In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
```

In [2]:
```
House = pd.read_csv('karteek//rsrt_train.csv')
```

finding missing values percentage

In [4]:
```
House.isnull().sum()/len(House) # no missing values found
```

Out[4]:
```
nomination_date    0.0
cost               0.0
join_date          0.0
dob                0.0
parch              0.0
digital_address    0.0
proportion         0.0
name               0.0
family_max_age     0.0
country            0.0
income             0.0
house_country      0.0
previous_income    0.0
relation           0.0
city               0.0
target             0.0
index              0.0
dtype: float64
```

In [5]:
```
House.dtypes # data types of House
```

Out[5]:
```
nomination_date     object
cost                 int64
join_date           object
dob                 object
parch              float64
digital_address      int64
proportion         float64
name                object
family_max_age     float64
country             object
income             float64
house_country       object
previous_income    float64
relation            object
city                object
target               int64
index               object
dtype: object
```

converting nomination_date,join_date,dob to date format

In [6]:
```
House.nomination_date = pd.to_datetime(House.nomination_date)
House.join_date = pd.to_datetime(House.join_date)
House.dob = pd.to_datetime(House.dob)
```

Age of person at nomination time and join time

In [7]:
```
House['nomination_date'] =House.nomination_date.apply(lambda x: x.year)
House['join_date'] =House.join_date.apply(lambda x: x.year)
House.dob = House.dob.apply(lambda x: x.year)
```

In [8]:
```
House['age_nomination'] = House['nomination_date'] - House['dob']
House['age_join'] = House['join_date'] - House['dob']
```

removing the following columns

- **Column: Reason**
- nomination_date , dob , join_date - created age diff
- index - all unique

In [9]:
```
House_drop = ["nomination_date","join_date","dob","index"]
House.drop(House_drop, axis = 1,inplace = True)
```

creating family size

In [10]:
```
House['Family_size'] = House['parch'] + 1
```

locality of house as per country

In [11]:
```
House['House_location'] = np.where((House['country'] == House['house_country'
]),"Local" , "NRI")
```

In [12]:
```
House['digital_address'] = House['digital_address'].astype(str) # since its a
 pincode it has to be static
```

converting currency to global(US Dollar)

In [13]:
```
columns = ["income" ,"cost", "previous_income"]
def currencyconversion(columns):
    conditions = [(House['country'] == "China"), House['country'] == "USA",Hou
se['country'] == "UK",House['country'] == "Pakistan" ,House['country'] == "Ind
ia"]

    for eachcol in columns:
        choices = [House[eachcol] * 0.16 , House[eachcol] * 1 ,House[eachcol]
* 1.39 ,House[eachcol] *  0.0090, House[eachcol] * 0.015]
        House[eachcol] = np.select(conditions,choices,default = np.nan)
```

In [14]:
```
currencyconversion(columns)
```

difference between income and finding promotion of candidate as per his income

In [15]:
```
House['income_diff'] = House['income'] - House['previous_income']
House['promotion_indicator']  = [1 if i > 0 else 0 for i in House.income_diff]
```

Title,firstname , lastname extraction from name

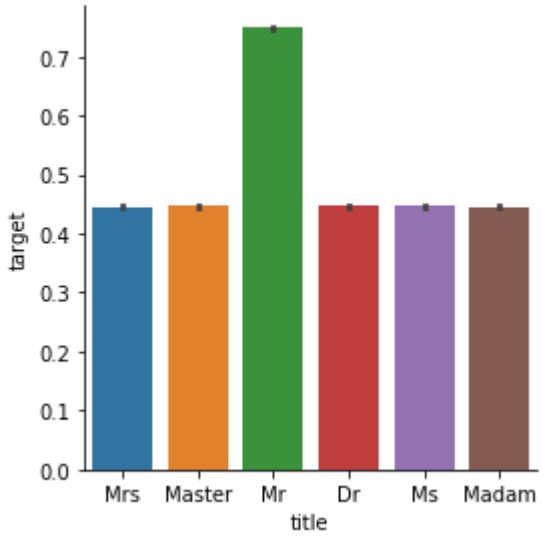
In [16]:
```
House['temp1'] =  House['name'].str.split('.')
House['title'] = House['temp1'].str.get(0)
House['temp2'] = House['temp1'].str.get(1).str.split(' ')
House['firstname'] = House['temp2'].str.get(1)
House['lastname'] = House['temp2'].str.get(2)
```

In [63]:
```
del House['temp1']
del House['temp2']
```

EDA

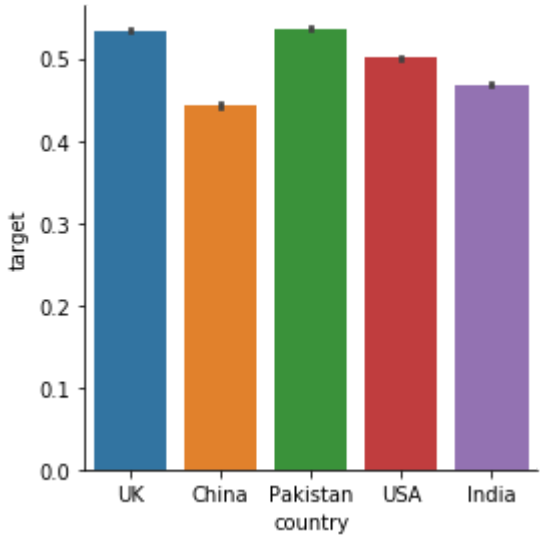
In [17]:
```
sns.factorplot(x = "title",y = "target",kind = "bar" , data=House) #people who
 are Mr have bought the houses more than others
```

Out[17]: <seaborn.axisgrid.FacetGrid at 0x1cbbfdf1e80>



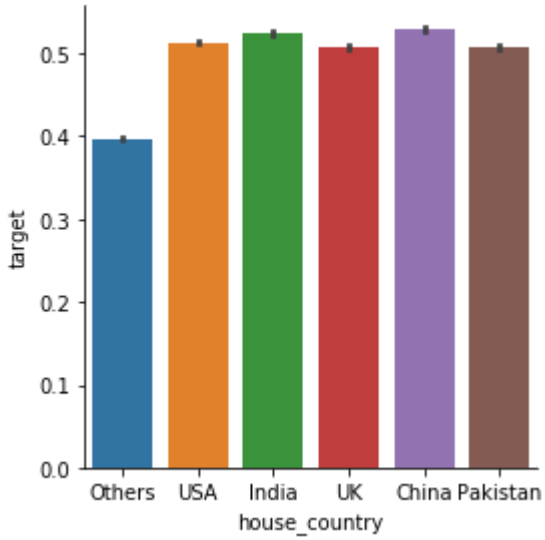
In [18]:
```
sns.factorplot(x = "country",y = "target",kind = "bar" , data=House) # ppl who
 live in china has bought less
```

Out[18]: <seaborn.axisgrid.FacetGrid at 0x1cbc66e6a20>



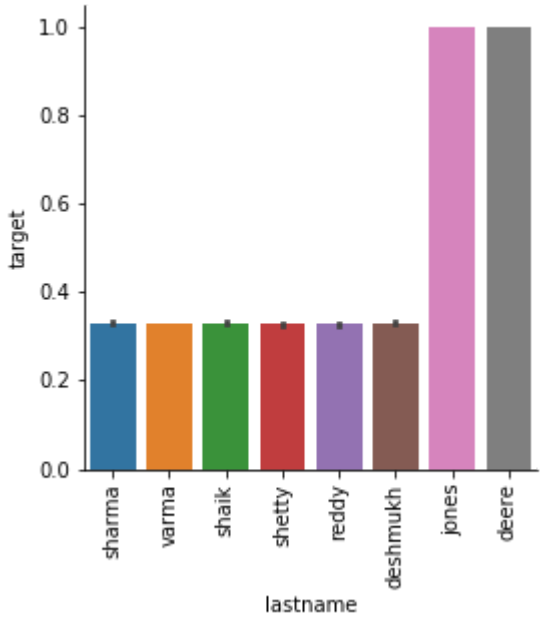
In [19]:
```
sns.factorplot(x = "house_country",y = "target",kind = "bar" , data=House)
```

Out[19]: <seaborn.axisgrid.FacetGrid at 0x1cb80aef4a8>

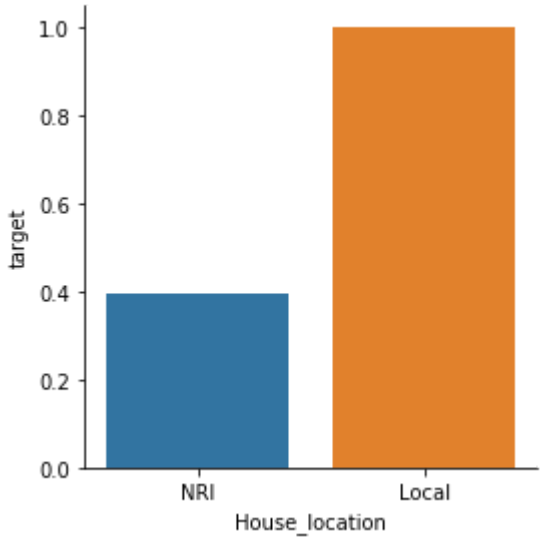


In [20]:
```
grid = sns.factorplot(x = "lastname",y = "target",kind = "bar" , data=House)
grid.set_xticklabels(rotation = 90) # ppl whos last name is jones and deere ha
s bought the houses more
```

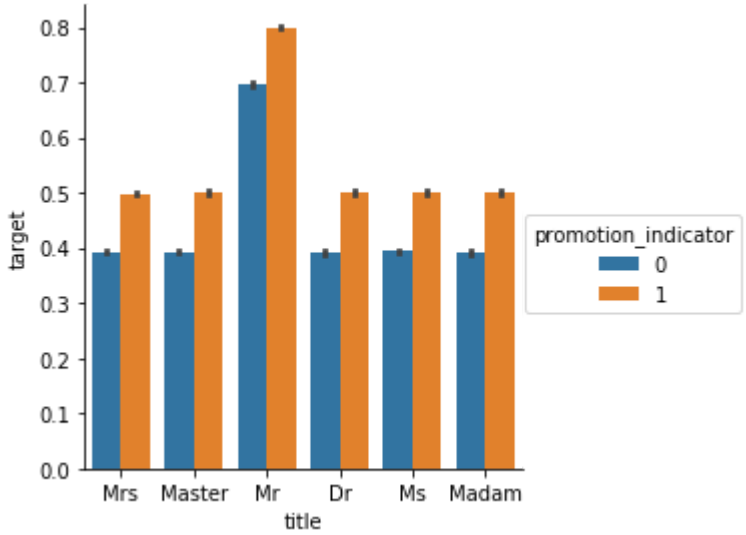
Out[20]: <seaborn.axisgrid.FacetGrid at 0x1cbbff88630>



In [21]:
```
grid = sns.factorplot(x = "House_location",y = "target",kind = "bar" , data=Ho
use)
# Local(if candidate country and house location country is same then they are
 sold more)
```



In [22]:
```
grid = sns.factorplot(x = "title",y = "target",hue = "promotion_indicator" , k
ind = "bar" , data=House)
# In all the categories promoted candidates bought more houses than ppl who ar
e not promoted
```



getting the columns of object type

In [23]:
```
df_str = House.select_dtypes(include=[np.object])
categorycolumns = df_str.columns.tolist()
categorycolumns
```

Out[23]:
```
['digital_address',
 'name',
 'country',
 'house_country',
 'relation',
 'city',
 'House_location',
 'temp1',
 'title',
 'temp2',
 'firstname',
 'lastname']
```

removing name as we got new columns from it and city as more unique columns found

In [24]:
```
del House['name']
del House['city']
```

In [25]:
```
House['target'].value_counts(normalize = True) # balanced state
```

Out[25]:
```
0    0.503387
1    0.496613
Name: target, dtype: float64
```

label encoding the category columns

In [26]:
```
from sklearn.preprocessing import LabelEncoder
cat_col = ['relation', 'House_location', 'title', 'firstname','lastname']
```

In [27]:
```
le = LabelEncoder()
for col in cat_col:
    House[col] = le.fit_transform(House[col])
```

In [28]:
```
del cat_col
```

one hot encoding

as these are not ordinal and if done label encoding functionality may be missing

columns : digital_address,country,house_country

In [29]:
```
cat_one = ['digital_address','country','house_country']
for each in cat_one:
    dummies = pd.get_dummies(House[each],prefix = each,drop_first = False)
    House = pd.concat([House,dummies],axis = 1)
```

In [30]:
```
House.drop(cat_one,axis = 1,inplace=True) # dropping actual columns
```

Modeling

In [31]:
```
from sklearn.model_selection import train_test_split
from sklearn.model_selection import cross_val_score
from sklearn.metrics import f1_score
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
```

In [65]:
```
feature_names = [x for x in House.columns if x not in ['target']]
target = House['target']
```

In [71]:
```
X = House[feature_names]
y = House['target']
```

In [72]:
```
X_train, X_valid, y_train, y_valid=  train_test_split(X,y,train_size = 0.7,str
atify = y,random_state = 0)
```

```
C:\Users\AA\Anaconda3\lib\site-packages\sklearn\model_selection\_split.py:202
6: FutureWarning: From version 0.21, test_size will always complement train_s
ize unless both are specified.
  FutureWarning)
```

Decission Tree

In [73]:
```
clf = DecisionTreeClassifier(random_state = 0)
```

In [74]:
```
clf.fit(X_train,y_train)
```

Out[74]:
```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=None,
            max_features=None, 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, presort=False, random_state=0,
            splitter='best')
```

In [77]:
```
f1_score(y_valid,clf.predict(X_valid))
```

Out[77]:
```
0.9999304808091074
```

cross validation with f score

In [78]:
```
from sklearn.preprocessing import LabelBinarizer
lb = LabelBinarizer()
lb.fit(y_train)
```

Out[78]:
```
LabelBinarizer(neg_label=0, pos_label=1, sparse_output=False)
```

In [79]:
```
f1 = cross_val_score(clf, X_train, y_train, cv=3, scoring='f1')
```

In [80]:
```
f1
```

Out[80]:
```
array([0.99991986, 0.99995993, 0.99992911])
```

In [81]:
```
from sklearn.metrics import confusion_matrix
```

In [82]:
```
confusion_matrix(y_valid,clf.predict(X_valid))
```

Out[82]:
```
array([[211411,     12],
       [    17, 208561]], dtype=int64)
```

Random Forest

In [83]:
```
rclf = RandomForestClassifier(random_state = 0)
```

In [84]:
```
rclf.fit(X_train,y_train)
```

Out[84]:
```
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=10, n_jobs=1,
            oob_score=False, random_state=0, verbose=0, warm_start=False)
```

In [86]:
```
f1_score(y_valid,rclf.predict(X_valid))
```

Out[86]:
```
0.998630770964671
```

lets see grid search now instead of only kfold

In [95]:
```
from sklearn.model_selection import GridSearchCV
parameters = [{'max_depth' :[5,10,15,20] , 'max_features':[4,5,6]}]
grid_search = GridSearchCV(rclf,param_grid = parameters,scoring = 'f1',cv = 3,
n_jobs = -1)
```

In [96]:
```
grid_search = grid_search.fit(X_train,y_train)
```

In [97]:
```
grid_search.best_score_
```

Out[97]:
```
0.9990603594185444
```

In [98]:
```
grid_search.best_params_ # these are best params and you can put these in your
 classifier and run model
```

Out[98]:
```
{'max_depth': 20, 'max_features': 6}
```

xgboost

In [92]:
```
from xgboost import XGBClassifier
```

In [99]:
```
xgb = XGBClassifier(random_state = 0, n_estimators=100)
xgb.fit(X_train,y_train)
```

Out[99]:
```
XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
       colsample_bytree=1, gamma=0, learning_rate=0.1, max_delta_step=0,
       max_depth=3, min_child_weight=1, missing=None, n_estimators=100,
       n_jobs=1, nthread=None, objective='binary:logistic', random_state=0,
       reg_alpha=0, reg_lambda=1, scale_pos_weight=1, seed=None,
       silent=True, subsample=1)
```

In [100]:
```
f1_score(y_valid,xgb.predict(X_valid))
```

```
C:\Users\AA\Anaconda3\lib\site-packages\sklearn\preprocessing\label.py:151: D
eprecationWarning: 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 ch
eck that an array is not empty.
  if diff:
```

Out[100]:
```
0.9991446212972525
```

can perform Kfold and gridsearch same as above