

dicting-credit-risk-model-pipeline

March 24, 2024

1. Librarys:

```
[263]: #Load the librarys
import pandas as pd #To work with dataset
import numpy as np #Math library
import seaborn as sns #Graph library that use matplotlib in background
import matplotlib.pyplot as plt #to plot some parameters in seaborn
# it's a library that we work with plotly
import plotly.offline as py
py.init_notebook_mode(connected=True) # this code, allow us to work with
    ↪offline plotly version
import plotly.graph_objs as go # it's like "plt" of matplotlib
import plotly.tools as tls # It's useful to we get some tools of plotly
import warnings # This library will be used to ignore some warnings
from collections import Counter # To do counter of some features
```

1 2. import dataset

```
[264]: #Importing the data
df_credit = pd.read_csv("../input/german-credit-data-with-risk/
    ↪german_credit_data.csv",index_col=0)
```

3. First Look : - Type of Data , Null Numbers ,Unique values

```
[265]: #Searching for Missings,type of data and also known the shape of data
print(df_credit.info())
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1000 entries, 0 to 999
Data columns (total 10 columns):
Age                1000 non-null int64
Sex                1000 non-null object
Job                1000 non-null int64
Housing            1000 non-null object
Saving accounts    817 non-null object
Checking account   606 non-null object
Credit amount     1000 non-null int64
```

```

Duration          1000 non-null int64
Purpose           1000 non-null object
Risk              1000 non-null object
dtypes: int64(4), object(6)
memory usage: 85.9+ KB
None

```

```

[266]: #Looking unique values
print(df_credit.nunique())
#Looking the data
print(df_credit.head())

```

```

Age          53
Sex          2
Job          4
Housing      3
Saving accounts  4
Checking account  3
Credit amount  921
Duration     33
Purpose      8
Risk         2
dtype: int64

```

	Age	Sex	Job	...	Duration	Purpose	Risk
0	67	male	2	...	6	radio/TV	good
1	22	female	2	...	48	radio/TV	bad
2	49	male	1	...	12	education	good
3	45	male	2	...	42	furniture/equipment	good
4	53	male	2	...	24	car	bad

[5 rows x 10 columns]

2 4. explorations:

Let's start looking through target variable and their distribution

```

[267]: # Count the occurrences of 'good' and 'bad' in the 'Risk' column
good_counts = df_credit['Risk'].value_counts()['good']
bad_counts = df_credit['Risk'].value_counts()['bad']

# Create the traces for the bar chart
trace0 = go.Bar(x=['good'], y=[good_counts], name='Good credit')
trace1 = go.Bar(x=['bad'], y=[bad_counts], name='Bad credit')

# Create the layout for the plot
layout = go.Layout(
    title='Target variable distribution',

```

```

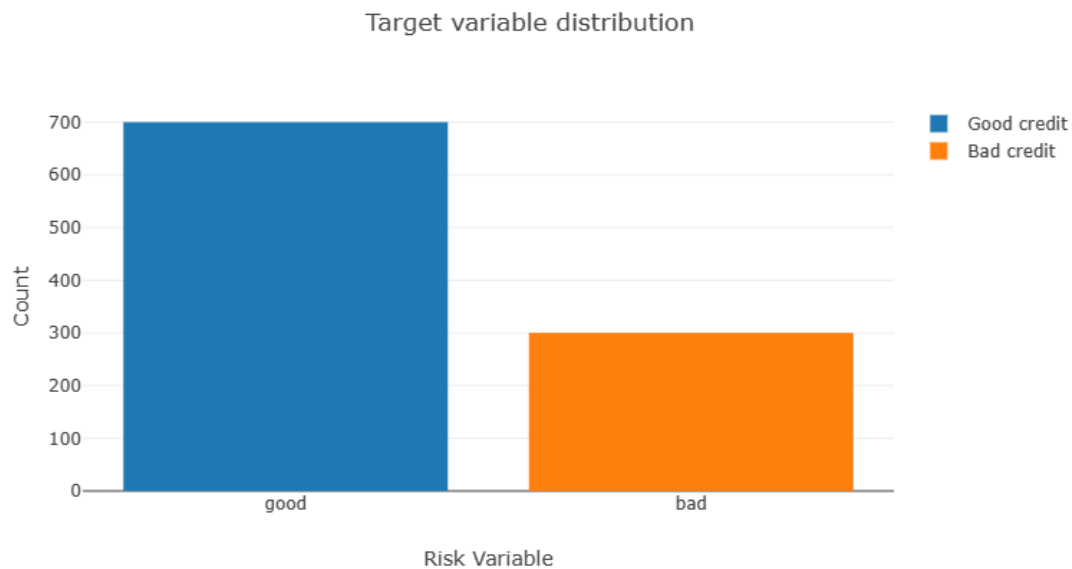
    xaxis=dict(title='Risk Variable'),
    yaxis=dict(title='Count')
)

# Add traces to data list
data = [trace0, trace1]

# Create the figure
fig = go.Figure(data=data, layout=layout)

# Plot the figure
py.iplot(fig, filename='grouped-bar')

```



I will try implement some interactive visuals in my Kernels, this will be the first, inspired in Alexander's Kernel and I will also continue implementing plotly and bokeh in my Kerne

```

[270]: df_good = df_credit.loc[df_credit["Risk"] == 'good']['Age'].values.tolist()
df_bad = df_credit.loc[df_credit["Risk"] == 'bad']['Age'].values.tolist()
df_age = df_credit['Age'].values.tolist()

trace0 = go.Histogram(
    x=df_good,
    histnorm='probability',
    name="Good Credit"
)
trace1 = go.Histogram(

```

```

x=df_bad,
histnorm='probability',
name="Bad Credit"
)

fig = tls.make_subplots(rows=2, cols=2, specs=[[{}], {}], [{"colspan": 2},
↪None]],
                        subplot_titles=('Good', 'Bad', 'General_
↪Distribution'))

fig.append_trace(trace0, 1, 1)
fig.append_trace(trace1, 1, 2)
fig.append_trace(trace2, 2, 1)

fig['layout'].update(showlegend=True, title='Age Distribution', bargap=0.05)
py.iplot(fig, filename='custom-sized-subplot-with-subplot-titles')

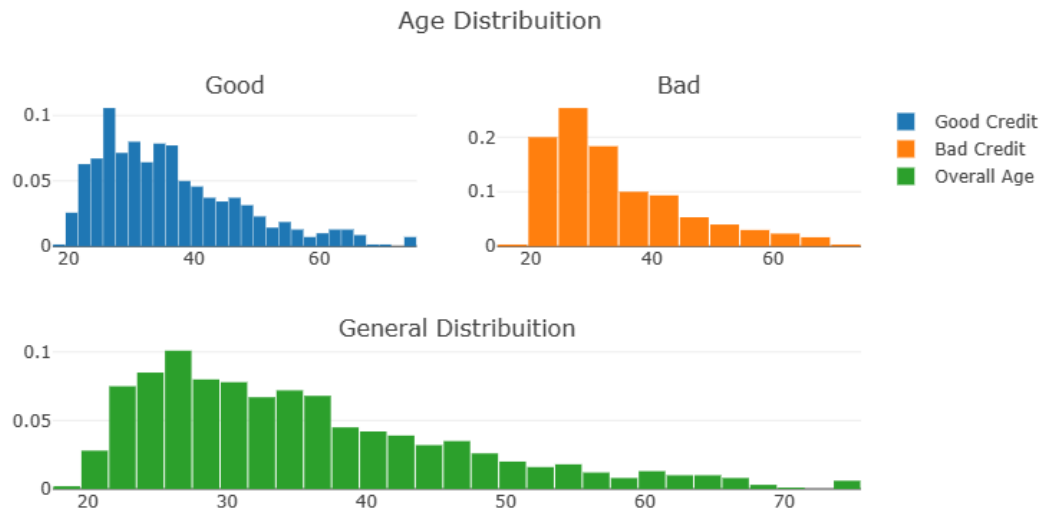
```

This is the format of your plot grid:

```

[ (1,1) x1,y1 ] [ (1,2) x2,y2 ]
[ (2,1) x3,y3   -   ]

```



categorical variable

```
[272]: interval = (18, 25, 35, 60, 120)

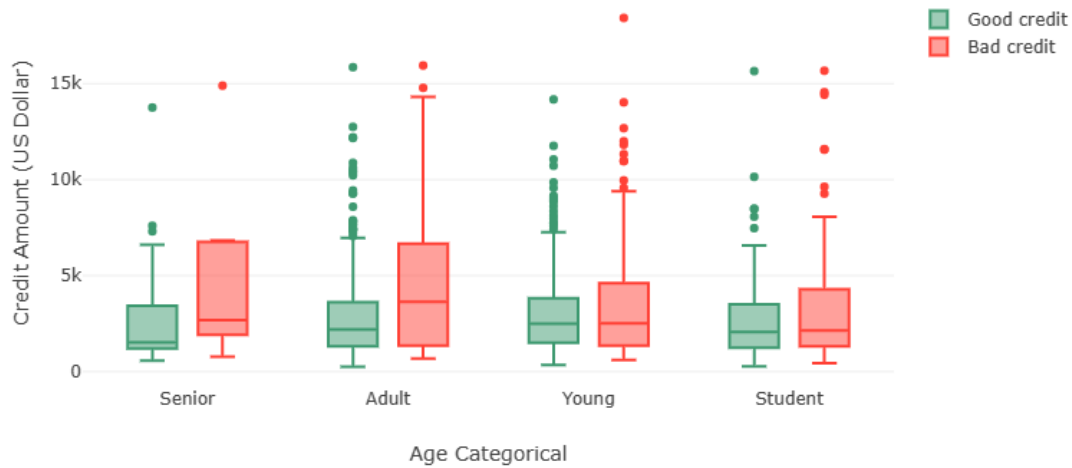
cats = ['Student', 'Young', 'Adult', 'Senior']
df_credit["Age_cat"] = pd.cut(df_credit.Age, interval, labels=cats)

df_good = df_credit[df_credit["Risk"] == 'good']
df_bad = df_credit[df_credit["Risk"] == 'bad']
```

```
[273]: trace0 = go.Box(
    y=df_good["Credit amount"],
    x=df_good["Age_cat"],
    name='Good credit',
    marker=dict(
        color='#3D9970'
    )
)
trace1 = go.Box(
    y=df_bad['Credit amount'],
    x=df_bad['Age_cat'],
    name='Bad credit',
    marker=dict(
        color='#FF4136'
    )
)
data = [trace0, trace1]

layout = go.Layout(
    yaxis=dict(
        title='Credit Amount (US Dollar)',
        zeroline=False
    ),
    xaxis=dict(
        title='Age Categorical'
    ),
    boxmode='group'
)
fig = go.Figure(data=data, layout=layout)

py.iplot(fig, filename='box-age-cat')
```



Interesting distribution

distribution of Housing own and rent by Risk

```
[274]: trace0 = go.Bar(
    x = df_credit[df_credit["Risk"]== 'good']["Housing"].value_counts().index.
    ↪values,
    y = df_credit[df_credit["Risk"]== 'good']["Housing"].value_counts().values,
    name='Good credit'
)

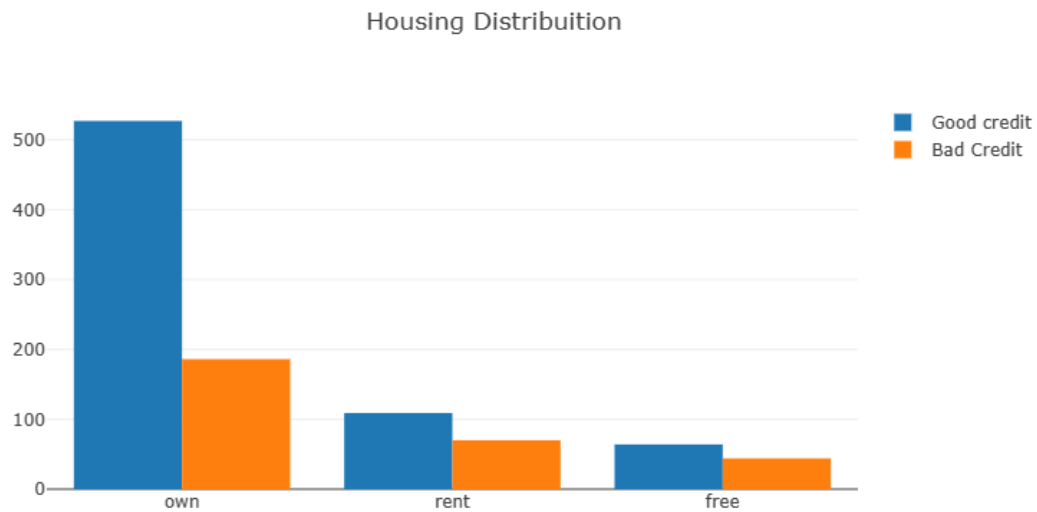
trace1 = go.Bar(
    x = df_credit[df_credit["Risk"]== 'bad']["Housing"].value_counts().index.
    ↪values,
    y = df_credit[df_credit["Risk"]== 'bad']["Housing"].value_counts().values,
    name="Bad Credit"
)

data = [trace0, trace1]

layout = go.Layout(
    title='Housing Distribution'
)

fig = go.Figure(data=data, layout=layout)
```

```
py.ipplot(fig, filename='Housing-Grouped')
```



we can see that the own and good risk have a high correlation

Distribution of Credit Amount by Housing

```
[ ]: fig = {  
    "data": [  
        {  
            "type": 'violin',  
            "x": df_good['Housing'],  
            "y": df_good['Credit amount'],  
            "legendgroup": 'Good Credit',  
            "scalegroup": 'No',  
            "name": 'Good Credit',  
            "side": 'negative',  
            "box": {  
                "visible": True  
            },  
            "meanline": {  
                "visible": True  
            },  
            "line": {  
                "color": 'blue'  
            }  
        },  
        {  
            "type": 'violin',  
            "x": df_bad['Housing'],  
            "y": df_bad['Credit amount'],  
            "legendgroup": 'Bad Credit',  
            "scalegroup": 'No',  
            "name": 'Bad Credit',  
            "side": 'positive',  
            "box": {  
                "visible": True  
            },  
            "meanline": {  
                "visible": True  
            },  
            "line": {  
                "color": 'red'  
            }  
        }  
    ],  
    "title": 'Distribution of Credit Amount by Housing',  
    "x_labels": 'Housing',  
    "y_labels": 'Credit amount',  
    "x_ticks": ['own', 'rent', 'free'],  
    "y_ticks": [0, 100, 200, 300, 400, 500],  
    "legends": [  
        {  
            "label": 'Good Credit',  
            "color": 'blue',  
            "side": 'negative'  
        },  
        {  
            "label": 'Bad Credit',  
            "color": 'red',  
            "side": 'positive'  
        }  
    ],  
    "boxplots": True  
}
```

```

        "type": 'violin',
        "x": df_bad['Housing'],
        "y": df_bad['Credit amount'],
        "legendgroup": 'Bad Credit',
        "scalegroup": 'No',
        "name": 'Bad Credit',
        "side": 'positive',
        "box": {
            "visible": True
        },
        "meanline": {
            "visible": True
        },
        "line": {
            "color": 'green'
        }
    }
],
"layout" : {
    "yaxis": {
        "zeroline": False,
    },
    "violingap": 0,
    "violinmode": "overlay"
}
}

py.iplot(fig, filename = 'violin/split', validate = False)

```

Interesting moviments! Highest values come from category “free” and we have a different distribution by Risk

Looking the diference by Sex

```

[275]: trace0 = go.Bar(
        x = df_credit[df_credit["Risk"]== 'good']["Sex"].value_counts().index.
        ↪values,
        y = df_credit[df_credit["Risk"]== 'good']["Sex"].value_counts().values,
        name='Good credit'
    )

trace1 = go.Bar(
        x = df_credit[df_credit["Risk"]== 'bad']["Sex"].value_counts().index.values,
        y = df_credit[df_credit["Risk"]== 'bad']["Sex"].value_counts().values,
        name="Bad Credit"
    )

```



```

trace2 = go.Box(
    x = df_credit[df_credit["Risk"]== 'good']["Sex"],
    y = df_credit[df_credit["Risk"]== 'good']["Credit amount"],
    name=trace0.name
)

trace3 = go.Box(
    x = df_credit[df_credit["Risk"]== 'bad']["Sex"],
    y = df_credit[df_credit["Risk"]== 'bad']["Credit amount"],
    name=trace1.name
)

data = [trace0, trace1, trace2, trace3]

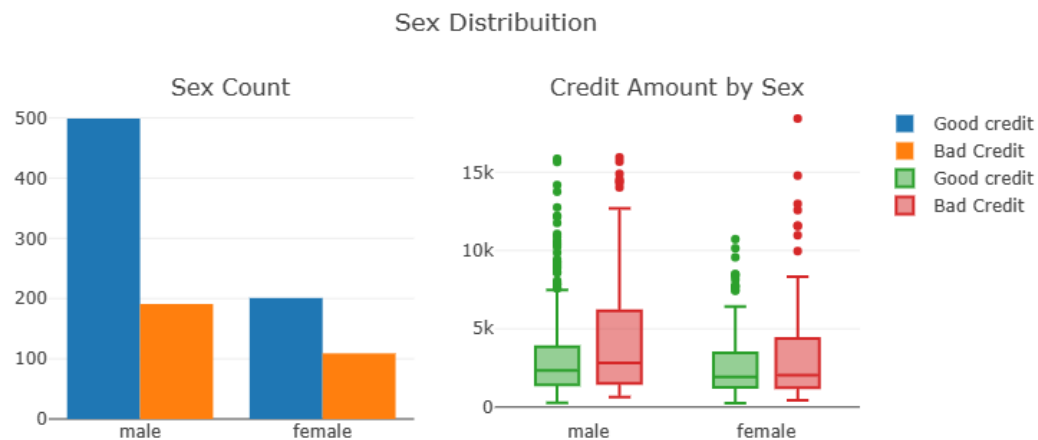
fig = tls.make_subplots(rows=1, cols=2,
                        subplot_titles=('Sex Count', 'Credit Amount by Sex'))

fig.append_trace(trace0, 1, 1)
fig.append_trace(trace1, 1, 1)
fig.append_trace(trace2, 1, 2)
fig.append_trace(trace3, 1, 2)

fig['layout'].update(height=400, width=800, title='Sex Distribution',
                    boxmode='group')
py.iplot(fig, filename='sex-subplot')

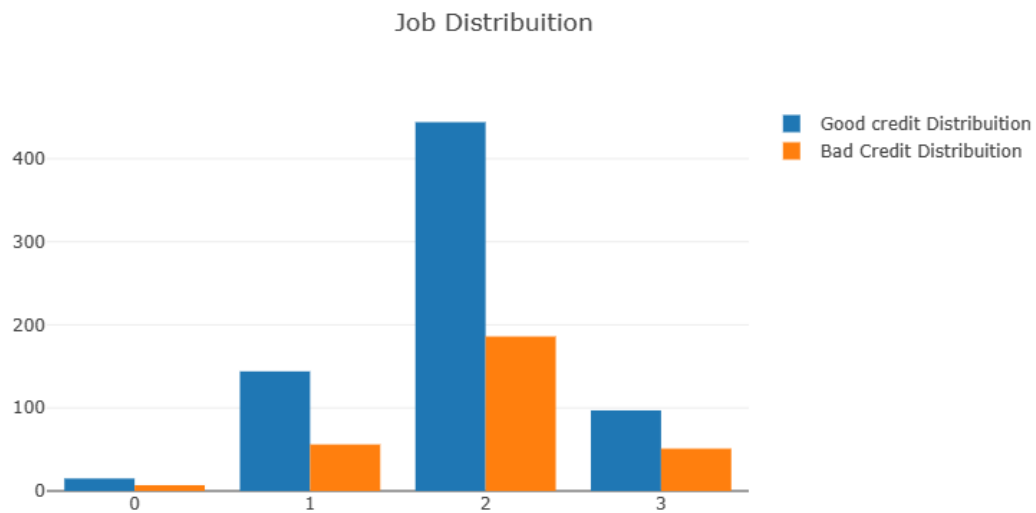
```

This is the format of your plot grid:
 [(1,1) x1,y1] [(1,2) x2,y2]



I will create categories of Age and look the distribution of Credit Amount by Risk...

```
[276]: trace0 = go.Bar(  
        x = df_credit[df_credit["Risk"]== 'good']["Job"].value_counts().index.  
        ↪values,  
        y = df_credit[df_credit["Risk"]== 'good']["Job"].value_counts().values,  
        name='Good credit Distribution'  
    )  
    trace1 = go.Bar(  
        x = df_credit[df_credit["Risk"]== 'bad']["Job"].value_counts().index.values,  
        y = df_credit[df_credit["Risk"]== 'bad']["Job"].value_counts().values,  
        name="Bad Credit Distribution"  
    )  
  
    data = [trace0, trace1]  
  
    layout = go.Layout(  
        title='Job Distribution'  
    )  
  
    fig = go.Figure(data=data, layout=layout)  
  
    py.iplot(fig, filename='grouped-bar')
```



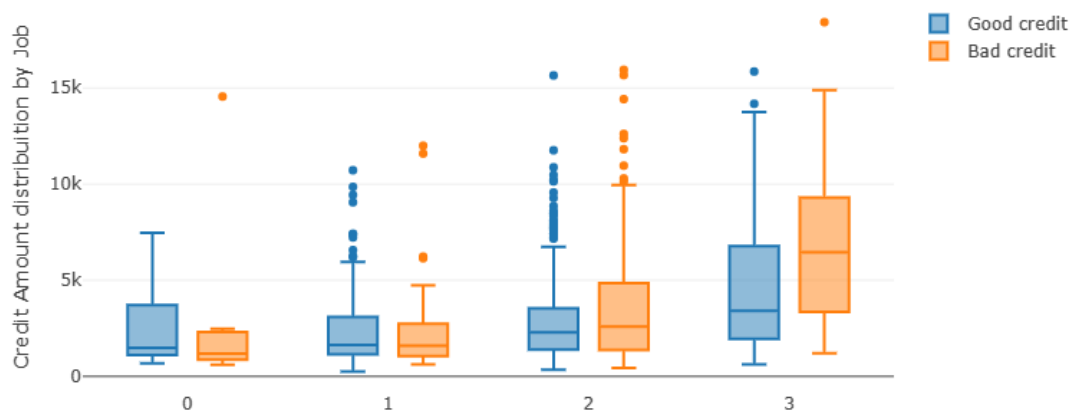
```
[277]: trace0 = go.Box(
        x=df_good["Job"],
        y=df_good["Credit amount"],
        name='Good credit'
    )

    trace1 = go.Box(
        x=df_bad['Job'],
        y=df_bad['Credit amount'],
        name='Bad credit'
    )

    data = [trace0, trace1]

    layout = go.Layout(
        yaxis=dict(
            title='Credit Amount distribution by Job'
        ),
        boxmode='group'
    )
    fig = go.Figure(data=data, layout=layout)

    py.iplot(fig, filename='box-age-cat')
```



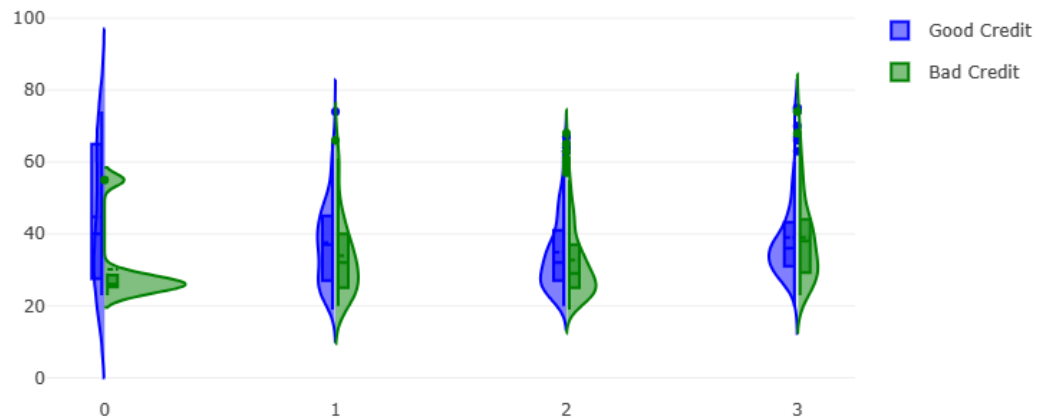
```
[278]: fig = {
        "data": [
```

```

{
  "type": 'violin',
  "x": df_good['Job'],
  "y": df_good['Age'],
  "legendgroup": 'Good Credit',
  "scalegroup": 'No',
  "name": 'Good Credit',
  "side": 'negative',
  "box": {
    "visible": True
  },
  "meanline": {
    "visible": True
  },
  "line": {
    "color": 'blue'
  }
},
{
  "type": 'violin',
  "x": df_bad['Job'],
  "y": df_bad['Age'],
  "legendgroup": 'Bad Credit',
  "scalegroup": 'No',
  "name": 'Bad Credit',
  "side": 'positive',
  "box": {
    "visible": True
  },
  "meanline": {
    "visible": True
  },
  "line": {
    "color": 'green'
  }
}
],
"layout" : {
  "yaxis": {
    "zeroline": False,
  },
  "violingap": 0,
  "violinmode": "overlay"
}
}

```

```
py.iplot(fig, filename = 'Age-Housing', validate = False)
```



```
[280]: import plotly.figure_factory as ff

import numpy as np

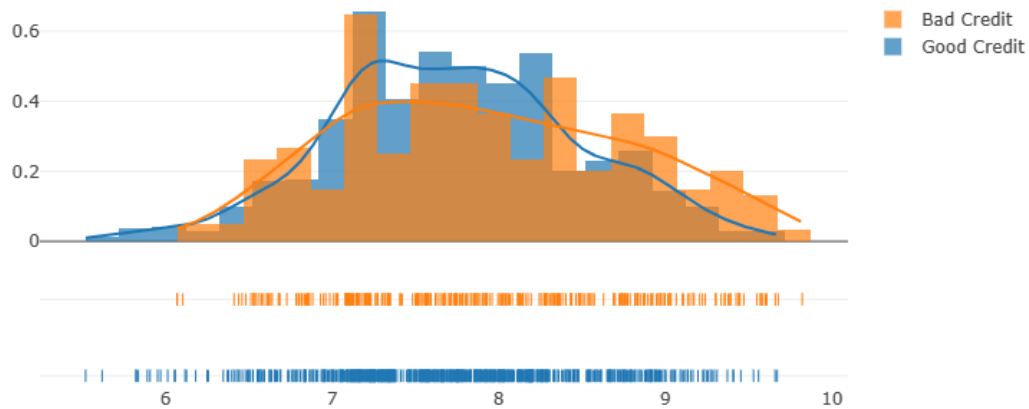
# Add histogram data
x1 = np.log(df_good['Credit amount'])
x2 = np.log(df_bad["Credit amount"])

# Group data together
hist_data = [x1, x2]

group_labels = ['Good Credit', 'Bad Credit']

# Create distplot with custom bin_size
fig = ff.create_distplot(hist_data, group_labels, bin_size=.2)

# Plot!
py.iplot(fig, filename='Distplot with Multiple Datasets')
```



```
[282]: from plotly import tools
import numpy as np
import plotly.graph_objs as go

count_good = go.Bar(
    x = df_good["Saving accounts"].value_counts().index.values,
    y = df_good["Saving accounts"].value_counts().values,
    name='Good credit'
)
count_bad = go.Bar(
    x = df_bad["Saving accounts"].value_counts().index.values,
    y = df_bad["Saving accounts"].value_counts().values,
    name='Bad credit'
)

box_1 = go.Box(
    x=df_good["Saving accounts"],
    y=df_good["Credit amount"],
    name='Good credit'
)
box_2 = go.Box(
    x=df_bad["Saving accounts"],
    y=df_bad["Credit amount"],
    name='Bad credit'
)
```

```

scat_1 = go.Box(
    x=df_good["Saving accounts"],
    y=df_good["Age"],
    name='Good credit'
)
scat_2 = go.Box(
    x=df_bad["Saving accounts"],
    y=df_bad["Age"],
    name='Bad credit'
)

data = [scat_1, scat_2, box_1, box_2, count_good, count_bad]

fig = tools.make_subplots(rows=2, cols=2, specs=[[{}], {}], [{'colspan': 2},
↪None]],
                        subplot_titles=('Count Saving Accounts', 'Credit_
↪Amount by Savings Acc',
                                         'Age by Saving accounts'))

fig.append_trace(count_good, 1, 1)
fig.append_trace(count_bad, 1, 1)

fig.append_trace(box_2, 1, 2)
fig.append_trace(box_1, 1, 2)

fig.append_trace(scat_1, 2, 1)
fig.append_trace(scat_2, 2, 1)

fig['layout'].update(height=700, width=800, title='Saving Accounts_
↪Exploration', boxmode='group')

py.ipplot(fig, filename='combined-savings')

```

This is the format of your plot grid:

```

[ (1,1) x1,y1 ] [ (1,2) x2,y2 ]
[ (2,1) x3,y3   -       ]

```

Saving Accounts Exploration



How can I better configure the legends? I am trying to substitute the graph below, so how can I use the violinplot on subplots of plotly?

```
[283]: print("Description of Distribution Saving accounts by Risk: ")
print(pd.crosstab(df_credit["Saving accounts"],df_credit.Risk))

fig, ax = plt.subplots(3,1, figsize=(12,12))
g = sns.countplot(x="Saving accounts", data=df_credit, palette="hls",
                  ax=ax[0],hue="Risk")
g.set_title("Saving Accounts Count", fontsize=15)
g.set_xlabel("Saving Accounts type", fontsize=12)
g.set_ylabel("Count", fontsize=12)

g1 = sns.violinplot(x="Saving accounts", y="Job", data=df_credit, palette="hls",
                   hue = "Risk", ax=ax[1],split=True)
g1.set_title("Saving Accounts by Job", fontsize=15)
```



```

g1.set_xlabel("Savings Accounts type", fontsize=12)
g1.set_ylabel("Job", fontsize=12)

g = sns.boxplot(x="Saving accounts", y="Credit amount", data=df_credit,
               ↪ax=ax[2],
               hue = "Risk",palette="hls")
g2.set_title("Saving Accounts by Credit Amount", fontsize=15)
g2.set_xlabel("Savings Accounts type", fontsize=12)
g2.set_ylabel("Credit Amount(US)", fontsize=12)

plt.subplots_adjust(hspace = 0.4,top = 0.9)

plt.show()

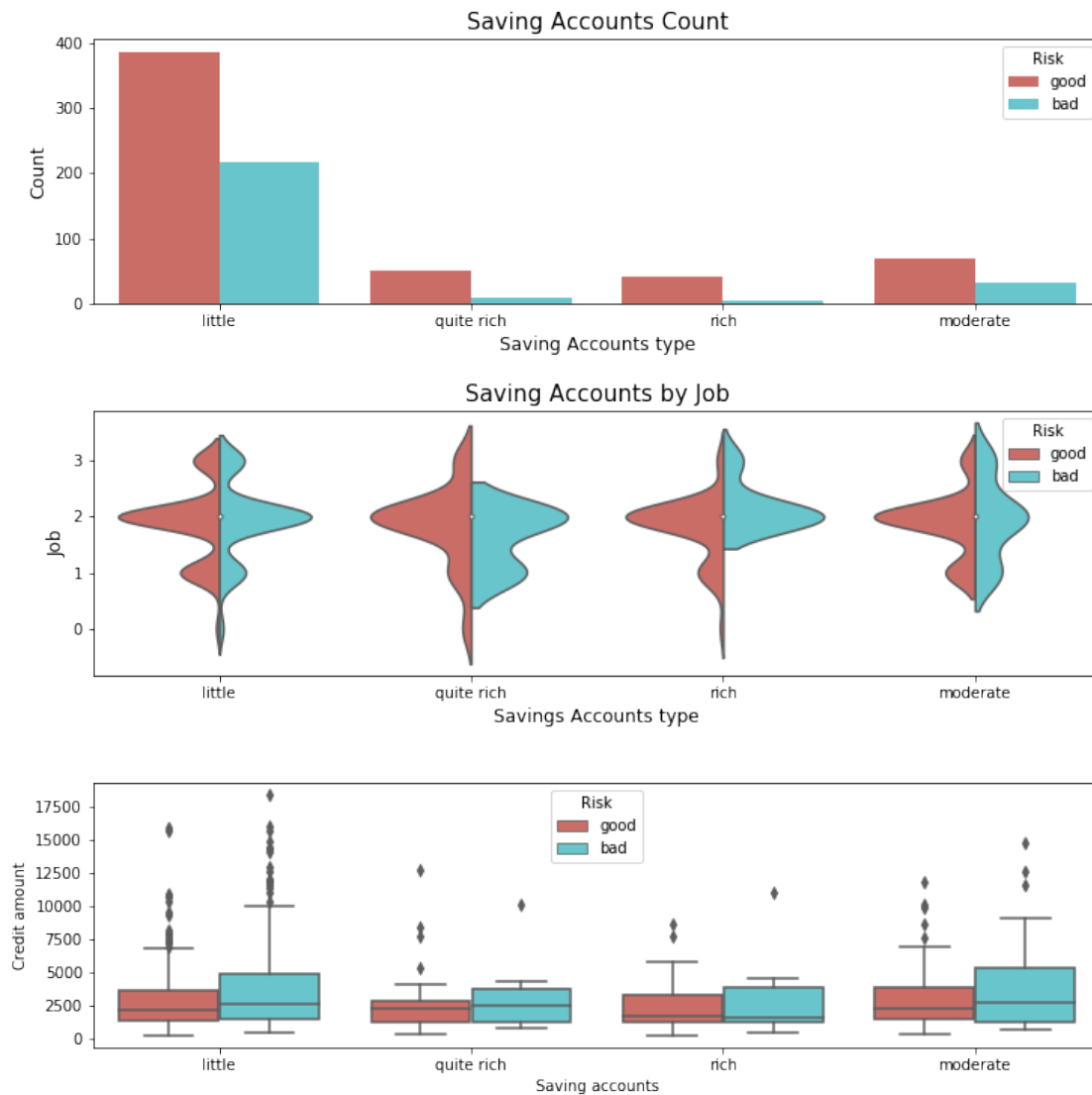
```

Description of Distribution Saving accounts by Risk:

Risk	bad	good
Saving accounts		
little	217	386
moderate	34	69
quite rich	11	52
rich	6	42

/opt/conda/lib/python3.6/site-packages/scipy/stats/stats.py:1713: FutureWarning:

Using a non-tuple sequence for multidimensional indexing is deprecated; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted as an array index, `arr[np.array(seq)]`, which will result either in an error or a different result.



Duration of the loans distribution and density

```
[285]: plt.figure(figsize = (12,14))

g= plt.subplot(311)
g = sns.countplot(x="Duration", data=df_credit,
                  palette="hls", hue = "Risk")
g.set_xlabel("Duration Distribution", fontsize=12)
g.set_ylabel("Count", fontsize=12)
g.set_title("Duration Count", fontsize=20)

g1 = plt.subplot(312)
g1 = sns.pointplot(x="Duration", y = "Credit amount", data=df_credit,
```

```

        hue="Risk", palette="hls")
g1.set_xlabel("Duration", fontsize=12)
g1.set_ylabel("Credit Amount(US)", fontsize=12)
g1.set_title("Credit Amount distribution by Duration", fontsize=20)

g2 = plt.subplot(313)
g2 = sns.distplot(df_good["Duration"], color='g')
g2 = sns.distplot(df_bad["Duration"], color='r')
g2.set_xlabel("Duration", fontsize=12)
g2.set_ylabel("Frequency", fontsize=12)
g2.set_title("Duration Frequency x good and bad Credit", fontsize=20)

plt.subplots_adjust(wspace = 0.4, hspace = 0.4, top = 0.9)

plt.show()

```

/opt/conda/lib/python3.6/site-packages/scipy/stats/stats.py:1713: FutureWarning:

Using a non-tuple sequence for multidimensional indexing is deprecated; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted as an array index, `arr[np.array(seq)]`, which will result either in an error or a different result.

/opt/conda/lib/python3.6/site-packages/matplotlib/axes/_axes.py:6571:

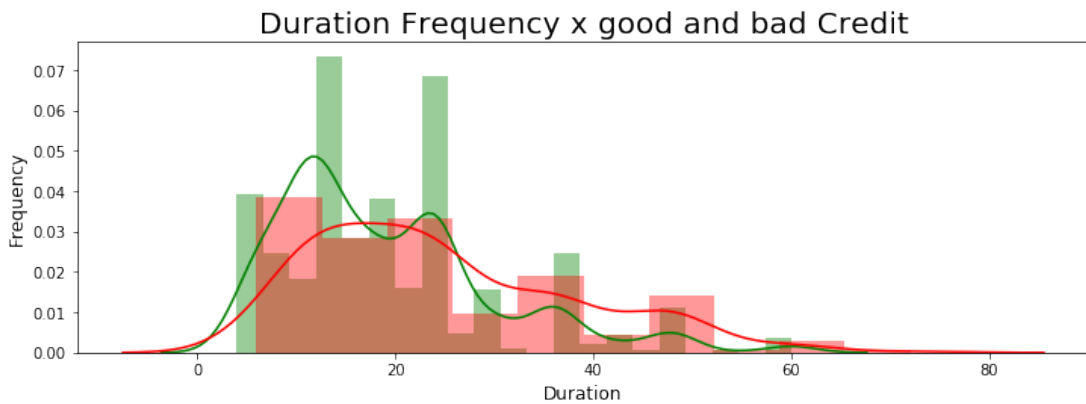
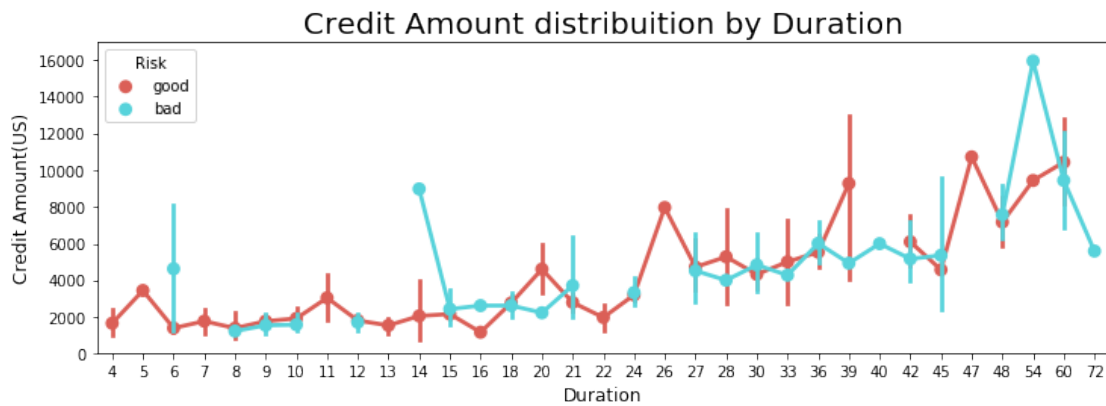
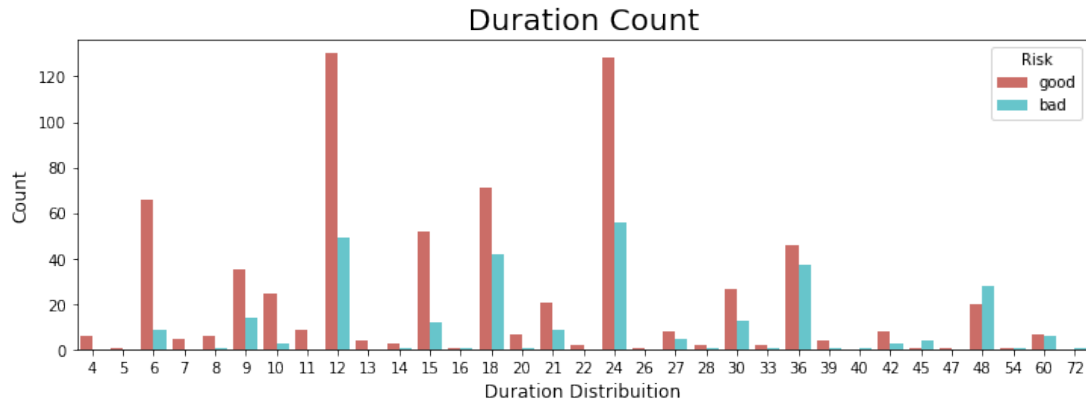
UserWarning:

The 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.

/opt/conda/lib/python3.6/site-packages/matplotlib/axes/_axes.py:6571:

UserWarning:

The 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.



Interesting, we can see that the highest duration have the high amounts. The highest density is between [12 ~ 18 ~ 24] months It all make sense.

Checking Account variable

Now, we will verify the values through Checking Accounts

```
[286]: df_good = df_credit[df_credit["Risk"] == 'good']
df_bad = df_credit[df_credit["Risk"] == 'bad']
```

```

trace0 = go.Box(
    y=df_good["Credit amount"],
    x=df_good["Checking account"],
    name='Good credit',
    marker=dict(
        color='#3D9970'
    )
)

trace1 = go.Box(
    y=df_bad['Credit amount'],
    x=df_bad['Checking account'],
    name='Bad credit',
    marker=dict(
        color='#FF4136'
    )
)

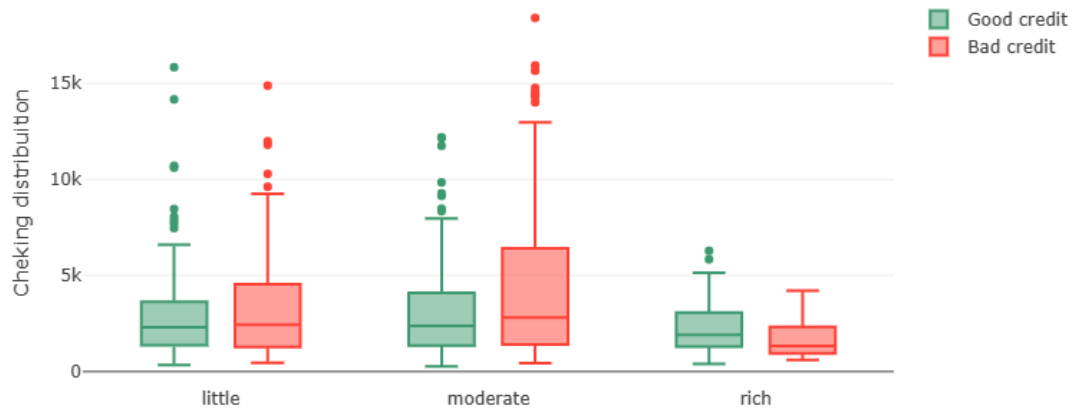
data = [trace0, trace1]

layout = go.Layout(
    yaxis=dict(
        title='Cheking distribution'
    ),
    boxmode='group'
)

fig = go.Figure(data=data, layout=layout)

py.ipplot(fig, filename='box-age-cat')

```



The old plot that I am trying to substitute with interactive plots

```
[287]: print("Total values of the most missing variable: ")
print(df_credit.groupby("Checking account")["Checking account"].count())

plt.figure(figsize = (12,10))

g = plt.subplot(221)
g = sns.countplot(x="Checking account", data=df_credit,
                  palette="hls", hue="Risk")
g.set_xlabel("Checking Account", fontsize=12)
g.set_ylabel("Count", fontsize=12)
g.set_title("Checking Account Counting by Risk", fontsize=20)

g1 = plt.subplot(222)
g1 = sns.violinplot(x="Checking account", y="Age", data=df_credit,
                   palette="hls", hue = "Risk",split=True)
g1.set_xlabel("Checking Account", fontsize=12)
g1.set_ylabel("Age", fontsize=12)
g1.set_title("Age by Checking Account", fontsize=20)

g2 = plt.subplot(212)
g2 = sns.boxplot(x="Checking account",y="Credit amount",
                 data=df_credit,hue='Risk',palette="hls")
g2.set_xlabel("Checking Account", fontsize=12)
g2.set_ylabel("Credit Amount(US)", fontsize=12)
```

```

g2.set_title("Credit Amount by Cheking Account", fontsize=20)

plt.subplots_adjust(wspace = 0.2, hspace = 0.3, top = 0.9)

plt.show()
plt.show()

```

Total values of the most missing variable:

Checking account

little 274

moderate 269

rich 63

Name: Checking account, dtype: int64

/opt/conda/lib/python3.6/site-packages/scipy/stats/stats.py:1713: FutureWarning:

Using a non-tuple sequence for multidimensional indexing is deprecated; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted as an array index, `arr[np.array(seq)]`, which will result either in an error or a different result.



Crosstab session and another to explore our data by another metrics a little deep

```
[289]: plt.figure(figsize = (10,6))

g = sns.violinplot(x="Housing",y="Job",data=df_credit,
                  hue="Risk", palette="hls",split=True)
g.set_xlabel("Housing", fontsize=12)
g.set_ylabel("Job", fontsize=12)
g.set_title("Housing x Job - Dist", fontsize=20)

plt.show()
```

/opt/conda/lib/python3.6/site-packages/scipy/stats/stats.py:1713: FutureWarning:

Using a non-tuple sequence for multidimensional indexing is deprecated; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted as an array index, `arr[np.array(seq)]`, which will result either in an error or a different result.



```
[290]: print(pd.crosstab(df_credit["Checking account"],df_credit.Sex))
```


Sex	female	male
Checking account		
little	88	186
moderate	86	183
rich	20	43

2.1 Looking the total of values in each categorical feature

```
[292]: print("Purpose : ",df_credit.Purpose.unique())
print("Sex : ",df_credit.Sex.unique())
print("Housing : ",df_credit.Housing.unique())
print("Saving accounts : ",df_credit['Saving accounts'].unique())
print("Risk : ",df_credit['Risk'].unique())
print("Checking account : ",df_credit['Checking account'].unique())
print("Aget_cat : ",df_credit['Age_cat'].unique())
```

```
Purpose : ['radio/TV' 'education' 'furniture/equipment' 'car' 'business'
'domestic appliances' 'repairs' 'vacation/others']
Sex : ['male' 'female']
Housing : ['own' 'free' 'rent']
Saving accounts : [nan 'little' 'quite rich' 'rich' 'moderate']
Risk : ['good' 'bad']
Checking account : ['little' 'moderate' nan 'rich']
Aget_cat : [Senior, Student, Adult, Young]
Categories (4, object): [Student < Young < Adult < Senior]
```

2.2 Let's do some feature engineering on this values and create variable Dummies of the values

```
[294]: def one_hot_encoder(df, nan_as_category = False):
original_columns = list(df.columns)
categorical_columns = [col for col in df.columns if df[col].dtype ==
↳'object']
df = pd.get_dummies(df, columns= categorical_columns, dummy_na=
↳nan_as_category, drop_first=True)
new_columns = [c for c in df.columns if c not in original_columns]
return df, new_columns
```

2.3 Transforming the data into Dummy variables

```
[295]: df_credit['Saving accounts'] = df_credit['Saving accounts'].fillna('no_inf')
df_credit['Checking account'] = df_credit['Checking account'].fillna('no_inf')

#Purpose to Dummies Variable
df_credit = df_credit.merge(pd.get_dummies(df_credit.Purpose, drop_first=True,
↳prefix='Purpose'), left_index=True, right_index=True)
#Sex feature in dummies
```

```

df_credit = df_credit.merge(pd.get_dummies(df_credit.Sex, drop_first=True,
    ↪prefix='Sex'), left_index=True, right_index=True)
# Housing get dummies
df_credit = df_credit.merge(pd.get_dummies(df_credit.Housing, drop_first=True,
    ↪prefix='Housing'), left_index=True, right_index=True)
# Housing get Saving Accounts
df_credit = df_credit.merge(pd.get_dummies(df_credit["Saving accounts"],
    ↪drop_first=True, prefix='Savings'), left_index=True, right_index=True)
# Housing get Risk
df_credit = df_credit.merge(pd.get_dummies(df_credit.Risk, prefix='Risk'),
    ↪left_index=True, right_index=True)
# Housing get Checking Account
df_credit = df_credit.merge(pd.get_dummies(df_credit["Checking account"],
    ↪drop_first=True, prefix='Check'), left_index=True, right_index=True)
# Housing get Age categorical
df_credit = df_credit.merge(pd.get_dummies(df_credit["Age_cat"],
    ↪drop_first=True, prefix='Age_cat'), left_index=True, right_index=True)

```

2.4 Deleting the old features

```

[296]: #Excluding the missing columns
del df_credit["Saving accounts"]
del df_credit["Checking account"]
del df_credit["Purpose"]
del df_credit["Sex"]
del df_credit["Housing"]
del df_credit["Age_cat"]
del df_credit["Risk"]
del df_credit['Risk_good']

```

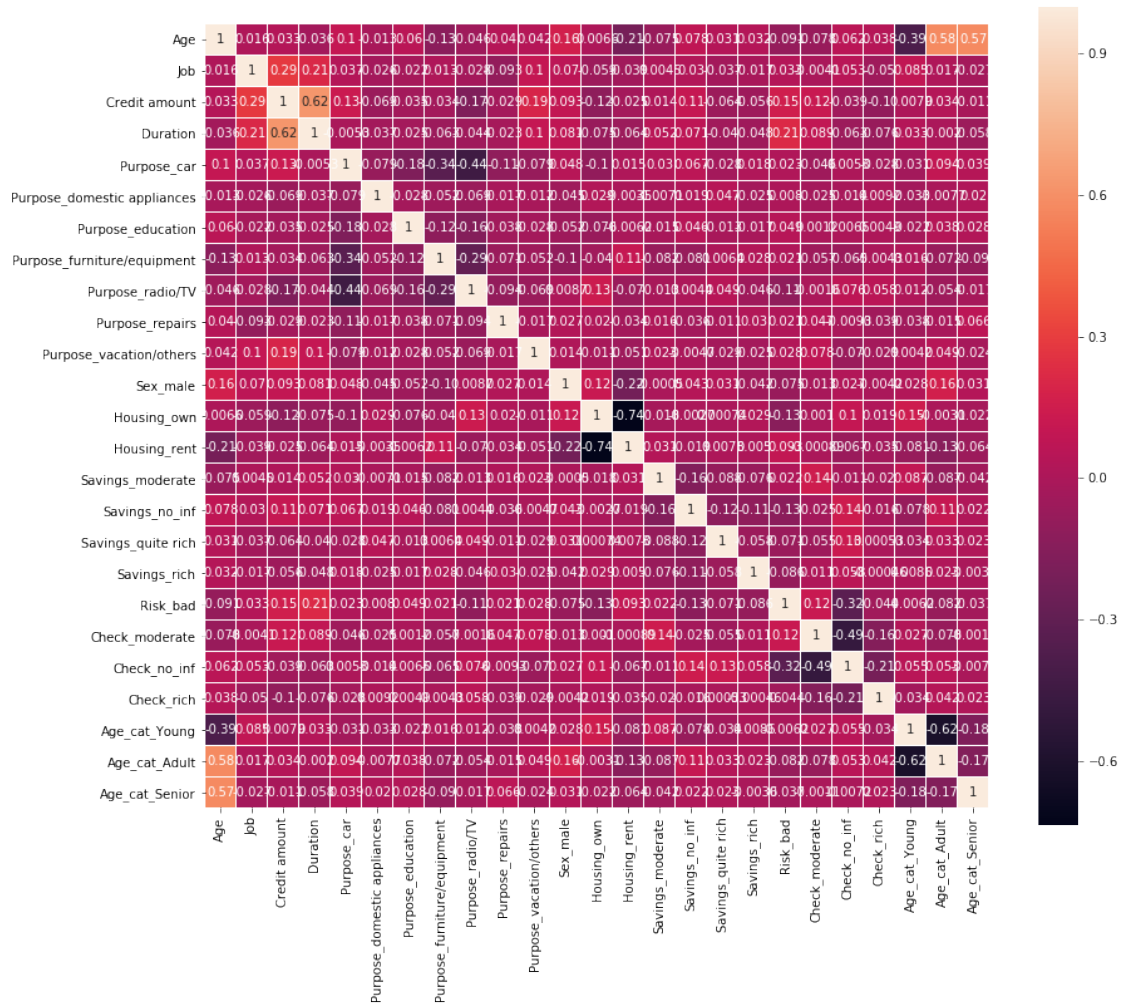
3 5. Correlation:

- Looking the data correlation
Looking the correlation of the data

```

[297]: plt.figure(figsize=(14,12))
sns.heatmap(df_credit.astype(float).corr(),linewidths=0.1,vmax=1.0,
    square=True, linecolor='white', annot=True)
plt.show()

```



4 6. Preprocessing:

```
[299]: from sklearn.model_selection import train_test_split, KFold, cross_val_score #_
        ↪to split the data
from sklearn.metrics import accuracy_score, confusion_matrix,
        ↪classification_report, fbeta_score #To evaluate our model

from sklearn.model_selection import GridSearchCV

from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
```

```

from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
from xgboost import XGBClassifier

```

```
[300]: df_credit['Credit amount'] = np.log(df_credit['Credit amount'])
```

```
[301]: #Creating the X and y variables
X = df_credit.drop('Risk_bad', 1).values
y = df_credit["Risk_bad"].values

# Splitting X and y into train and test version
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.25,
↳random_state=42)

```

```
[302]: # random state
seed = 7

models = []
models.append(('LR', LogisticRegression()))
models.append(('LDA', LinearDiscriminantAnalysis()))
models.append(('KNN', KNeighborsClassifier()))
models.append(('CART', DecisionTreeClassifier()))
models.append(('NB', GaussianNB()))
models.append(('RF', RandomForestClassifier()))
models.append(('SVM', SVC(gamma='auto')))
models.append(('XGB', XGBClassifier()))

# evaluate each model in turn
results = []
names = []
scoring = 'recall'

for name, model in models:
    kfold = KFold(n_splits=10, random_state=seed)
    cv_results = cross_val_score(model, X_train, y_train, cv=kfold,
↳scoring=scoring)
    results.append(cv_results)
    names.append(name)
    msg = "%s: %f (%f)" % (name, cv_results.mean(), cv_results.std())
    print(msg)

# boxplot algorithm comparison
fig = plt.figure(figsize=(11,6))
fig.suptitle('Algorithm Comparison')
ax = fig.add_subplot(111)
plt.boxplot(results)
ax.set_xticklabels(names)

```

```
plt.show()
```

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

```
/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:  
FutureWarning:
```

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:
FutureWarning:

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

/opt/conda/lib/python3.6/site-packages/sklearn/linear_model/logistic.py:432:
FutureWarning:

Default solver will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

LR: 0.387574 (0.077970)
LDA: 0.428815 (0.093162)
KNN: 0.263130 (0.035560)
CART: 0.543739 (0.090978)
NB: 0.596300 (0.081365)

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of n_estimators will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of n_estimators will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of n_estimators will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of n_estimators will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of `n_estimators` will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of `n_estimators` will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of `n_estimators` will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of `n_estimators` will change from 10 in version 0.20 to 100 in 0.22.

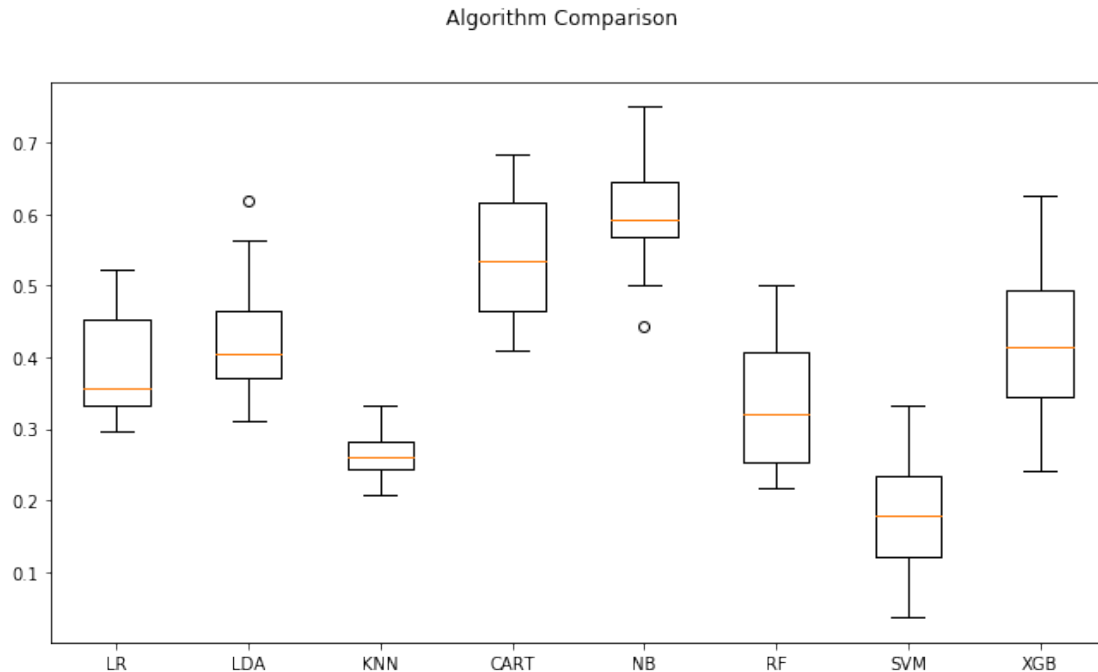
/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of `n_estimators` will change from 10 in version 0.20 to 100 in 0.22.

/opt/conda/lib/python3.6/site-packages/sklearn/ensemble/forest.py:248:
FutureWarning:

The default value of `n_estimators` will change from 10 in version 0.20 to 100 in 0.22.

RF: 0.331457 (0.094337)
SVM: 0.182230 (0.088462)
XGB: 0.422917 (0.110550)



Very interesting. Almost all models shows a low value to recall.

We can observe that our best results was with CART, NB and XGBoost. I will implement some models and try to do a simple Tuning on them

5 7.1 Model 1 :

- Using Random Forest to predictict the credit score
- Some of Validation Parameters

```
[303]: #Seting the Hyper Parameters
param_grid = {"max_depth": [3,5, 7, 10, None],
              "n_estimators": [3,5,10,25,50,150],
              "max_features": [4,7,15,20]}

#Creating the classifier
model = RandomForestClassifier(random_state=2)

grid_search = GridSearchCV(model, param_grid=param_grid, cv=5,
                             scoring='recall', verbose=4)
grid_search.fit(X_train, y_train)
```

Fitting 5 folds for each of 120 candidates, totalling 600 fits

[CV] max_depth=3, max_features=4, n_estimators=3 ...

[CV] max_depth=3, max_features=4, n_estimators=3, score=0.08695652173913043,
total= 0.0s


```

[CV] max_depth=3, max_features=4, n_estimators=3 ...
[CV] max_depth=3, max_features=4, n_estimators=3, score=0.10869565217391304,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=3 ...
[CV] max_depth=3, max_features=4, n_estimators=3, score=0.08695652173913043,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=3 ...
[CV] max_depth=3, max_features=4, n_estimators=3, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=3 ...
[CV] max_depth=3, max_features=4, n_estimators=3, score=0.08888888888888889,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=5 ...
[CV] max_depth=3, max_features=4, n_estimators=5, score=0.08695652173913043,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=5 ...
[CV] max_depth=3, max_features=4, n_estimators=5, score=0.13043478260869565,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=5 ...
[CV] max_depth=3, max_features=4, n_estimators=5, score=0.13043478260869565,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=5 ...
[CV] max_depth=3, max_features=4, n_estimators=5, score=0.11111111111111111,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=5 ...
[CV] max_depth=3, max_features=4, n_estimators=5, score=0.08888888888888889,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=10 ...
[CV] max_depth=3, max_features=4, n_estimators=10, score=0.043478260869565216,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=10 ...
[CV] max_depth=3, max_features=4, n_estimators=10, score=0.10869565217391304,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=10 ...
[CV] max_depth=3, max_features=4, n_estimators=10, score=0.08695652173913043,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=10 ...
[CV] max_depth=3, max_features=4, n_estimators=10, score=0.08888888888888889,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=10 ...
[CV] max_depth=3, max_features=4, n_estimators=10, score=0.044444444444444446,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=25 ...

[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done 1 out of 1 | elapsed: 0.0s remaining: 0.0s
[Parallel(n_jobs=1)]: Done 2 out of 2 | elapsed: 0.0s remaining: 0.0s
[Parallel(n_jobs=1)]: Done 3 out of 3 | elapsed: 0.0s remaining: 0.0s

```

```

[CV] max_depth=3, max_features=4, n_estimators=25, score=0.021739130434782608,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=25 ...
[CV] max_depth=3, max_features=4, n_estimators=25, score=0.06521739130434782,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=25 ...
[CV] max_depth=3, max_features=4, n_estimators=25, score=0.043478260869565216,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=25 ...
[CV] max_depth=3, max_features=4, n_estimators=25, score=0.08888888888888889,
total= 0.2s
[CV] max_depth=3, max_features=4, n_estimators=25 ...
[CV] max_depth=3, max_features=4, n_estimators=25, score=0.022222222222222223,
total= 0.0s
[CV] max_depth=3, max_features=4, n_estimators=50 ...
[CV] max_depth=3, max_features=4, n_estimators=50, score=0.021739130434782608,
total= 0.1s
[CV] max_depth=3, max_features=4, n_estimators=50 ...
[CV] max_depth=3, max_features=4, n_estimators=50, score=0.06521739130434782,
total= 0.1s
[CV] max_depth=3, max_features=4, n_estimators=50 ...
[CV] max_depth=3, max_features=4, n_estimators=50, score=0.06521739130434782,
total= 0.1s
[CV] max_depth=3, max_features=4, n_estimators=50 ...
[CV] max_depth=3, max_features=4, n_estimators=50, score=0.06666666666666667,
total= 0.1s
[CV] max_depth=3, max_features=4, n_estimators=50 ...
[CV] max_depth=3, max_features=4, n_estimators=50, score=0.0, total= 0.1s
[CV] max_depth=3, max_features=4, n_estimators=150 ...
[CV] max_depth=3, max_features=4, n_estimators=150, score=0.043478260869565216,
total= 0.2s
[CV] max_depth=3, max_features=4, n_estimators=150 ...
[CV] max_depth=3, max_features=4, n_estimators=150, score=0.10869565217391304,
total= 0.2s
[CV] max_depth=3, max_features=4, n_estimators=150 ...
[CV] max_depth=3, max_features=4, n_estimators=150, score=0.06521739130434782,
total= 0.2s
[CV] max_depth=3, max_features=4, n_estimators=150 ...
[CV] max_depth=3, max_features=4, n_estimators=150, score=0.044444444444444446,
total= 0.2s
[CV] max_depth=3, max_features=4, n_estimators=150 ...
[CV] max_depth=3, max_features=4, n_estimators=150, score=0.022222222222222223,
total= 0.2s
[CV] max_depth=3, max_features=7, n_estimators=3 ...
[CV] max_depth=3, max_features=7, n_estimators=3, score=0.08695652173913043,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=3 ...
[CV] max_depth=3, max_features=7, n_estimators=3, score=0.2608695652173913,

```

```

total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=3 ...
[CV] max_depth=3, max_features=7, n_estimators=3, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=3 ...
[CV] max_depth=3, max_features=7, n_estimators=3, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=3 ...
[CV] max_depth=3, max_features=7, n_estimators=3, score=0.1111111111111111,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=5 ...
[CV] max_depth=3, max_features=7, n_estimators=5, score=0.13043478260869565,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=5 ...
[CV] max_depth=3, max_features=7, n_estimators=5, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=5 ...
[CV] max_depth=3, max_features=7, n_estimators=5, score=0.17391304347826086,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=5 ...
[CV] max_depth=3, max_features=7, n_estimators=5, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=5 ...
[CV] max_depth=3, max_features=7, n_estimators=5, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=10 ...
[CV] max_depth=3, max_features=7, n_estimators=10, score=0.10869565217391304,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=10 ...
[CV] max_depth=3, max_features=7, n_estimators=10, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=10 ...
[CV] max_depth=3, max_features=7, n_estimators=10, score=0.15217391304347827,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=10 ...
[CV] max_depth=3, max_features=7, n_estimators=10, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=10 ...
[CV] max_depth=3, max_features=7, n_estimators=10, score=0.08888888888888889,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=25 ...
[CV] max_depth=3, max_features=7, n_estimators=25, score=0.08695652173913043,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=25 ...
[CV] max_depth=3, max_features=7, n_estimators=25, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=25 ...
[CV] max_depth=3, max_features=7, n_estimators=25, score=0.10869565217391304,

```

```

total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=25 ...
[CV] max_depth=3, max_features=7, n_estimators=25, score=0.1111111111111111,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=25 ...
[CV] max_depth=3, max_features=7, n_estimators=25, score=0.044444444444444446,
total= 0.0s
[CV] max_depth=3, max_features=7, n_estimators=50 ...
[CV] max_depth=3, max_features=7, n_estimators=50, score=0.06521739130434782,
total= 0.1s
[CV] max_depth=3, max_features=7, n_estimators=50 ...
[CV] max_depth=3, max_features=7, n_estimators=50, score=0.17391304347826086,
total= 0.1s
[CV] max_depth=3, max_features=7, n_estimators=50 ...
[CV] max_depth=3, max_features=7, n_estimators=50, score=0.13043478260869565,
total= 0.1s
[CV] max_depth=3, max_features=7, n_estimators=50 ...
[CV] max_depth=3, max_features=7, n_estimators=50, score=0.13333333333333333,
total= 0.1s
[CV] max_depth=3, max_features=7, n_estimators=50 ...
[CV] max_depth=3, max_features=7, n_estimators=50, score=0.06666666666666667,
total= 0.1s
[CV] max_depth=3, max_features=7, n_estimators=150 ...
[CV] max_depth=3, max_features=7, n_estimators=150, score=0.08695652173913043,
total= 0.2s
[CV] max_depth=3, max_features=7, n_estimators=150 ...
[CV] max_depth=3, max_features=7, n_estimators=150, score=0.1956521739130435,
total= 0.2s
[CV] max_depth=3, max_features=7, n_estimators=150 ...
[CV] max_depth=3, max_features=7, n_estimators=150, score=0.13043478260869565,
total= 0.2s
[CV] max_depth=3, max_features=7, n_estimators=150 ...
[CV] max_depth=3, max_features=7, n_estimators=150, score=0.13333333333333333,
total= 0.2s
[CV] max_depth=3, max_features=7, n_estimators=150 ...
[CV] max_depth=3, max_features=7, n_estimators=150, score=0.08888888888888889,
total= 0.2s
[CV] max_depth=3, max_features=15, n_estimators=3 ...
[CV] max_depth=3, max_features=15, n_estimators=3, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=3 ...
[CV] max_depth=3, max_features=15, n_estimators=3, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=3 ...
[CV] max_depth=3, max_features=15, n_estimators=3, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=3 ...
[CV] max_depth=3, max_features=15, n_estimators=3, score=0.13333333333333333,

```

```

total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=3 ...
[CV] max_depth=3, max_features=15, n_estimators=3, score=0.26666666666666666,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=5 ...
[CV] max_depth=3, max_features=15, n_estimators=5, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=5 ...
[CV] max_depth=3, max_features=15, n_estimators=5, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=5 ...
[CV] max_depth=3, max_features=15, n_estimators=5, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=5 ...
[CV] max_depth=3, max_features=15, n_estimators=5, score=0.2, total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=5 ...
[CV] max_depth=3, max_features=15, n_estimators=5, score=0.24444444444444444,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=10 ...
[CV] max_depth=3, max_features=15, n_estimators=10, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=10 ...
[CV] max_depth=3, max_features=15, n_estimators=10, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=10 ...
[CV] max_depth=3, max_features=15, n_estimators=10, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=10 ...
[CV] max_depth=3, max_features=15, n_estimators=10, score=0.2, total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=10 ...
[CV] max_depth=3, max_features=15, n_estimators=10, score=0.24444444444444444,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=25 ...
[CV] max_depth=3, max_features=15, n_estimators=25, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=25 ...
[CV] max_depth=3, max_features=15, n_estimators=25, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=25 ...
[CV] max_depth=3, max_features=15, n_estimators=25, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=25 ...
[CV] max_depth=3, max_features=15, n_estimators=25, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=25 ...
[CV] max_depth=3, max_features=15, n_estimators=25, score=0.24444444444444444,
total= 0.0s
[CV] max_depth=3, max_features=15, n_estimators=50 ...

```

```

[CV] max_depth=3, max_features=15, n_estimators=50, score=0.1956521739130435,
total= 0.1s
[CV] max_depth=3, max_features=15, n_estimators=50 ...
[CV] max_depth=3, max_features=15, n_estimators=50, score=0.2608695652173913,
total= 0.1s
[CV] max_depth=3, max_features=15, n_estimators=50 ...
[CV] max_depth=3, max_features=15, n_estimators=50, score=0.2391304347826087,
total= 0.1s
[CV] max_depth=3, max_features=15, n_estimators=50 ...
[CV] max_depth=3, max_features=15, n_estimators=50, score=0.24444444444444444,
total= 0.1s
[CV] max_depth=3, max_features=15, n_estimators=50 ...
[CV] max_depth=3, max_features=15, n_estimators=50, score=0.26666666666666666,
total= 0.1s
[CV] max_depth=3, max_features=15, n_estimators=150 ...
[CV] max_depth=3, max_features=15, n_estimators=150, score=0.17391304347826086,
total= 0.2s
[CV] max_depth=3, max_features=15, n_estimators=150 ...
[CV] max_depth=3, max_features=15, n_estimators=150, score=0.2826086956521739,
total= 0.2s
[CV] max_depth=3, max_features=15, n_estimators=150 ...
[CV] max_depth=3, max_features=15, n_estimators=150, score=0.2391304347826087,
total= 0.2s
[CV] max_depth=3, max_features=15, n_estimators=150 ...
[CV] max_depth=3, max_features=15, n_estimators=150, score=0.24444444444444444,
total= 0.2s
[CV] max_depth=3, max_features=15, n_estimators=150 ...
[CV] max_depth=3, max_features=15, n_estimators=150, score=0.28888888888888886,
total= 0.2s
[CV] max_depth=3, max_features=20, n_estimators=3 ...
[CV] max_depth=3, max_features=20, n_estimators=3, score=0.10869565217391304,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=3 ...
[CV] max_depth=3, max_features=20, n_estimators=3, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=3 ...
[CV] max_depth=3, max_features=20, n_estimators=3, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=3 ...
[CV] max_depth=3, max_features=20, n_estimators=3, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=3 ...
[CV] max_depth=3, max_features=20, n_estimators=3, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=5 ...
[CV] max_depth=3, max_features=20, n_estimators=5, score=0.13043478260869565,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=5 ...

```

```

[CV] max_depth=3, max_features=20, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=5 ...
[CV] max_depth=3, max_features=20, n_estimators=5, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=5 ...
[CV] max_depth=3, max_features=20, n_estimators=5, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=5 ...
[CV] max_depth=3, max_features=20, n_estimators=5, score=0.26666666666666666,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=10 ...
[CV] max_depth=3, max_features=20, n_estimators=10, score=0.13043478260869565,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=10 ...
[CV] max_depth=3, max_features=20, n_estimators=10, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=10 ...
[CV] max_depth=3, max_features=20, n_estimators=10, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=10 ...
[CV] max_depth=3, max_features=20, n_estimators=10, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=10 ...
[CV] max_depth=3, max_features=20, n_estimators=10, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=25 ...
[CV] max_depth=3, max_features=20, n_estimators=25, score=0.15217391304347827,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=25 ...
[CV] max_depth=3, max_features=20, n_estimators=25, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=25 ...
[CV] max_depth=3, max_features=20, n_estimators=25, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=25 ...
[CV] max_depth=3, max_features=20, n_estimators=25, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=25 ...
[CV] max_depth=3, max_features=20, n_estimators=25, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=3, max_features=20, n_estimators=50 ...
[CV] max_depth=3, max_features=20, n_estimators=50, score=0.17391304347826086,
total= 0.1s
[CV] max_depth=3, max_features=20, n_estimators=50 ...
[CV] max_depth=3, max_features=20, n_estimators=50, score=0.3695652173913043,
total= 0.1s
[CV] max_depth=3, max_features=20, n_estimators=50 ...

```

```

[CV] max_depth=3, max_features=20, n_estimators=50, score=0.21739130434782608,
total= 0.1s
[CV] max_depth=3, max_features=20, n_estimators=50 ...
[CV] max_depth=3, max_features=20, n_estimators=50, score=0.24444444444444444,
total= 0.1s
[CV] max_depth=3, max_features=20, n_estimators=50 ...
[CV] max_depth=3, max_features=20, n_estimators=50, score=0.26666666666666666,
total= 0.1s
[CV] max_depth=3, max_features=20, n_estimators=150 ...
[CV] max_depth=3, max_features=20, n_estimators=150, score=0.21739130434782608,
total= 0.3s
[CV] max_depth=3, max_features=20, n_estimators=150 ...
[CV] max_depth=3, max_features=20, n_estimators=150, score=0.34782608695652173,
total= 0.3s
[CV] max_depth=3, max_features=20, n_estimators=150 ...
[CV] max_depth=3, max_features=20, n_estimators=150, score=0.2391304347826087,
total= 0.2s
[CV] max_depth=3, max_features=20, n_estimators=150 ...
[CV] max_depth=3, max_features=20, n_estimators=150, score=0.24444444444444444,
total= 0.2s
[CV] max_depth=3, max_features=20, n_estimators=150 ...
[CV] max_depth=3, max_features=20, n_estimators=150, score=0.28888888888888886,
total= 0.2s
[CV] max_depth=5, max_features=4, n_estimators=3 ...
[CV] max_depth=5, max_features=4, n_estimators=3, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=3 ...
[CV] max_depth=5, max_features=4, n_estimators=3, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=3 ...
[CV] max_depth=5, max_features=4, n_estimators=3, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=3 ...
[CV] max_depth=5, max_features=4, n_estimators=3, score=0.26666666666666666,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=3 ...
[CV] max_depth=5, max_features=4, n_estimators=3, score=0.24444444444444444,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=5 ...
[CV] max_depth=5, max_features=4, n_estimators=5, score=0.15217391304347827,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=5 ...
[CV] max_depth=5, max_features=4, n_estimators=5, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=5 ...
[CV] max_depth=5, max_features=4, n_estimators=5, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=5 ...

```



```

[CV] max_depth=5, max_features=4, n_estimators=5, score=0.2, total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=5 ...
[CV] max_depth=5, max_features=4, n_estimators=5, score=0.17777777777777778,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=10 ...
[CV] max_depth=5, max_features=4, n_estimators=10, score=0.15217391304347827,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=10 ...
[CV] max_depth=5, max_features=4, n_estimators=10, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=10 ...
[CV] max_depth=5, max_features=4, n_estimators=10, score=0.17391304347826086,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=10 ...
[CV] max_depth=5, max_features=4, n_estimators=10, score=0.15555555555555556,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=10 ...
[CV] max_depth=5, max_features=4, n_estimators=10, score=0.08888888888888889,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=25 ...
[CV] max_depth=5, max_features=4, n_estimators=25, score=0.10869565217391304,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=25 ...
[CV] max_depth=5, max_features=4, n_estimators=25, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=25 ...
[CV] max_depth=5, max_features=4, n_estimators=25, score=0.15217391304347827,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=25 ...
[CV] max_depth=5, max_features=4, n_estimators=25, score=0.13333333333333333,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=25 ...
[CV] max_depth=5, max_features=4, n_estimators=25, score=0.17777777777777778,
total= 0.0s
[CV] max_depth=5, max_features=4, n_estimators=50 ...
[CV] max_depth=5, max_features=4, n_estimators=50, score=0.10869565217391304,
total= 0.1s
[CV] max_depth=5, max_features=4, n_estimators=50 ...
[CV] max_depth=5, max_features=4, n_estimators=50, score=0.1956521739130435,
total= 0.1s
[CV] max_depth=5, max_features=4, n_estimators=50 ...
[CV] max_depth=5, max_features=4, n_estimators=50, score=0.15217391304347827,
total= 0.1s
[CV] max_depth=5, max_features=4, n_estimators=50 ...
[CV] max_depth=5, max_features=4, n_estimators=50, score=0.15555555555555556,
total= 0.1s
[CV] max_depth=5, max_features=4, n_estimators=50 ...
[CV] max_depth=5, max_features=4, n_estimators=50, score=0.15555555555555556,

```

```

total= 0.1s
[CV] max_depth=5, max_features=4, n_estimators=150 ...
[CV] max_depth=5, max_features=4, n_estimators=150, score=0.08695652173913043,
total= 0.2s
[CV] max_depth=5, max_features=4, n_estimators=150 ...
[CV] max_depth=5, max_features=4, n_estimators=150, score=0.2391304347826087,
total= 0.2s
[CV] max_depth=5, max_features=4, n_estimators=150 ...
[CV] max_depth=5, max_features=4, n_estimators=150, score=0.17391304347826086,
total= 0.2s
[CV] max_depth=5, max_features=4, n_estimators=150 ...
[CV] max_depth=5, max_features=4, n_estimators=150, score=0.2, total= 0.2s
[CV] max_depth=5, max_features=4, n_estimators=150 ...
[CV] max_depth=5, max_features=4, n_estimators=150, score=0.2, total= 0.2s
[CV] max_depth=5, max_features=7, n_estimators=3 ...
[CV] max_depth=5, max_features=7, n_estimators=3, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=3 ...
[CV] max_depth=5, max_features=7, n_estimators=3, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=3 ...
[CV] max_depth=5, max_features=7, n_estimators=3, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=3 ...
[CV] max_depth=5, max_features=7, n_estimators=3, score=0.35555555555555557,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=3 ...
[CV] max_depth=5, max_features=7, n_estimators=3, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=5 ...
[CV] max_depth=5, max_features=7, n_estimators=5, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=5 ...
[CV] max_depth=5, max_features=7, n_estimators=5, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=5 ...
[CV] max_depth=5, max_features=7, n_estimators=5, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=5 ...
[CV] max_depth=5, max_features=7, n_estimators=5, score=0.26666666666666666,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=5 ...
[CV] max_depth=5, max_features=7, n_estimators=5, score=0.2, total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=10 ...
[CV] max_depth=5, max_features=7, n_estimators=10, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=10 ...
[CV] max_depth=5, max_features=7, n_estimators=10, score=0.391304347826087,

```

```

total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=10 ...
[CV] max_depth=5, max_features=7, n_estimators=10, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=10 ...
[CV] max_depth=5, max_features=7, n_estimators=10, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=10 ...
[CV] max_depth=5, max_features=7, n_estimators=10, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=25 ...
[CV] max_depth=5, max_features=7, n_estimators=25, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=25 ...
[CV] max_depth=5, max_features=7, n_estimators=25, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=25 ...
[CV] max_depth=5, max_features=7, n_estimators=25, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=25 ...
[CV] max_depth=5, max_features=7, n_estimators=25, score=0.24444444444444444,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=25 ...
[CV] max_depth=5, max_features=7, n_estimators=25, score=0.26666666666666666,
total= 0.0s
[CV] max_depth=5, max_features=7, n_estimators=50 ...
[CV] max_depth=5, max_features=7, n_estimators=50, score=0.15217391304347827,
total= 0.1s
[CV] max_depth=5, max_features=7, n_estimators=50 ...
[CV] max_depth=5, max_features=7, n_estimators=50, score=0.30434782608695654,
total= 0.1s
[CV] max_depth=5, max_features=7, n_estimators=50 ...
[CV] max_depth=5, max_features=7, n_estimators=50, score=0.21739130434782608,
total= 0.1s
[CV] max_depth=5, max_features=7, n_estimators=50 ...
[CV] max_depth=5, max_features=7, n_estimators=50, score=0.24444444444444444,
total= 0.1s
[CV] max_depth=5, max_features=7, n_estimators=50 ...
[CV] max_depth=5, max_features=7, n_estimators=50, score=0.26666666666666666,
total= 0.1s
[CV] max_depth=5, max_features=7, n_estimators=150 ...
[CV] max_depth=5, max_features=7, n_estimators=150, score=0.17391304347826086,
total= 0.2s
[CV] max_depth=5, max_features=7, n_estimators=150 ...
[CV] max_depth=5, max_features=7, n_estimators=150, score=0.2826086956521739,
total= 0.2s
[CV] max_depth=5, max_features=7, n_estimators=150 ...
[CV] max_depth=5, max_features=7, n_estimators=150, score=0.2391304347826087,

```

```

total= 0.2s
[CV] max_depth=5, max_features=7, n_estimators=150 ...
[CV] max_depth=5, max_features=7, n_estimators=150, score=0.24444444444444444,
total= 0.2s
[CV] max_depth=5, max_features=7, n_estimators=150 ...
[CV] max_depth=5, max_features=7, n_estimators=150, score=0.26666666666666666,
total= 0.2s
[CV] max_depth=5, max_features=15, n_estimators=3 ...
[CV] max_depth=5, max_features=15, n_estimators=3, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=3 ...
[CV] max_depth=5, max_features=15, n_estimators=3, score=0.391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=3 ...
[CV] max_depth=5, max_features=15, n_estimators=3, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=3 ...
[CV] max_depth=5, max_features=15, n_estimators=3, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=3 ...
[CV] max_depth=5, max_features=15, n_estimators=3, score=0.28888888888888886,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=5 ...
[CV] max_depth=5, max_features=15, n_estimators=5, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=5 ...
[CV] max_depth=5, max_features=15, n_estimators=5, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=5 ...
[CV] max_depth=5, max_features=15, n_estimators=5, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=5 ...
[CV] max_depth=5, max_features=15, n_estimators=5, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=5 ...
[CV] max_depth=5, max_features=15, n_estimators=5, score=0.37777777777777777,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=10 ...
[CV] max_depth=5, max_features=15, n_estimators=10, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=10 ...
[CV] max_depth=5, max_features=15, n_estimators=10, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=10 ...
[CV] max_depth=5, max_features=15, n_estimators=10, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=10 ...
[CV] max_depth=5, max_features=15, n_estimators=10, score=0.28888888888888886,

```

```

total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=10 ...
[CV] max_depth=5, max_features=15, n_estimators=10, score=0.4, total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=25 ...
[CV] max_depth=5, max_features=15, n_estimators=25, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=25 ...
[CV] max_depth=5, max_features=15, n_estimators=25, score=0.43478260869565216,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=25 ...
[CV] max_depth=5, max_features=15, n_estimators=25, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=25 ...
[CV] max_depth=5, max_features=15, n_estimators=25, score=0.3333333333333333,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=25 ...
[CV] max_depth=5, max_features=15, n_estimators=25, score=0.35555555555555557,
total= 0.0s
[CV] max_depth=5, max_features=15, n_estimators=50 ...
[CV] max_depth=5, max_features=15, n_estimators=50, score=0.2608695652173913,
total= 0.1s
[CV] max_depth=5, max_features=15, n_estimators=50 ...
[CV] max_depth=5, max_features=15, n_estimators=50, score=0.391304347826087,
total= 0.1s
[CV] max_depth=5, max_features=15, n_estimators=50 ...
[CV] max_depth=5, max_features=15, n_estimators=50, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=5, max_features=15, n_estimators=50 ...
[CV] max_depth=5, max_features=15, n_estimators=50, score=0.3333333333333333,
total= 0.1s
[CV] max_depth=5, max_features=15, n_estimators=50 ...
[CV] max_depth=5, max_features=15, n_estimators=50, score=0.4222222222222222,
total= 0.1s
[CV] max_depth=5, max_features=15, n_estimators=150 ...
[CV] max_depth=5, max_features=15, n_estimators=150, score=0.2608695652173913,
total= 0.3s
[CV] max_depth=5, max_features=15, n_estimators=150 ...
[CV] max_depth=5, max_features=15, n_estimators=150, score=0.41304347826086957,
total= 0.3s
[CV] max_depth=5, max_features=15, n_estimators=150 ...
[CV] max_depth=5, max_features=15, n_estimators=150, score=0.34782608695652173,
total= 0.3s
[CV] max_depth=5, max_features=15, n_estimators=150 ...
[CV] max_depth=5, max_features=15, n_estimators=150, score=0.35555555555555557,
total= 0.3s
[CV] max_depth=5, max_features=15, n_estimators=150 ...
[CV] max_depth=5, max_features=15, n_estimators=150, score=0.4, total= 0.3s
[CV] max_depth=5, max_features=20, n_estimators=3 ...

```

```

[CV] max_depth=5, max_features=20, n_estimators=3, score=0.2391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=3 ...
[CV] max_depth=5, max_features=20, n_estimators=3, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=3 ...
[CV] max_depth=5, max_features=20, n_estimators=3, score=0.391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=3 ...
[CV] max_depth=5, max_features=20, n_estimators=3, score=0.35555555555555557,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=3 ...
[CV] max_depth=5, max_features=20, n_estimators=3, score=0.35555555555555557,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=5 ...
[CV] max_depth=5, max_features=20, n_estimators=5, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=5 ...
[CV] max_depth=5, max_features=20, n_estimators=5, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=5 ...
[CV] max_depth=5, max_features=20, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=5 ...
[CV] max_depth=5, max_features=20, n_estimators=5, score=0.37777777777777777,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=5 ...
[CV] max_depth=5, max_features=20, n_estimators=5, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=10 ...
[CV] max_depth=5, max_features=20, n_estimators=10, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=10 ...
[CV] max_depth=5, max_features=20, n_estimators=10, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=10 ...
[CV] max_depth=5, max_features=20, n_estimators=10, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=10 ...
[CV] max_depth=5, max_features=20, n_estimators=10, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=10 ...
[CV] max_depth=5, max_features=20, n_estimators=10, score=0.4, total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=25 ...
[CV] max_depth=5, max_features=20, n_estimators=25, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=25 ...
[CV] max_depth=5, max_features=20, n_estimators=25, score=0.41304347826086957,

```

```

total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=25 ...
[CV] max_depth=5, max_features=20, n_estimators=25, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=25 ...
[CV] max_depth=5, max_features=20, n_estimators=25, score=0.3111111111111111,
total= 0.1s
[CV] max_depth=5, max_features=20, n_estimators=25 ...
[CV] max_depth=5, max_features=20, n_estimators=25, score=0.4444444444444444,
total= 0.0s
[CV] max_depth=5, max_features=20, n_estimators=50 ...
[CV] max_depth=5, max_features=20, n_estimators=50, score=0.2826086956521739,
total= 0.1s
[CV] max_depth=5, max_features=20, n_estimators=50 ...
[CV] max_depth=5, max_features=20, n_estimators=50, score=0.43478260869565216,
total= 0.1s
[CV] max_depth=5, max_features=20, n_estimators=50 ...
[CV] max_depth=5, max_features=20, n_estimators=50, score=0.30434782608695654,
total= 0.1s
[CV] max_depth=5, max_features=20, n_estimators=50 ...
[CV] max_depth=5, max_features=20, n_estimators=50, score=0.3333333333333333,
total= 0.1s
[CV] max_depth=5, max_features=20, n_estimators=50 ...
[CV] max_depth=5, max_features=20, n_estimators=50, score=0.4222222222222222,
total= 0.1s
[CV] max_depth=5, max_features=20, n_estimators=150 ...
[CV] max_depth=5, max_features=20, n_estimators=150, score=0.2608695652173913,
total= 0.3s
[CV] max_depth=5, max_features=20, n_estimators=150 ...
[CV] max_depth=5, max_features=20, n_estimators=150, score=0.43478260869565216,
total= 0.3s
[CV] max_depth=5, max_features=20, n_estimators=150 ...
[CV] max_depth=5, max_features=20, n_estimators=150, score=0.32608695652173914,
total= 0.3s
[CV] max_depth=5, max_features=20, n_estimators=150 ...
[CV] max_depth=5, max_features=20, n_estimators=150, score=0.3111111111111111,
total= 0.3s
[CV] max_depth=5, max_features=20, n_estimators=150 ...
[CV] max_depth=5, max_features=20, n_estimators=150, score=0.4, total= 0.3s
[CV] max_depth=7, max_features=4, n_estimators=3 ...
[CV] max_depth=7, max_features=4, n_estimators=3, score=0.21739130434782608,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=3 ...
[CV] max_depth=7, max_features=4, n_estimators=3, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=3 ...
[CV] max_depth=7, max_features=4, n_estimators=3, score=0.32608695652173914,
total= 0.0s

```

```

[CV] max_depth=7, max_features=4, n_estimators=3 ...
[CV] max_depth=7, max_features=4, n_estimators=3, score=0.2888888888888886,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=3 ...
[CV] max_depth=7, max_features=4, n_estimators=3, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=5 ...
[CV] max_depth=7, max_features=4, n_estimators=5, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=5 ...
[CV] max_depth=7, max_features=4, n_estimators=5, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=5 ...
[CV] max_depth=7, max_features=4, n_estimators=5, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=5 ...
[CV] max_depth=7, max_features=4, n_estimators=5, score=0.2888888888888886,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=5 ...
[CV] max_depth=7, max_features=4, n_estimators=5, score=0.3777777777777777,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=10 ...
[CV] max_depth=7, max_features=4, n_estimators=10, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=10 ...
[CV] max_depth=7, max_features=4, n_estimators=10, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=10 ...
[CV] max_depth=7, max_features=4, n_estimators=10, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=10 ...
[CV] max_depth=7, max_features=4, n_estimators=10, score=0.3555555555555557,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=10 ...
[CV] max_depth=7, max_features=4, n_estimators=10, score=0.2888888888888886,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=25 ...
[CV] max_depth=7, max_features=4, n_estimators=25, score=0.1956521739130435,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=25 ...
[CV] max_depth=7, max_features=4, n_estimators=25, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=25 ...
[CV] max_depth=7, max_features=4, n_estimators=25, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=25 ...
[CV] max_depth=7, max_features=4, n_estimators=25, score=0.3111111111111111,
total= 0.0s

```



```

[CV] max_depth=7, max_features=4, n_estimators=25 ...
[CV] max_depth=7, max_features=4, n_estimators=25, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=7, max_features=4, n_estimators=50 ...
[CV] max_depth=7, max_features=4, n_estimators=50, score=0.15217391304347827,
total= 0.1s
[CV] max_depth=7, max_features=4, n_estimators=50 ...
[CV] max_depth=7, max_features=4, n_estimators=50, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=7, max_features=4, n_estimators=50 ...
[CV] max_depth=7, max_features=4, n_estimators=50, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=7, max_features=4, n_estimators=50 ...
[CV] max_depth=7, max_features=4, n_estimators=50, score=0.3111111111111111,
total= 0.1s
[CV] max_depth=7, max_features=4, n_estimators=50 ...
[CV] max_depth=7, max_features=4, n_estimators=50, score=0.3111111111111111,
total= 0.1s
[CV] max_depth=7, max_features=4, n_estimators=150 ...
[CV] max_depth=7, max_features=4, n_estimators=150, score=0.1956521739130435,
total= 0.2s
[CV] max_depth=7, max_features=4, n_estimators=150 ...
[CV] max_depth=7, max_features=4, n_estimators=150, score=0.32608695652173914,
total= 0.2s
[CV] max_depth=7, max_features=4, n_estimators=150 ...
[CV] max_depth=7, max_features=4, n_estimators=150, score=0.34782608695652173,
total= 0.2s
[CV] max_depth=7, max_features=4, n_estimators=150 ...
[CV] max_depth=7, max_features=4, n_estimators=150, score=0.3333333333333333,
total= 0.2s
[CV] max_depth=7, max_features=4, n_estimators=150 ...
[CV] max_depth=7, max_features=4, n_estimators=150, score=0.3111111111111111,
total= 0.2s
[CV] max_depth=7, max_features=7, n_estimators=3 ...
[CV] max_depth=7, max_features=7, n_estimators=3, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=3 ...
[CV] max_depth=7, max_features=7, n_estimators=3, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=3 ...
[CV] max_depth=7, max_features=7, n_estimators=3, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=3 ...
[CV] max_depth=7, max_features=7, n_estimators=3, score=0.4, total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=3 ...
[CV] max_depth=7, max_features=7, n_estimators=3, score=0.4666666666666667,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=5 ...

```

```

[CV] max_depth=7, max_features=7, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=5 ...
[CV] max_depth=7, max_features=7, n_estimators=5, score=0.5217391304347826,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=5 ...
[CV] max_depth=7, max_features=7, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=5 ...
[CV] max_depth=7, max_features=7, n_estimators=5, score=0.3777777777777777,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=5 ...
[CV] max_depth=7, max_features=7, n_estimators=5, score=0.5333333333333333,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=10 ...
[CV] max_depth=7, max_features=7, n_estimators=10, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=10 ...
[CV] max_depth=7, max_features=7, n_estimators=10, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=10 ...
[CV] max_depth=7, max_features=7, n_estimators=10, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=10 ...
[CV] max_depth=7, max_features=7, n_estimators=10, score=0.3333333333333333,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=10 ...
[CV] max_depth=7, max_features=7, n_estimators=10, score=0.4444444444444444,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=25 ...
[CV] max_depth=7, max_features=7, n_estimators=25, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=25 ...
[CV] max_depth=7, max_features=7, n_estimators=25, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=25 ...
[CV] max_depth=7, max_features=7, n_estimators=25, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=25 ...
[CV] max_depth=7, max_features=7, n_estimators=25, score=0.28888888888888886,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=25 ...
[CV] max_depth=7, max_features=7, n_estimators=25, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=7, max_features=7, n_estimators=50 ...
[CV] max_depth=7, max_features=7, n_estimators=50, score=0.2826086956521739,
total= 0.1s
[CV] max_depth=7, max_features=7, n_estimators=50 ...

```

[CV] max_depth=7, max_features=7, n_estimators=50, score=0.3695652173913043,
 total= 0.1s
 [CV] max_depth=7, max_features=7, n_estimators=50 ...
 [CV] max_depth=7, max_features=7, n_estimators=50, score=0.391304347826087,
 total= 0.1s
 [CV] max_depth=7, max_features=7, n_estimators=50 ...
 [CV] max_depth=7, max_features=7, n_estimators=50, score=0.3111111111111111,
 total= 0.1s
 [CV] max_depth=7, max_features=7, n_estimators=50 ...
 [CV] max_depth=7, max_features=7, n_estimators=50, score=0.3555555555555557,
 total= 0.1s
 [CV] max_depth=7, max_features=7, n_estimators=150 ...
 [CV] max_depth=7, max_features=7, n_estimators=150, score=0.2391304347826087,
 total= 0.2s
 [CV] max_depth=7, max_features=7, n_estimators=150 ...
 [CV] max_depth=7, max_features=7, n_estimators=150, score=0.41304347826086957,
 total= 0.2s
 [CV] max_depth=7, max_features=7, n_estimators=150 ...
 [CV] max_depth=7, max_features=7, n_estimators=150, score=0.41304347826086957,
 total= 0.2s
 [CV] max_depth=7, max_features=7, n_estimators=150 ...
 [CV] max_depth=7, max_features=7, n_estimators=150, score=0.3555555555555557,
 total= 0.2s
 [CV] max_depth=7, max_features=7, n_estimators=150 ...
 [CV] max_depth=7, max_features=7, n_estimators=150, score=0.3333333333333333,
 total= 0.2s
 [CV] max_depth=7, max_features=15, n_estimators=3 ...
 [CV] max_depth=7, max_features=15, n_estimators=3, score=0.2608695652173913,
 total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=3 ...
 [CV] max_depth=7, max_features=15, n_estimators=3, score=0.5, total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=3 ...
 [CV] max_depth=7, max_features=15, n_estimators=3, score=0.391304347826087,
 total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=3 ...
 [CV] max_depth=7, max_features=15, n_estimators=3, score=0.3777777777777777,
 total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=3 ...
 [CV] max_depth=7, max_features=15, n_estimators=3, score=0.3777777777777777,
 total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=5 ...
 [CV] max_depth=7, max_features=15, n_estimators=5, score=0.32608695652173914,
 total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=5 ...
 [CV] max_depth=7, max_features=15, n_estimators=5, score=0.41304347826086957,
 total= 0.0s
 [CV] max_depth=7, max_features=15, n_estimators=5 ...
 [CV] max_depth=7, max_features=15, n_estimators=5, score=0.3695652173913043,

```

total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=5 ...
[CV] max_depth=7, max_features=15, n_estimators=5, score=0.3555555555555557,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=5 ...
[CV] max_depth=7, max_features=15, n_estimators=5, score=0.3555555555555557,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=10 ...
[CV] max_depth=7, max_features=15, n_estimators=10, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=10 ...
[CV] max_depth=7, max_features=15, n_estimators=10, score=0.43478260869565216,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=10 ...
[CV] max_depth=7, max_features=15, n_estimators=10, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=10 ...
[CV] max_depth=7, max_features=15, n_estimators=10, score=0.3555555555555557,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=10 ...
[CV] max_depth=7, max_features=15, n_estimators=10, score=0.3777777777777777,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=25 ...
[CV] max_depth=7, max_features=15, n_estimators=25, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=25 ...
[CV] max_depth=7, max_features=15, n_estimators=25, score=0.5, total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=25 ...
[CV] max_depth=7, max_features=15, n_estimators=25, score=0.391304347826087,
total= 0.0s
[CV] max_depth=7, max_features=15, n_estimators=25 ...
[CV] max_depth=7, max_features=15, n_estimators=25, score=0.3777777777777777,
total= 0.1s
[CV] max_depth=7, max_features=15, n_estimators=25 ...
[CV] max_depth=7, max_features=15, n_estimators=25, score=0.4444444444444444,
total= 0.1s
[CV] max_depth=7, max_features=15, n_estimators=50 ...
[CV] max_depth=7, max_features=15, n_estimators=50, score=0.3695652173913043,
total= 0.1s
[CV] max_depth=7, max_features=15, n_estimators=50 ...
[CV] max_depth=7, max_features=15, n_estimators=50, score=0.45652173913043476,
total= 0.1s
[CV] max_depth=7, max_features=15, n_estimators=50 ...
[CV] max_depth=7, max_features=15, n_estimators=50, score=0.41304347826086957,
total= 0.1s
[CV] max_depth=7, max_features=15, n_estimators=50 ...
[CV] max_depth=7, max_features=15, n_estimators=50, score=0.3333333333333333,
total= 0.1s

```

[CV] max_depth=7, max_features=15, n_estimators=50 ...
 [CV] max_depth=7, max_features=15, n_estimators=50, score=0.5333333333333333,
 total= 0.1s
 [CV] max_depth=7, max_features=15, n_estimators=150 ...
 [CV] max_depth=7, max_features=15, n_estimators=150, score=0.2826086956521739,
 total= 0.3s
 [CV] max_depth=7, max_features=15, n_estimators=150 ...
 [CV] max_depth=7, max_features=15, n_estimators=150, score=0.41304347826086957,
 total= 0.3s
 [CV] max_depth=7, max_features=15, n_estimators=150 ...
 [CV] max_depth=7, max_features=15, n_estimators=150, score=0.45652173913043476,
 total= 0.3s
 [CV] max_depth=7, max_features=15, n_estimators=150 ...
 [CV] max_depth=7, max_features=15, n_estimators=150, score=0.3333333333333333,
 total= 0.3s
 [CV] max_depth=7, max_features=15, n_estimators=150 ...
 [CV] max_depth=7, max_features=15, n_estimators=150, score=0.5111111111111111,
 total= 0.3s
 [CV] max_depth=7, max_features=20, n_estimators=3 ...
 [CV] max_depth=7, max_features=20, n_estimators=3, score=0.30434782608695654,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=3 ...
 [CV] max_depth=7, max_features=20, n_estimators=3, score=0.5217391304347826,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=3 ...
 [CV] max_depth=7, max_features=20, n_estimators=3, score=0.45652173913043476,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=3 ...
 [CV] max_depth=7, max_features=20, n_estimators=3, score=0.4, total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=3 ...
 [CV] max_depth=7, max_features=20, n_estimators=3, score=0.4888888888888889,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=5 ...
 [CV] max_depth=7, max_features=20, n_estimators=5, score=0.32608695652173914,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=5 ...
 [CV] max_depth=7, max_features=20, n_estimators=5, score=0.43478260869565216,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=5 ...
 [CV] max_depth=7, max_features=20, n_estimators=5, score=0.4782608695652174,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=5 ...
 [CV] max_depth=7, max_features=20, n_estimators=5, score=0.4444444444444444,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=5 ...
 [CV] max_depth=7, max_features=20, n_estimators=5, score=0.4444444444444444,
 total= 0.0s
 [CV] max_depth=7, max_features=20, n_estimators=10 ...

```

[CV] max_depth=7, max_features=20, n_estimators=10, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=7, max_features=20, n_estimators=10 ...
[CV] max_depth=7, max_features=20, n_estimators=10, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=7, max_features=20, n_estimators=10 ...
[CV] max_depth=7, max_features=20, n_estimators=10, score=0.43478260869565216,
total= 0.0s
[CV] max_depth=7, max_features=20, n_estimators=10 ...
[CV] max_depth=7, max_features=20, n_estimators=10, score=0.3333333333333333,
total= 0.0s
[CV] max_depth=7, max_features=20, n_estimators=10 ...
[CV] max_depth=7, max_features=20, n_estimators=10, score=0.5111111111111111,
total= 0.0s
[CV] max_depth=7, max_features=20, n_estimators=25 ...
[CV] max_depth=7, max_features=20, n_estimators=25, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=25 ...
[CV] max_depth=7, max_features=20, n_estimators=25, score=0.41304347826086957,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=25 ...
[CV] max_depth=7, max_features=20, n_estimators=25, score=0.43478260869565216,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=25 ...
[CV] max_depth=7, max_features=20, n_estimators=25, score=0.35555555555555557,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=25 ...
[CV] max_depth=7, max_features=20, n_estimators=25, score=0.5333333333333333,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=50 ...
[CV] max_depth=7, max_features=20, n_estimators=50, score=0.34782608695652173,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=50 ...
[CV] max_depth=7, max_features=20, n_estimators=50, score=0.43478260869565216,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=50 ...
[CV] max_depth=7, max_features=20, n_estimators=50, score=0.43478260869565216,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=50 ...
[CV] max_depth=7, max_features=20, n_estimators=50, score=0.4, total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=50 ...
[CV] max_depth=7, max_features=20, n_estimators=50, score=0.5111111111111111,
total= 0.1s
[CV] max_depth=7, max_features=20, n_estimators=150 ...
[CV] max_depth=7, max_features=20, n_estimators=150, score=0.34782608695652173,
total= 0.3s
[CV] max_depth=7, max_features=20, n_estimators=150 ...
[CV] max_depth=7, max_features=20, n_estimators=150, score=0.45652173913043476,

```

```

total= 0.3s
[CV] max_depth=7, max_features=20, n_estimators=150 ...
[CV] max_depth=7, max_features=20, n_estimators=150, score=0.4782608695652174,
total= 0.3s
[CV] max_depth=7, max_features=20, n_estimators=150 ...
[CV] max_depth=7, max_features=20, n_estimators=150, score=0.37777777777777777,
total= 0.3s
[CV] max_depth=7, max_features=20, n_estimators=150 ...
[CV] max_depth=7, max_features=20, n_estimators=150, score=0.5333333333333333,
total= 0.3s
[CV] max_depth=10, max_features=4, n_estimators=3 ...
[CV] max_depth=10, max_features=4, n_estimators=3, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=3 ...
[CV] max_depth=10, max_features=4, n_estimators=3, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=3 ...
[CV] max_depth=10, max_features=4, n_estimators=3, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=3 ...
[CV] max_depth=10, max_features=4, n_estimators=3, score=0.37777777777777777,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=3 ...
[CV] max_depth=10, max_features=4, n_estimators=3, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=5 ...
[CV] max_depth=10, max_features=4, n_estimators=5, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=5 ...
[CV] max_depth=10, max_features=4, n_estimators=5, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=5 ...
[CV] max_depth=10, max_features=4, n_estimators=5, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=5 ...
[CV] max_depth=10, max_features=4, n_estimators=5, score=0.2222222222222222,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=5 ...
[CV] max_depth=10, max_features=4, n_estimators=5, score=0.4444444444444444,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=10 ...
[CV] max_depth=10, max_features=4, n_estimators=10, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=10 ...
[CV] max_depth=10, max_features=4, n_estimators=10, score=0.391304347826087,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=10 ...
[CV] max_depth=10, max_features=4, n_estimators=10, score=0.391304347826087,

```

```

total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=10 ...
[CV] max_depth=10, max_features=4, n_estimators=10, score=0.3333333333333333,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=10 ...
[CV] max_depth=10, max_features=4, n_estimators=10, score=0.3777777777777777,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=25 ...
[CV] max_depth=10, max_features=4, n_estimators=25, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=25 ...
[CV] max_depth=10, max_features=4, n_estimators=25, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=25 ...
[CV] max_depth=10, max_features=4, n_estimators=25, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=25 ...
[CV] max_depth=10, max_features=4, n_estimators=25, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=25 ...
[CV] max_depth=10, max_features=4, n_estimators=25, score=0.3333333333333333,
total= 0.0s
[CV] max_depth=10, max_features=4, n_estimators=50 ...
[CV] max_depth=10, max_features=4, n_estimators=50, score=0.30434782608695654,
total= 0.1s
[CV] max_depth=10, max_features=4, n_estimators=50 ...
[CV] max_depth=10, max_features=4, n_estimators=50, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=10, max_features=4, n_estimators=50 ...
[CV] max_depth=10, max_features=4, n_estimators=50, score=0.43478260869565216,
total= 0.1s
[CV] max_depth=10, max_features=4, n_estimators=50 ...
[CV] max_depth=10, max_features=4, n_estimators=50, score=0.3333333333333333,
total= 0.1s
[CV] max_depth=10, max_features=4, n_estimators=50 ...
[CV] max_depth=10, max_features=4, n_estimators=50, score=0.3777777777777777,
total= 0.1s
[CV] max_depth=10, max_features=4, n_estimators=150 ...
[CV] max_depth=10, max_features=4, n_estimators=150, score=0.2608695652173913,
total= 0.2s
[CV] max_depth=10, max_features=4, n_estimators=150 ...
[CV] max_depth=10, max_features=4, n_estimators=150, score=0.34782608695652173,
total= 0.2s
[CV] max_depth=10, max_features=4, n_estimators=150 ...
[CV] max_depth=10, max_features=4, n_estimators=150, score=0.3695652173913043,
total= 0.2s
[CV] max_depth=10, max_features=4, n_estimators=150 ...
[CV] max_depth=10, max_features=4, n_estimators=150, score=0.35555555555555557,

```



```

total= 0.2s
[CV] max_depth=10, max_features=4, n_estimators=150 ...
[CV] max_depth=10, max_features=4, n_estimators=150, score=0.3555555555555557,
total= 0.2s
[CV] max_depth=10, max_features=7, n_estimators=3 ...
[CV] max_depth=10, max_features=7, n_estimators=3, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=3 ...
[CV] max_depth=10, max_features=7, n_estimators=3, score=0.391304347826087,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=3 ...
[CV] max_depth=10, max_features=7, n_estimators=3, score=0.391304347826087,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=3 ...
[CV] max_depth=10, max_features=7, n_estimators=3, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=3 ...
[CV] max_depth=10, max_features=7, n_estimators=3, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=5 ...
[CV] max_depth=10, max_features=7, n_estimators=5, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=5 ...
[CV] max_depth=10, max_features=7, n_estimators=5, score=0.30434782608695654,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=5 ...
[CV] max_depth=10, max_features=7, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=5 ...
[CV] max_depth=10, max_features=7, n_estimators=5, score=0.28888888888888886,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=5 ...
[CV] max_depth=10, max_features=7, n_estimators=5, score=0.3555555555555557,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=10 ...
[CV] max_depth=10, max_features=7, n_estimators=10, score=0.2826086956521739,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=10 ...
[CV] max_depth=10, max_features=7, n_estimators=10, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=10 ...
[CV] max_depth=10, max_features=7, n_estimators=10, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=10 ...
[CV] max_depth=10, max_features=7, n_estimators=10, score=0.28888888888888886,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=10 ...
[CV] max_depth=10, max_features=7, n_estimators=10, score=0.4666666666666667,

```

```

total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=25 ...
[CV] max_depth=10, max_features=7, n_estimators=25, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=25 ...
[CV] max_depth=10, max_features=7, n_estimators=25, score=0.43478260869565216,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=25 ...
[CV] max_depth=10, max_features=7, n_estimators=25, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=25 ...
[CV] max_depth=10, max_features=7, n_estimators=25, score=0.37777777777777777,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=25 ...
[CV] max_depth=10, max_features=7, n_estimators=25, score=0.35555555555555557,
total= 0.0s
[CV] max_depth=10, max_features=7, n_estimators=50 ...
[CV] max_depth=10, max_features=7, n_estimators=50, score=0.2826086956521739,
total= 0.1s
[CV] max_depth=10, max_features=7, n_estimators=50 ...
[CV] max_depth=10, max_features=7, n_estimators=50, score=0.391304347826087,
total= 0.1s
[CV] max_depth=10, max_features=7, n_estimators=50 ...
[CV] max_depth=10, max_features=7, n_estimators=50, score=0.41304347826086957,
total= 0.1s
[CV] max_depth=10, max_features=7, n_estimators=50 ...
[CV] max_depth=10, max_features=7, n_estimators=50, score=0.4, total= 0.1s
[CV] max_depth=10, max_features=7, n_estimators=50 ...
[CV] max_depth=10, max_features=7, n_estimators=50, score=0.35555555555555557,
total= 0.1s
[CV] max_depth=10, max_features=7, n_estimators=150 ...
[CV] max_depth=10, max_features=7, n_estimators=150, score=0.2826086956521739,
total= 0.3s
[CV] max_depth=10, max_features=7, n_estimators=150 ...
[CV] max_depth=10, max_features=7, n_estimators=150, score=0.3695652173913043,
total= 0.3s
[CV] max_depth=10, max_features=7, n_estimators=150 ...
[CV] max_depth=10, max_features=7, n_estimators=150, score=0.45652173913043476,
total= 0.2s
[CV] max_depth=10, max_features=7, n_estimators=150 ...
[CV] max_depth=10, max_features=7, n_estimators=150, score=0.35555555555555557,
total= 0.2s
[CV] max_depth=10, max_features=7, n_estimators=150 ...
[CV] max_depth=10, max_features=7, n_estimators=150, score=0.4222222222222222,
total= 0.3s
[CV] max_depth=10, max_features=15, n_estimators=3 ...
[CV] max_depth=10, max_features=15, n_estimators=3, score=0.4782608695652174,
total= 0.0s

```

```

[CV] max_depth=10, max_features=15, n_estimators=3 ...
[CV] max_depth=10, max_features=15, n_estimators=3, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=3 ...
[CV] max_depth=10, max_features=15, n_estimators=3, score=0.5, total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=3 ...
[CV] max_depth=10, max_features=15, n_estimators=3, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=3 ...
[CV] max_depth=10, max_features=15, n_estimators=3, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=5 ...
[CV] max_depth=10, max_features=15, n_estimators=5, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=5 ...
[CV] max_depth=10, max_features=15, n_estimators=5, score=0.5217391304347826,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=5 ...
[CV] max_depth=10, max_features=15, n_estimators=5, score=0.4782608695652174,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=5 ...
[CV] max_depth=10, max_features=15, n_estimators=5, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=5 ...
[CV] max_depth=10, max_features=15, n_estimators=5, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=10 ...
[CV] max_depth=10, max_features=15, n_estimators=10, score=0.391304347826087,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=10 ...
[CV] max_depth=10, max_features=15, n_estimators=10, score=0.5217391304347826,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=10 ...
[CV] max_depth=10, max_features=15, n_estimators=10, score=0.5, total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=10 ...
[CV] max_depth=10, max_features=15, n_estimators=10, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=10 ...
[CV] max_depth=10, max_features=15, n_estimators=10, score=0.5333333333333333,
total= 0.0s
[CV] max_depth=10, max_features=15, n_estimators=25 ...
[CV] max_depth=10, max_features=15, n_estimators=25, score=0.30434782608695654,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=25 ...
[CV] max_depth=10, max_features=15, n_estimators=25, score=0.5434782608695652,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=25 ...
[CV] max_depth=10, max_features=15, n_estimators=25, score=0.45652173913043476,

```

```

total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=25 ...
[CV] max_depth=10, max_features=15, n_estimators=25, score=0.35555555555555557,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=25 ...
[CV] max_depth=10, max_features=15, n_estimators=25, score=0.5111111111111111,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=50 ...
[CV] max_depth=10, max_features=15, n_estimators=50, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=50 ...
[CV] max_depth=10, max_features=15, n_estimators=50, score=0.4782608695652174,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=50 ...
[CV] max_depth=10, max_features=15, n_estimators=50, score=0.5, total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=50 ...
[CV] max_depth=10, max_features=15, n_estimators=50, score=0.3333333333333333,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=50 ...
[CV] max_depth=10, max_features=15, n_estimators=50, score=0.5333333333333333,
total= 0.1s
[CV] max_depth=10, max_features=15, n_estimators=150 ...
[CV] max_depth=10, max_features=15, n_estimators=150,
score=0.32608695652173914, total= 0.3s
[CV] max_depth=10, max_features=15, n_estimators=150 ...
[CV] max_depth=10, max_features=15, n_estimators=150, score=0.4782608695652174,
total= 0.3s
[CV] max_depth=10, max_features=15, n_estimators=150 ...
[CV] max_depth=10, max_features=15, n_estimators=150, score=0.5, total= 0.3s
[CV] max_depth=10, max_features=15, n_estimators=150 ...
[CV] max_depth=10, max_features=15, n_estimators=150, score=0.4, total= 0.3s
[CV] max_depth=10, max_features=15, n_estimators=150 ...
[CV] max_depth=10, max_features=15, n_estimators=150, score=0.4888888888888889,
total= 0.3s
[CV] max_depth=10, max_features=20, n_estimators=3 ...
[CV] max_depth=10, max_features=20, n_estimators=3, score=0.2608695652173913,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=3 ...
[CV] max_depth=10, max_features=20, n_estimators=3, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=3 ...
[CV] max_depth=10, max_features=20, n_estimators=3, score=0.4444444444444444,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=3 ...
[CV] max_depth=10, max_features=20, n_estimators=3, score=0.4, total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=5 ...

```

```

[CV] max_depth=10, max_features=20, n_estimators=5, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=5 ...
[CV] max_depth=10, max_features=20, n_estimators=5, score=0.41304347826086957,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=5 ...
[CV] max_depth=10, max_features=20, n_estimators=5, score=0.5217391304347826,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=5 ...
[CV] max_depth=10, max_features=20, n_estimators=5, score=0.4444444444444444,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=5 ...
[CV] max_depth=10, max_features=20, n_estimators=5, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=10 ...
[CV] max_depth=10, max_features=20, n_estimators=10, score=0.391304347826087,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=10 ...
[CV] max_depth=10, max_features=20, n_estimators=10, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=10 ...
[CV] max_depth=10, max_features=20, n_estimators=10, score=0.5434782608695652,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=10 ...
[CV] max_depth=10, max_features=20, n_estimators=10, score=0.37777777777777777,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=10 ...
[CV] max_depth=10, max_features=20, n_estimators=10, score=0.5111111111111111,
total= 0.0s
[CV] max_depth=10, max_features=20, n_estimators=25 ...
[CV] max_depth=10, max_features=20, n_estimators=25, score=0.34782608695652173,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=25 ...
[CV] max_depth=10, max_features=20, n_estimators=25, score=0.43478260869565216,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=25 ...
[CV] max_depth=10, max_features=20, n_estimators=25, score=0.5652173913043478,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=25 ...
[CV] max_depth=10, max_features=20, n_estimators=25, score=0.35555555555555557,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=25 ...
[CV] max_depth=10, max_features=20, n_estimators=25, score=0.5555555555555556,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=50 ...
[CV] max_depth=10, max_features=20, n_estimators=50, score=0.32608695652173914,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=50 ...

```

```

[CV] max_depth=10, max_features=20, n_estimators=50, score=0.5, total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=50 ...
[CV] max_depth=10, max_features=20, n_estimators=50, score=0.5, total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=50 ...
[CV] max_depth=10, max_features=20, n_estimators=50, score=0.4, total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=50 ...
[CV] max_depth=10, max_features=20, n_estimators=50, score=0.5555555555555556,
total= 0.1s
[CV] max_depth=10, max_features=20, n_estimators=150 ...
[CV] max_depth=10, max_features=20, n_estimators=150, score=0.3695652173913043,
total= 0.4s
[CV] max_depth=10, max_features=20, n_estimators=150 ...
[CV] max_depth=10, max_features=20, n_estimators=150,
score=0.45652173913043476, total= 0.4s
[CV] max_depth=10, max_features=20, n_estimators=150 ...
[CV] max_depth=10, max_features=20, n_estimators=150, score=0.5434782608695652,
total= 0.4s
[CV] max_depth=10, max_features=20, n_estimators=150 ...
[CV] max_depth=10, max_features=20, n_estimators=150, score=0.3333333333333333,
total= 0.4s
[CV] max_depth=10, max_features=20, n_estimators=150 ...
[CV] max_depth=10, max_features=20, n_estimators=150, score=0.4888888888888889,
total= 0.4s
[CV] max_depth=None, max_features=4, n_estimators=3 ...
[CV] max_depth=None, max_features=4, n_estimators=3, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=3 ...
[CV] max_depth=None, max_features=4, n_estimators=3, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=3 ...
[CV] max_depth=None, max_features=4, n_estimators=3, score=0.45652173913043476,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=3 ...
[CV] max_depth=None, max_features=4, n_estimators=3, score=0.5333333333333333,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=3 ...
[CV] max_depth=None, max_features=4, n_estimators=3, score=0.4444444444444444,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=5 ...
[CV] max_depth=None, max_features=4, n_estimators=5, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=5 ...
[CV] max_depth=None, max_features=4, n_estimators=5, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=5 ...
[CV] max_depth=None, max_features=4, n_estimators=5, score=0.5, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=5 ...
[CV] max_depth=None, max_features=4, n_estimators=5, score=0.4222222222222222,

```

```

total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=5 ...
[CV] max_depth=None, max_features=4, n_estimators=5, score=0.4, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=10 ...
[CV] max_depth=None, max_features=4, n_estimators=10,
score=0.21739130434782608, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=10 ...
[CV] max_depth=None, max_features=4, n_estimators=10, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=10 ...
[CV] max_depth=None, max_features=4, n_estimators=10,
score=0.43478260869565216, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=10 ...
[CV] max_depth=None, max_features=4, n_estimators=10,
score=0.28888888888888886, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=10 ...
[CV] max_depth=None, max_features=4, n_estimators=10,
score=0.35555555555555557, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=25 ...
[CV] max_depth=None, max_features=4, n_estimators=25,
score=0.34782608695652173, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=25 ...
[CV] max_depth=None, max_features=4, n_estimators=25, score=0.391304347826087,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=25 ...
[CV] max_depth=None, max_features=4, n_estimators=25, score=0.4782608695652174,
total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=25 ...
[CV] max_depth=None, max_features=4, n_estimators=25, score=0.4, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=25 ...
[CV] max_depth=None, max_features=4, n_estimators=25, score=0.4, total= 0.0s
[CV] max_depth=None, max_features=4, n_estimators=50 ...
[CV] max_depth=None, max_features=4, n_estimators=50, score=0.2608695652173913,
total= 0.1s
[CV] max_depth=None, max_features=4, n_estimators=50 ...
[CV] max_depth=None, max_features=4, n_estimators=50, score=0.391304347826087,
total= 0.1s
[CV] max_depth=None, max_features=4, n_estimators=50 ...
[CV] max_depth=None, max_features=4, n_estimators=50, score=0.4782608695652174,
total= 0.1s
[CV] max_depth=None, max_features=4, n_estimators=50 ...
[CV] max_depth=None, max_features=4, n_estimators=50,
score=0.35555555555555557, total= 0.1s
[CV] max_depth=None, max_features=4, n_estimators=50 ...
[CV] max_depth=None, max_features=4, n_estimators=50,
score=0.37777777777777777, total= 0.1s
[CV] max_depth=None, max_features=4, n_estimators=150 ...
[CV] max_depth=None, max_features=4, n_estimators=150,

```

```

score=0.2608695652173913, total= 0.3s
[CV] max_depth=None, max_features=4, n_estimators=150 ...
[CV] max_depth=None, max_features=4, n_estimators=150, score=0.391304347826087,
total= 0.3s
[CV] max_depth=None, max_features=4, n_estimators=150 ...
[CV] max_depth=None, max_features=4, n_estimators=150, score=0.391304347826087,
total= 0.2s
[CV] max_depth=None, max_features=4, n_estimators=150 ...
[CV] max_depth=None, max_features=4, n_estimators=150,
score=0.3777777777777777, total= 0.3s
[CV] max_depth=None, max_features=4, n_estimators=150 ...
[CV] max_depth=None, max_features=4, n_estimators=150, score=0.4, total= 0.2s
[CV] max_depth=None, max_features=7, n_estimators=3 ...
[CV] max_depth=None, max_features=7, n_estimators=3, score=0.3695652173913043,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=3 ...
[CV] max_depth=None, max_features=7, n_estimators=3, score=0.34782608695652173,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=3 ...
[CV] max_depth=None, max_features=7, n_estimators=3, score=0.6521739130434783,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=3 ...
[CV] max_depth=None, max_features=7, n_estimators=3, score=0.4, total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=3 ...
[CV] max_depth=None, max_features=7, n_estimators=3, score=0.5555555555555556,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=5 ...
[CV] max_depth=None, max_features=7, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=5 ...
[CV] max_depth=None, max_features=7, n_estimators=5, score=0.32608695652173914,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=5 ...
[CV] max_depth=None, max_features=7, n_estimators=5, score=0.5217391304347826,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=5 ...
[CV] max_depth=None, max_features=7, n_estimators=5, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=5 ...
[CV] max_depth=None, max_features=7, n_estimators=5, score=0.5555555555555556,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=10 ...
[CV] max_depth=None, max_features=7, n_estimators=10,
score=0.43478260869565216, total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=10 ...
[CV] max_depth=None, max_features=7, n_estimators=10,
score=0.30434782608695654, total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=10 ...

```



```

[CV] max_depth=None, max_features=7, n_estimators=10, score=0.4782608695652174,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=10 ...
[CV] max_depth=None, max_features=7, n_estimators=10, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=10 ...
[CV] max_depth=None, max_features=7, n_estimators=10, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=25 ...
[CV] max_depth=None, max_features=7, n_estimators=25,
score=0.34782608695652173, total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=25 ...
[CV] max_depth=None, max_features=7, n_estimators=25, score=0.391304347826087,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=25 ...
[CV] max_depth=None, max_features=7, n_estimators=25, score=0.5652173913043478,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=25 ...
[CV] max_depth=None, max_features=7, n_estimators=25, score=0.4, total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=25 ...
[CV] max_depth=None, max_features=7, n_estimators=25, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=None, max_features=7, n_estimators=50 ...
[CV] max_depth=None, max_features=7, n_estimators=50,
score=0.32608695652173914, total= 0.1s
[CV] max_depth=None, max_features=7, n_estimators=50 ...
[CV] max_depth=None, max_features=7, n_estimators=50,
score=0.32608695652173914, total= 0.1s
[CV] max_depth=None, max_features=7, n_estimators=50 ...
[CV] max_depth=None, max_features=7, n_estimators=50, score=0.5, total= 0.1s
[CV] max_depth=None, max_features=7, n_estimators=50 ...
[CV] max_depth=None, max_features=7, n_estimators=50,
score=0.37777777777777777, total= 0.1s
[CV] max_depth=None, max_features=7, n_estimators=50 ...
[CV] max_depth=None, max_features=7, n_estimators=50, score=0.4444444444444444,
total= 0.1s
[CV] max_depth=None, max_features=7, n_estimators=150 ...
[CV] max_depth=None, max_features=7, n_estimators=150,
score=0.32608695652173914, total= 0.3s
[CV] max_depth=None, max_features=7, n_estimators=150 ...
[CV] max_depth=None, max_features=7, n_estimators=150,
score=0.34782608695652173, total= 0.3s
[CV] max_depth=None, max_features=7, n_estimators=150 ...
[CV] max_depth=None, max_features=7, n_estimators=150,
score=0.45652173913043476, total= 0.3s
[CV] max_depth=None, max_features=7, n_estimators=150 ...
[CV] max_depth=None, max_features=7, n_estimators=150,
score=0.35555555555555557, total= 0.3s

```

```

[CV] max_depth=None, max_features=7, n_estimators=150 ...
[CV] max_depth=None, max_features=7, n_estimators=150,
score=0.4222222222222222, total= 0.3s
[CV] max_depth=None, max_features=15, n_estimators=3 ...
[CV] max_depth=None, max_features=15, n_estimators=3,
score=0.41304347826086957, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=3 ...
[CV] max_depth=None, max_features=15, n_estimators=3,
score=0.43478260869565216, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=3 ...
[CV] max_depth=None, max_features=15, n_estimators=3,
score=0.45652173913043476, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=3 ...
[CV] max_depth=None, max_features=15, n_estimators=3, score=0.5111111111111111,
total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=3 ...
[CV] max_depth=None, max_features=15, n_estimators=3, score=0.3111111111111111,
total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=5 ...
[CV] max_depth=None, max_features=15, n_estimators=5, score=0.391304347826087,
total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=5 ...
[CV] max_depth=None, max_features=15, n_estimators=5,
score=0.43478260869565216, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=5 ...
[CV] max_depth=None, max_features=15, n_estimators=5, score=0.5217391304347826,
total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=5 ...
[CV] max_depth=None, max_features=15, n_estimators=5, score=0.4, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=5 ...
[CV] max_depth=None, max_features=15, n_estimators=5, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=10 ...
[CV] max_depth=None, max_features=15, n_estimators=10,
score=0.34782608695652173, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=10 ...
[CV] max_depth=None, max_features=15, n_estimators=10,
score=0.34782608695652173, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=10 ...
[CV] max_depth=None, max_features=15, n_estimators=10,
score=0.4782608695652174, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=10 ...
[CV] max_depth=None, max_features=15, n_estimators=10,
score=0.3333333333333333, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=10 ...
[CV] max_depth=None, max_features=15, n_estimators=10,
score=0.4888888888888889, total= 0.0s
[CV] max_depth=None, max_features=15, n_estimators=25 ...

```

```

[CV] max_depth=None, max_features=15, n_estimators=25,
score=0.43478260869565216, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=25 ...
[CV] max_depth=None, max_features=15, n_estimators=25, score=0.391304347826087,
total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=25 ...
[CV] max_depth=None, max_features=15, n_estimators=25,
score=0.4782608695652174, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=25 ...
[CV] max_depth=None, max_features=15, n_estimators=25, score=0.4, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=25 ...
[CV] max_depth=None, max_features=15, n_estimators=25,
score=0.5777777777777777, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=50 ...
[CV] max_depth=None, max_features=15, n_estimators=50,
score=0.3695652173913043, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=50 ...
[CV] max_depth=None, max_features=15, n_estimators=50, score=0.391304347826087,
total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=50 ...
[CV] max_depth=None, max_features=15, n_estimators=50,
score=0.4782608695652174, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=50 ...
[CV] max_depth=None, max_features=15, n_estimators=50, score=0.4, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=50 ...
[CV] max_depth=None, max_features=15, n_estimators=50,
score=0.5777777777777777, total= 0.1s
[CV] max_depth=None, max_features=15, n_estimators=150 ...
[CV] max_depth=None, max_features=15, n_estimators=150,
score=0.3695652173913043, total= 0.3s
[CV] max_depth=None, max_features=15, n_estimators=150 ...
[CV] max_depth=None, max_features=15, n_estimators=150,
score=0.43478260869565216, total= 0.3s
[CV] max_depth=None, max_features=15, n_estimators=150 ...
[CV] max_depth=None, max_features=15, n_estimators=150,
score=0.5434782608695652, total= 0.3s
[CV] max_depth=None, max_features=15, n_estimators=150 ...
[CV] max_depth=None, max_features=15, n_estimators=150,
score=0.35555555555555557, total= 0.3s
[CV] max_depth=None, max_features=15, n_estimators=150 ...
[CV] max_depth=None, max_features=15, n_estimators=150,
score=0.5555555555555556, total= 0.3s
[CV] max_depth=None, max_features=20, n_estimators=3 ...
[CV] max_depth=None, max_features=20, n_estimators=3,
score=0.41304347826086957, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=3 ...
[CV] max_depth=None, max_features=20, n_estimators=3, score=0.5, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=3 ...

```

```

[CV] max_depth=None, max_features=20, n_estimators=3, score=0.5, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=3 ...
[CV] max_depth=None, max_features=20, n_estimators=3, score=0.4666666666666667,
total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=3 ...
[CV] max_depth=None, max_features=20, n_estimators=3, score=0.4888888888888889,
total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=5 ...
[CV] max_depth=None, max_features=20, n_estimators=5,
score=0.45652173913043476, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=5 ...
[CV] max_depth=None, max_features=20, n_estimators=5, score=0.5, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=5 ...
[CV] max_depth=None, max_features=20, n_estimators=5, score=0.5434782608695652,
total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=5 ...
[CV] max_depth=None, max_features=20, n_estimators=5, score=0.4222222222222222,
total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=5 ...
[CV] max_depth=None, max_features=20, n_estimators=5, score=0.5333333333333333,
total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=10 ...
[CV] max_depth=None, max_features=20, n_estimators=10,
score=0.34782608695652173, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=10 ...
[CV] max_depth=None, max_features=20, n_estimators=10,
score=0.34782608695652173, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=10 ...
[CV] max_depth=None, max_features=20, n_estimators=10,
score=0.5217391304347826, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=10 ...
[CV] max_depth=None, max_features=20, n_estimators=10,
score=0.3333333333333333, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=10 ...
[CV] max_depth=None, max_features=20, n_estimators=10,
score=0.5555555555555556, total= 0.0s
[CV] max_depth=None, max_features=20, n_estimators=25 ...
[CV] max_depth=None, max_features=20, n_estimators=25,
score=0.34782608695652173, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=25 ...
[CV] max_depth=None, max_features=20, n_estimators=25,
score=0.43478260869565216, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=25 ...
[CV] max_depth=None, max_features=20, n_estimators=25,
score=0.5652173913043478, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=25 ...
[CV] max_depth=None, max_features=20, n_estimators=25,
score=0.37777777777777777, total= 0.1s

```

```

[CV] max_depth=None, max_features=20, n_estimators=25 ...
[CV] max_depth=None, max_features=20, n_estimators=25,
score=0.5555555555555556, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=50 ...
[CV] max_depth=None, max_features=20, n_estimators=50, score=0.391304347826087,
total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=50 ...
[CV] max_depth=None, max_features=20, n_estimators=50,
score=0.45652173913043476, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=50 ...
[CV] max_depth=None, max_features=20, n_estimators=50,
score=0.5652173913043478, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=50 ...
[CV] max_depth=None, max_features=20, n_estimators=50,
score=0.3555555555555557, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=50 ...
[CV] max_depth=None, max_features=20, n_estimators=50,
score=0.5777777777777777, total= 0.1s
[CV] max_depth=None, max_features=20, n_estimators=150 ...
[CV] max_depth=None, max_features=20, n_estimators=150,
score=0.41304347826086957, total= 0.4s
[CV] max_depth=None, max_features=20, n_estimators=150 ...
[CV] max_depth=None, max_features=20, n_estimators=150,
score=0.4782608695652174, total= 0.4s
[CV] max_depth=None, max_features=20, n_estimators=150 ...
[CV] max_depth=None, max_features=20, n_estimators=150,
score=0.5434782608695652, total= 0.4s
[CV] max_depth=None, max_features=20, n_estimators=150 ...
[CV] max_depth=None, max_features=20, n_estimators=150,
score=0.37777777777777777, total= 0.4s
[CV] max_depth=None, max_features=20, n_estimators=150 ...
[CV] max_depth=None, max_features=20, n_estimators=150,
score=0.5111111111111111, total= 0.4s

```

```

[Parallel(n_jobs=1)]: Done 600 out of 600 | elapsed: 48.3s finished
/opt/conda/lib/python3.6/site-packages/sklearn/model_selection/_search.py:841:
DeprecationWarning:

```

The default of the `iid` parameter will change from True to False in version 0.22 and will be removed in 0.24. This will change numeric results when test-set sizes are unequal.

```

[303]: GridSearchCV(cv=5, error_score='raise-deprecating',
    estimator=RandomForestClassifier(bootstrap=True, class_weight=None,
    criterion='gini',
    max_depth=None, max_features='auto', max_leaf_nodes=None,
    min_impurity_decrease=0.0, min_impurity_split=None,

```

```

        min_samples_leaf=1, min_samples_split=2,
        min_weight_fraction_leaf=0.0, n_estimators='warn', n_jobs=None,
        oob_score=False, random_state=2, verbose=0, warm_start=False),
        fit_params=None, iid='warn', n_jobs=None,
        param_grid={'max_depth': [3, 5, 7, 10, None], 'n_estimators': [3, 5, 10,
25, 50, 150], 'max_features': [4, 7, 15, 20]},
        pre_dispatch='2*n_jobs', refit=True, return_train_score='warn',
        scoring='recall', verbose=4)

```

```

[304]: print(grid_search.best_score_)
       print(grid_search.best_params_)

```

```

0.49111239935587764
{'max_depth': None, 'max_features': 20, 'n_estimators': 5}

```

```

[305]: rf = RandomForestClassifier(max_depth=None, max_features=10, n_estimators=15,
    ↪ random_state=2)

#training with the best params
rf.fit(X_train, y_train)

```

```

[305]: RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
    max_depth=None, max_features=10, max_leaf_nodes=None,
    min_impurity_decrease=0.0, min_impurity_split=None,
    min_samples_leaf=1, min_samples_split=2,
    min_weight_fraction_leaf=0.0, n_estimators=15, n_jobs=None,
    oob_score=False, random_state=2, verbose=0, warm_start=False)

```

```

[306]: #Testing the model
       #Predicting using our model
       y_pred = rf.predict(X_test)

       # Verificaar os resultados obtidos
       print(accuracy_score(y_test,y_pred))
       print("\n")
       print(confusion_matrix(y_test, y_pred))
       print("\n")
       print(fbeta_score(y_test, y_pred, beta=2))

```

```

0.736

```

```

[[158  20]
 [ 46  26]]

```

```

0.3892215568862275

```

Very sucks results! How can I increase my model?

6 Model 2:

```
[311]: from sklearn.utils import resample
       from sklearn.metrics import roc_curve
```

```
[313]: # Criando o classificador logreg
       GNB = GaussianNB()

       # Fitting with train data
       model = GNB.fit(X_train, y_train)
```

```
[314]: # Printing the Training Score
       print("Training score data: ")
       print(model.score(X_train, y_train))
```

Training score data:
0.7053333333333334

```
[316]: y_pred = model.predict(X_test)

       print(accuracy_score(y_test, y_pred))
       print("\n")
       print(confusion_matrix(y_test, y_pred))
       print("\n")
       print(classification_report(y_test, y_pred))
```

0.648

```
[[124  54]
 [ 34  38]]
```

	precision	recall	f1-score	support
0	0.78	0.70	0.74	178
1	0.41	0.53	0.46	72
micro avg	0.65	0.65	0.65	250
macro avg	0.60	0.61	0.60	250
weighted avg	0.68	0.65	0.66	250

With the Gaussian Model we got a best recall.