```
import pandas as pd
import seaborn as sns
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split,cross_val_score,KFold,GridSearchCV
from sklearn.metrics import confusion_matrix,classification_report,accuracy_score



dataset=pd.read_csv("adult (2).csv")


print(dataset.isnull().sum())
print(dataset.dtypes)
```

```
age               0
workclass         0
fnlwgt            0
education         0
education.num     0
marital.status    0
occupation        0
relationship      0
race              0
sex               0
capital.gain      0
capital.loss      0
hours.per.week    0
native.country    0
income            0
dtype: int64
age                int64
workclass         object
fnlwgt             int64
education         object
education.num      int64
marital.status    object
occupation        object
relationship      object
race              object
sex               object
capital.gain       int64
capital.loss       int64
hours.per.week     int64
native.country    object
```

```
income            object
dtype: object
```

```
dataset.head()
```

	age	workclass	fnlwgt	education	education.num	marital.status	occupation	relationship	race	sex	capital.gain	capital.loss	hours.per.week
0	90	?	77053	HS-grad	9	Widowed	?	Not-in-family	White	Female	0	4356	40
1	82	Private	132870	HS-grad	9	Widowed	Exec-managerial	Not-in-family	White	Female	0	4356	18
2	66	?	186061	Some-college	10	Widowed	?	Unmarried	Black	Female	0	4356	40
3	54	Private	140359	7th-8th	4	Divorced	Machine-op-inspct	Unmarried	White	Female	0	3900	40
4	41	Private	264663	Some-college	10	Separated	Prof-specialty	Own-child	White	Female	0	3900	40

```
#removing '?' containing rows
dataset = dataset[(dataset != '?').all(axis=1)]
#label the income objects as 0 and 1
dataset['income']=dataset['income'].map({'<=50K': 0, '>50K': 1})
```

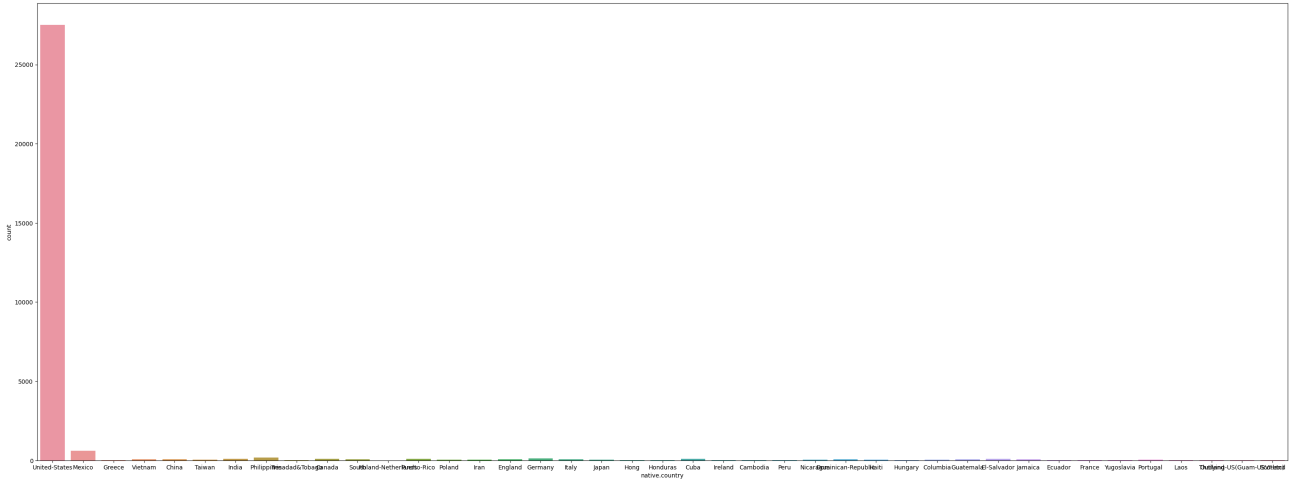
```
<ipython-input-34-39ed73805135>:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dataset['income']=dataset['income'].map({'<=50K': 0, '>50K': 1})
```

```
dataset.head()
```

age	workclass	fnlwgt	education	education.num	marital.status	occupation	relationship	race	sex	capital.gain	capital.loss	hours.per.week

```
#explore which country do most people belong
plt.figure(figsize=(38,14))
sns.countplot(x='native.country',data=dataset)
plt.show()
```




```
#we can reformat marital.status values to single and married
dataset['marital.status']=dataset['marital.status'].map({'Married-civ-spouse':'Married', 'Divorced':'Single', 'Never-married':'Single', 'Separated':'Single',
'Widowed':'Single', 'Married-spouse-absent':'Married', 'Married-AF-spouse':'Married'})
```

Label encoding

```
for column in dataset:
    enc=LabelEncoder()
    if dataset.dtypes[column]==np.object:
        dataset[column]=enc.fit_transform(dataset[column])
```

```
<ipython-input-38-5d7d7fe4d7c0>:3: DeprecationWarning: `np.object` is a deprecated alias for the builtin `object`. To silence this warning, use `object` by its
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  if dataset.dtypes[column]==np.object:
<ipython-input-38-5d7d7fe4d7c0>:3: DeprecationWarning: `np.object` is a deprecated alias for the builtin `object`. To silence this warning, use `object` by its
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
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Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  if dataset.dtypes[column]==np.object:
```
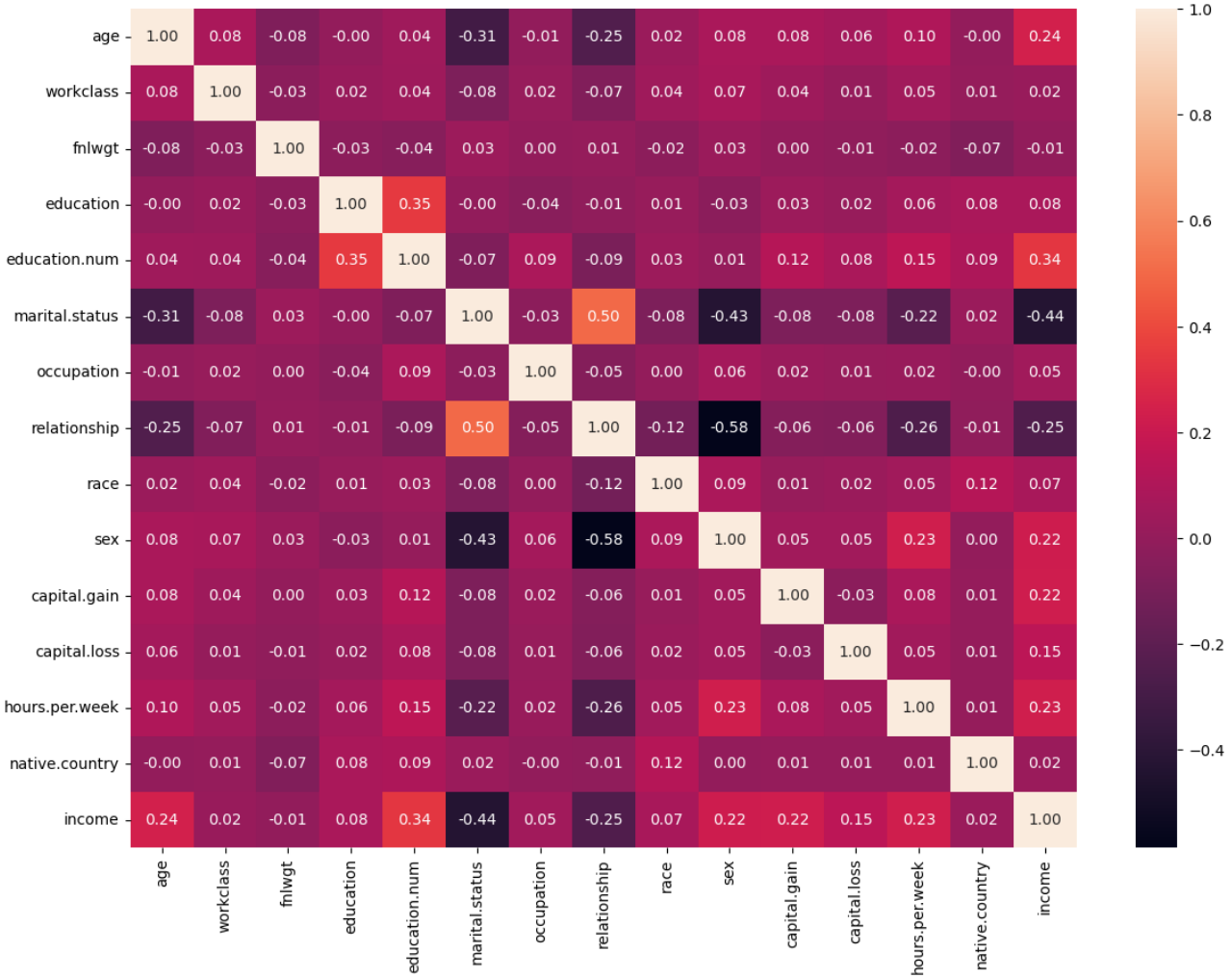

Correlation using heatmap

```
plt.figure(figsize=(14,10))
sns.heatmap(dataset.corr(),annot=True,fmt='.2f')
plt.show()
```




```
dataset=dataset.drop(['relationship','education'],axis=1)
```

```
dataset=dataset.drop(['occupation','fnlwgt','native.country'],axis=1)


print(dataset.head())

        age  workclass  education  education.num  marital.status  relationship  \
    1   82          2         11              9               1             1
    3   54          2          5              4               1             4
    4   41          2         15             10               1             3
    5   34          2         11              9               1             4
    6   38          2          0              6               1             4

        race  sex  capital.gain  capital.loss  hours.per.week  income
    1     4    0             0          4356              18       0
    3     4    0             0          3900              40       0
    4     4    0             0          3900              40       0
    5     4    0             0          3770              45       0
    6     4    1             0          3770              40       0


X=dataset.iloc[:,0:-1]
y=dataset.iloc[:,-1]
print(X.head())
print(y.head())
x_train,x_test,y_train,y_test=train_test_split(X,y,test_size=0.33,shuffle=False)

        age  workclass  education  education.num  marital.status  relationship  \
    1   82          2         11              9               1             1
    3   54          2          5              4               1             4
    4   41          2         15             10               1             3
    5   34          2         11              9               1             4
    6   38          2          0              6               1             4

        race  sex  capital.gain  capital.loss  hours.per.week
    1     4    0             0          4356              18
    3     4    0             0          3900              40
    4     4    0             0          3900              40
    5     4    0             0          3770              45
    6     4    1             0          3770              40
    1    0
    3    0
    4    0
    5    0
    6    0
    Name: income, dtype: int64


clf=RandomForestClassifier(n_estimators=50,max_features=5,min_samples_leaf=50)
clf.fit(x_train,y_train)
```

```
RandomForestClassifier
RandomForestClassifier(max_features=5, min_samples_leaf=50, n_estimators=50)
```

Make predictions

```
pred=clf.predict(x_test)
pred
```

```
array([1, 1, 1, ..., 0, 0, 0])
```

```
print("Accuracy: %f " % (100*accuracy_score(y_test, pred)))
```

```
Accuracy: 84.508740
```