Data Science Masters :Assignment 25

Problem:

To predict whether a person makes over 50K per year or not from classic adult dataset using XGBoost algorithm.

Solution:

Importing Libraries...

In [1]:

```
# Mathematical computation
import numpy as np

# DateFrame setup
import pandas as pd

# Data Visualization
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns

# Machine learning pkgs
from xgboost.sklearn import XGBClassifier
from sklearn.model_selection import train_test_split
from xgboost import plot_tree , plot_importance
from sklearn.metrics import accuracy_score , classification_report , confusion_matrix , pre
```

Data Pre-processing Steps

In [2]:

```
# loading Dataset
df_AdultData_trainSet = pd.read_csv('http://archive.ics.uci.edu/ml/machine-learning-databas
df_AdultData_testSet = pd.read_csv('http://archive.ics.uci.edu/ml/machine-learning-database
```

In [3]:

```
# Naming Columns to dataframes
col_labels = ['age', 'workclass', 'fnlwgt', 'education', 'education_num', 'marital_status',
'native_country', 'wage_class']
df_AdultData_trainSet.columns=col_labels
df_AdultData_testSet.columns=col_labels
```

In [4]:

```
df_AdultData_trainSet.head()
```

Out[4]:

	age	workclass	fnlwgt	education	education_num	marital_status	occupation	relationship
0	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family
1	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband
2	38	Private	215646	HS-grad	9	Divorced	Handlers-cleaners	Not-in-family
3	53	Private	234721	11th	7	Married-civ-spouse	Handlers-cleaners	Husband
4	28	Private	338409	Bachelors	13	Married-civ-spouse	Prof-specialty	Wife

In [5]:

```
df_AdultData_testSet.head()
```

Out[5]:

	age	workclass	fnlwgt	education	education_num	marital_status	occupation	relationship
0	25	Private	226802	11th	7	Never-married	Machine-op-inspct	Own-child
1	38	Private	89814	HS-grad	9	Married-civ-spouse	Farming-fishing	Husband
2	28	Local-gov	336951	Assoc-acdm	12	Married-civ-spouse	Protective-serv	Husband
3	44	Private	160323	Some-college	10	Married-civ-spouse	Machine-op-inspct	Husband
4	18	?	103497	Some-college	10	Never-married	?	Own-child

Exploring Data - Analysis

In [6]:

```
# info on training set
df_AdultData_trainSet.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 32561 entries, 0 to 32560
Data columns (total 15 columns):
age               32561 non-null int64
workclass         32561 non-null object
fnlwgt            32561 non-null int64
education         32561 non-null object
education_num     32561 non-null int64
marital_status    32561 non-null object
occupation        32561 non-null object
relationship      32561 non-null object
race              32561 non-null object
sex               32561 non-null object
capital_gain      32561 non-null int64
capital_loss      32561 non-null int64
hours_per_week    32561 non-null int64
native_country    32561 non-null object
wage_class        32561 non-null object
dtypes: int64(6), object(9)
memory usage: 3.7+ MB
```

In [7]:

```
# info on test set
df_AdultData_testSet.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 16281 entries, 0 to 16280
Data columns (total 15 columns):
age               16281 non-null int64
workclass         16281 non-null object
fnlwgt            16281 non-null int64
education         16281 non-null object
education_num     16281 non-null int64
marital_status    16281 non-null object
occupation        16281 non-null object
relationship      16281 non-null object
race              16281 non-null object
sex               16281 non-null object
capital_gain      16281 non-null int64
capital_loss      16281 non-null int64
hours_per_week    16281 non-null int64
native_country    16281 non-null object
wage_class        16281 non-null object
dtypes: int64(6), object(9)
memory usage: 1.9+ MB
```

In [8]:

```
# Statictical observation of training set
df_AdultData_trainSet.describe()
```

Out[8]:

	age	fnlwgt	education_num	capital_gain	capital_loss	hours_per_wee
count	32561.000000	3.256100e+04	32561.000000	32561.000000	32561.000000	32561.00000
mean	38.581647	1.897784e+05	10.080679	1077.648844	87.303830	40.43745
std	13.640433	1.055500e+05	2.572720	7385.292085	402.960219	12.34742
min	17.000000	1.228500e+04	1.000000	0.000000	0.000000	1.00000
25%	28.000000	1.178270e+05	9.000000	0.000000	0.000000	40.00000
50%	37.000000	1.783560e+05	10.000000	0.000000	0.000000	40.00000
75%	48.000000	2.370510e+05	12.000000	0.000000	0.000000	45.00000
max	90.000000	1.484705e+06	16.000000	99999.000000	4356.000000	99.00000

In [9]:

```
df_AdultData_trainSet.describe(include=[np.object]) # np.object for object type data
```

Out[9]:

	workclass	education	marital_status	occupation	relationship	race	sex	native_co
count	32561	32561	32561	32561	32561	32561	32561	3
unique	9	16	7	15	6	5	2	
top	Private	HS-grad	Married-civ-spouse	Prof-specialty	Husband	White	Male	United-S
freq	22696	10501	14976	4140	13193	27816	21790	2

In [10]:

```
df_AdultData_trainSet=df_AdultData_trainSet.apply(lambda x: x.str.strip() if x.dtype == "ob
df_AdultData_testSet=df_AdultData_testSet.apply(lambda x: x.str.strip() if x.dtype == "obje
```

In [11]:

```
# checking for duplicates and dropping the same...
# Training Set
if(df_AdultData_trainSet.duplicated().any()):
    df_AdultData_trainSet=df_AdultData_trainSet.drop_duplicates(keep='first')

# Test Set
if(df_AdultData_testSet.duplicated().any()):
    df_AdultData_testSet=df_AdultData_testSet.drop_duplicates(keep='first')
```

In [12]:

```
# Printing unique values in each column in training set
for col in df_AdultData_trainSet.select_dtypes(include=[np.object]).columns:
        print(col , " :" , df_AdultData_trainSet[col].unique(),"\n")
```

```
workclass  : ['State-gov' 'Self-emp-not-inc' 'Private' 'Federal-gov' 'Local-
gov' '?'
 'Self-emp-inc' 'Without-pay' 'Never-worked']

education  : ['Bachelors' 'HS-grad' '11th' 'Masters' '9th' 'Some-college' 'A
ssoc-acdm'
 'Assoc-voc' '7th-8th' 'Doctorate' 'Prof-school' '5th-6th' '10th'
 '1st-4th' 'Preschool' '12th']

marital_status  : ['Never-married' 'Married-civ-spouse' 'Divorced' 'Married-
spouse-absent'
 'Separated' 'Married-AF-spouse' 'Widowed']

occupation  : ['Adm-clerical' 'Exec-managerial' 'Handlers-cleaners' 'Prof-sp
ecialty'
 'Other-service' 'Sales' 'Craft-repair' 'Transport-moving'
 'Farming-fishing' 'Machine-op-inspct' 'Tech-support' '?'
 'Protective-serv' 'Armed-Forces' 'Priv-house-serv']

relationship  : ['Not-in-family' 'Husband' 'Wife' 'Own-child' 'Unmarried' 'O
ther-relative']

race  : ['White' 'Black' 'Asian-Pac-Islander' 'Amer-Indian-Eskimo' 'Other']

sex  : ['Male' 'Female']

native_country  : ['United-States' 'Cuba' 'Jamaica' 'India' '?' 'Mexico' 'So
uth'
 'Puerto-Rico' 'Honduras' 'England' 'Canada' 'Germany' 'Iran'
 'Philippines' 'Italy' 'Poland' 'Columbia' 'Cambodia' 'Thailand' 'Ecuador'
 'Laos' 'Taiwan' 'Haiti' 'Portugal' 'Dominican-Republic' 'El-Salvador'
 'France' 'Guatemala' 'China' 'Japan' 'Yugoslavia' 'Peru'
 'Outlying-US(Guam-USVI-etc)' 'Scotland' 'Trinadad&Tobago' 'Greece'
 'Nicaragua' 'Vietnam' 'Hong' 'Ireland' 'Hungary' 'Holand-Netherlands']

wage_class  : ['<=50K' '>50K']
```

In [13]:

```
# Printing unique values in each column in test set
for col in df_AdultData_testSet.select_dtypes(include=[np.object]).columns:
        print(col , " :" , df_AdultData_testSet[col].unique(),"\n")
```

```
workclass  : ['Private' 'Local-gov' '?' 'Self-emp-not-inc' 'Federal-gov' 'St
ate-gov'
 'Self-emp-inc' 'Without-pay' 'Never-worked']

education  : ['11th' 'HS-grad' 'Assoc-acdm' 'Some-college' '10th' 'Prof-scho
ol'
 '7th-8th' 'Bachelors' 'Masters' 'Doctorate' '5th-6th' 'Assoc-voc' '9th'
 '12th' '1st-4th' 'Preschool']

marital_status  : ['Never-married' 'Married-civ-spouse' 'Widowed' 'Divorced'
'Separated'
 'Married-spouse-absent' 'Married-AF-spouse']

occupation  : ['Machine-op-inspct' 'Farming-fishing' 'Protective-serv' '?'
 'Other-service' 'Prof-specialty' 'Craft-repair' 'Adm-clerical'
 'Exec-managerial' 'Tech-support' 'Sales' 'Priv-house-serv'
 'Transport-moving' 'Handlers-cleaners' 'Armed-Forces']

relationship  : ['Own-child' 'Husband' 'Not-in-family' 'Unmarried' 'Wife' 'O
ther-relative']

race  : ['Black' 'White' 'Asian-Pac-Islander' 'Other' 'Amer-Indian-Eskimo']

sex  : ['Male' 'Female']

native_country  : ['United-States' '?' 'Peru' 'Guatemala' 'Mexico' 'Dominica
n-Republic'
 'Ireland' 'Germany' 'Philippines' 'Thailand' 'Haiti' 'El-Salvador'
 'Puerto-Rico' 'Vietnam' 'South' 'Columbia' 'Japan' 'India' 'Cambodia'
 'Poland' 'Laos' 'England' 'Cuba' 'Taiwan' 'Italy' 'Canada' 'Portugal'
 'China' 'Nicaragua' 'Honduras' 'Iran' 'Scotland' 'Jamaica' 'Ecuador'
 'Yugoslavia' 'Hungary' 'Hong' 'Greece' 'Trinadad&Tobago'
 'Outlying-US(Guam-USVI-etc)' 'France']

wage_class  : ['<=50K.' '>50K.']
```

In [14]:

```
# replacing ? values in dataframe
df_AdultData_trainSet=df_AdultData_trainSet.replace('?', np.nan).dropna()
df_AdultData_testSet=df_AdultData_testSet.replace('?', np.nan).dropna()
```

In [15]:

```
# removing . in wage_claas variable in test set
df_AdultData_testSet['wage_class']=df_AdultData_testSet['wage_class'].replace({'<=50K.': '<
```

In [16]:

```
# Replacing Categorial object in dataframe - Training Set
for col in df_AdultData_trainSet.columns:
        if df_AdultData_trainSet[col].dtype=='object':
            df_AdultData_trainSet[col]=pd.Categorical(df_AdultData_trainSet[col]).codes
df_AdultData_trainSet.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 30139 entries, 0 to 32560
Data columns (total 15 columns):
age               30139 non-null int64
workclass         30139 non-null int8
fnlwgt            30139 non-null int64
education         30139 non-null int8
education_num     30139 non-null int64
marital_status    30139 non-null int8
occupation        30139 non-null int8
relationship      30139 non-null int8
race              30139 non-null int8
sex               30139 non-null int8
capital_gain      30139 non-null int64
capital_loss      30139 non-null int64
hours_per_week    30139 non-null int64
native_country    30139 non-null int8
wage_class        30139 non-null int8
dtypes: int64(6), int8(9)
memory usage: 1.9 MB
```

In [17]:

```
# Replacing Categorial object in dataframe - Test Set
for col in df_AdultData_testSet.columns:
        if df_AdultData_testSet[col].dtype=='object':
            df_AdultData_testSet[col]=pd.Categorical(df_AdultData_testSet[col]).codes
df_AdultData_testSet.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 15055 entries, 0 to 16280
Data columns (total 15 columns):
age               15055 non-null int64
workclass         15055 non-null int8
fnlwgt            15055 non-null int64
education         15055 non-null int8
education_num     15055 non-null int64
marital_status    15055 non-null int8
occupation        15055 non-null int8
relationship      15055 non-null int8
race              15055 non-null int8
sex               15055 non-null int8
capital_gain      15055 non-null int64
capital_loss      15055 non-null int64
hours_per_week    15055 non-null int64
native_country    15055 non-null int8
wage_class        15055 non-null int8
dtypes: int64(6), int8(9)
memory usage: 955.6 KB
```

In [18]:

```
df_AdultData_trainSet.head(3)
```

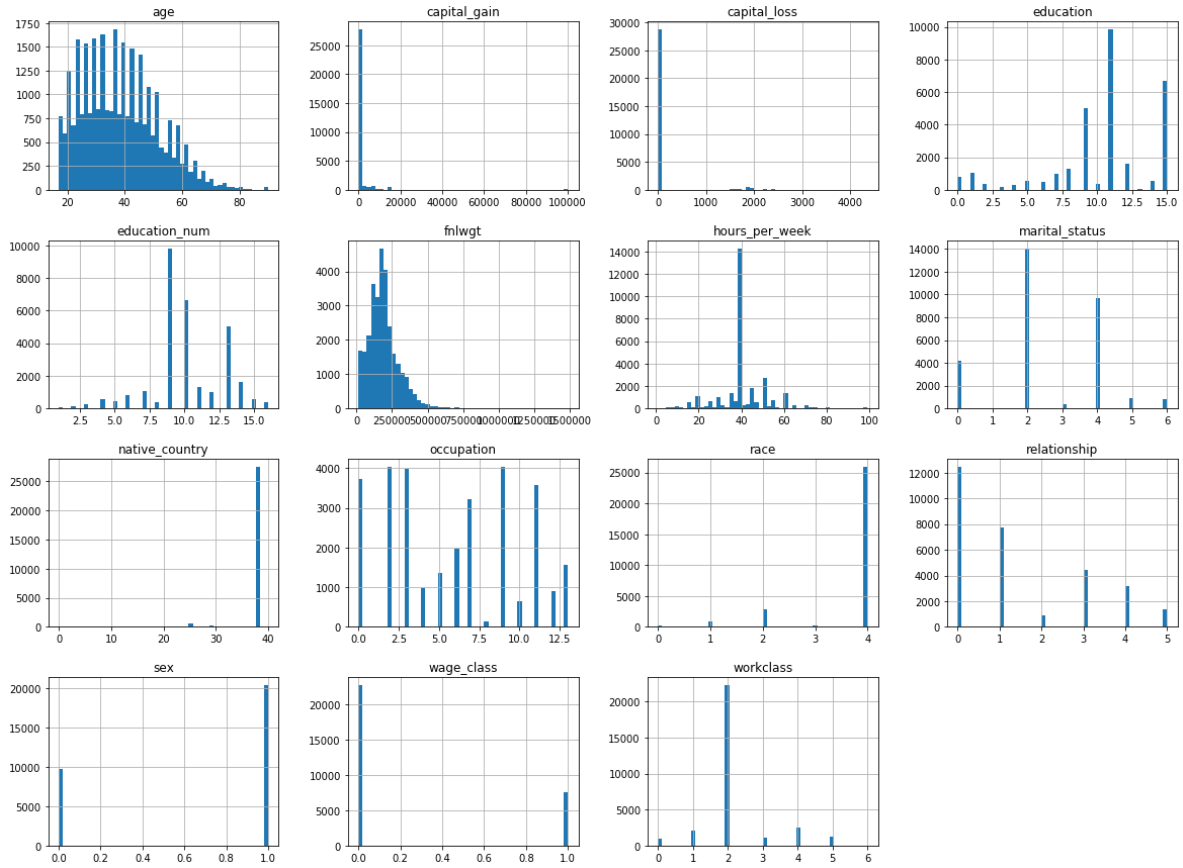
Out[18]:

	age	workclass	fnlwgt	education	education_num	marital_status	occupation	relationship
0	39	5	77516	9	13	4	0	1
1	50	4	83311	9	13	2	3	0
2	38	2	215646	11	9	0	5	1

Data Visualisation

In [19]:

```
# Training Set
df_AdultData_trainSet.hist(bins=50, figsize=(20,15))
plt.show()
```



Train & Test sets

In [20]:

```
# Spliting Data to Train and test
X_train,X_test , y_train, y_test = train_test_split(df_AdultData_trainSet.iloc[:,:-1], df_A
X_train.shape,X_test.shape, y_train.shape,y_test.shape
```

Out[20]:

```
((21097, 14), (9042, 14), (21097, 1), (9042, 1))
```

Modeling - XGBoost

In [21]:

```
# Define parameter for XGBoost model
params = {'objective':'binary:logistic' , 'max_depth':7, 'learning_rate':1.0,'silent':True
          'n_estimators':500,  'random_state':15 ,'subsample':0.6,'gamma':0.9 , 'n_jobs':-1}
XGBCls = XGBClassifier(**params)
XGBClsModel =XGBCls.fit(X=X_train, y=np.ravel(y_train))
```

In [22]:

```
y_pred_train = XGBClsModel.predict(X_train)
y_pred_prob_train = XGBClsModel.predict_proba(X_train)
print("Training datset")
print("Predicted target variable (first 5 values):",y_pred_train[0:5])
print("Predicted target variable probabilities (first 5 values):",y_pred_prob_train[0:5])
```

```
C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\sk
learn\preprocessing\label.py:151: DeprecationWarning: The truth value of an
empty array is ambiguous. Returning False, but in future this will result in
an error. Use `array.size > 0` to check that an array is not empty.
  if diff:

Training datset
Predicted target variable (first 5 values): [0 1 0 0 1]
Predicted target variable probabilities (first 5 values): [[9.9999917e-01 8.
0788692e-07]
 [6.5188587e-02 9.3481141e-01]
 [9.9707270e-01 2.9272775e-03]
 [9.7596651e-01 2.4033478e-02]
 [4.1512251e-03 9.9584877e-01]]
```

In [23]:

```
# Confusion Matrix and Classification report
actual_target_variable= y_train
predicted_target_variable= y_pred_train
matrix = confusion_matrix(y_true=actual_target_variable , y_pred=predicted_target_variable)
report = classification_report(y_true=actual_target_variable , y_pred=predicted_target_vari
print("Confusion Matrix - Training Set\n",matrix)
print("Classification Report - Training Set\n",report)
```

```
Confusion Matrix - Training Set
 [[15837     4]
 [    1  5255]]
Classification Report - Training Set
              precision    recall  f1-score   support

          0       1.00      1.00      1.00     15841
          1       1.00      1.00      1.00      5256

avg / total       1.00      1.00      1.00     21097
```

In [24]:

```
# Get precision , recall , acuuracy , and F1-score
actual_target_variable=y_train
predicted_target_variable=y_pred_train
acc_score= accuracy_score(y_true=actual_target_variable , y_pred=predicted_target_variable)
prec_score=precision_score(y_true=actual_target_variable , y_pred=predicted_target_variable
recl_score= recall_score(y_true=actual_target_variable, y_pred=predicted_target_variable)
f1score= f1_score(y_true= actual_target_variable, y_pred=predicted_target_variable)
print("Model Accuracy score :", acc_score )
print("Model Precision score :", prec_score )
print("Model Recall score :", recl_score )
print("Model F-1 score :", f1score )
```

```
Model Accuracy score : 0.9997629994785988
Model Precision score : 0.999239399125309
Model Recall score : 0.9998097412480974
Model F-1 score : 0.9995244888254873
```

In [25]:

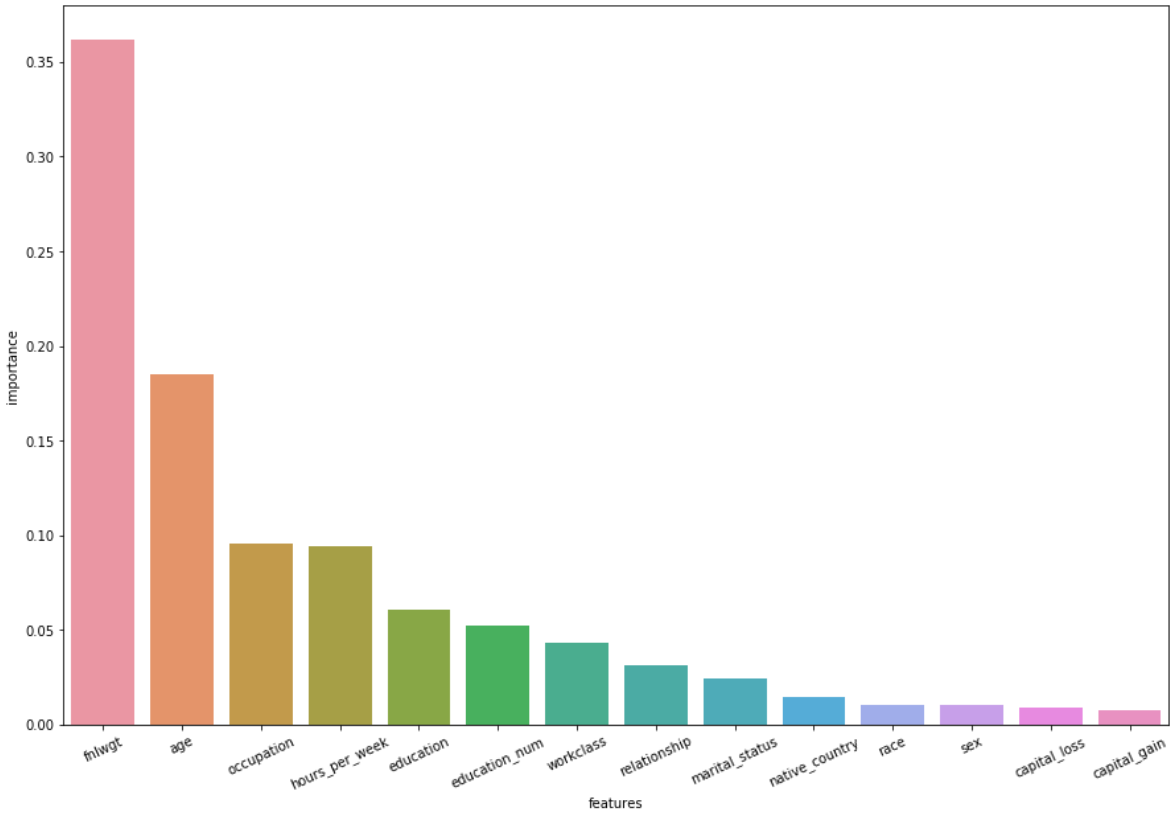
```
# Feature Importance based upon Xgboost model

importance = pd.DataFrame.from_dict({'features':X_train.columns, 'importance': XGBClsModel.
importance=importance.sort_values(by='importance', ascending=False)
importance
```

Out[25]:

	features	importance
2	fnlwgt	0.361771
0	age	0.185020
6	occupation	0.095412
12	hours_per_week	0.094061
3	education	0.060746
4	education_num	0.051920
1	workclass	0.043174
7	relationship	0.031645
5	marital_status	0.024171
13	native_country	0.014471
8	race	0.010575
9	sex	0.010098
11	capital_loss	0.009144
10	capital_gain	0.007792

In [26]:

```
# Visualisation of feature importance
plt.figure(figsize=(15,10))
sns.barplot(importance.features, importance.importance)
plt.xticks(rotation=25)
plt.show()
```

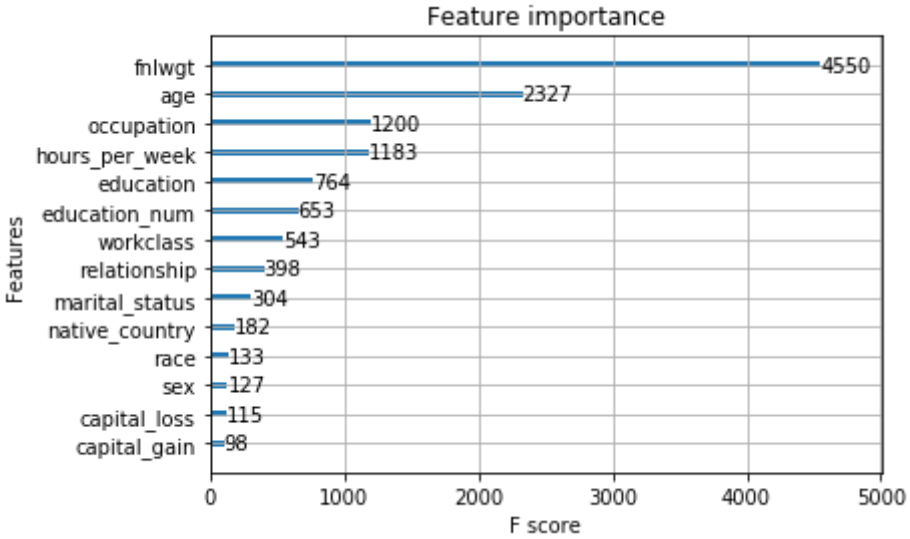


In [27]:

```
# Feature importance using Xgboost plot_importance
plot_importance(XGBClsModel)
```

Out[27]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1e4f6faac88>
```



In [28]:

```
# Model Evaluation on Test -Training set
y_pred_test = XGBClsModel.predict(X_test)
y_pred_prob_test = XGBClsModel.predict_proba(X_test)
print("Test - Training datset")
print("Predicted target variable (first 5 values):",y_pred_test[0:5])
print("Predicted target variable probabilities (first 5 values):",y_pred_prob_test[0:5])
```

```
Test - Training datset
Predicted target variable (first 5 values): [0 0 0 1 0]
Predicted target variable probabilities (first 5 values): [[7.6140380e-01 2.
3859622e-01]
 [9.9998951e-01 1.0511583e-05]
 [9.9900824e-01 9.9174725e-04]
 [2.8100610e-03 9.9718994e-01]
 [8.6246139e-01 1.3753861e-01]]

C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\sk
learn\preprocessing\label.py:151: DeprecationWarning: The truth value of an
empty array is ambiguous. Returning False, but in future this will result in
an error. Use `array.size > 0` to check that an array is not empty.
  if diff:
```

In [29]:

```
# Confusion Matrix and Classification report for test-Training Set
actual_target_variable= y_test
predicted_target_variable= y_pred_test
matrix = confusion_matrix(y_true=actual_target_variable , y_pred=predicted_target_variable)
report = classification_report(y_true=actual_target_variable , y_pred=predicted_target_vari
print("Confusion Matrix - Test -Training Set\n",matrix)
print("Classification Report Test- Training Set\n",report)
```

```
Confusion Matrix - Test -Training Set
 [[6017  775]
 [ 831 1419]]
Classification Report Test- Training Set
              precision    recall  f1-score   support

          0       0.88      0.89      0.88      6792
          1       0.65      0.63      0.64      2250

avg / total       0.82      0.82      0.82      9042
```

In [30]:

```
# Get precision , recall , acuuracy , and F1-score
actual_target_variable=y_test
predicted_target_variable=y_pred_test
acc_score= accuracy_score(y_true=actual_target_variable , y_pred=predicted_target_variable)
prec_score=precision_score(y_true=actual_target_variable , y_pred=predicted_target_variable
recl_score= recall_score(y_true=actual_target_variable, y_pred=predicted_target_variable)
f1score= f1_score(y_true= actual_target_variable, y_pred=predicted_target_variable)
print("Model Accuracy score :", acc_score )
print("Model Precision score :", prec_score )
print("Model Recall score :", recl_score )
print("Model F-1 score :", f1score )
```

```
Model Accuracy score : 0.8223844282238443
Model Precision score : 0.646763901549681
Model Recall score : 0.6306666666666667
Model F-1 score : 0.6386138613861386
```

Model Evalution on Test dataset

In [35]:

```
#Select Feature and target variable
X_feature= df_AdultData_testSet.iloc[:,:-1]
y_target= df_AdultData_testSet.iloc[:,-1:]
```

In [36]:

```
y_pred_test = XGBClsModel.predict(X_feature)
y_pred_prob_test = XGBClsModel.predict_proba(X_feature)
print("Test datset")
print("Predicted target variable (first 5 values):",y_pred_test[0:5])
print("Predicted target variable probabilities (first 5 values):",y_pred_prob_test[0:5])
```

```
Test datset
Predicted target variable (first 5 values): [0 0 0 1 0]
Predicted target variable probabilities (first 5 values): [[1.0000000e+00 4.
6236539e-11]
 [9.9279028e-01 7.2097033e-03]
 [7.3016727e-01 2.6983276e-01]
 [4.8995018e-05 9.9995100e-01]
 [9.9999994e-01 7.1961125e-08]]

C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\sk
learn\preprocessing\label.py:151: DeprecationWarning: The truth value of an
empty array is ambiguous. Returning False, but in future this will result in
an error. Use `array.size > 0` to check that an array is not empty.
  if diff:
```

In [37]:

```
# Confusion Matrix and Classification report for test-Training Set
actual_target_variable= y_target
predicted_target_variable= y_pred_test
matrix = confusion_matrix(y_true=actual_target_variable , y_pred=predicted_target_variable)
report = classification_report(y_true=actual_target_variable , y_pred=predicted_target_vari
print("Confusion Matrix - Test -Training Set\n",matrix)
print("Classification Report Test- Training Set\n",report)
```

```
Confusion Matrix - Test -Training Set
 [[10353  1002]
 [ 1590  2110]]
Classification Report Test- Training Set
              precision    recall  f1-score   support

          0       0.87      0.91      0.89     11355
          1       0.68      0.57      0.62      3700

avg / total       0.82      0.83      0.82     15055
```

In [38]:

```
# Get precision , recall , acuuracy , and F1-score
actual_target_variable=y_target
predicted_target_variable=y_pred_test
acc_score= accuracy_score(y_true=actual_target_variable , y_pred=predicted_target_variable)
prec_score=precision_score(y_true=actual_target_variable , y_pred=predicted_target_variable
recl_score= recall_score(y_true=actual_target_variable, y_pred=predicted_target_variable)
f1score= f1_score(y_true= actual_target_variable, y_pred=predicted_target_variable)
print("Model Accuracy score :", acc_score )
print("Model Precision score :", prec_score )
print("Model Recall score :", recl_score )
print("Model F-1 score :", f1score )
```

```
Model Accuracy score : 0.82783128528728
Model Precision score : 0.6780205655526992
Model Recall score : 0.5702702702702702
Model F-1 score : 0.6194950088079859
```

In [33]:

```
# Cross Validation Score
from sklearn.model_selection import cross_val_score

scores = cross_val_score(estimator= XGBClsModel,      # Model to test
                X= df_AdultData_testSet.iloc[:,:-1],
                y = np.ravel(df_AdultData_testSet.iloc[:,-1:]),          # Target variat
                scoring = "accuracy",              # Scoring metric
                cv=10)                             # Cross validation folds

print("Accuracy per fold: ")
print(scores)
print("Average accuracy: ", scores.mean())
```

```
C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\sk
learn\preprocessing\label.py:151: DeprecationWarning: The truth value of an
empty array is ambiguous. Returning False, but in future this will result in
an error. Use `array.size > 0` to check that an array is not empty.
  if diff:
C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\sk
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an error. Use `array.size > 0` to check that an array is not empty.
  if diff:
```

```
Accuracy per fold:
[0.82071713 0.82602922 0.82934927 0.83266932 0.81606906 0.82724252
 0.8372093  0.82126246 0.84119601 0.80730897]
Average accuracy:  0.8259053266446947
```

```
C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\sk
learn\preprocessing\label.py:151: DeprecationWarning: The truth value of an
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an error. Use `array.size > 0` to check that an array is not empty.
  if diff:
```

Looks like, our Model can predict whether a person makes 50K over year or not with around 82% accuracy

In [41]:

```
df_wage=pd.DataFrame(y_pred_test, columns=['wage_class'])
df_wage.wage_class.value_counts(normalize=True)
```

Out[41]:

```
0    0.793291
1    0.206709
Name: wage_class, dtype: float64
```

For the given test set, model predicted 79.3% of person were earning wage less than-equal to 50K and rest 20.6% were earning wage more than 50K.