In [100]:

```
##https://github.com/martindlarsson/blocket_scraper
import argparse
import os
import scipy
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import sklearn
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.preprocessing import LabelEncoder
import sqlite3
from sklearn import linear_model
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import accuracy_score

%matplotlib inline

PATH = "data.csv";
train_car_data = pd.read_csv(PATH)
```

In [101]:

```
train_car_data.head(5)
```

Out[101]:

	id	brand	gear	model	price	fuel	milage	hp	type	geo	model_
0	0	Saab	Manuell	9-5	25000	Diesel	30 000 - 34 999	149	Kombi	Simrishamn	
1	1	Volvo	Automat	S80	85000	Diesel	18 000	163	Sedan	Helsingborg	
2	2	Renault	Manuell	CLIO	143900	Bensin	140	89	Halvkombi	Göteborg, Hisingen	
3	3	Volvo	Automat	V70	32500	Bensin	20 000	199	Kombi	NaN	
4	4	Peugeot	Automat	207	98900	Bensin	10 588	119	Cab	NaN	

In [102]:

```
train_car_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 107305 entries, 0 to 107304
Data columns (total 11 columns):
id            107305 non-null int64
brand         107305 non-null object
gear          107305 non-null object
model         107305 non-null object
price         107305 non-null int64
fuel          107305 non-null object
milage        107305 non-null object
hp            107305 non-null object
type          107305 non-null object
geo           45384 non-null object
model_year    107305 non-null int64
dtypes: int64(3), object(8)
memory usage: 9.0+ MB
```

In [103]:

```
#droping extra/unneeded columns
#train_car_data = train_car_data.drop('regnr', axis =1)
train_car_data = train_car_data.drop('id', axis =1)
#train_car_data = train_car_data.drop('add_date', axis =1)
#train_car_data = train_car_data.drop('make_year', axis =1)
train_car_data = train_car_data[train_car_data.brand != "Övriga"]
train_car_data = train_car_data.dropna(subset=['model', 'brand','price'])
```

In [104]:

```
train_car_data.head(5)
```

Out[104]:

	brand	gear	model	price	fuel	milage	hp	type	geo	model_yea
0	Saab	Manuell	9-5	25000	Diesel	30 000 - 34 999	149	Kombi	Simrishamn	200(
1	Volvo	Automat	S80	85000	Diesel	18 000	163	Sedan	Helsingborg	201
2	Renault	Manuell	CLIO	143900	Bensin	140	89	Halvkombi	Göteborg, Hisingen	201
3	Volvo	Automat	V70	32500	Bensin	20 000	199	Kombi	NaN	200
4	Peugeot	Automat	207	98900	Bensin	10 588	119	Cab	NaN	201(

In [105]:

```
train_car_data.shape
```

Out[105]:

```
(107305, 10)
```

In [106]:

```
train_car_data["geo"] = train_car_data["geo"].replace(np.nan,"Sweden", regex=True)
train_car_data["geo"] = train_car_data["geo"].replace("-","Sweden", regex=True)
train_car_data["type"] = train_car_data["type"].replace(np.nan,"Sedan", regex=True)
train_car_data["type"] = train_car_data["type"].replace("-","Sedan", regex=True)
train_car_data["gear"] = train_car_data["gear"].replace(np.nan,"Manuell", regex=True)
train_car_data["gear"] = train_car_data["gear"].replace("-","Manuell", regex=True)
train_car_data["fuel"] = train_car_data["fuel"].replace(np.nan,"Bensin", regex=True)
train_car_data["fuel"] = train_car_data["fuel"].replace("-","Bensin", regex=True)


train_car_data['milage'] = train_car_data['milage'].replace(" ", "", regex=True)
train_car_data['milage'] = train_car_data['milage'].apply(lambda x: x[5:] if "Merän" in
x else (x if x.find("-") == -1 else x[:x.find("-")]))
train_car_data['milage'] = train_car_data['milage'].astype(float)

train_car_data["hp"] = train_car_data["hp"].replace("0",np.nan, regex=True)
train_car_data["hp"] = train_car_data["hp"].replace("-",np.nan, regex=True)
train_car_data['hp'] = train_car_data['hp'].astype(float)
#BRAND SHOULD BE CHANGE WITH MODEL(model) FOR BETTER ACCURECY FOR NOW THIS COUSE 5% WOR
ST ACCURECY IN OUR MODEL
train_car_data["hp"]= train_car_data.groupby(["brand"])["hp"].transform(lambda x:x.fill
na(x.median()))
```

In [107]:

```
#drop the outlier
train_car_data = train_car_data[(train_car_data.hp > 40)]
train_car_data = train_car_data[(train_car_data.price > 4000)]
train_car_data = train_car_data[(train_car_data.price < 5000000)]
train_car_data =  train_car_data[(train_car_data.milage < 300000)]
train_car_data = train_car_data[(train_car_data.hp < 800)]
```

In [108]:

```
import seaborn as sns
sns.set()

sns.heatmap(train_car_data.corr().round(2), annot=True)
```

Out[108]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x298392bd808>
```

In [109]:

```
train_car_data.groupby(['brand','model','model_year']).agg({'price':['mean','count']}).
sort_values(('price','count'), ascending=False)[:10]
```

Out[109]:

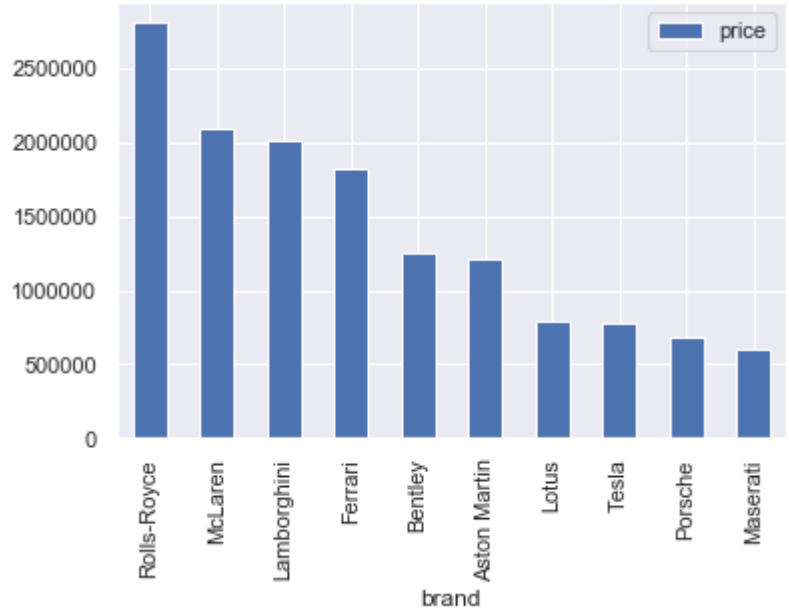
			price	
			mean	count
brand	model	model_year		
Volkswagen	GOL	2018	224073.205634	710
		2016	155660.164360	578
	PASSAT	2018	314325.751880	532
	GOL	2017	184061.134576	483
Mercedes-Benz	C220	2019	470588.111345	476
Volvo	V90	2019	409413.711584	423
Mercedes-Benz	C220	2018	410492.426540	422
Volvo	V40	2018	231160.952381	420
	V60	2018	298142.564103	390
Volkswagen	GOL	2019	230266.490765	379

In [110]:

```
train_car_data.pivot_table(index=['brand'], values=['price'], aggfunc=np.mean).round(2)
.sort_values('price', ascending=False)[:10].plot.bar()
```

Out[110]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29839212148>
```

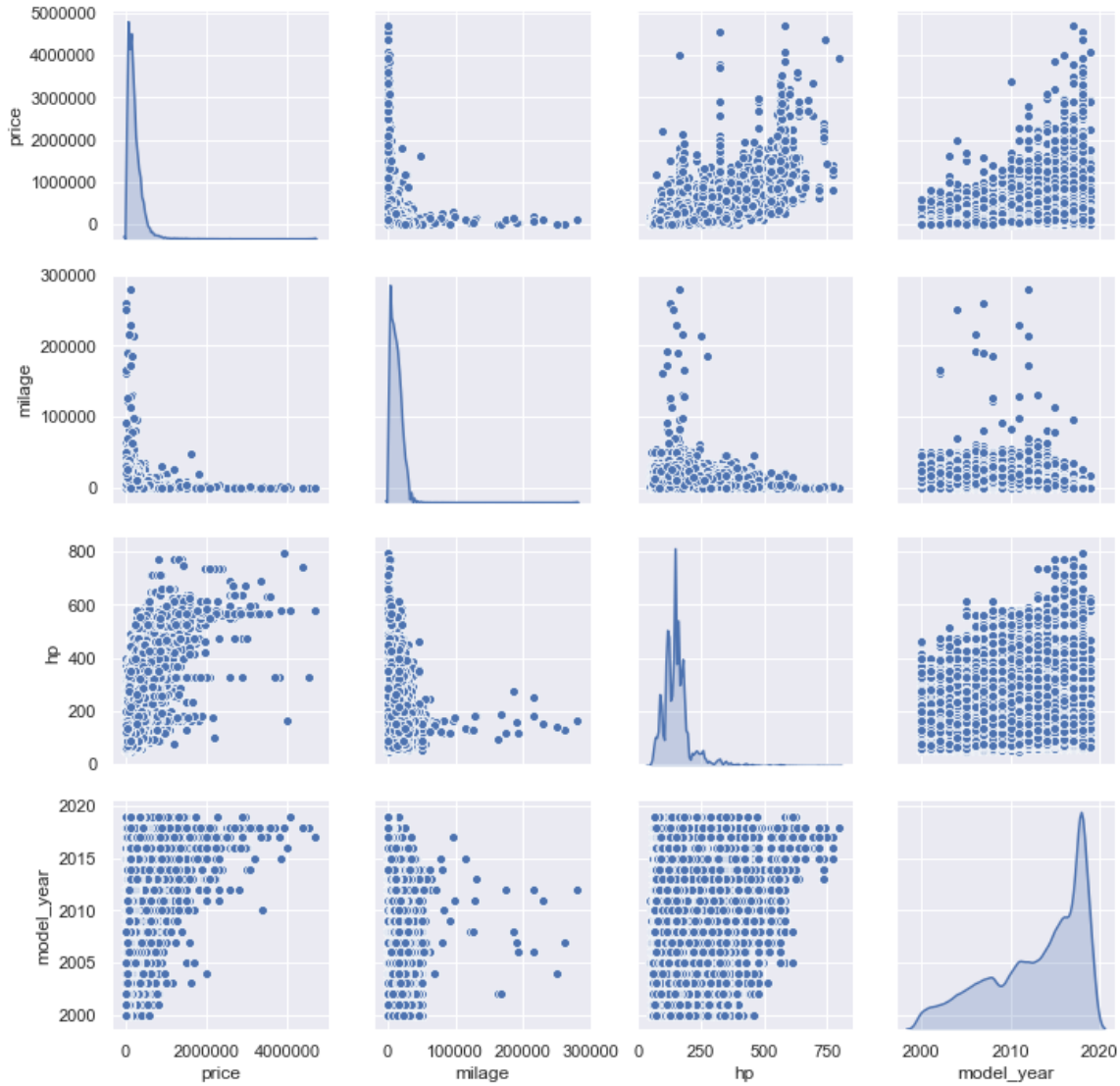


In [111]:

```
sns.pairplot(train_car_data[['price','milage','hp','model_year']], diag_kind='kde')
```

Out[111]:

```
<seaborn.axisgrid.PairGrid at 0x298391af9c8>
```



In [112]:

```
# correlation of each numeric feature with target 'price_eur' feature
feature_corr = train_car_data.corr()
print(feature_corr['price'].sort_values(ascending=False))
```

```
price         1.000000
hp            0.563394
model_year    0.553860
milage       -0.518123
Name: price, dtype: float64
```

In [113]:

```
X = train_car_data.drop(['price'], axis=1).copy()
X = pd.get_dummies(X, dummy_na = False, columns=['gear','fuel'] )
lb_make = LabelEncoder()
X["geo"] = lb_make.fit_transform(X["geo"])
X["type"] = lb_make.fit_transform(X["type"])
X["model_code"] = lb_make.fit_transform(X["model"])
X["brand_code"] = lb_make.fit_transform(X["brand"])
X = X.drop('brand', axis =1)
X = X.drop('model', axis =1)

y = train_car_data.price.values.copy() # prices in R$

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
```

In [114]:

```
from sklearn import linear_model
from sklearn.neighbors import KNeighborsRegressor
from sklearn.dummy import DummyRegressor
from sklearn import ensemble

models = [DummyRegressor(),
          KNeighborsRegressor(),
          linear_model.Lasso(),
          linear_model.Ridge(),
          linear_model.ElasticNet(),
          ensemble.GradientBoostingRegressor(),
          ensemble.RandomForestRegressor(),
          ensemble.ExtraTreesRegressor()]

models_names = ['Dummy','K-nn','Lasso','Ridge','Elastic','Boost','Forest','Extra']
```

In [115]:

```
scores = []
mse = []
mae = []

for model in models:
    model = model.fit(X_train,y_train)
    scores.append(metrics.r2_score(y_test, model.predict(X_test)))
    mse.append(metrics.mean_squared_error(y_test, model.predict(X_test)))
    mae.append(metrics.median_absolute_error(y_test, model.predict(X_test)))
```

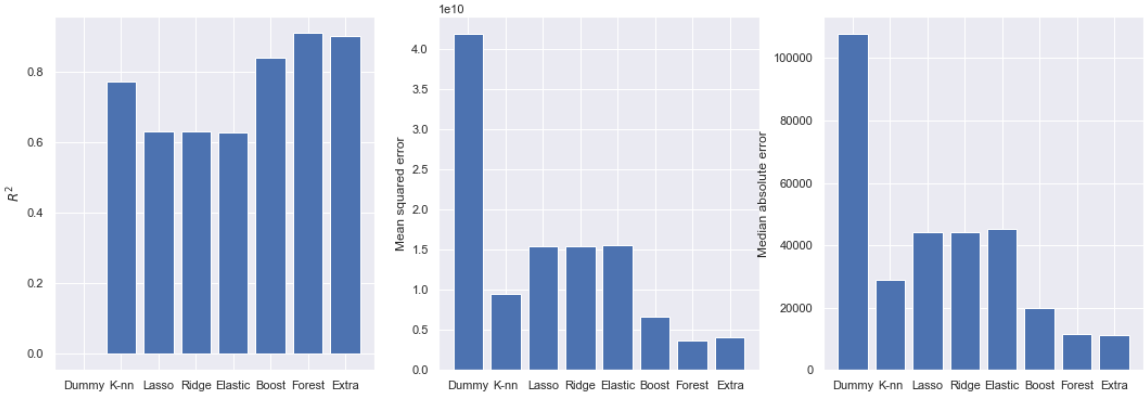
```
C:\Users\sakog\Anaconda3\lib\site-packages\sklearn\ensemble\forest.py:246:
FutureWarning: The default value of n_estimators will change from 10 in ve
rsion 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
C:\Users\sakog\Anaconda3\lib\site-packages\sklearn\ensemble\forest.py:246:
FutureWarning: The default value of n_estimators will change from 10 in ve
rsion 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
```

In [116]:

```
f, (ax1, ax2, ax3) = plt.subplots(ncols=3, sharex=True, sharey=False, figsize=(18,6))
ax1.bar(models_names, scores)
ax1.set_ylabel('$R^2$')
ax2.bar(models_names, mse)
ax2.set_ylabel('Mean squared error')
ax3.bar(models_names, mae)
ax3.set_ylabel('Median absolute error')
```

Out[116]:

```
Text(0, 0.5, 'Median absolute error')
```



In [117]:

```
model = models[6]
```

In [118]:

```
pred = pd.DataFrame.from_dict({'predicted':model.predict(X_test), 'true':y_test})
pred['difference'] = pred.predicted - pred.true
pred.sample(n=10).round(2)
```

Out[118]:

	predicted	true	difference
6857	127850.00	114900	12950.00
14726	84847.50	49000	35847.50
7377	61920.00	69900	-7980.00
249	284900.00	299900	-15000.00
8042	200320.00	199900	420.00
15105	234620.00	235700	-1080.00
19330	408570.00	639900	-231330.00
17677	179627.50	169900	9727.50
19561	37770.00	19900	17870.00
1064	184116.19	182600	1516.19

In [119]:

```
pred.difference.describe().round(2)
```

Out[119]:

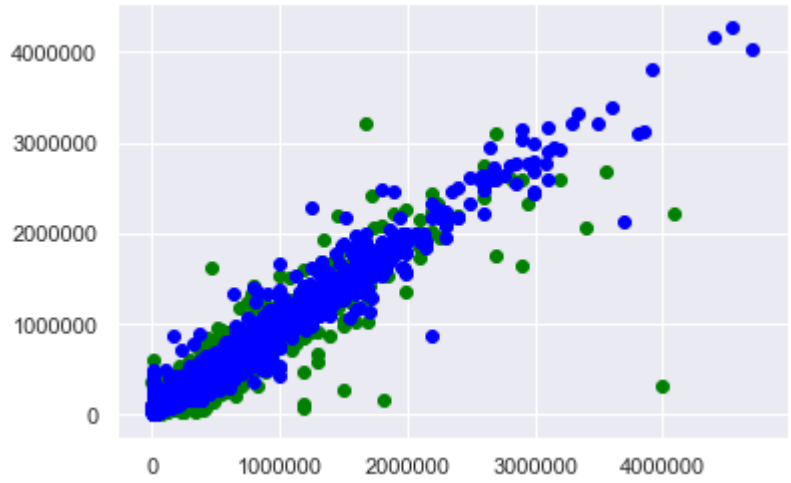
```
count      21262.00
mean         540.91
std        61032.45
min     -3677100.10
25%        -9540.00
50%         1540.00
75%        13370.00
max      1551000.00
Name: difference, dtype: float64
```

In [123]:

```
ypredtest = model.predict(X_test)
ypredtrain = model.predict(X_train)

plt.scatter(y_test, ypredtest, color='green')
plt.scatter(y_train, ypredtrain, color='blue')

plt.show()
```



In [122]:

```
from sklearn.model_selection import learning_curve

learn_tr_size, learn_train_sc, learn_test_sc = learning_curve(model, X_train, y_train,
cv=50)

# calculate mean over cross-validation folds
learn_train_m = np.apply_along_axis(np.mean, 1, learn_train_sc)
learn_test_m  = np.apply_along_axis(np.mean, 1, learn_test_sc)

plt.plot(learn_tr_size, learn_train_m)
plt.plot(learn_tr_size, learn_test_m)
plt.title('Learning curve')
plt.xlabel('Training samples')
plt.ylabel('Scores')
plt.legend(['Train score','Test score'])
```

Out[122]:

```
<matplotlib.legend.Legend at 0x298376d3908>
```