                                      0.66
                                                0.70
                                                         9883
                    1
                            0.77
                                      1.00
                                                0.87
                                                         9883
                    2
                            0.89
                                      0.72
                                                0.80
                                                         9883
                                                0.79
             accuracy
                                                        29649
            macro avg
                            0.80
                                     0.79
                                                0.79
                                                        29649
                            0.80
                                      0.79
                                                0.79
                                                        29649
         weighted avg
         [[6532 2472 879]
          [ 19 9855
          [2266 471 7146]]
         7
                       precision
                                   recall f1-score
                                                      support
                    0
                            0.76
                                     0.67
                                                0.71
                                                         9883
                                      0.99
                    1
                            0.78
                                                0.88
                                                         9883
                    2
                            0.89
                                      0.75
                                                0.81
                                                         9883
                                                0.81
                                                         29649
             accuracy
                            0.81
                                      0.81
                                                0.80
                                                        29649
            macro avg
                            0.81
                                      0.81
                                               0.80
                                                        29649
         weighted avg
         [[6656 2290 937]
          [ 36 9832
                      15]
          [2076 425 7382]]
         8
                       precision recall f1-score
                                                      support
                            0.77
                                      0.67
                                                0.72
                                                         9883
                    1
                            0.79
                                     1.00
                                                0.88
                                                         9883
                    2
                            0.88
                                      0.76
                                                0.82
                                                         9883
                                                        29649
             accuracy
                                                0.81
                            0.81
                                      0.81
                                                0.81
                                                        29649
            macro avg
                                                        29649
         weighted avg
                            0.81
                                     0.81
                                                0.81
         [[6620 2250 1013]
          [ 30 9845
                     8]
          [1940 392 7551]]
In [85]: #no use of applying pruning on rfc as scores get reduced
         #trail for rfc with min_sample_leaf
In [87]:
         for i in range(1,9):
             rfc2=RandomForestClassifier(n_estimators=48,random_state=1,min_samples_leaf=i)
             rfc2=create_model(rfc2)
```

1				
	precision	recall	f1-score	support
0	0.80	0.75	0.77	9883
1	0.89	0.89	0.89	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.84	0.85	0.84	29649
weighted avg	0.84	0.85	0.84	29649
[[7398 945 1] [1009 8797 [897 102 88	77]			
2	precision	recall	f1-score	support
0	0.80	0.74	0.77	9883
1	0.89	0.90	0.90	9883
2	0.85	0.90	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7314 1015 11 [898 8930 [897 121 83	55]			
	precision	recall	f1-score	support
0	0.81	0.74	0.77	9883
1	0.88	0.92	0.90	9883
2	0.85	0.89	0.87	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7327 1062 14 [762 9086 [948 133 83	35]			
	precision	recall	f1-score	support
0	0.82	0.75	0.78	9883
1	0.88	0.93	0.91	9883
2	0.85	0.89	0.87	9883
accuracy			0.86	29649
macro avg	0.85	0.86	0.85	29649
weighted avg	0.85	0.86	0.85	29649
[[7369 1068 146	48]			
-	precision	recall	f1-score	support
0	0.82	0.74	0.78	9883
1	0.88	0.94		
2	0.86	0.88	0.87	9883
accuracy			0.85	29649

```
0.85
                                       0.85
                                                29649
                   0.85
   macro avg
                             0.85
                                       0.85
                                                29649
weighted avg
                   0.85
[[7310 1139 1434]
[ 614 9249
             20]
[1005 155 8723]]
6
              precision
                        recall f1-score
                                              support
           0
                             0.74
                   0.82
                                       0.78
                                                 9883
           1
                   0.87
                             0.94
                                       0.91
                                                 9883
           2
                   0.86
                             0.88
                                       0.87
                                                 9883
                                       0.85
   accuracy
                                                29649
                   0.85
   macro avg
                             0.85
                                       0.85
                                                29649
weighted avg
                   0.85
                             0.85
                                       0.85
                                                29649
[[7270 1172 1441]
[ 584 9279
              20]
[1013 157 8713]]
7
              precision
                           recall f1-score
                                              support
           0
                   0.83
                             0.74
                                       0.78
                                                 9883
                             0.95
                                                 9883
           1
                   0.88
                                       0.91
           2
                   0.86
                             0.88
                                       0.87
                                                 9883
                                       0.86
                                                29649
   accuracy
                   0.85
                             0.86
                                       0.85
                                                29649
   macro avg
weighted avg
                   0.85
                             0.86
                                       0.85
                                                29649
[[7321 1160 1402]
 [ 508 9349
              26]
 [1036 164 8683]]
8
                           recall f1-score
              precision
                                              support
                   0.82
                             0.73
                                       0.77
                                                 9883
                             0.95
           1
                   0.87
                                       0.91
                                                 9883
           2
                   0.86
                             0.87
                                       0.87
                                                 9883
                                       0.85
                                                29649
    accuracy
                   0.85
                             0.85
                                       0.85
                                                29649
   macro avg
                             0.85
                                       0.85
                                                29649
weighted avg
                   0.85
[[7244 1213 1426]
[ 501 9370
            12]
[1083 170 8630]]
```

In [88]: rfc2=RandomForestClassifier(n_estimators=48,random_state=1,min_samples_leaf=4)
 rfc2=create_model(rfc2)

```
precision recall f1-score support
                  0
                          0.82
                                  0.75
                                          0.78
                                                    9883
                  1
                          0.88
                                  0.93
                                            0.91
                                                    9883
                  2
                                  0.89
                          0.85
                                            0.87
                                                     9883
            accuracy
                                            0.86
                                                    29649
                                 0.86
           macro avg
                          0.85
                                          0.85
                                                    29649
                                            0.85
        weighted avg
                          0.85
                                  0.86
                                                    29649
        [[7369 1068 1446]
         [ 639 9196 48]
         [ 949 141 8793]]
In [89]: #only bit of effct of one percent on pruning in min samples leaf incerasing
         #it at 86%
        from sklearn.ensemble import AdaBoostClassifier
In [90]:
        for i in range(1,17):
In [91]:
            ada=AdaBoostClassifier(n_estimators=i,random_state=1)
            print('decision stump:',i)
            ada=create_model(ada)
```

decision stum	p: 1 precision	nocall	f1-score	cuppont
	precision	recarr	11-30016	support
0	0.00	0.00	0.00	9883
1	0.68	1.00	0.81	9883
2	0.52	0.79	0.63	9883
accuracy			0.60	29649
macro avg	0.40	0.60	0.48	29649
weighted avg	0.40	0.60	0.48	29649
[[0 2621 7 [0 9883 [0 2072 7 decision stum	0] 811]] p: 2			
	precision	recall	f1-score	support
0	0.61	0.73	0.66	9883
1	0.76	1.00	0.86	9883
2	0.98	0.47	0.64	9883
accuracy			0.73	29649
macro avg	0.78	0.73	0.72	29649
weighted avg	0.78	0.73	0.72	29649
[[7194 2594 [0 9883 [4618 588 4 decision stum	p: 3			
	precision	recall	f1-score	support
0	0.61	0.73	0.66	9883
1	0.76	1.00	0.86	9883
2	0.98	0.47	0.64	9883
accuracy			0.73	29649
macro avg	0.78	0.73		
weighted avg				29649
[[7194 2594 [0 9883 [4618 588 4 decision stum	0] 677]] p: 4			
	precision	recall	f1-score	support
0	0.62	0.71	0.66	9883
1	0.77	1.00	0.87	9883
2	0.92	0.51	0.66	9883
accuracy			0.74	29649
macro avg	0.77	0.74		
weighted avg	0.77	0.74	0.73	
[[7009 2456 [0 9856 [4352 492 5 decision stum	418] 27] 039]]			
	precision	recall	f1-score	support
0	0.62	0.71	0.66	9883
1				
2	0.92	0.51	0.66	9883
accuracy			0.74	29649
accar acy			J., T	

macro avg weighted avg	0.77 0.77	0.74 0.74	0.73 0.73	29649 29649
[[7009 2456 418] [0 9856 27] [4352 492 5039] decision stump: 6]]]]			
pre	ecision	recall	f1-score	support
0 1 2	0.62 0.77 0.94	0.72 1.00 0.51	0.66 0.87 0.66	9883 9883 9883
accuracy macro avg weighted avg	0.77 0.77	0.74 0.74	0.74 0.73 0.73	29649 29649 29649
[[7100 2456 327] [17 9856 10] [4385 492 5006] decision stump:]]]			
•	ecision	recall	f1-score	support
0 1 2	0.63 0.77 0.92	0.71 1.00 0.53	0.67 0.87 0.68	9883 9883 9883
accuracy macro avg weighted avg	0.77 0.77	0.75 0.75	0.75 0.74 0.74	29649 29649 29649
[[7012 2444 427] [17 9856 10] [4142 457 5284] decision stump: 8]]]			
pre		recall	f1-score	support
0 1 2	0.64 0.77 0.88	0.68 1.00 0.57	0.66 0.87 0.70	9883 9883 9883
accuracy macro avg weighted avg	0.76 0.76	0.75 0.75	0.75 0.74 0.74	29649 29649 29649
[[6682 2444 757] [2 9856 25] [3744 457 5682] decision stump: 9]]]			
pre	ecision	recall	f1-score	support
0 1 2	0.64 0.77 0.88	0.68 1.00 0.58	0.66 0.87 0.70	9883 9883 9883
accuracy macro avg weighted avg	0.76 0.76	0.75 0.75	0.75 0.74 0.74	29649 29649 29649
[[6682 2444 757] [2 9856 25] [3742 457 5684] decision stump: 1]]]	recall	f1-score	support

0	0.68	0.65	0.67	9883
1	0.77	1.00	0.87	9883
2	0.86	0.65	0.74	9883
accuracy			0.77	29649
macro avg	0.77	0.77	0.76	29649
weighted avg	0.77	0.77	0.76	29649
[[6409 2444 1 [2 9856 [2956 457 6 decision stum	25] 470]]	recall	f1-score	support
	•			
0	0.69	0.65	0.67	9883
1	0.77	1.00	0.87	9883
2	0.86	0.66	0.75	9883
accuracy			0.77	29649
macro avg	0.77	0.77	0.76	29649
weighted avg	0.77	0.77	0.76	29649
[[6444 2444 [1 9856 [2939 457 6 decision stum	26] 487]] p: 12			
	precision	recall	f1-score	support
0	0.69	0.65	0.67	9883
1	0.78	1.00	0.87	9883
2	0.86	0.66	0.75	9883
accuracy			0.77	29649
macro avg	0.78	0.77	0.76	29649
weighted avg	0.78	0.77	0.76	29649
[[6465 2414 1 [2 9855 [2943 436 6 decision stum	26] 504]]	recall	f1-score	support
	p. 55222			
0	0.68	0.67	0.68	9883
1	0.78	0.99	0.87	9883
2	0.87	0.65	0.75	9883
accuracy			0.77	29649
macro avg	0.78	0.77	0.76	29649
weighted avg	0.78	0.77	0.76	29649
[[6600 2349 [67 9806 [3004 437 6 decision stum	10] 442]] p: 14	nocall	f1 score	support
	precision	LECGII	f1-score	support
0	0.68	0.69	0.68	9883
1	0.78	0.99	0.87	9883
2	0.89	0.64	0.75	9883
accuracy				
			0.77	29649
macro avg	0.78	0.77	0.77 0.77	29649 29649
	0.78 0.78	0.77 0.77		

```
[[6782 2317 784]
          [ 71 9802
                      10]
          [3093 424 6366]]
         decision stump: 15
                       precision recall f1-score
                                                       support
                    0
                            0.67
                                      0.70
                                                0.68
                                                          9883
                                      0.99
                    1
                            0.78
                                                0.87
                                                          9883
                    2
                            0.90
                                      0.62
                                                0.73
                                                          9883
                                                0.77
                                                         29649
             accuracy
            macro avg
                            0.78
                                      0.77
                                                0.76
                                                         29649
         weighted avg
                            0.78
                                      0.77
                                                0.76
                                                         29649
         [[6893 2317 673]
          [ 71 9802
                      10]
          [3348 424 6111]]
         decision stump: 16
                       precision
                                  recall f1-score
                                                       support
                    0
                            0.68
                                      0.67
                                                0.68
                                                          9883
                    1
                            0.78
                                      0.99
                                                0.87
                                                          9883
                    2
                                      0.66
                                                          9883
                            0.87
                                                0.75
             accuracy
                                                0.77
                                                         29649
                                      0.77
                                                0.77
                                                         29649
            macro avg
                            0.78
                                      0.77
         weighted avg
                            0.78
                                                0.77
                                                         29649
         [[6616 2317 950]
          [ 71 9802 10]
          [2979 424 6480]]
         ada=AdaBoostClassifier(n_estimators=10, random_state=i)
In [92]:
         ada=create_model(ada)
                                    recall f1-score
                       precision
                                                       support
                    0
                            0.68
                                      0.65
                                                0.67
                                                          9883
                                      1.00
                    1
                            0.77
                                                0.87
                                                          9883
                    2
                            0.86
                                      0.65
                                                0.74
                                                          9883
                                                0.77
             accuracy
                                                         29649
                            0.77
                                      0.77
                                                0.76
                                                         29649
            macro avg
         weighted avg
                            0.77
                                      0.77
                                                0.76
                                                         29649
         [[6409 2444 1030]
          [ 2 9856
                       25]
          [2956 457 6470]]
In [93]: #check impotant features
         dict={'Input':X.columns,'IG':ada.feature_importances_}
         df1=pd.DataFrame(dict)
         df1.sort_values('IG',ascending=False)
```

```
Out[93]:
                        Input IG
           1
                      int_rate 0.2
           3
               home_ownership 0.2
          14
               last_pymnt_amnt 0.2
           0
                        term 0.1
           2
                        grade 0.1
           5
                      issue_d 0.1
          12
                   installment 0.1
             verification_status 0.0
           6
                   pymnt_plan 0.0
           7
                      purpose 0.0
           8
               application_type 0.0
           9
                    loan_amnt 0.0
                  funded_amnt 0.0
          10
              funded_amnt_inv 0.0
          11
          13
                    annual_inc 0.0
          #for algo and reading purpose we used the adaboost technique but here score is get
In [94]:
          #reduced upto 77% max
          from sklearn.ensemble import GradientBoostingClassifier
          for i in range(10,101):
In [97]:
              gbc=GradientBoostingClassifier(random_state=1,n_estimators=i)
              print('no.of iteration:',i)
```

gbc=create_model(gbc)

no.of iterati	ion: 10			
	precision	recall	f1-score	support
0	0.71	0.69	0.70	9883
1	0.79	1.00	0.88	9883
2	0.88	0.67	0.76	9883
accuracy	0.79	0.79	0.79 0.78	29649 29649
macro avg weighted avg	0.79	0.79	0.78	29649
weighted avg	0.75	0.75	0.70	25045
[[6827 2200 [22 9852 [2783 457 6	9] 6643]]			
	precision	recall	f1-score	support
0	0.71	0.69	0.70	9883
1	0.79	1.00	0.88	9883
2	0.89	0.67	0.76	9883
accuracy			0.79	29649
macro avg	0.79	0.79	0.78	29649
weighted avg	0.79	0.79	0.78	29649
[[6845 2183 [22 9852 [2762 465 6 no.of iteration	9] 6656]] Jon: 12	11	6 1	
	precision	recall	f1-score	support
0	0.71	0.69	0.70	9883
1	0.79	1.00	0.88	9883
2	0.89	0.68	0.77	9883
accuracy			0.79	29649
macro avg	0.80	0.79	0.78	29649
weighted avg	0.80	0.79	0.78	29649
[[6828 2197 [21 9853 [2703 482 6 no.of iteration	9] 6698]] Jon: 13		64	
	precision	recall	f1-score	support
0	0.72	0.69	0.71	9883
1			0.88	9883
2	0.89	0.68	0.77	9883
accuracy			0.79	29649
macro avg	0.80	0.79	0.79	29649
weighted avg	0.80	0.79	0.79	29649
[[6863 2157 [22 9852 [2693 464 6 no.of iterati	9] 5726]]	recall	f1-score	support
2	0.70	0.60	0 74	0000
0	0.72	0.69	0.71	9883
1 2	0.79 0.89	1.00 0.68	0.88 0.77	9883 9883
_	0.05	0.00		
accuracy			0.79	29649

macro avg weighted avg	0.80 0.80	0.79 0.79	0.79 0.79	29649 29649			
[[6834 2185 864	1] 9] 3]]						
рі	recision	recall	f1-score	support			
0 1 2	0.72 0.79 0.89	0.69 1.00 0.69	0.71 0.88 0.78	9883 9883 9883			
accuracy macro avg weighted avg	0.80 0.80	0.79 0.79	0.79 0.79 0.79	29649 29649 29649			
[[6840 2172 871] [21 9853 9] [2589 475 6819]] no.of iteration: 16							
рі	recision	recall	f1-score	support			
0 1 2	0.73 0.79 0.89	0.70 1.00 0.69	0.71 0.88 0.78	9883 9883 9883			
accuracy macro avg weighted avg	0.80 0.80	0.80 0.80	0.80 0.79 0.79	29649 29649 29649			
[[6881 2151 853 [25 9853	5] 1]]						
pı		recall	f1-score	support			
0 1 2	0.73 0.79 0.89	0.70 1.00 0.70	0.71 0.88 0.78	9883 9883 9883			
accuracy macro avg weighted avg	0.80 0.80	0.80 0.80	0.80 0.79 0.79	29649 29649 29649			
[2510 460 6913 no.of iteration	5] 3]] : 18	macall	£1 score	cuppent			
рі	recision		f1-score	support			
0 1 2	0.74 0.79 0.89	0.70 1.00 0.71	0.72 0.88 0.79	9883 9883 9883			
accuracy macro avg weighted avg	0.81 0.81	0.80 0.80	0.80 0.80 0.80	29649 29649 29649			
[2449 458 6976 no.of iteration	5] 5]]	recall	f1-score	support			

0	0.74	0.70	0.72	9883
1	0.79 0.89	1.00 0.71	0.88 0.79	9883 9883
2	0.05	0.71	0.75	3003
accuracy			0.80	29649
macro avg	0.81	0.80	0.80	29649
weighted avg	0.81	0.80	0.80	29649
[[6908 2110 [25 9853 [2393 460 7 no.of iterati	5] 030]] on: 20			
	precision	recall	f1-score	support
0	0.74	0.70	0.72	9883
1	0.80	1.00	0.89	9883
2	0.89	0.72	0.79	9883
accupacy			0.81	29649
accuracy macro avg	0.81	0.81	0.81	29649
weighted avg	0.81	0.81	0.80	29649
[[6945 2061 [26 9852 [2360 444 7 no.of iterati	5] 079]]			
	precision	recall	f1-score	support
0	0.75	0.70	0.72	9883
1	0.80	1.00	0.89	9883
2	0.89	0.72	0.80	9883
accuracy			0.81	29649
accuracy macro avg	0.81	0.81	0.80	29649
weighted avg	0.81	0.81	0.80	29649
[[6934 2057 [26 9852 [2313 442 7 no.of iterati	5] 128]]			
	precision	recall	f1-score	support
0	0.75	0.70	0.72	9883
1	0.80	1.00	0.89	9883
2	0.89	0.72	0.80	9883
266419264			0.01	20640
accuracy macro avg	0.81	0.81	0.81 0.80	29649 29649
weighted avg	0.81	0.81	0.80	29649
[[6928 2059 [26 9852 [2281 442 7 no.of iterati	896] 5] 160]] on: 23			
	precision	recall	f1-score	support
0	0.76	0.70	0.73	9883
1	0.80	1.00	0.89	9883
	0.00			
2	0.89	0.73	0.80	9883
_		0.73		
accuracy	0.89		0.81	29649
_		0.73 0.81 0.81		

[[6953 2047 88 [26 9852 [2229 437 723 no.of iteration	5] [7]]	recall	f1-score	support
0 1 2	0.76 0.80 0.89	0.70 1.00 0.74	0.73 0.89 0.80	9883 9883 9883
accuracy macro avg weighted avg	0.81 0.81	0.81 0.81	0.81 0.81 0.81	29649 29649 29649
[[6919 2039 92 [25 9852 [2171 437 727 no.of iteration	6] 75]]			
ţ	precision	recall	f1-score	support
0 1 2	0.76 0.80 0.88	0.70 1.00 0.74	0.73 0.89 0.81	9883 9883 9883
accuracy macro avg weighted avg	0.82 0.82	0.81 0.81	0.81 0.81 0.81	29649 29649 29649
[[6887 2032 96 [24 9852 [2099 430 735 no.of iteration	7] 54]]	recall	f1-score	support
0 1 2	0.77 0.80 0.88	0.70 1.00 0.75	0.73 0.89 0.81	9883 9883 9883
accuracy macro avg weighted avg	0.82 0.82	0.81 0.81	0.81 0.81 0.81	29649 29649 29649
[[6895 2027 96 [24 9852 [2065 428 739 no.of iteration	7] 90]]			
	orecision	recall	f1-score	support
0 1 2	0.77 0.80 0.88	0.70 1.00 0.75	0.73 0.89 0.81	9883 9883 9883
accuracy macro avg weighted avg	0.82 0.82	0.81 0.81	0.81 0.81 0.81	29649 29649 29649
[[6880 2030 97 [26 9852 [2045 431 740 no.of iteration	5] 97]]			
	precision	recall	f1-score	support
0	0.77	0.70	0.73	9883

1 2	0.80 0.88	1.00 0.75	0.89 0.81	9883 9883
accuracy macro avg weighted avg	0.82 0.82	0.82 0.82	0.82 0.81 0.81	29649 29649 29649
[[6921 1993 [25 9852 [2049 422] no.of iterat:	6] 7412]] ion: 29		£1	
	precision	recall	f1-score	support
0	0.77	0.70	0.74	9883
1	0.80	1.00	0.89	9883
2	0.88	0.75	0.81	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.81	29649
weighted avg	0.82	0.82	0.81	29649
[[6936 1981 [25 9852 [2017 420] no.of iterat:		recall	f1-score	support
	precision	rccarr	11 30010	заррог с
0	0.77	0.70	0.74	9883
1	0.80	1.00	0.89	9883
2	0.88	0.75	0.81	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.81	29649
weighted avg	0.82	0.82	0.81	29649
[[6925 1985 [26 9852 [2008 420] no.of iterati		recall	f1-score	support
0	0.77	0.70	0.74	9883
1	0.80	1.00	0.89	9883
2	0.88	0.76	0.82	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.81	29649
weighted avg	0.82	0.82	0.81	29649
[[6917 1982 [26 9852 [1985 419 7 no.of iteration	5] 7479]]	recall	f1-score	support
•	0.70	0.70	0.74	0000
0 1	0.78 0.80	0.70 1.00	0.74 0.89	9883 9883
2	0.88	0.76	0.89	9883
accuracy			0.82	29649
macro avg weighted avg	0.82 0.82	0.82 0.82	0.81 0.81	29649 29649
METRILLER AVB	۷.02	v.02	0.01	Z3043

[[6917 1974 992]

[26 9852 [1968 416 7 no.of iterati	499]]			
	precision	recall	f1-score	support
0	0.78	0.70	0.74	9883
1	0.81	1.00	0.89	9883
2	0.89	0.76	0.82	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.82	29649
weighted avg	0.82	0.82	0.82	29649
[[6947 1968 [25 9852 [1939 415 7 no.of iterati	6] 529]]	nocall	f1-score	support
				заррог с
0	0.78	0.70	0.74	9883
1	0.81	1.00	0.89	9883
2	0.88	0.76	0.82	9883
accuracy			0.82	29649
macro avg	0.82	0.82	0.82	29649
weighted avg	0.82	0.82	0.82	29649
[[6944 1964 [25 9852 [1944 413 7 no.of iterati	6] 526]]	recall	f1-score	support
0	0.78	0.70	0.74	9883
1	0.78	1.00	0.74	9883
2	0.89	0.76	0.82	9883
2	0.05	0.70	0.02	2003
accuracy			0.82	29649
macro avg	0.82	0.82	0.82	29649
weighted avg	0.82	0.82	0.82	29649
[[6967 1955 [26 9852 [1924 408 7 no.of iterati	5] 551]] on: 36		£1	
	precision		f1-score	support
0	0.78	0.71	0.74	9883
1	0.81	1.00	0.89	9883
2	0.89	0.76	0.82	9883
accuracy			0.82	29649
macro avg	0.83	0.82	0.82	29649
weighted avg	0.83	0.82	0.82	29649
[[6989 1933 [26 9852 [1920 406 7 no.of iterati	5] 557]]	recall	f1-score	support
	p. 20232011		50010	237701 6
0	0.78	0.71	0.74	9883
1	0.81	1.00	0.89	9883
2	0.89	0.77	0.82	9883

accuracy	0.00	0.00	0.82	29649
macro avg	0.83	0.82	0.82	29649
weighted avg	0.83	0.82	0.82	29649
[1908 404 7571 no.of iteration:	5] L]] : 38			
pr	recision	recall	f1-score	support
0	0.78	0.71	0.74	9883
1	0.81	1.00	0.89	9883
2	0.89	0.77	0.82	9883
accuracy	0.00	0.00	0.82	29649
macro avg	0.83	0.82	0.82	29649
weighted avg	0.83	0.82	0.82	29649
[1893 400 7590 no.of iteration:	5] 9]] : 39	nocall	f1 ccono	support
pr	recision	recall	f1-score	support
0	0.79	0.71	0.74	9883
1	0.81	1.00	0.89	9883
2	0.88	0.77	0.82	9883
accuracy			0.82	29649
accuracy macro avg	0.83	0.82	0.82	29649
weighted avg	0.83	0.82	0.82	29649
[1875 394 7614 no.of iteration:	5] 1]]	recall	f1-score	support
·				
0	0.79	0.71	0.75	9883
1	0.81	1.00	0.89	9883
2	0.89	0.77	0.82	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.82	29649
weighted avg	0.83	0.83	0.82	29649
[1868 394 7621 no.of iteration:	5] L]]	recall	f1-score	support
·				
0	0.79	0.71	0.75	9883
1	0.81	1.00	0.89	9883
2	0.88	0.77	0.82	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.82	29649
weighted avg	0.83	0.83	0.82	29649
[[6992 1903 988	3] 5]			

no.of iteration	on· 42			
no.or iteration	precision	recall	f1-score	support
_				
0 1	0.79 0.81	0.71 1.00	0.75 0.89	9883
2	0.89	0.77	0.82	9883 9883
2	0.09	0.77	0.82	9005
accuracy			0.83	29649
macro avg	0.83	0.83	0.82	29649
weighted avg	0.83	0.83	0.82	29649
[[7006 1892 9 [27 9851 [1856 393 76 no.of iteration	5] 534]] on: 43			
	precision	recall	f1-score	support
0	0.79	0.71	0.75	9883
1	0.81	1.00	0.90	9883
2	0.88	0.77	0.83	9883
266412264			0.02	20640
accuracy	0 02	0.83	0.83	29649
macro avg weighted avg	0.83 0.83	0.83	0.82 0.82	29649 29649
weighted avg	0.83	0.03	0.02	23043
[[6998 1888 9 [27 9851 [1840 391 70 no.of iteration	5] 552]]	necall	f1-score	support
	precision	recarr	11-30016	suppor c
0	0.79	0.71	0.75	9883
1	0.81	1.00	0.90	9883
2	0.88	0.78	0.83	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.82	29649
weighted avg	0.83	0.83		
[[7007 1883 9 [27 9851 [1833 387 76 no.of iteration	5] 663]]	recall	f1-score	support
0	0.79	0.71	0.75	9883
1	0.81			
2	0.88	0.78	0.83	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.82	29649
weighted avg	0.83	0.83	0.82	29649
[[6993 1882 10 [27 9851 [1814 387 70 no.of iteration	5] 582]]	recall	f1-score	support
0	0.79	0.71	0.75	9883
1	0.81	1.00	0.90	9883
2	0.88	0.78	0.83	9883
accuracy			0.83	29649

macro avg	0.83	0.83	0.82	29649	
weighted avg	0.83	0.83	0.82	29649	
[[6999 1874 101 [27 9851 [1795 387 770 no.of iteration	5] 1]]	nocall	f1-score	support	
۲	n.ect21011	recarr	TI-SCORE	Support	
0	0.79	0.71	0.75	9883	
1	0.81	1.00	0.90	9883	
2	0.88	0.78	0.83	9883	
accuracy			0.83	29649	
macro avg	0.83	0.83	0.83	29649	
weighted avg	0.83	0.83	0.83	29649	
[[7020 1860 100 [27 9851 [1790 382 771 no.of iteration	5] 1]]	recall	f1-score	support	
۲	il ecision	recarr	11-3001-6	Support	
0	0.79	0.71	0.75	9883	
1	0.82	1.00	0.90	9883	
2	0.88	0.78	0.83	9883	
accuracy			0.83	29649	
macro avg	0.83	0.83	0.82	29649	
weighted avg	0.83	0.83	0.82	29649	
[[7009 1853 102 [30 9848 [1788 380 771 no.of iteration	5] 5]]	recall	f1-score	support	
·					
0	0.80	0.71	0.75	9883	
1	0.82	1.00	0.90	9883	
2	0.88	0.78	0.83	9883	
accupacy			0.83	29649	
accuracy macro avg	0.83	0.83	0.83	29649	
weighted avg	0.83	0.83	0.83	29649	
[[7028 1844 101 [30 9848 [1765 381 773 no.of iteration	5] 7]]	recall	f1-score	support	
		_	_		
0	0.80	0.71	0.75	9883	
1 2	0.82 0.88	1.00	0.90	9883	
2	0.00	0.78	0.83	9883	
accuracy			0.83	29649	
macro avg	0.83	0.83	0.83	29649	
weighted avg	0.83	0.83	0.83	29649	
[[7030 1838 101 [30 9848 [1756 381 774 no.of iteration	5] .6]]	recall	f1-score	support	

0				
	0.80	0.71	0.75	9883
1	0.82	1.00	0.90	9883
2	0.88	0.79	0.83	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7026 1832 10 [31 9846 [1734 376 77 no.of iteration	6] 73]]	recall	f1-score	support
	•			
0	0.80	0.71	0.75	9883
1	0.82	1.00	0.90	9883
2	0.88	0.79	0.83	9883
accuracy			0.83	29649
macro avg	0.83	0.83	0.83	29649
weighted avg	0.83	0.83	0.83	29649
[[7044 1824 10 [33 9845 [1727 373 77 no.of iteration	5] /83]] on: 53		6	
	precision	recall	f1-score	support
0	0.80	0.71	0.75	9883
1	0.82	1.00	0.90	9883
2	0.88	0.79	0.83	9883
			0.00	20640
accuracy	0.02	0 02	0.83	29649
macro avg weighted avg	0.83 0.83	0.83 0.83	0.83 0.83	29649 29649
[[7050 1823 10 [33 9845	010] 5]			220.5
[1710 374 77				
[1710 374 77 no.of iteration		recall	f1-score	support
no.of iteratio	n: 54 precision			
no.of iteration	on: 54 precision 0.80	0.71	0.76	9883
no.of iteration	0.80 0.82	0.71 1.00	0.76 0.90	9883 9883
no.of iteration	on: 54 precision 0.80	0.71	0.76	9883
no.of iteration	0.80 0.82	0.71 1.00	0.76 0.90	9883 9883
no.of iteration	0.80 0.82	0.71 1.00	0.76 0.90 0.83	9883 9883 9883
no.of iteration 0 1 2 accuracy	0.80 0.82 0.88	0.71 1.00 0.79	0.76 0.90 0.83	9883 9883 9883 29649
no.of iteration 0 1 2 accuracy macro avg	0.80 0.82 0.88 0.84 0.84 0.91 5] 517]]	0.71 1.00 0.79 0.83 0.83	0.76 0.90 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649
no.of iteration 0 1 2 accuracy macro avg weighted avg [[7049 1815 16] [33 9845 [1693 373 78]	0.80 0.82 0.88 0.84 0.84 0.84	0.71 1.00 0.79 0.83 0.83	0.76 0.90 0.83 0.83	9883 9883 9883 29649 29649
no.of iteration 0 1 2 accuracy macro avg weighted avg [[7049 1815 16] [33 9845 [1693 373 78]	0.80 0.82 0.88 0.84 0.84 0.91 5] 517]]	0.71 1.00 0.79 0.83 0.83	0.76 0.90 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649
no.of iteration 0 1 2 accuracy macro avg weighted avg [[7049 1815 16 [33 9845 [1693 373 78 no.of iteration 0 1	0.80 0.82 0.88 0.84 0.84 0.84 0.84 0.84 0.84 0.84	0.71 1.00 0.79 0.83 0.83 recall 0.71 1.00	0.76 0.90 0.83 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649 support 9883 9883
accuracy macro avg weighted avg [[7049 1815 16] [33 9845 [1693 373 78] no.of iteration	0.80 0.82 0.88 0.84 0.84 0.84 0.91 5] 5] 617]] on: 55 precision 0.80	0.71 1.00 0.79 0.83 0.83	0.76 0.90 0.83 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649 support
accuracy macro avg weighted avg [[7049 1815 16] [33 9845 [1693 373 78] no.of iteration	0.80 0.82 0.88 0.84 0.84 0.84 0.84 0.84 0.84 0.84	0.71 1.00 0.79 0.83 0.83 recall 0.71 1.00	0.76 0.90 0.83 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649 support 9883 9883 9883
accuracy macro avg weighted avg [[7049 1815 16 [33 9845 [1693 373 78 no.of iteration	0.80 0.82 0.88 0.84 0.84 0.84 0.89	0.71 1.00 0.79 0.83 0.83 recall 0.71 1.00 0.79	0.76 0.90 0.83 0.83 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649 support 9883 9883 9883
accuracy macro avg weighted avg [[7049 1815 16] [33 9845 [1693 373 78] no.of iteration	0.80 0.82 0.88 0.84 0.84 0.84 0.84 0.84 0.84 0.84	0.71 1.00 0.79 0.83 0.83 recall 0.71 1.00	0.76 0.90 0.83 0.83 0.83 0.83	9883 9883 9883 29649 29649 29649 support 9883 9883 9883

[[7064 1809 10] [38 9840 [1687 370 78] no.of iteration	5] 26]] n: 56		C 1	
	precision	recall	f1-score	support
0	0.80	0.71	0.76	9883
1	0.82	1.00	0.90	9883
2	0.88	0.79	0.84	9883
			0.03	20640
accuracy	0.04	0.02	0.83	29649
macro avg weighted avg	0.84 0.84	0.83 0.83	0.83 0.83	29649 29649
weighted avg	0.04	0.05	0.05	23043
[[7061 1801 10] [38 9840 [1685 366 78] no.of iteration	5] 32]] n: 57			
	precision	recall	f1-score	support
0	0.81	0.71	0.76	9883
1	0.82	1.00	0.90	9883
2	0.88	0.79	0.84	9883
			0.03	20640
accuracy	0.94	0.83	0.83 0.83	29649 29649
macro avg weighted avg	0.84 0.84	0.83	0.83	29649
[[7058 1797 10. [38 9839 [1666 361 78 no.of iteration	6] 56]]			
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.82	1.00	0.90	9883
2	0.88	0.79	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7073 1781 10] [41 9836 [1671 359 78] no.of iteration	6] 53]]	recall	f1-score	support
	p. cc1310		. 1 300.0	Suppor c
0	0.81	0.72	0.76	9883
1	0.82	1.00	0.90	
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7078 1773 10 [38 9839 [1662 358 78 no.of iteration	6] 63]]			
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883

1 2	0.82 0.88	0.99 0.80	0.90 0.84	9883 9883
accuracy macro avg weighted avg	0.84 0.84	0.84 0.84	0.84 0.83 0.83	29649 29649 29649
[[7087 1762 10 [48 9829 [1649 356 78 no.of iteration	6] 378]] on: 61		£1	
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.82	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7084 1757 10 [48 9829 [1631 354 78 no.of iteration	6] 398]] on: 62			
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.82	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7078 1755 10 [48 9829 [1629 353 79 no.of iteration	6] 901]]	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.82	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7081 1746 10 [51 9826 [1610 350 79 no.of iteration	6] 923]]	recall	f1-score	support
	p. 00151011	. ccarr	. 1 30010	24ppoi C
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
accuracy macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
_				

[55 9822 [1600 343 7 no.of iterati	on: 65			
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7093 1728 1 [58 9819 [1603 343 7 no.of iterati	6] '937]]	recall	f1-score	support
	p. cc1310		. 1 300.0	зарро. с
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7097 1724 1 [60 9817 [1586 342 7 no.of iterati	6] [955]] .on: 67	11	C1	
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7090 1719 1 [59 9818 [1573 342 7 no.of iterati	6] [968]]	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.84	9883
accuracy			0.84	29649
accuracy macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7092 1718 1 [59 9818 [1565 339 7 no.of iterati	6] [979]]	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.72	0.70	9883
2	0.88	0.81	0.84	9883

accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7093 1715 10 [59 9818 [1561 338 70	6] 984]]			
no.of iteration			C 4	
	precision	recall	f1-score	support
0	0.02	0.72	0.76	0003
0	0.82	0.72	0.76	9883
1	0.83		0.90	9883
2	0.88	0.81	0.84	9883
			0.04	20640
accuracy	0.04	0.04	0.84	29649
macro avg	0.84			29649
weighted avg	0.84	0.84	0.84	29649
[[7086 1712 10 [59 9818 [1549 332 80 no.of iteration	6] 002]] on: 71	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7088 1710 10 [59 9818 [1550 331 80 no.of iteration	6] 002]]	recall	f1-score	support
0	a 02	0.72	0.76	0002
0	0.82	0.72	0.76	9883
1 2	0.83	0.99	0.90	9883
2	0.88	0.81	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
weighted avg	0.04	0.04	0.04	25045
[[7089 1710 10 [59 9818 [1536 331 80 no.of iteration	6] 016]] on: 73	recall	f1-score	support
0	0.82	0.72	0.76	9883
1	0.83			9883
2	0.88	0.99	0.84	9883
2	v.00	6.01	v.04	2003
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7099 1704 10 [59 9818 [1530 332 80	080] 6]			

no.of iterati	on: 74			
	precision	recall	f1-score	support
0	0.82	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7099 1704 1 [60 9817 [1525 332 8 no.of iterati	6] 026]]	recall	f1-score	support
	precision	rccarr	11 30010	заррог с
0	0.82	0.72	0.77	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7101 1702 1 [60 9817 [1519 332 8 no.of iterati	6] 032]]	recall	f1-score	support
	precision	recuii	11 30010	Support
0	0.82	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.85	9883
accuracy	0.04	0.04	0.84	29649
macro avg	0.84	0.84 0.84	0.84	29649 29649
weighted avg	0.84	0.84	0.84	29649
[[7103 1697 1 [68 9809 [1519 332 8 no.of iterati	6] 032]] on: 77	macall	£1 ccope	cuppent
	precision	recarr	f1-score	support
0		0.72	0.77	9883
1	0.83			9883
2	0.88	0.81	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	
weighted avg	0.84	0.84	0.84	29649
[[7098 1695 1 [65 9812 [1503 333 8 no.of iterati	090] 6] 047]]			
	precision	recall	f1-score	support
0	0.82	0.72	0.77	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.85	9883
			0.84	29649
accuracy			0.84	27049

macro avg	0.84	0.84	0.84	29649	
weighted avg	0.84	0.84	0.84	29649	
[1501 329 8053 no.of iteration:	5] 3]] 79	recall	f1-score	support	
r					
0	0.82	0.72	0.77	9883	
1	0.83	0.99	0.90	9883	
2	0.88	0.82	0.85	9883	
accuracy			0.84	29649	
macro avg	0.84	0.84	0.84	29649	
weighted avg	0.84	0.84	0.84	29649	
[1497 329 8057 no.of iteration:	5] 7]] 80		C 1		
pr	recision	recall	f1-score	support	
0	0.82	0.72	0.77	9883	
1	0.83	0.72		9883	
2	0.88	0.82	0.85	9883	
2	0.00	0.02	0.05	2003	
accuracy			0.84	29649	
macro avg	0.84	0.84	0.84	29649	
weighted avg	0.84	0.84	0.84	29649	
[1486 328 8069 no.of iteration:	5] 9]]	recall	f1-score	support	
ρ.			000. 0	suppo. c	
0	0.82	0.72	0.77	9883	
1	0.83	0.99	0.90	9883	
2	0.88	0.82	0.85	9883	
accuracy			0.84	29649	
macro avg	0.84	0.84	0.84	29649	
weighted avg	0.84	0.84	0.84	29649	
[1485 325 8073 no.of iteration:	5] 3]]	recall	f1-score	support	
ρ	0.82	0 72	0.77	0002	
0 1	0.82 0.83	0.72 0.99	0.77	9883 9883	
2	0.88	0.82	0.85	9883	
2	0.00	0.02	0.85	9883	
accuracy			0.84	29649	
macro avg	0.84	0.84	0.84	29649	
weighted avg	0.84	0.84	0.84	29649	
[[7106 1682 1095 [73 9804 6 [1482 324 8077 no.of iteration:	5] 5] 7]] : 83		f1-score	support	

0				
	0.82	0.72	0.77	9883
1	0.83	0.99	0.90	9883
2	0.88	0.82	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7112 1682 10 [74 9803 [1478 322 80 no.of iteratio	6] 83]]	recall	f1-score	support
	precision	rccair	11 30010	заррог с
0	0.82	0.72	0.77	9883
1	0.83	0.99	0.90	9883
2	0.88	0.82	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7103 1676 110 [75 9802 [1468 321 800 no.of iteration	6] 94]]			
	precision	recall	f1-score	support
0	0.82	0.72	0.77	9883
1	0.83	0.99	0.90	9883
2	0.88	0.82	0.85	9883
2661102614			0.84	29649
accuracy macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7117 1671 10	95]			
[74 9803 [1474 318 809 no.of iteration	6] 91]]			
[1474 318 809 no.of iteration	6] 91]]	recall	f1-score	support
[1474 318 809 no.of iteration	6] 91]] n: 86	recall 0.72	f1-score 0.77	support 9883
[1474 318 80] no.of iteration	6] 91]] n: 86 precision			• •
[1474 318 80] no.of iteration	6] 91]] n: 86 precision 0.82	0.72	0.77	9883
[1474 318 80] no.of iteration 0 1 2	6] 91]] n: 86 precision 0.82 0.83	0.72 0.99	0.77 0.90 0.85	9883 9883 9883
[1474 318 80] no.of iteration 0 1 2 accuracy	6] 91]] n: 86 precision 0.82 0.83 0.88	0.72 0.99 0.82	0.77 0.90 0.85	9883 9883 9883 29649
[1474 318 80] no.of iteration 0 1 2	6] 91]] n: 86 precision 0.82 0.83	0.72 0.99	0.77 0.90 0.85	9883 9883 9883
[1474 318 80 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]]	0.72 0.99 0.82 0.84 0.84	0.77 0.90 0.85 0.84 0.84	9883 9883 9883 29649 29649 29649
[1474 318 80 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84	0.72 0.99 0.82 0.84 0.84	0.77 0.90 0.85 0.84 0.84	9883 9883 9883 29649 29649
[1474 318 80 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]]	0.72 0.99 0.82 0.84 0.84	0.77 0.90 0.85 0.84 0.84	9883 9883 9883 29649 29649 29649
[1474 318 800 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]] n: 87 precision	0.72 0.99 0.82 0.84 0.84	0.77 0.90 0.85 0.84 0.84 0.84	9883 9883 9883 29649 29649 29649
[1474 318 80 no.of iteration of	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]] n: 87 precision 0.82	0.72 0.99 0.82 0.84 0.84	0.77 0.90 0.85 0.84 0.84 0.84	9883 9883 9883 29649 29649 29649
[1474 318 80 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]] n: 87 precision 0.82 0.83	0.72 0.99 0.82 0.84 0.84 recall 0.72 0.99	0.77 0.90 0.85 0.84 0.84 0.84 f1-score 0.77 0.90 0.85	9883 9883 9883 29649 29649 29649 support 9883 9883 9883
[1474 318 800 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]] n: 87 precision 0.82 0.83 0.88	0.72 0.99 0.82 0.84 0.84 recall 0.72 0.99 0.82	0.77 0.90 0.85 0.84 0.84 0.84 f1-score 0.77 0.90 0.85 0.84	9883 9883 9883 29649 29649 29649 support 9883 9883 9883
[1474 318 80 no.of iteration	6] 91]] n: 86 precision 0.82 0.83 0.88 0.84 0.84 94] 6] 92]] n: 87 precision 0.82 0.83	0.72 0.99 0.82 0.84 0.84 recall 0.72 0.99	0.77 0.90 0.85 0.84 0.84 0.84 f1-score 0.77 0.90 0.85	9883 9883 9883 29649 29649 29649 support 9883 9883 9883

[1463 317 8103 no.of iteration:]]]	recall	f1-score	support
0 1 2	0.82 0.83 0.88	0.72 0.99 0.82	0.77 0.90 0.85	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.84 0.84	0.84 0.84 0.84	29649 29649 29649
[[7124 1664 1095 [77 9800 6 [1456 317 8110 no.of iteration:]]]			
pr	ecision	recall	f1-score	support
0 1 2	0.82 0.83 0.88	0.72 0.99 0.82	0.77 0.90 0.85	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.84 0.84	0.84 0.84 0.84	29649 29649 29649
[1452 317 8114 no.of iteration:]]] 90	macall	f1 score	cuppont
pr	ecision	recall	f1-score	support
0 1 2	0.82 0.83 0.88	0.72 0.99 0.82	0.77 0.91 0.85	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.84 0.84	0.84 0.84 0.84	29649 29649 29649
[[7127 1658 1098 [79 9798 6 [1451 314 8118 no.of iteration:]]]			
	ecision	recall	f1-score	support
0 1 2	0.82 0.83 0.88	0.72 0.99 0.82	0.77 0.91 0.85	9883 9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.84 0.84	0.84 0.84 0.84	29649 29649 29649
[[7127 1654 1102 [80 9797 6 [1444 314 8125 no.of iteration:]]]			
	ecision	recall	f1-score	support
0	0.82	0.72	0.77	9883

1 2	0.83 0.88	0.99 0.82	0.91 0.85	9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.84 0.84	29649 29649 29649
[[7137 1650 16 [85 9792 [1431 311 83 no.of iteration	6] 141]] on: 93		£1	
	precision	recall	f1-score	support
0	0.83	0.72	0.77	9883
1	0.83	0.99	0.91	9883
2	0.88	0.82	0.85	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.84	29649
weighted avg	0.85	0.85	0.84	29649
[[7139 1643 13 [87 9790 [1422 308 83 no.of iteration	6] 153]] on: 94			
	precision	recall	f1-score	support
0	0.83	0.72	0.77	9883
1	0.83	0.99	0.91	9883
2	0.88	0.83	0.85	9883
accuracy			0.85	29649
accuracy macro avg	0.85	0.85	0.84	29649
weighted avg	0.85	0.85	0.84	29649
[[7134 1640 13 [89 9788 [1409 309 83 no.of iteration	6] 165]]	recall	f1-score	support
0	0.00	0.70	0.77	0000
0 1	0.83 0.83	0.72 0.99	0.77 0.91	9883
2	0.88	0.83	0.91	9883 9883
accuracy macro avg weighted avg	0.85 0.85	0.85 0.85	0.85 0.84 0.84	29649 29649 29649
[[7139 1637 13 [94 9783 [1415 306 83 no.of iteration	6] 162]]			
	precision	recall	f1-score	support
0				0000
0	0.83	0.72	0.77	9883
1	0.83 0.83	0.72 0.99	0.77 0.91	9883 9883
1 2	0.83	0.99	0.91 0.85	9883 9883
1 2 accuracy	0.83 0.88	0.99 0.83	0.91 0.85 0.85	9883 9883 29649
1 2	0.83	0.99	0.91 0.85	9883 9883

```
[ 94 9783
              6]
 [1405 306 8172]]
no.of iteration: 97
              precision recall f1-score
                                             support
          0
                           0.72
                                      0.77
                                                9883
                  0.83
          1
                  0.84
                           0.99
                                      0.91
                                                9883
           2
                  0.88
                            0.83
                                      0.85
                                                9883
                                      0.85
                                               29649
   accuracy
   macro avg
                  0.85
                            0.85
                                      0.84
                                               29649
weighted avg
                  0.85
                            0.85
                                      0.84
                                               29649
[[7145 1628 1110]
[ 96 9781
              6]
 [1389 302 8192]]
no.of iteration: 98
              precision
                        recall f1-score
                                             support
          0
                  0.83
                            0.72
                                      0.77
                                                9883
          1
                  0.84
                            0.99
                                      0.91
                                                9883
           2
                  0.88
                            0.83
                                      0.85
                                                9883
                                      0.85
                                               29649
   accuracy
                  0.85
                            0.85
                                      0.84
                                               29649
   macro avg
weighted avg
                  0.85
                            0.85
                                      0.84
                                               29649
[[7145 1623 1115]
[ 101 9776
             6]
[1391 299 8193]]
no.of iteration: 99
             precision recall f1-score
                                             support
                            0.72
          0
                  0.83
                                      0.77
                                                9883
          1
                  0.84
                            0.99
                                      0.91
                                                9883
          2
                  0.88
                            0.83
                                      0.85
                                                9883
                                      0.85
                                               29649
   accuracy
   macro avg
                  0.85
                            0.85
                                      0.84
                                               29649
weighted avg
                  0.85
                            0.85
                                      0.84
                                               29649
[[7152 1622 1109]
[ 109 9768
              6]
[1388 296 8199]]
no.of iteration: 100
             precision
                        recall f1-score
                                             support
          0
                  0.83
                            0.72
                                      0.77
                                                9883
          1
                  0.84
                            0.99
                                      0.91
                                                9883
           2
                  0.88
                            0.83
                                      0.85
                                                9883
                                      0.85
                                               29649
   accuracy
                                               29649
                  0.85
                            0.85
                                      0.84
   macro avg
weighted avg
                  0.85
                            0.85
                                      0.84
                                               29649
[[7163 1616 1104]
 [ 105 9770 8]
 [1384 295 8204]]
```

```
In [98]: gbc=GradientBoostingClassifier(random_state=1,n_estimators=92)
    gbc=create_model(gbc)
    #score is neutral in terms of algos
```

```
precision recall f1-score
                                                     support
                    0
                            0.82
                                    0.72
                                               0.77
                                                         9883
                                    0.99
                    1
                            0.83
                                               0.91
                                                         9883
                    2
                            0.88
                                     0.82
                                               0.85
                                                         9883
                                               0.85
                                                        29649
             accuracy
                            0.85
                                     0.85
                                               0.84
                                                        29649
            macro avg
         weighted avg
                            0.85
                                     0.85
                                               0.84
                                                        29649
          [[7137 1650 1096]
          [ 85 9792 6]
          [1431 311 8141]]
In [99]: from xgboost import XGBClassifier
          for i in range(10,101):
In [100...
             xgb=XGBClassifier(n_estimators=i,reg_alpha=1)
             print(i)
             xgb=create_model(xgb)
```

10	nnocicion	nocall	f1 scope	cuppont
	precision	recall	f1-score	support
0	0.80	0.71	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.80	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.83	29649
weighted avg	0.84	0.84	0.83	29649
[[7052 1754 1 [53 9800 [1656 295 7	30]			
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.84	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7108 1708 1 [57 9801 [1608 282 7	25]			
	precision	recall	f1-score	support
0	0.81	0.72	0.76	9883
1	0.83	0.99	0.90	9883
2	0.88	0.81	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7081 1712 1 [62 9805 [1563 277 8	16]			
	precision	recall	f1-score	support
0	0.82	0.72	0.77	9883
1	0.83	0.99	0.91	9883
2	0.88	0.82	0.85	9883
accuracy			0.84	29649
macro avg	0.84	0.84	0.84	29649
weighted avg	0.84	0.84	0.84	29649
[[7128 1683 1 [69 9802 [1530 273 8	12]			
	precision	recall	f1-score	support
0	0.82	0.72	0.77	9883
1	0.84	0.99		9883
2	0.88	0.82	0.85	9883
accuracy			0.85	29649

macro avg weighted avg	0.85 0.85	0.85 0.85	0.84 0.84	29649 29649
[[7162 1648 16 [83 9793 [1505 268 81	7]			
	precision	recall	f1-score	support
0	0.82	0.73	0.77	9883
1	0.84	0.99	0.91	9883
2	0.88	0.83	0.85	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.84	29649
weighted avg	0.85	0.85	0.84	29649
[[7199 1617 16 [107 9768 [1469 246 81	8]			
	precision	recall	f1-score	support
0	0.83	0.73	0.77	9883
1	0.84	0.99	0.91	9883
2	0.88	0.83	0.86	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7197 1602 16 [98 9777 [1406 240 82	8]			
17	precision	recall	f1-score	support
0	0.83	0.73	0.78	9883
1	0.84	0.99	0.91	9883
2	0.88	0.84	0.86	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7224 1578 16 [112 9755 [1384 233 82	16]			
10	precision	recall	f1-score	support
0	0.83	0.73	0.78	9883
1	0.84	0.99	0.91	9883
2	0.88	0.84	0.86	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7239 1559 16 [118 9749 [1328 231 83	16]	recall	f1-score	support
	P. CC131011	. CCUII	12 30016	24bboi c

0	0.84	0.73	0.78	9883
1	0.85	0.99	0.91	9883
2	0.88	0.85	0.86	9883
accuracy			0.85	29649
macro avg	0.85	0.85	0.85	29649
weighted avg	0.85	0.85	0.85	29649
[[7228 1547 1	L108]			
[118 9746	19]			
[1286 232 8	3365]]			
20	precision	recall	f1-score	support
	precision	1 CCUII	11 30010	Suppor c
0	0.84	0.73	0.78	9883
1	0.85	0.99	0.91	9883
2	0.88	0.85	0.87	9883
			0.06	20640
accuracy	0.86	0.86	0.86 0.85	29649 29649
macro avg weighted avg	0.86	0.86	0.85	29649
weighted dvg	0.00	0.00	0.03	25045
[[7255 1538 1	L090]			
[121 9744	18]			
[1245 229 8	3409]]			
21			C4	
	precision	recall	f1-score	support
0	0.84	0.73	0.78	9883
1	0.85	0.99	0.91	9883
2				
2	0.88	0.85	0.87	9883
_	0.88	0.85		
accuracy			0.86	29649
accuracy macro avg	0.86	0.86	0.86 0.85	29649 29649
accuracy			0.86	29649
accuracy macro avg	0.86 0.86	0.86	0.86 0.85	29649 29649
accuracy macro avg weighted avg	0.86 0.86	0.86	0.86 0.85	29649 29649
accuracy macro avg weighted avg [[7243 1534 1 [119 9743 [1235 225 8	0.86 0.86 1106] 21]	0.86	0.86 0.85	29649 29649
accuracy macro avg weighted avg [[7243 1534 1 [119 9743	0.86 0.86 1106] 21] 3423]]	0.86 0.86	0.86 0.85 0.85	29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 1 [119 9743 [1235 225 8	0.86 0.86 1106] 21]	0.86 0.86	0.86 0.85	29649 29649
accuracy macro avg weighted avg [[7243 1534 2 [119 9743 [1235 225 8	0.86 0.86 1106] 21] 3423]] precision	0.86 0.86 recall	0.86 0.85 0.85	29649 29649 29649 support
accuracy macro avg weighted avg [[7243 1534 1 [119 9743 [1235 225 8	0.86 0.86 1106] 21] 3423]]	0.86 0.86	0.86 0.85 0.85	29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 2 [119 9743 [1235 225 8 22	0.86 0.86 1106] 21] 3423]] precision 0.85	0.86 0.86 recall 0.73	0.86 0.85 0.85 f1-score	29649 29649 29649 support
accuracy macro avg weighted avg [[7243 1534 1 [119 9743 [1235 225 8 22	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99	0.86 0.85 0.85 f1-score 0.79 0.91 0.87	29649 29649 29649 support 9883 9883
accuracy macro avg weighted avg [[7243 1534 2 [119 9743 [1235 225 8 22	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 f1-score 0.79 0.91 0.87	29649 29649 29649 support 9883 9883 9883
accuracy macro avg weighted avg [[7243 1534 2] [119 9743 [1235 225 8 22	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649
accuracy macro avg weighted avg [[7243 1534 2 [119 9743 [1235 225 8 22	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 f1-score 0.79 0.91 0.87	29649 29649 29649 support 9883 9883 9883
accuracy macro avg weighted avg [[7243 1534 2	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649
accuracy macro avg weighted avg [[7243 1534 2] [119 9743 [1235 225 8 22	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649
accuracy macro avg weighted avg [[7243 1534 1	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649
accuracy macro avg weighted avg [[7243 1534 1	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86 0.86	0.86 0.86 recall 0.73 0.99 0.86 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 2] [119 9743 [1235 225 8] 22 0 1 2 accuracy macro avg weighted avg [[7247 1523 2] [121 9741 [1196 222 8]	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86	0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649
accuracy macro avg weighted avg [[7243 1534 1	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86 0.86	0.86 0.86 recall 0.73 0.99 0.86 0.86	0.86 0.85 0.85 0.85 f1-score	29649 29649 29649 support 9883 9883 9883 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 1	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86 1113] 21] 3465]] precision 0.85	0.86 0.86 recall 0.73 0.99 0.86 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.87 0.86 0.86 0.86	29649 29649 29649 support 9883 9883 9883 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 1	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86 0.86	0.86 0.86 recall 0.73 0.99 0.86 0.86	0.86 0.85 0.85 0.85 f1-score	29649 29649 29649 support 9883 9883 9883 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 2]	0.86 0.86 1106] 21] 3423]] precision 0.85 0.88 0.86 0.86 1113] 21] 3465]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99 0.86 0.86 recall 0.73 0.99	0.86 0.85 0.85 0.85 f1-score 0.91 0.86 0.86 0.86 0.86	29649 29649 29649 support 9883 9883 29649 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 2]	0.86 0.86 1106] 21] 3423]] precision 0.85 0.88 0.86 0.86 1113] 21] 3465]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99 0.86 0.86 recall 0.73 0.99	0.86 0.85 0.85 0.85 f1-score 0.91 0.86 0.86 0.86 0.86	29649 29649 29649 support 9883 9883 29649 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 2]	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86 1113] 21] 3465]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99 0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.91 0.86 0.86 0.86 f1-score 0.79 0.91 0.87 0.86 0.86	29649 29649 29649 29649 3883 9883 9883 29649 29649 29649 29649 29649 29649
accuracy macro avg weighted avg [[7243 1534 1	0.86 0.86 1106] 21] 3423]] precision 0.85 0.85 0.88 0.86 1113] 21] 3465]] precision 0.85 0.85	0.86 0.86 recall 0.73 0.99 0.86 0.86 recall 0.73 0.99 0.86	0.86 0.85 0.85 0.85 f1-score 0.79 0.86 0.86 0.86 f1-score 0.79 0.91 0.87	29649 29649 29649 29649 3883 9883 9883 29649 29649 29649 29649

```
[[7259 1513 1111]
[ 123 9739 21]
[1166 218 8499]]
24
             precision recall f1-score
                                           support
          0
                  0.85
                           0.74
                                     0.79
                                               9883
                           0.98
          1
                  0.85
                                     0.91
                                               9883
          2
                  0.88
                           0.86
                                     0.87
                                               9883
   accuracy
                                     0.86
                                              29649
                          0.86
0.86
                                     0.86
                                              29649
  macro avg
                  0.86
                                     0.86
weighted avg
                  0.86
                                              29649
[[7291 1487 1105]
[ 131 9730 22]
[1143 215 8525]]
25
             precision recall f1-score
                                            support
          0
                  0.85
                           0.74
                                     0.79
                                               9883
          1
                  0.85
                           0.98
                                     0.91
                                               9883
          2
                  0.88
                           0.86
                                     0.87
                                               9883
   accuracy
                                     0.86
                                              29649
                            0.86
                                     0.86
                                              29649
  macro avg
                  0.86
                  0.86
                           0.86
                                     0.86
weighted avg
                                              29649
[[7320 1465 1098]
[ 143 9718 22]
[1142 206 8535]]
26
             precision recall f1-score
                                            support
                  0.85
                           0.74
                                     0.79
          0
                                               9883
                  0.85
                           0.98
                                     0.91
                                               9883
          1
          2
                  0.88
                           0.87
                                     0.87
                                               9883
   accuracy
                                     0.86
                                              29649
                          0.86
  macro avg
                  0.86
                                     0.86
                                              29649
                           0.86
                                     0.86
                                              29649
weighted avg
                  0.86
[[7313 1459 1111]
[ 143 9718 22]
[1116 205 8562]]
27
             precision recall f1-score
                                            support
          0
                  0.86
                           0.74
                                     0.79
                                               9883
                  0.86
                           0.98
          1
                                     0.91
                                               9883
                  0.88
                            0.87
                                     0.88
                                               9883
   accuracy
                                     0.86
                                              29649
  macro avg
                  0.86
                            0.86
                                     0.86
                                              29649
                  0.86
                            0.86
                                     0.86
                                              29649
weighted avg
[[7332 1442 1109]
[ 143 9719 21]
[1090 206 8587]]
28
             precision
                       recall f1-score
                                            support
                  0.86
                          0.74
                                     0.80
                                               9883
          0
```

1 2	0.86 0.88	0.98 0.87	0.91 0.88	9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.86 0.86	0.86 0.86 0.86	29649 29649 29649
[[7341 1436 1 [143 9719 [1092 206 8 29	21]			
	precision	recall	f1-score	support
0 1 2	0.86 0.86 0.88	0.74 0.98 0.87	0.80 0.92 0.88	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.86 0.86	29649 29649 29649
[[7343 1436 1 [147 9714 [1077 198 8	22]			
	precision	recall	f1-score	support
0	0.86	0.74	0.80	9883
1 2	0.86 0.88	0.98 0.87	0.92 0.88	9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.86 0.86	29649 29649 29649
[[7342 1424 1 [148 9713 [1074 191 8	22]			
<i>J</i> 1	precision	recall	f1-score	support
0 1 2	0.86 0.86 0.88	0.74 0.98 0.87	0.80 0.91 0.88	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.86 0.86	29649 29649 29649
[[7341 1424 1 [171 9690 [1066 189 8	22]			
<i>5</i> 2	precision	recall	f1-score	support
0 1 2	0.86 0.86 0.88	0.74 0.98 0.88	0.80 0.91 0.88	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.86 0.86	29649 29649 29649

[[7346 1411 1126]

```
[ 194 9666
            23]
[1051 182 8650]]
33
              precision
                        recall f1-score
                                             support
           0
                   0.85
                            0.74
                                       0.80
                                                 9883
           1
                   0.86
                            0.98
                                       0.91
                                                9883
           2
                   0.88
                            0.88
                                       0.88
                                                9883
                                       0.87
                                                29649
   accuracy
   macro avg
                  0.87
                            0.87
                                       0.86
                                                29649
weighted avg
                  0.87
                            0.87
                                       0.86
                                                29649
[[7353 1405 1125]
[ 205 9655
             23]
 [1044 180 8659]]
34
              precision
                        recall f1-score
                                              support
           0
                   0.86
                            0.74
                                       0.80
                                                 9883
           1
                   0.86
                            0.98
                                       0.91
                                                9883
           2
                   0.88
                            0.88
                                       0.88
                                                9883
                                       0.87
                                                29649
   accuracy
                   0.87
                             0.87
                                       0.86
                                                29649
   macro avg
weighted avg
                   0.87
                            0.87
                                       0.86
                                                29649
[[7362 1397 1124]
[ 205 9655 23]
[1032 182 8669]]
35
              precision recall f1-score
                                              support
           0
                            0.74
                   0.86
                                       0.80
                                                 9883
           1
                   0.86
                            0.98
                                       0.91
                                                 9883
           2
                   0.88
                            0.88
                                       0.88
                                                 9883
                                       0.87
                                                29649
   accuracy
   macro avg
                  0.87
                            0.87
                                       0.86
                                                29649
weighted avg
                   0.87
                            0.87
                                       0.86
                                                29649
[[7340 1401 1142]
[ 213 9646
             24]
[1017 182 8684]]
36
              precision
                          recall f1-score
                                              support
           0
                   0.86
                            0.75
                                       0.80
                                                 9883
           1
                   0.86
                            0.98
                                       0.91
                                                 9883
                   0.88
                            0.88
                                       0.88
                                                 9883
                                       0.87
                                                29649
   accuracy
                  0.87
                             0.87
                                       0.86
                                                29649
   macro avg
weighted avg
                  0.87
                             0.87
                                       0.86
                                                29649
[[7363 1390 1130]
[ 221 9638 24]
[1012 175 8696]]
37
              precision
                          recall f1-score
                                              support
           0
                   0.86
                             0.75
                                       0.80
                                                 9883
           1
                   0.86
                             0.97
                                       0.91
                                                 9883
                            0.88
                                                 9883
                   0.88
                                       0.88
```

accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7392 1378 1113] [243 9616 24] [988 174 8721] 38]			
	cision	recall	f1-score	support
0 1 2	0.86 0.86 0.89	0.75 0.97 0.88	0.80 0.91 0.88	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7404 1373 1106] [247 9613 23] [985 173 8725] 39]			
	cision	recall	f1-score	support
0 1 2	0.86 0.86 0.89	0.75 0.97 0.89	0.80 0.91 0.89	9883 9883 9883
accuracy	0.07	0.07	0.87	29649
macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87	29649 29649
[[7405 1370 1108] [246 9615 22] [959 169 8755]]			
[246 9615 22] [959 169 8755] 40] cision	recall	f1-score	support
[246 9615 22] [959 169 8755] 40 pre	cision 0.86	0.75	0.80	9883
[246 9615 22] [959 169 8755] 40 pre	cision			
[246 9615 22] [959 169 8755] 40 pre	0.86 0.86	0.75 0.97	0.80 0.92	9883 9883
[246 9615 22] [959 169 8755] 40 pre 0 1 2 accuracy macro avg weighted avg [[7422 1341 1120] [250 9611 22] [950 171 8762]	cision 0.86 0.86 0.88 0.87 0.87	0.75 0.97 0.89	0.80 0.92 0.89 0.87 0.87	9883 9883 9883 29649 29649
[246 9615 22] [959 169 8755] 40	cision 0.86 0.86 0.88 0.87 0.87	0.75 0.97 0.89 0.87 0.87	0.80 0.92 0.89 0.87 0.87	9883 9883 9883 29649 29649
[246 9615 22] [959 169 8755] 40 pre 0 1 2 accuracy macro avg weighted avg [[7422 1341 1120] [250 9611 22] [950 171 8762] 41 pre	cision 0.86 0.86 0.88 0.87 0.87	0.75 0.97 0.89 0.87 0.87	0.80 0.92 0.89 0.87 0.87 0.87	9883 9883 9883 29649 29649 29649 support
[246 9615 22] [959 169 8755] 40	cision 0.86 0.86 0.88 0.87 0.87	0.75 0.97 0.89 0.87 0.87	0.80 0.92 0.89 0.87 0.87	9883 9883 9883 29649 29649 29649
[246 9615 22] [959 169 8755] 40	cision 0.86 0.86 0.88 0.87 0.87 cision 0.86 0.86 0.88	0.75 0.97 0.89 0.87 0.87 recall 0.75 0.97 0.89	0.80 0.92 0.89 0.87 0.87 0.87 0.89 0.89 0.87	9883 9883 9883 29649 29649 29649 support 9883 9883 9883 29649 29649
[246 9615 22] [959 169 8755] 40	cision 0.86 0.86 0.88 0.87 0.87 0.86 0.86 0.88	0.75 0.97 0.89 0.87 0.87	0.80 0.92 0.89 0.87 0.87 0.87	9883 9883 9883 29649 29649 support 9883 9883 9883

4	1
4	

	42				
		precision	recall	f1-score	support
	0	0.86	0.75	0.80	9883
	1	0.87	0.97	0.92	9883
	2	0.88	0.89	0.89	9883
	accuracy	0.07	0.07	0.87	29649
,	macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87	29649 29649
	weighted avg	0.07	0.07	0.07	29049
	[[7440 1319 11 [262 9599 [936 169 87	22]			
		precision	recall	f1-score	support
	0	0.86	0.75	0.80	9883
	1	0.87	0.97	0.92	9883
	2	0.88	0.89	0.89	9883
	26649264			0.07	20640
	accuracy	0.07	0.07	0.87 0.87	29649
,	macro avg weighted avg	0.87 0.87	0.87 0.87	0.87	29649 29649
	weighted avg	0.07	0.07	0.07	23043
	[[7427 1320 11 [268 9593 [930 167 87 44	22]			
		precision	recall	f1-score	support
	0	0.86	0.75	0.80	9883
	1	0.87	0.97	0.92	9883
	2	0.88	0.89	0.89	9883
	accuracy			0.87	29649
,	macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87	29649 29649
	weighted avg	0.07	0.07	0.07	29049
	[[7435 1320 11 [272 9589 [921 167 87	22]			
		precision	recall	f1-score	support
	0	0.86	0.75	0.80	9883
	1	0.87			9883
	2	0.88	0.89	0.89	9883
	accuracy			0.87	29649
	macro avg	0.87	0.87		
,	weighted avg	0.87	0.87	0.87	29649
	[[7442 1315 11 [281 9580 [919 167 87	22]			
		precision	recall	f1-score	support
	0	0.86	0.75	0.80	9883
	1	0.87	0.97		9883
	2	0.88	0.89	0.89	9883
	accuracy			0.87	29649

macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87	29649 29649
[[7445 1315 1123 [279 9582 22 [910 164 8809]			
	ecision	recall	f1-score	support
0	0.86	0.75	0.80	9883
1	0.87	0.97	0.91	9883
2	0.89	0.89	0.89	9883
accuracy			0.87	29649
macro avg	0.87	0.87	0.87	29649
weighted avg	0.87	0.87	0.87	29649
[[7450 1310 1123 [295 9566 22 [905 165 8813]			
-	ecision	recall	f1-score	support
0	0.86	0.75	0.80	9883
1	0.87	0.97	0.91	9883
2	0.89	0.89	0.89	9883
accuracy			0.87	29649
macro avg	0.87	0.87	0.87	29649
weighted avg	0.87	0.87	0.87	29649
[[7453 1311 1119 [301 9560 22 [905 162 8816 49]			
	ecision	recall	f1-score	support
0	0.86	0.76	0.81	9883
1	0.87	0.97	0.91	9883
2	0.89	0.89	0.89	9883
accuracy			0.87	29649
macro avg	0.87	0.87	0.87	29649
weighted avg	0.87	0.87	0.87	29649
[[7474 1304 1105 [308 9553 22 [901 160 8822 50]			
	ecision	recall	f1-score	support
0	0.86	0.76	0.81	9883
1	0.87	0.97	0.91	9883
2	0.89	0.89	0.89	9883
accuracy			0.87	29649
macro avg	0.87	0.87	0.87	29649
weighted avg	0.87	0.87	0.87	29649
[[7488 1292 1103 [315 9545 23 [902 156 8825 51]			
pr	ecision	recall	f1-score	support

0 1	0.86 0.87	0.76 0.96	0.81 0.91	9883 9883
2	0.89	0.89	0.89	9883
accuracy			0.87	29649
macro avg	0.87 0.87	0.87 0.87	0.87 0.87	29649 29649
weighted avg	0.87	0.07	0.07	23043
[[7491 1282 1	110]			
[333 9527	23]			
[887 155 8 52	841]]			
-	precision	recall	f1-score	support
0	0.06	0.76	0.01	0003
0 1	0.86 0.87	0.76 0.96	0.81 0.91	9883 9883
2	0.89	0.89	0.89	9883
accuracy			0.87	29649
macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87	29649 29649
weighted avg	0.87	0.07	0.87	23043
[[7488 1282 1	113]			
[338 9523	22]			
[888 155 8	840]]			
53	precision	recall	f1-score	support
	,			
0	0.86	0.76	0.81	9883
1	0.87	0.96	0.91	9883
2	0.89	0.90	0.89	9883
accuracy			0.87	29649
accuracy macro avg	0.87	0.87	0.87 0.87	29649 29649
-	0.87 0.87	0.87 0.87		
macro avg weighted avg	0.87		0.87	29649
macro avg weighted avg [[7495 1269 1	0.87 119]		0.87	29649
macro avg weighted avg	0.87 119] 23]		0.87	29649
macro avg weighted avg [[7495 1269 1 [344 9516	0.87 119] 23] 847]]	0.87	0.87 0.87	29649 29649
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8	0.87 119] 23]	0.87	0.87	29649
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8	0.87 119] 23] 847]]	0.87	0.87 0.87	29649 29649
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86 0.87	0.87 recall 0.76 0.96	0.87 0.87 f1-score 0.80 0.91	29649 29649 support 9883 9883
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86	0.87 recall 0.76	0.87 0.87 f1-score 0.80	29649 29649 support
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86 0.87	0.87 recall 0.76 0.96	0.87 0.87 f1-score 0.80 0.91 0.89	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86 0.87	0.87 recall 0.76 0.96	0.87 0.87 f1-score 0.80 0.91	29649 29649 support 9883 9883
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86 0.87 0.88	0.87 recall 0.76 0.96 0.90	0.87 0.87 f1-score 0.80 0.91 0.89 0.87	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86 0.87 0.88	0.87 recall 0.76 0.96 0.90	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 131]	0.87 recall 0.76 0.96 0.90	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87	0.87 recall 0.76 0.96 0.90	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7495 1269 1 [344 9516 [885 151 8 54	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87	0.87 recall 0.76 0.96 0.90	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87	0.87 recall 0.76 0.96 0.90 0.87 0.87	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87 131] 23] 850]] precision	0.87 recall 0.76 0.96 0.90 0.87 0.87	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87	0.87 recall 0.76 0.96 0.90 0.87 0.87	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87 131] 23] 850]] precision 0.86	0.87 recall 0.76 0.90 0.87 0.87	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649 29649 29649
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87 131] 23] 850]] precision 0.86 0.87	0.87 recall 0.76 0.90 0.87 0.87 recall 0.76 0.96	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87 0.87	29649 29649 support 9883 9883 29649 29649 29649 support 9883 9883 9883
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 131] 23] 850]] precision 0.86 0.87 0.88	0.87 recall 0.76 0.96 0.90 0.87 0.87 recall 0.76 0.96 0.98	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87	29649 29649 support 9883 9883 9883 29649 29649 support 9883 9883 9883
macro avg weighted avg [[7495 1269 1	0.87 119] 23] 847]] precision 0.86 0.87 0.88 0.87 0.87 131] 23] 850]] precision 0.86 0.87	0.87 recall 0.76 0.90 0.87 0.87 recall 0.76 0.96	0.87 0.87 f1-score 0.80 0.91 0.89 0.87 0.87 0.87	29649 29649 support 9883 9883 29649 29649 29649 support 9883 9883 9883

```
[[7495 1256 1132]
[ 362 9498 23]
[ 893 145 8845]]
56
            precision recall f1-score
                                       support
                0.86
                        0.76
                                  0.80
                                          9883
                        0.96
         1
                0.87
                                  0.91
                                          9883
                        0.90
         2
                0.89
                                  0.89
                                           9883
                                  0.87
                                          29649
   accuracy
              0.87 0.87
0.87 0.87
                                  0.87
                                          29649
  macro avg
                                  0.87
weighted avg
                                          29649
[[7498 1258 1127]
[ 376 9484 23]
[ 885 145 8853]]
57
            precision recall f1-score
                                       support
         0
                0.86
                        0.76
                                  0.80
                                           9883
         1
                0.87
                         0.96
                                  0.91
                                           9883
         2
                0.88
                         0.90
                                  0.89
                                          9883
   accuracy
                                  0.87
                                          29649
                        0.87
                                  0.87
                                          29649
  macro avg
                0.87
                        0.87
weighted avg
                0.87
                                  0.87
                                          29649
[[7504 1248 1131]
[ 372 9487 24]
[ 885 141 8857]]
58
            precision recall f1-score support
                0.86
0.87
                        0.76
         0
                0.86
                                  0.81
                                          9883
                        0.96
                                  0.91
                                          9883
         1
                0.89
                        0.90
                                  0.89
                                          9883
   accuracy
                                  0.87
                                          29649
             0.87 0.87 0.87
  macro avg
                                          29649
                        0.87
                                  0.87
                                          29649
weighted avg
                0.87
[[7516 1241 1126]
[ 391 9469 23]
[ 876 137 8870]]
59
            precision recall f1-score support
         0
                0.86
                        0.76
                                  0.81
                                           9883
                0.87
                         0.96
                                  0.91
         1
                                           9883
                0.89
                         0.90
                                  0.89
                                          9883
   accuracy
                                  0.87
                                          29649
  macro avg
               0.87
                        0.87
                                  0.87
                                          29649
                         0.87
                0.87
                                  0.87
                                          29649
weighted avg
[[7531 1241 1111]
[ 402 9458 23]
[ 864 137 8882]]
60
            precision recall f1-score
                                       support
                0.86 0.76 0.81
                                         9883
```

1 2	0.87 0.89	0.96 0.90	0.91 0.89	9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7533 1239 1 [412 9447 [865 135 8	24]			
01	precision	recall	f1-score	support
0 1 2	0.85 0.87 0.89	0.76 0.95 0.90	0.81 0.91 0.89	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7546 1229 1 [424 9435 [866 133 8	24]			
	precision	recall	f1-score	support
0	0.85	0.76	0.81	9883
1 2	0.87 0.89	0.95 0.90	0.91 0.89	9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7557 1218 1 [429 9429 [856 134 8	25]			
03	precision	recall	f1-score	support
0 1 2	0.85 0.87 0.89	0.77 0.95 0.90	0.81 0.91 0.89	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7561 1216 1 [441 9419 [851 132 8	23]			
U -1	precision	recall	f1-score	support
0 1 2	0.85 0.88 0.89	0.77 0.95 0.90	0.81 0.91 0.89	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649

[[7571 1206 1106]

```
[ 444 9415 24]
[ 843 131 8909]]
65
             precision recall f1-score
                                         support
                 0.85
                         0.77
                                    0.81
                                            9883
          0
          1
                 0.88
                         0.95
                                    0.91
                                            9883
          2
                 0.89
                          0.90
                                    0.89
                                            9883
                                    0.87
   accuracy
                                            29649
  macro avg
                 0.87
                          0.87
                                    0.87
                                            29649
                          0.87
weighted avg
                 0.87
                                    0.87
                                            29649
[[7573 1200 1110]
[ 447 9413 23]
[ 839 130 8914]]
66
             precision recall f1-score
                                          support
                 0.85
                          0.77
                                    0.81
                                            9883
          1
                 0.88
                          0.95
                                    0.91
                                             9883
          2
                 0.89
                          0.90
                                    0.89
                                            9883
                                    0.87
                                            29649
   accuracy
                 0.87
                         0.87
                                    0.87
                                            29649
  macro avg
weighted avg
                 0.87
                         0.87
                                    0.87
                                            29649
[[7573 1194 1116]
[ 467 9392 24]
[ 837 130 8916]]
67
             precision recall f1-score support
                          0.77
          0
                 0.85
                                    0.81
                                             9883
          1
                 0.88
                          0.95
                                    0.91
                                             9883
          2
                 0.89
                          0.90
                                    0.89
                                             9883
                                    0.87
                                            29649
   accuracy
                         0.87
  macro avg
               0.87
                                   0.87
                                            29649
                          0.87
weighted avg
                 0.87
                                    0.87
                                            29649
[[7576 1191 1116]
[ 472 9388 23]
[ 829 128 8926]]
68
             precision recall f1-score
                                         support
          0
                 0.85
                          0.77
                                    0.81
                                             9883
          1
                 0.88
                          0.95
                                    0.91
                                             9883
                 0.89
                          0.90
                                    0.89
                                             9883
                                    0.87
                                            29649
   accuracy
                 0.87
                         0.87
                                            29649
                                    0.87
  macro avg
weighted avg
                 0.87
                          0.87
                                    0.87
                                            29649
[[7587 1179 1117]
[ 474 9386 23]
[ 830 127 8926]]
69
             precision
                      recall f1-score
                                          support
                          0.77
          0
                 0.85
                                    0.81
                                             9883
          1
                 0.88
                          0.95
                                    0.91
                                             9883
                          0.90
                                    0.90
                                             9883
                 0.89
```

accuracy macro avg weighted avg	0.87 0.87	0.87 0.87	0.87 0.87 0.87	29649 29649 29649
[[7585 1177 1121] [472 9386 25] [821 125 8937]]			
	cision	recall	f1-score	support
0 1 2	0.86 0.88 0.89	0.77 0.95 0.91	0.81 0.91 0.90	9883 9883 9883
accuracy macro avg weighted avg	0.87 0.87	0.88 0.88	0.88 0.87 0.87	29649 29649 29649
[[7619 1177 1087] [473 9387 23] [811 123 8949]]			
	cision	recall	f1-score	support
0 1 2	0.86 0.88 0.89	0.77 0.95 0.91	0.81 0.91 0.90	9883 9883 9883
accuracy	0.00	0.00	0.88	29649
macro avg weighted avg	0.88 0.88	0.88 0.88	0.87 0.87	29649 29649
[[7618 1175 1090] [481 9380 22] [789 121 8973]]			
pre	cision	recall	f1-score	support
0 1	0.86	0.77	0.81 0.91	9883
2	0.88 0.89	0.95 0.91	0.90	9883 9883
accuracy			0.88	29649
macro avg weighted avg	0.88 0.88	0.88 0.88	0.87 0.87	29649 29649
[[7622 1175 1086] [477 9381 25] [780 117 8986]]			
pre	cision	recall	f1-score	support
0	0.86	0.77	0.81	9883
1 2	0.88 0.89	0.95 0.91	0.91 0.90	9883 9883
accuracy			0.88	29649
macro avg	0.88	0.88	0.87	29649
weighted avg	0.88	0.88	0.87	29649
[[7622 1168 1093] [491 9367 25] [781 119 8983]	1			

\neg	
	/1

74				
	precision	recall	f1-score	support
0	0.86	0.77	0.81	9883
1	0.88	0.95	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
[[7618 1167 1 [516 9341 [772 112 8	26]			
73	precision	recall	f1-score	support
0	0.86	0.77	0.81	9883
1	0.88	0.95	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.88	0.88	0.87	29649
weighted avg	0.88	0.88	0.87	29649
[[7629 1165 1 [517 9340 [766 109 9 76	26]			
	precision	recall	f1-score	support
0	0.86	0.77	0.81	9883
1	0.88	0.95	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.88	0.88	0.87	29649
weighted avg	0.88	0.88	0.87	29649
[[7634 1166 1 [516 9340 [769 105 9	27]			
	precision	recall	f1-score	support
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
[[7631 1165 1 [532 9325 [772 104 9	26]			
-	precision	recall	f1-score	support
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649

macro avg weighted avg	0.87 0.87	0.88 0.88	0.87 0.87	29649 29649
[[7625 1160 1098 [540 9316 27 [768 103 9012]			
	ecision	recall	f1-score	support
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
[[7630 1153 1100 [542 9314 27 [771 103 9009]			
	ecision	recall	f1-score	support
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
[[7627 1151 1105 [552 9307 24 [765 100 9018]			
-	ecision	recall	f1-score	support
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
[[7651 1144 1088 [557 9300 26 [765 100 9018 82]			
_	ecision	recall	f1-score	support
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
accuracy			0.88	29649
macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
[[7646 1139 1098 [561 9294 28 [767 99 9017 83]			
pr			f1-score	support

0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
266118267			0.88	29649
accuracy macro avg	0.87	0.88	0.87	29649
weighted avg	0.87	0.88	0.87	29649
weighted avg	0.07	0.00	0.07	23043
[[7644 1134 1	105]			
[558 9297	28]			
[761 98 9	024]]			
84	precision	recall	f1-score	support
	precision	rccarr	11 30010	3uppor c
0	0.85	0.77	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.91	0.90	9883
2664192614			Δ 00	20640
accuracy macro avg	0.88	0.88	0.88 0.87	29649 29649
weighted avg	0.88	0.88	0.87	29649
8	0.00	0.00		200.0
[[7657 1130 1	096]			
[564 9292	27]			
-	030]]			
85			£1	
	precision	recall	f1-score	support
0	0.85	0.78	0.81	9883
1	0.88	0.94	0.91	9883
2	0.89	0.92	0.90	9883
			0.00	20640
accuracy	a 99		0.88	29649
macro avg	0.88 0.88	0.88	0.88	29649
-	0.88 0.88			
macro avg	0.88	0.88	0.88	29649
macro avg weighted avg [[7675 1125 1 [568 9288	0.88 083] 27]	0.88	0.88	29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9	0.88 083]	0.88	0.88	29649
macro avg weighted avg [[7675 1125 1 [568 9288	0.88 083] 27] 044]]	0.88 0.88	0.88 0.88	29649 29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9	0.88 083] 27]	0.88 0.88	0.88	29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9	0.88 083] 27] 044]] precision	0.88 0.88 recall	0.88 0.88 f1-score	29649 29649 support
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9	0.88 083] 27] 044]]	0.88 0.88	0.88 0.88	29649 29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9 86	0.88 083] 27] 044]] precision 0.85	0.88 0.88 recall 0.78	0.88 0.88 f1-score 0.81	29649 29649 support 9883
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9 86	0.88 083] 27] 044]] precision 0.85 0.88	0.88 0.88 recall 0.78 0.94	0.88 0.88 f1-score 0.81 0.91 0.90	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9 86	0.88 083] 27] 044]] precision 0.85 0.88 0.89	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.91 0.90	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9 86	0.88 083] 27] 044]] precision 0.85 0.88 0.89	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9 86	0.88 083] 27] 044]] precision 0.85 0.88 0.89	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.91 0.90	29649 29649 support 9883 9883 9883
macro avg weighted avg [[7675 1125 1 [568 9288	0.88 083] 27] 044]] precision 0.85 0.88 0.89	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745 94 9 86	0.88 083] 27] 044]] precision 0.85 0.88 0.89	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.91 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88 0.88 0.89 precision	0.88 0.88 recall 0.78 0.94 0.92 0.88 0.88	0.88 0.88 f1-score 0.81 0.91 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649 29649
macro avg weighted avg [[7675 1125 1 [568 9288 [745	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88	0.88 0.88 recall 0.78 0.94 0.92	0.88 0.88 f1-score 0.81 0.90 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88 085] 27] 046]] precision 0.85	0.88 0.88 recall 0.78 0.94 0.92 0.88 0.88	0.88 0.88 f1-score 0.81 0.91 0.90 0.88 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649 29649 29649
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88 085] 27] 046]] precision 0.85 0.88	0.88 0.88 recall 0.78 0.94 0.92 0.88 0.88	0.88 0.88 f1-score 0.81 0.90 0.88 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649 29649 2983 9883
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88 0.88 0.88 0.88 0.89	0.88 0.88 recall 0.78 0.94 0.92 0.88 0.88	0.88 0.88 0.88 f1-score 0.81 0.90 0.88 0.88 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649 support 9883 9883 9883
macro avg weighted avg [[7675 1125 1	0.88 083] 27] 044]] precision 0.85 0.88 0.89 0.88 0.88 085] 27] 046]] precision 0.85 0.88	0.88 0.88 recall 0.78 0.94 0.92 0.88 0.88	0.88 0.88 0.88 f1-score 0.81 0.90 0.88 0.88 0.88	29649 29649 support 9883 9883 9883 29649 29649 29649 support 9883 9883 9883

```
[[7676 1123 1084]
[ 563 9294 26]
[ 740 92 9051]]
88
             precision recall f1-score support
          0
                 0.85
                          0.78
                                    0.81
                                             9883
                          0.94
                                     0.91
          1
                 0.88
                                             9883
          2
                 0.89
                          0.92
                                     0.90
                                             9883
   accuracy
                                    0.88
                                             29649
                                    0.88
0.88

      0.88
      0.88
      0.88

      0.88
      0.88
      0.88

                                             29649
  macro avg
                                             29649
weighted avg
[[7679 1118 1086]
[ 566 9291 26]
[ 740 91 9052]]
89
             precision recall f1-score support
          0
                 0.86
                          0.78
                                    0.81
                                              9883
          1
                 0.88
                          0.94
                                    0.91
                                              9883
          2
                 0.89
                          0.92
                                    0.90
                                             9883
   accuracy
                                    0.88
                                             29649
                 0.88
                          0.88
                                    0.88
                                             29649
  macro avg
                          0.88
weighted avg
                 0.88
                                    0.88
                                             29649
[[7683 1118 1082]
[ 569 9288 26]
[ 730 91 9062]]
90
             precision recall f1-score support
                 0.86
                          0.78
          0
                                    0.82
                                             9883
                 0.89
                          0.94
                                    0.91
                                             9883
          1
                  0.89
                          0.92
                                     0.90
                                             9883
                                    0.88
   accuracy
                                             29649
               0.88 0.88 0.88
  macro avg
                                             29649
                          0.88
                                    0.88
                                             29649
weighted avg
                 0.88
[[7706 1094 1083]
[ 575 9282 26]
[ 729 91 9063]]
91
             precision recall f1-score support
          0
                 0.86
                          0.78
                                    0.82
                                              9883
                 0.89
                          0.94
          1
                                     0.91
                                              9883
                 0.89
                           0.92
                                    0.90
                                             9883
   accuracy
                                    0.88
                                             29649
  macro avg
                 0.88
                          0.88
                                    0.88
                                             29649
                 0.88
                           0.88
                                    0.88
                                             29649
weighted avg
[[7717 1092 1074]
[ 577 9280 26]
[ 727 90 9066]]
92
             precision recall f1-score
                                           support
                 0.85 0.78 0.82
                                            9883
```

1 2	0.89 0.89	0.94 0.92	0.91 0.90	9883 9883
accuracy macro avg weighted avg	0.88 0.88	0.88 0.88	0.88 0.88 0.88	29649 29649 29649
[[7719 1090 1 [587 9271 [725 90 9	074] 25] 068]]			
	precision	recall	f1-score	support
0 1 2	0.85 0.89 0.89	0.78 0.94 0.92	0.82 0.91 0.90	9883 9883 9883
accuracy macro avg weighted avg	0.88 0.88	0.88 0.88	0.88 0.88 0.88	29649 29649 29649
[[7715 1090 1 [589 9269 [720 89 9	078] 25] 074]]			
	precision	recall	f1-score	support
0 1 2	0.85 0.89 0.89	0.78 0.93 0.92	0.81 0.91 0.90	9883 9883 9883
accuracy macro avg weighted avg	0.88 0.88	0.88 0.88	0.88 0.88 0.88	29649 29649 29649
[[7720 1089 1 [619 9240 [726 89 9	074] 24] 068]]			
	precision	recall	f1-score	support
0 1 2	0.85 0.89 0.89	0.78 0.93 0.92	0.81 0.91 0.90	9883 9883 9883
accuracy macro avg weighted avg	0.88 0.88	0.88 0.88	0.88 0.88 0.88	29649 29649 29649
[[7716 1081 1 [620 9239 [727 87 9	24]			
50	precision	recall	f1-score	support
0 1 2	0.85 0.89 0.89	0.78 0.93 0.92	0.82 0.91 0.90	9883 9883 9883
accuracy macro avg weighted avg	0.88 0.88	0.88 0.88	0.88 0.88 0.88	29649 29649 29649

```
[ 619 9238 26]
[ 723 87 9073]]
97
             precision
                        recall f1-score
                                            support
          0
                  0.85
                            0.78
                                      0.81
                                                9883
          1
                  0.89
                            0.93
                                      0.91
                                                9883
           2
                  0.89
                            0.92
                                      0.90
                                                9883
                                      0.88
                                               29649
   accuracy
   macro avg
                  0.88
                            0.88
                                      0.88
                                               29649
weighted avg
                  0.88
                            0.88
                                      0.88
                                               29649
[[7713 1084 1086]
[ 623 9235
             25]
 [ 724
        88 9071]]
98
             precision
                        recall f1-score
                                             support
          0
                  0.85
                            0.78
                                      0.82
                                                9883
          1
                  0.89
                            0.94
                                      0.91
                                                9883
          2
                            0.92
                                      0.90
                                               9883
                  0.89
                                      0.88
                                               29649
   accuracy
                                      0.88
                  0.88
                            0.88
                                               29649
   macro avg
weighted avg
                  0.88
                            0.88
                                      0.88
                                               29649
[[7729 1074 1080]
[ 617 9242 24]
[ 719
        86 9078]]
99
             precision recall f1-score
                                            support
                            0.78
          0
                  0.85
                                      0.82
                                                9883
          1
                  0.89
                            0.93
                                      0.91
                                                9883
          2
                  0.89
                            0.92
                                      0.91
                                                9883
                                      0.88
                                               29649
   accuracy
   macro avg
                  0.88
                            0.88
                                      0.88
                                               29649
weighted avg
                  0.88
                            0.88
                                      0.88
                                               29649
[[7736 1074 1073]
[ 622 9237
             24]
[ 715
       87 9081]]
100
             precision
                        recall f1-score
                                            support
          0
                  0.85
                            0.78
                                      0.82
                                                9883
          1
                  0.89
                            0.93
                                      0.91
                                                9883
                  0.89
                            0.92
                                      0.91
                                                9883
                                      0.88
                                               29649
   accuracy
                            0.88
                                               29649
                  0.88
                                      0.88
   macro avg
weighted avg
                  0.88
                            0.88
                                      0.88
                                               29649
[[7744 1071 1068]
 [ 637 9220 26]
 [ 704 88 9091]]
```

xgb=XGBClassifier(n_estimators=70,reg_alpha=1) In [101... xgb=create_model(xgb)

```
precision
                                      recall f1-score
                                                          support
                                        0.77
                                                  0.81
                      0
                              0.86
                                                             9883
                      1
                              0.88
                                        0.95
                                                  0.91
                                                             9883
                      2
                              0.89
                                        0.91
                                                  0.90
                                                             9883
                                                  0.88
                                                            29649
              accuracy
             macro avg
                              0.87
                                        0.88
                                                  0.87
                                                            29649
                                        0.88
          weighted avg
                              0.87
                                                  0.87
                                                            29649
           [[7619 1177 1087]
           [ 473 9387 23]
           [ 811 123 8949]]
          #check impotant features
In [102...
           dict={'Input':X.columns,'IG':xgb.feature_importances_}
           df1=pd.DataFrame(dict)
           df1.sort_values('IG',ascending=False)
Out[102]:
```

	Input	IG
0	term	0.695241
14	last_pymnt_amnt	0.079807
3	home_ownership	0.038092
1	int_rate	0.036447
2	grade	0.034768
10	funded_amnt	0.019024
12	installment	0.018983
9	loan_amnt	0.016324
5	issue_d	0.014157
7	purpose	0.014068
4	verification_status	0.013653
11	funded_amnt_inv	0.009838
13	annual_inc	0.009598
6	pymnt_plan	0.000000
8	application_type	0.000000

In the above all algos applied we got the result best on XGBClassifier i.e of 88% accuracy which is highest in the range of all algos This dataset might give results below expectation i.e non optimistic results as this dataset is unblanced and may get the chances more of data duplicacy in every terms. The results we got in all algorithms are #dtc=82% #svc=82% #rfc=85% #rfc min sample leaf=86% #ada boost=85% #xgboost=88%

In []: