Module import

In [1]:
```python
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import metrics # 모델평가시 이용
```

데이터 전처리

In [2]:
```python
X = pd.read_csv('./5조데이터(4차통합).csv',encoding='CP949') ; X
X_ = X.copy() ; X
```

Out[2]:

	날짜	요일	주문수	평균기온	최저기온	최고기온	강수량mm	구글검색량	네이버검색량	확진자	...	방학여부	도마1동인구	도마2동인구	변동인구	영업가게	[illegible]
0	2015-11-08	일	64	13.9	13.4	14.5	15.5	26.000000	NaN	0	...	0	17755.0	20916.0	18026.0	45	N
1	2015-11-09	월	31	13.1	11.5	15.2	1.7	27.428571	NaN	0	...	0	17753.0	20913.0	18025.0	45	N
2	2015-11-10	화	19	11.0	8.0	14.5	NaN	28.857143	NaN	0	...	0	17751.0	20910.0	18024.0	45	N
3	2015-11-11	수	28	11.9	6.8	18.3	NaN	30.285714	NaN	0	...	0	17749.0	20907.0	18023.0	45	N
4	2015-11-12	목	24	13.6	8.8	19.4	NaN	31.714286	NaN	0	...	0	17747.0	20904.0	18022.0	45	N
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
1692	2020-09-22	화	60	19.1	14.9	24.5	NaN	61.428571	13.00523	2	...	0	NaN	NaN	NaN	31	N
1693	2020-09-23	수	54	19.0	14.4	23.6	NaN	67.142857	13.21658	0	...	0	NaN	NaN	NaN	31	N
1694	2020-09-24	목	57	20.8	15.7	26.4	NaN	72.857143	13.80988	0	...	0	NaN	NaN	NaN	31	N
1695	2020-09-25	금	77	20.0	14.8	25.9	NaN	78.571429	17.88591	1	...	0	NaN	NaN	NaN	31	N
1696	2020-09-26	토	11	19.4	15.0	25.5	NaN	84.285714	19.52271	0	...	0	NaN	NaN	NaN	31	N

1697 rows × 25 columns

In [3]:
```python
# 월변수 만들기
X['월'] =  X['날짜'].str[5:7]

# 월 , 요일 변수 one hot vector 로 바꾸기
X = pd.get_dummies(X, columns=['요일','월'],drop_first= False)
```

In [4]:
```
# y 변수 추출
y = np.array(X['주문수'])
```

In [5]:
```
# 필요없는 변수 dropping
X.drop(columns=['복날','날짜','주문수','최저기온',
                '최고기온','확진자','사망자','완치자','전국확진자','전국완치
자','전국사망자','유튜브조회수','코로나발발'],inplace=True)
```

Imputation

In [6]:
```
# 강수량 Imputation
X['강수량mm'] = X['강수량mm'].fillna(0)
# 강수량 변환
X['강수량mm'] = np.log1p(X['강수량mm'])
```

In [7]:
```
# 네이버검색량 , 지하철 승하차인원 Imputation
from sklearn.impute import KNNImputer
imputer = KNNImputer(n_neighbors=5)

X[['네이버검색량']] = imputer.fit_transform(X[['네이버검색량']])
X[['지하철승하차인원']] = imputer.fit_transform(X[['지하철승하차인원']])
```

In [8]:
```
# 인구수 imputation
# 현재, 팀 과제 프로젝트에서 대부분 등차수열로(linear 하게) imputation 해놓은 상태
라, 맨 마지막 달의 인구만 na를 채우면 된다.
# 계속 감소하는 추세였으므로, 제일 마지막 달의 인구는, 제일 작은 값을 가질것이다.
# 그러므로 임시로 min 으로 채워넣자.
min1 = np.min(X['도마1동인구'])
min2 = np.min(X['도마2동인구'])
min3 = np.min(X['변동인구'])
```

In [9]:
```
print(min1,min2,min3)
```

```
15111.0 18486.0 16392.0
```

In [10]:
```
X['도마1동인구'].fillna(15111.0,inplace=True)
X['도마2동인구'].fillna(18486.0,inplace=True)
X['변동인구'].fillna(16392.0,inplace=True)
```

In [11]:
```
X = X.astype(float)
```

In [12]:
```
X.describe()
```

Out[12]:

	평균기온	강수량mm	구글검색량	네이버검색량	지하철승하차인원	공휴일	방학여부	도미

count	1697.000000	1697.000000	1697.000000	1697.000000	1697.000000	1697.000000	1697.000000	1697
mean	13.840837	0.527349	52.084266	14.701071	201813.465625	0.050088	0.389511	16400
std	10.143406	1.058985	16.230386	4.738835	46265.105986	0.218192	0.487783	900
min	-11.800000	0.000000	18.000000	6.817980	35976.000000	0.000000	0.000000	15111
25%	5.100000	0.000000	39.285714	11.704160	175118.000000	0.000000	0.000000	15494
50%	14.400000	0.000000	50.428571	14.295300	201813.465625	0.000000	0.000000	16796
75%	22.600000	0.405465	64.714286	17.149520	240340.000000	0.000000	1.000000	17191
max	33.400000	5.193512	100.000000	100.000000	289768.000000	1.000000	1.000000	17755

8 rows × 30 columns

In [13]:

```
# columns 의 명칭바꾸기. (한글로 하면 에러가 나온다.)
X.columns =
['temp','rain','google','naver','subway','holy','vacation','do1_pop','do2_pc


'byun_pop','store','fri','thu','wed','mon','sun','sat','tue',

'mon1','mon2','mon3','mon4','mon5','mon6','mon7','mon8','mon9','mon10','mon1
```

Scaling

In [14]:

```
# dataset train/test set 으로 나누기
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20,
random_state=0)
```

In [15]:

```
X_train
```

Out[15]:

	temp	rain	google	naver	subway	holy	vacation	do1_pop	do2_pop	byun_pop	...
801	1.1	0.000000	51.285714	10.495550	243130.000000	0.0	0.0	16898.0	19724.0	17134.0	...
1679	22.2	2.388763	67.714286	16.964600	140875.000000	0.0	0.0	15111.0	18486.0	16392.0	...
1223	23.4	0.000000	71.000000	12.348090	244722.000000	0.0	0.0	15616.0	18942.0	16711.0	...
1180	17.2	0.000000	66.000000	22.782000	201630.000000	0.0	0.0	15613.0	19033.0	16759.0	...
22	6.9	0.000000	45.428571	14.701071	201813.465625	0.0	0.0	17711.0	20850.0	18001.0	...
...	...	...	...	...	...	...	...	...	...	...	...
835	16.2	0.262364	34.571429	8.662820	243556.000000	0.0	0.0	16826.0	19661.0	17085.0	...
1216	17.9	2.734368	68.571429	15.084530	225629.000000	0.0	0.0	15625.0	18949.0	16718.0	...
1653	28.5	0.470004	82.285714	22.654320	183563.000000	0.0	1.0	15111.0	18493.0	16409.0	...
559	21.4	0.000000	40.000000	16.055380	164694.000000	0.0	0.0	17064.0	20262.0	17463.0	...
684	16.1	0.000000	45.428571	10.031040	244499.000000	0.0	0.0	17059.0	20078.0	17393.0	...

1357 rows × 30 columns

In [16]:

```
trans_col =
['temp','rain','google','naver','subway','holy','do1_pop','do2_pop','byun_pc
```

In [17]:

```
# standard transformation
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
```

In [18]:

```
# train set 에 scaling 을 fitting 한 이후, train 에서와 같은 변환을 test 에도
해주어야한다.
trans_col =
['temp','rain','google','naver','subway','holy','do1_pop','do2_pop','byun_pc

scaler.fit(X_train.loc[:,trans_col])
X_train.loc[:,trans_col] = scaler.transform(X_train.loc[:,trans_col])
X_test.loc[:,trans_col] = scaler.transform(X_test.loc[:,trans_col])
# 아래는 WARNING만 주는거라 걱정안해도 된다.(자세한건 SettingWithCopyWarning 검
색)
```

```
C:\Users\goran\Anaconda3\envs\tensor\lib\site-packages\pandas\core\indexing.py:670: Se
ttingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/use
r_guide/indexing.html#returning-a-view-versus-a-copy
  iloc._setitem_with_indexer(indexer, value)
C:\Users\goran\Anaconda3\envs\tensor\lib\site-packages\ipykernel_launcher.py:4: Settin
gWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/use
r_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
C:\Users\goran\Anaconda3\envs\tensor\lib\site-packages\pandas\core\indexing.py:670: Se
ttingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/use
r_guide/indexing.html#returning-a-view-versus-a-copy
  iloc._setitem_with_indexer(indexer, value)
C:\Users\goran\Anaconda3\envs\tensor\lib\site-packages\ipykernel_launcher.py:5: Settin
gWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/use
r_guide/indexing.html#returning-a-view-versus-a-copy
  """
```

Correlation plot

In [19]:

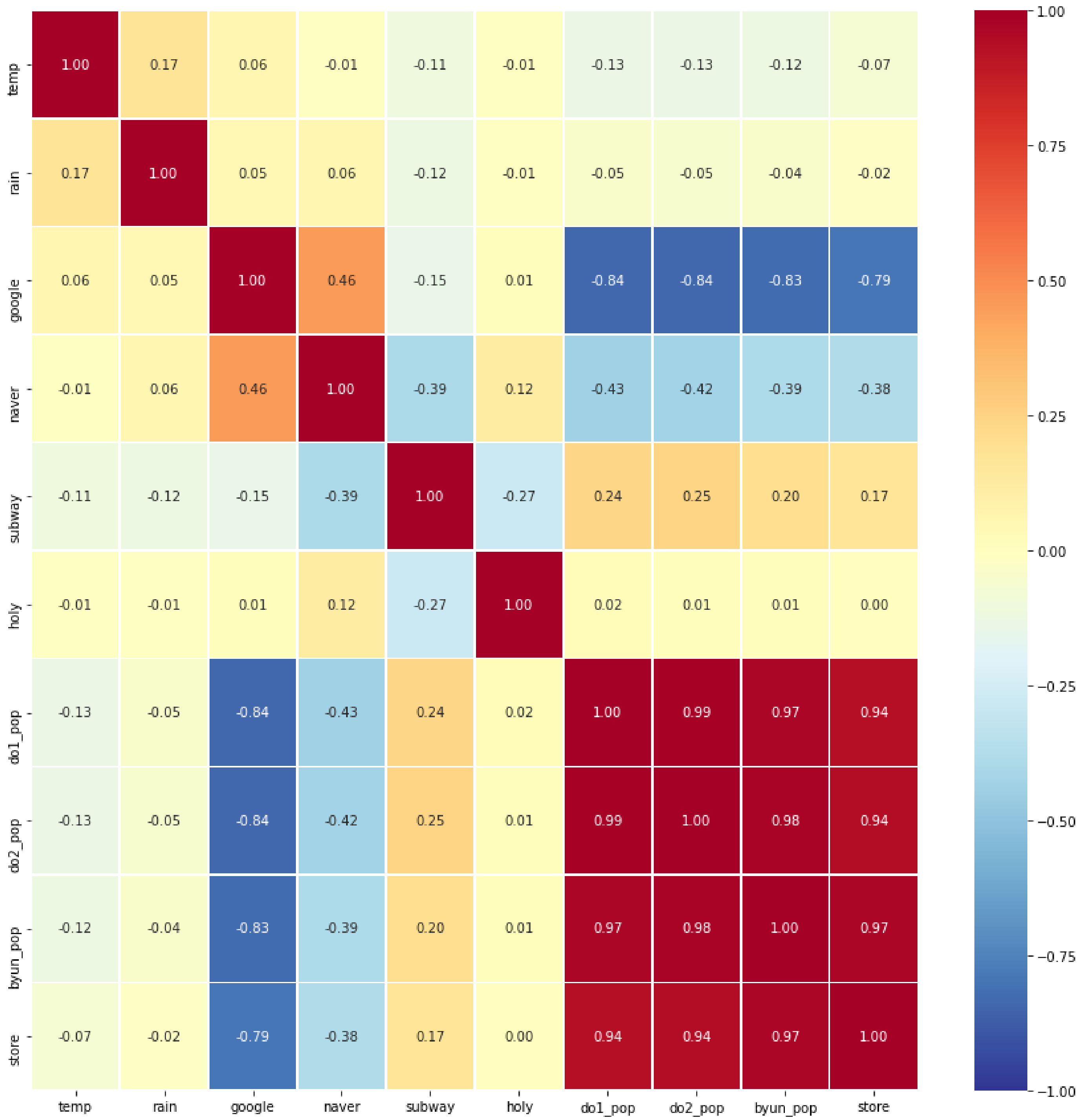
```
X_cor =
X[['temp','rain','google','naver','subway','holy','do1_pop','do2_pop','byun_
```

In [20]:

```
plt.figure(figsize=(15,15))
```

```
sns.heatmap(data = X_cor.corr(), annot=True,
fmt = '.2f', linewidths=.5, cmap='RdYlBu_r',vmin=-1,vmax=1)
```

Out[20]: <AxesSubplot:>



In [21]:

```
X_train
```

Out[21]:

	temp	rain	google	naver	subway	holy	vacation	do1_pop	do2_pop	byun_po
801	-1.232665	-0.502136	-0.049334	-0.874331	0.903906	-0.22248	0.0	0.548946	0.105571	-0.06621
1679	0.846370	1.724104	0.963010	0.478670	-1.326573	-0.22248	0.0	-1.438669	-1.509246	-1.46963
1223	0.964609	-0.502136	1.165479	-0.486873	0.938632	-0.22248	0.0	-0.876976	-0.914451	-0.86628
1180	0.353708	-0.502136	0.857374	1.695379	-0.001330	-0.22248	0.0	-0.880313	-0.795753	-0.77549
22	-0.661177	-0.502136	-0.410257	0.005253	0.002672	-0.22248	0.0	1.453216	1.574298	1.57362
...	...	...	...	...	...	...	...	...	...	...

835	0.255175	-0.257622	-1.079285	-1.257647	0.913198	-0.22248	0.0	0.468863	0.023395	-0.15889
1216	0.422680	2.046195	1.015828	0.085454	0.522158	-0.22248	0.0	-0.866965	-0.905320	-0.85304
1653	1.467124	-0.064109	1.860915	1.668674	-0.395424	-0.22248	1.0	-1.438669	-1.500116	-1.43748
559	0.767544	-0.502136	-0.744771	0.288507	-0.807011	-0.22248	0.0	0.733581	0.807325	0.55605
684	0.245322	-0.502136	-0.410257	-0.971483	0.933767	-0.22248	0.0	0.728020	0.567320	0.42365

1357 rows × 30 columns

In [22]:
```
X_test
```

Out[22]:

	temp	rain	google	naver	subway	holy	vacation	do1_pop	do2_pop	byun_po
1018	-0.542938	-0.502136	0.012287	-0.202550	0.985420	-0.22248	0.0	-0.645625	-0.271394	-0.52772
6	-0.010863	0.940136	-1.079285	0.005253	0.002672	-0.22248	0.0	1.488808	1.636908	1.60956
107	-1.508556	-0.502136	-1.035270	-0.173313	0.002672	-0.22248	1.0	1.260794	1.263856	1.59064
34	-0.621764	-0.502136	-0.832801	0.005253	0.002672	-0.22248	0.0	1.420960	1.511688	1.55092
1686	0.787250	1.136124	0.575678	0.088216	-1.213844	-0.22248	0.0	-1.438669	-1.509246	-1.46963
...	...	...	...	...	...	...	...	...	...	.
315	0.540919	-0.502136	-1.237739	-1.241071	0.002672	-0.22248	0.0	1.053913	1.119071	1.25776
578	1.151821	-0.502136	0.117923	0.838502	-1.359423	-0.22248	0.0	0.713561	0.747324	0.48796
170	-0.030569	2.104829	-1.008861	-0.465232	0.002672	-0.22248	0.0	1.210742	1.142550	1.42988
1635	1.023728	-0.188556	2.028172	1.255890	-2.658534	-0.22248	1.0	-1.438669	-1.480550	-1.40154
1014	-0.326166	-0.332219	-0.163773	1.501994	0.359019	-0.22248	0.0	-0.627829	-0.266176	-0.52772

340 rows × 30 columns

In [23]:
```
# na 값은 없다.
X_test.isnull().sum().sum()
```

Out[23]:
```
0
```

In [24]:
```
# 예측값 저장 dictionary
Data = { 'y_test' : y_test }
```

In [25]:
```
# 평가값 저장 dictionary
score = {}
```

Multi Linear Regression

In [26]:
```
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(X_train, y_train)
```

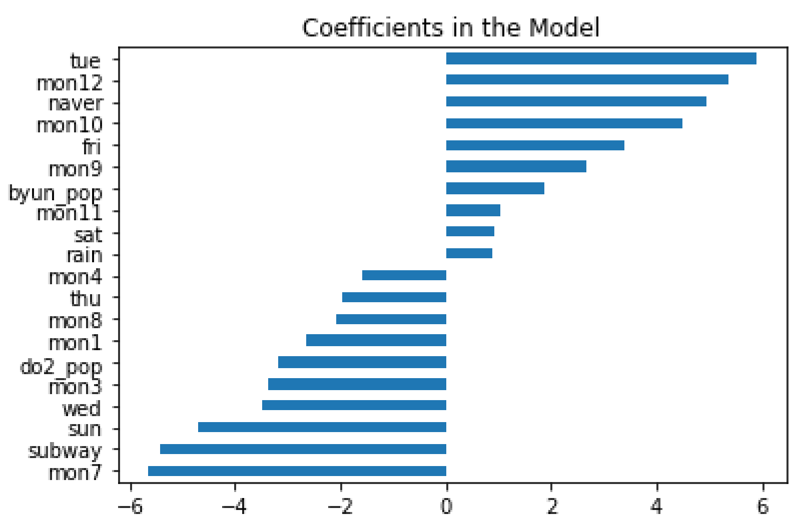
Out[26]:
```
LinearRegression()
```

In [27]:
```python
from sklearn import metrics
y_pred = model.predict(X_test)
print ("MSE :", metrics.mean_squared_error(y_test,y_pred))
print("R squared :", metrics.r2_score(y_test,y_pred))
score['linear'] =  [metrics.mean_squared_error(y_test,y_pred),
model.score(X_test, y_test)]
Data['linear'] = y_pred
```

```
MSE : 115.87375882979677
R squared : 0.5077488263894528
```

In [28]:
```python
coef = pd.Series(model.coef_, index = X_train.columns).sort_values()
imp_coef = pd.concat([coef.head(10), coef.tail(10)])
imp_coef.plot(kind = "barh")
plt.title("Coefficients in the Model")
```

Out[28]:
```
Text(0.5, 1.0, 'Coefficients in the Model')
```



Ridge regression

$w = \arg\min_w \left(\sum_{i=1}^{N} e_i^2 + \lambda \sum_{j=1}^{M} w_j^2\right)$

In [29]:
```python
from sklearn.linear_model import RidgeCV
from sklearn.linear_model import Ridge

para_range = np.logspace(-3, 3, num=50) # 10^-3 ~ 10^3
model = RidgeCV(alphas = para_range , cv=5)
# cross validaaion 을 5 fold cross validation 으로 지정 ,
# para_range 의 범위만큼 ,cv 를 해서 최적의 alpha를 구하려하였다.
model.fit(X_train, y_train) ;
```

In [30]:
```python
from sklearn import metrics

predicted = model.predict(X_test)
# 우리가 fitting 한 coefficient 로 X_test 를 이용해 Y_test 를 predict
#ridgecv.alpha_ # Estimated regularization parameter (최적값)
```

```python
print('best_alpha :',model.alpha_)
print ("MSE :", metrics.mean_squared_error(y_test, predicted))
print('R_squared :',model.score(X_test, y_test)) # C-V 로 찾은 최적의 ridge
로 계산한 R^2
```

```
best_alpha : 59.636233165946365
MSE : 115.78052629560398
R_squared : 0.5081448938411224
```

In [31]:

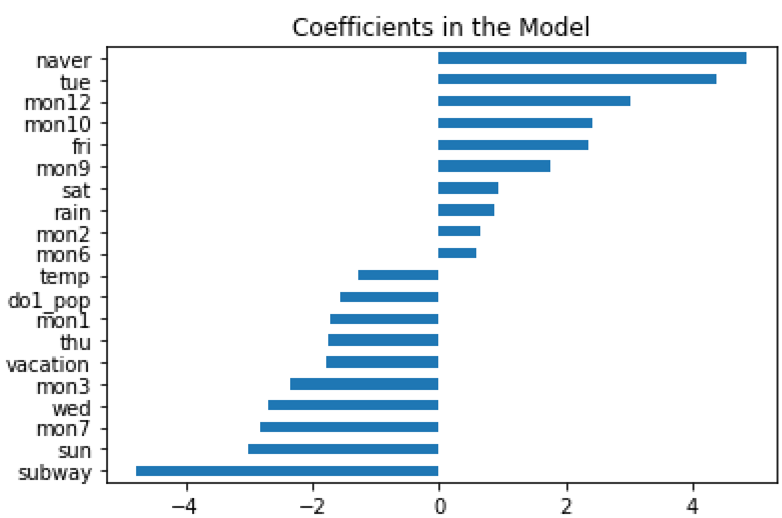
```python
# 데이터 저장
score['Ridge'] =  [metrics.mean_squared_error(y_test,
predicted),model.score(X_test, y_test)]
Data['Ridge'] = y_pred
```

In [32]:

```python
# 변수의 계수 시각화
coef = pd.Series(model.coef_, index = X_train.columns).sort_values()
imp_coef = pd.concat([coef.head(10), coef.tail(10)])
imp_coef.plot(kind = "barh")
plt.title("Coefficients in the Model")
```

Out[32]:

```
Text(0.5, 1.0, 'Coefficients in the Model')
```



lasso regression

$w = \arg\min_w \left(\sum_{i=1}^{N} e_i^2 + \lambda \sum_{j=1}^{M} |w_j| \right)$

In [34]:

```python
from sklearn.linear_model import LassoCV
from sklearn.linear_model import Lasso
alphas = np.logspace(-3, 3, num=50) # 10^-3 ~ 10^3
lassocv = LassoCV(alphas = alphas, cv=5)
# 위 ridge 때와 동일
lassocv.fit(X_train, y_train) ;
```

In [35]:

```python
from sklearn import metrics
predicted = lassocv.predict(X_test)
```

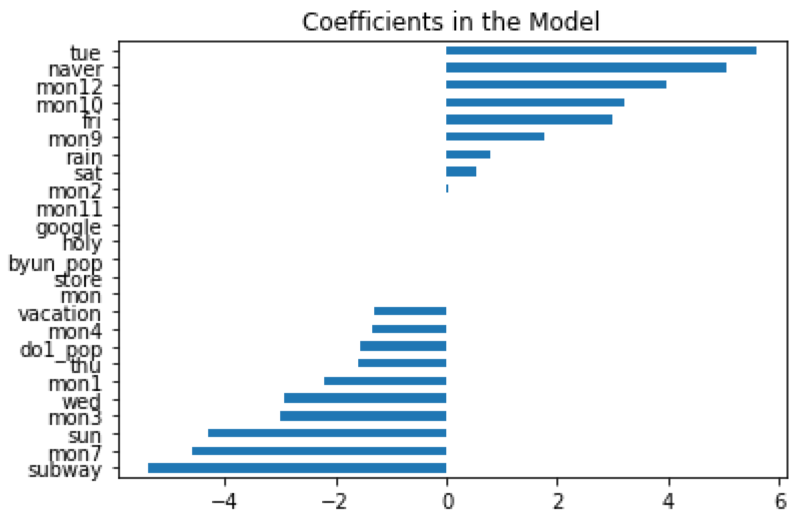
```
#lassocv.alpha_ # Estimated regularization parametor (최적값)
print('best_alpha :',lassocv.alpha_)
print ("MSE :", metrics.mean_squared_error(y_test, predicted))
print('R_squared :',lassocv.score(X_test, y_test)) # C-V 로 찾은 최적의
ridge 로 계산한 R^2
```

```
best_alpha : 0.0517947467923121
MSE : 114.83521939143081
R_squared : 0.5121607162128201
```

In [36]:
```
score['lasso'] = [metrics.mean_squared_error(y_test, predicted),
model.score(X_test, y_test)]
Data['lasso'] = y_pred
```

In [37]:
```
# 계수 시각화
coef = pd.Series(lassocv.coef_, index = X_train.columns).sort_values()
imp_coef = pd.concat([coef.head(10), coef.tail(15)])
imp_coef.plot(kind = "barh")
plt.title("Coefficients in the Model")
```

Out[37]:
```
Text(0.5, 1.0, 'Coefficients in the Model')
```



K-Neighbors Regression

In [38]:
```
from sklearn.neighbors import KNeighborsRegressor
from sklearn.model_selection import GridSearchCV
model = KNeighborsRegressor()
param_grid ={'n_neighbors' : np.arange(1,10)}
model = GridSearchCV(model,param_grid,cv=5)
model.fit(X_train,y_train)
```

Out[38]:
```
GridSearchCV(cv=5, estimator=KNeighborsRegressor(),
             param_grid={'n_neighbors': array([1, 2, 3, 4, 5, 6, 7, 8, 9])})
```

In [39]:
```
y_pred = model.predict(X_test)
print('best N :' ,model.best_params_)
```

```
print ("MSE :", metrics.mean_squared_error(y_test, y_pred))
print("R squared :", metrics.r2_score(y_test, y_pred))
```

```
best N : {'n_neighbors': 9}
MSE : 110.66125635439359
R squared : 0.5298924116746597
```

In [40]:
```
score['K-NN'] =  [metrics.mean_squared_error(y_test, y_pred),
model.score(X_test, y_test)]
Data['K-NN'] = y_pred
```

RandomForest Regressoion

In [41]:
```
from sklearn.ensemble import RandomForestRegressor
model =  RandomForestRegressor(random_state=42)
model.fit(X_train,y_train)
```

Out[41]:
```
RandomForestRegressor(random_state=42)
```

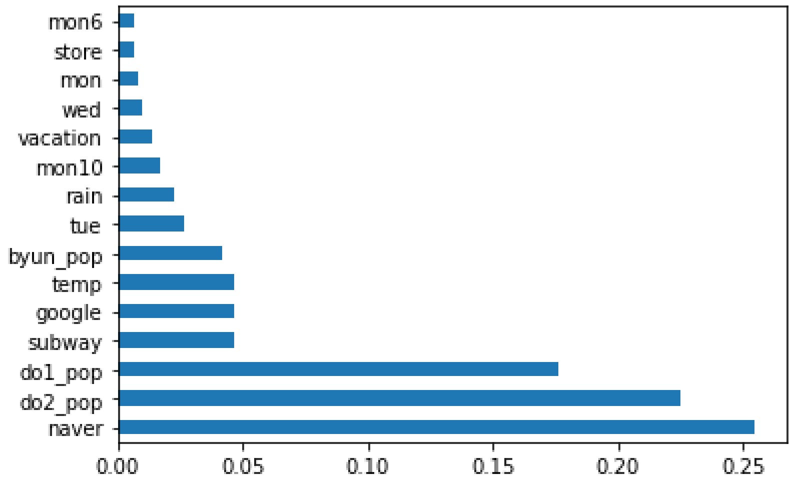
In [42]:
```
y_pred = model.predict(X_test)
print ("MSE :", metrics.mean_squared_error(y_test, y_pred))
print('R_squared :',model.score(X_test, y_test))
```

```
MSE : 91.9599994117647
R_squared : 0.6093384896388988
```

In [43]:
```
score['random_forest'] =  [metrics.mean_squared_error(y_test, y_pred),
model.score(X_test, y_test)]
Data['random_forest'] = y_pred
```

In [44]:
```
feat_importances = pd.Series(model.feature_importances_, index= X.columns)
feat_importances.nlargest(15).plot(kind='barh')
```

Out[44]:
```
<AxesSubplot:>
```



Gradient Boosting resgressoion

In [45]:
```python
from sklearn.ensemble import GradientBoostingRegressor
model = GradientBoostingRegressor(random_state=42)
model.fit(X_train, y_train)
```

Out[45]:
```
GradientBoostingRegressor(random_state=42)
```

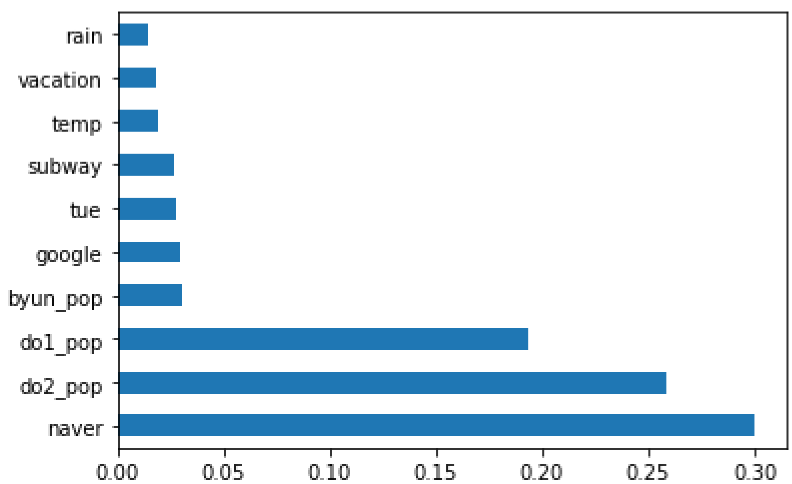
In [46]:
```python
y_pred = model.predict(X_test)
print ("MSE :", metrics.mean_squared_error(y_test, y_pred))
print('R_squared :',model.score(X_test, y_test))
```

```
MSE : 87.64051494326498
R_squared : 0.627688384563208
```

In [47]:
```python
score['Gradient_boosting'] = [metrics.mean_squared_error(y_test, y_pred),
model.score(X_test, y_test)]
Data['Gradient_boosting'] = y_pred
```

In [48]:
```python
feat_importances = pd.Series(model.feature_importances_, index= X.columns)
feat_importances.nlargest(10).plot(kind='barh')
```

Out[48]:
```
<AxesSubplot:>
```



xgboost Regression

In [49]:
```python
import xgboost as xgb
from xgboost.sklearn import XGBRegressor
model = XGBRegressor(n_estimators = 150,
learning_rate=0.08,max_depth=3,random_state=42)
model.fit(X_train, y_train)
```

Out[49]:
```
XGBRegressor(base_score=0.5, booster='gbtree', colsample_bylevel=1,
             colsample_bynode=1, colsample_bytree=1, gamma=0, gpu_id=-1,
             importance_type='gain', interaction_constraints='',
             learning_rate=0.08, max_delta_step=0, max_depth=3,
             min_child_weight=1, missing=nan, monotone_constraints='()',
             n_estimators=150, n_jobs=0, num_parallel_tree=1, random_state=42,
             reg_alpha=0, reg_lambda=1, scale_pos_weight=1, subsample=1,
             tree_method='exact', validate_parameters=1, verbosity=None)
```

In [50]:

```python
from sklearn import metrics
y_pred = model.predict(X_test)
print ("MSE :", metrics.mean_squared_error(y_test, y_pred))
print('R_squared :',model.score(X_test, y_test))
```

```
MSE : 86.19491623165206
R_squared : 0.6338295304926034
```

In [51]:

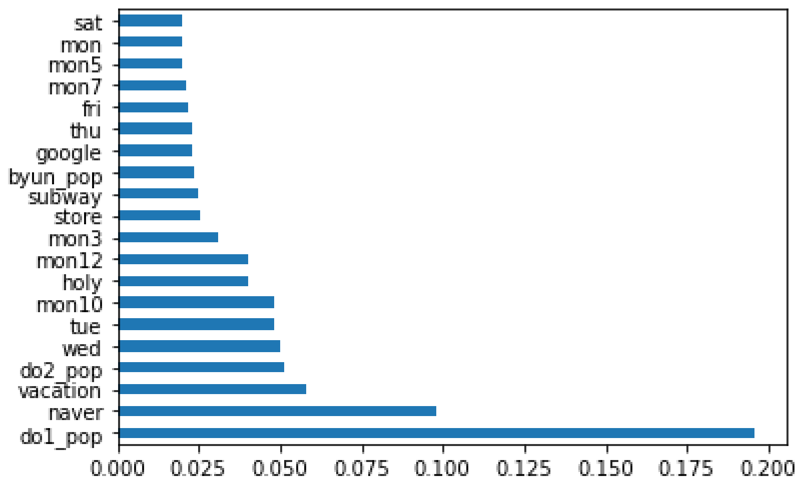
```python
score['xgb'] =  [metrics.mean_squared_error(y_test, y_pred),
model.score(X_test, y_test)]
Data['xgb'] = y_pred
```

In [52]:

```python
feat_importances = pd.Series(model.feature_importances_, index= X.columns)
feat_importances.nlargest(20).plot(kind='barh')
```

Out[52]:

```
<AxesSubplot:>
```



비교

In [53]:

```python
# 각 모델들의 MSE , R squre
score
```

Out[53]:

```
{'linear': [115.87375882979677, 0.5077488263894528],
 'Ridge': [115.78052629560398, 0.5081448938411224],
 'lasso': [114.83521939143081, 0.5081448938411224],
 'K-NN': [110.66125635439359, 0.5298924116746597],
 'random_forest': [91.9599994117647, 0.6093384896388988],
 'Gradient_boosting': [87.64051494326498, 0.627688384563208],
 'xgb': [86.19491623165206, 0.6338295304926034]}
```

In [54]:

```python
# 시각화 하기위해 파일저장.
pred_DATA = pd.DataFrame(Data)
pred_DATA.to_csv('예측.csv')
```

In [55]:

```python
pred_DATA.head(10)
```

Out[55]:

	y_test	linear	Ridge	lasso	K-NN	random_forest	Gradient_boosting	xgb
0	39	39.591610	39.591610	39.591610	47.555556	49.41	45.424855	47.355961

1	53	43.442307	43.442307	43.442307	45.666667	44.20	47.707230	48.964478
2	35	38.667962	38.667962	38.667962	34.000000	37.63	31.881639	31.860603
3	60	47.198234	47.198234	47.198234	52.888889	49.79	47.914982	48.031036
4	73	54.452415	54.452415	54.452415	67.555556	68.10	63.964419	63.798450
5	24	24.652574	24.652574	24.652574	27.888889	22.72	24.367213	24.255486
6	42	37.779270	37.779270	37.779270	40.000000	38.45	40.595756	39.900398
7	41	37.048577	37.048577	37.048577	36.111111	39.32	39.082240	39.168682
8	50	48.935753	48.935753	48.935753	49.222222	44.32	48.479283	46.267185
9	27	36.003448	36.003448	36.003448	36.888889	39.09	42.556822	40.453506

In [56]:

```
# 시각화는 따로 tableau 프로그램을 사용하였습니다.
```

In [ ]:

```
```