```
import numpy as np
import pandas as pd
import  matplotlib.pyplot as plt
import seaborn as sns

df=pd.read_csv('train.csv')

df.head()
```

```
   Id  MSSubClass MSZoning  LotFrontage  LotArea Street Alley LotShape
\
0   1          60       RL         65.0     8450   Pave   NaN      Reg

1   2          20       RL         80.0     9600   Pave   NaN      Reg

2   3          60       RL         68.0    11250   Pave   NaN      IR1

3   4          70       RL         60.0     9550   Pave   NaN      IR1

4   5          60       RL         84.0    14260   Pave   NaN      IR1


  LandContour Utilities  ... PoolArea PoolQC Fence MiscFeature MiscVal
MoSold  \
0         Lvl    AllPub  ...        0    NaN   NaN         NaN       0
2
1         Lvl    AllPub  ...        0    NaN   NaN         NaN       0
5
2         Lvl    AllPub  ...        0    NaN   NaN         NaN       0
9
3         Lvl    AllPub  ...        0    NaN   NaN         NaN       0
2
4         Lvl    AllPub  ...        0    NaN   NaN         NaN       0
12

  YrSold  SaleType  SaleCondition  SalePrice
0   2008        WD         Normal     208500
1   2007        WD         Normal     181500
2   2008        WD         Normal     223500
3   2006        WD        Abnorml     140000
4   2008        WD         Normal     250000

[5 rows x 81 columns]
```

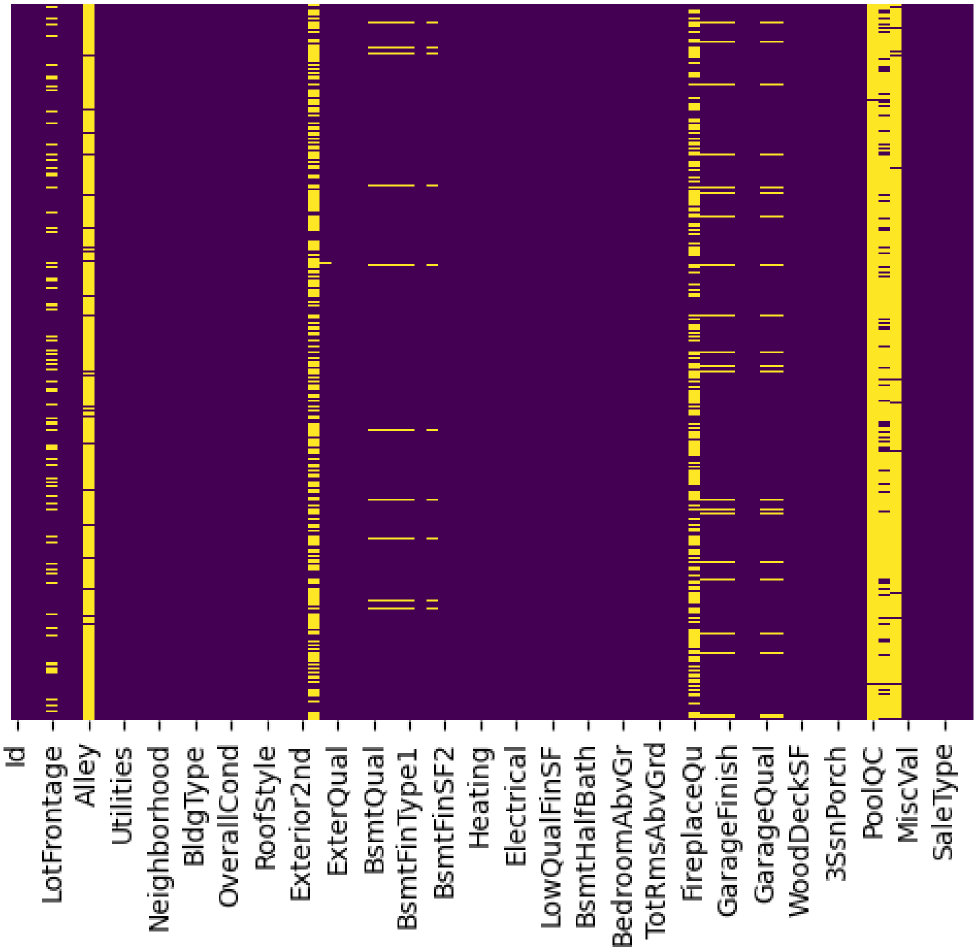
```
df.isnull().sum()
```

```
Id                 0
MSSubClass         0
MSZoning           0
LotFrontage      259
LotArea            0
```

```
                ...
MoSold             0
YrSold             0
SaleType           0
SaleCondition      0
SalePrice          0
Length: 81, dtype: int64
```

```
sns.heatmap(df.isnull(),yticklabels=False,cbar=False,cmap='viridis')
```

```
<Axes: >
```



```
df.shape
```

```
(1460, 81)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1460 entries, 0 to 1459
```

```
Data columns (total 81 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   Id             1460 non-null   int64  
 1   MSSubClass     1460 non-null   int64  
 2   MSZoning       1460 non-null   object 
 3   LotFrontage    1201 non-null   float64
 4   LotArea        1460 non-null   int64  
 5   Street         1460 non-null   object 
 6   Alley          91 non-null     object 
 7   LotShape       1460 non-null   object 
 8   LandContour    1460 non-null   object 
 9   Utilities      1460 non-null   object 
 10  LotConfig      1460 non-null   object 
 11  LandSlope      1460 non-null   object 
 12  Neighborhood   1460 non-null   object 
 13  Condition1     1460 non-null   object 
 14  Condition2     1460 non-null   object 
 15  BldgType       1460 non-null   object 
 16  HouseStyle     1460 non-null   object 
 17  OverallQual    1460 non-null   int64  
 18  OverallCond    1460 non-null   int64  
 19  YearBuilt      1460 non-null   int64  
 20  YearRemodAdd   1460 non-null   int64  
 21  RoofStyle      1460 non-null   object 
 22  RoofMatl       1460 non-null   object 
 23  Exterior1st    1460 non-null   object 
 24  Exterior2nd    1460 non-null   object 
 25  MasVnrType     588 non-null    object 
 26  MasVnrArea     1452 non-null   float64
 27  ExterQual      1460 non-null   object 
 28  ExterCond      1460 non-null   object 
 29  Foundation     1460 non-null   object 
 30  BsmtQual       1423 non-null   object 
 31  BsmtCond       1423 non-null   object 
 32  BsmtExposure   1422 non-null   object 
 33  BsmtFinType1   1423 non-null   object 
 34  BsmtFinSF1     1460 non-null   int64  
 35  BsmtFinType2   1422 non-null   object 
 36  BsmtFinSF2     1460 non-null   int64  
 37  BsmtUnfSF      1460 non-null   int64  
 38  TotalBsmtSF    1460 non-null   int64  
 39  Heating        1460 non-null   object 
 40  HeatingQC      1460 non-null   object 
 41  CentralAir     1460 non-null   object 
 42  Electrical     1459 non-null   object 
 43  1stFlrSF       1460 non-null   int64  
 44  2ndFlrSF       1460 non-null   int64  
 45  LowQualFinSF   1460 non-null   int64  
 46  GrLivArea      1460 non-null   int64
 47  BsmtFullBath   1460 non-null   int64
 48  BsmtHalfBath   1460 non-null   int64
 49  FullBath       1460 non-null   int64
 50  HalfBath       1460 non-null   int64
 51  BedroomAbvGr   1460 non-null   int64
 52  KitchenAbvGr   1460 non-null   int64
 53  KitchenQual    1460 non-null   object
 54  TotRmsAbvGrd   1460 non-null   int64
 55  Functional     1460 non-null   object
 56  Fireplaces     1460 non-null   int64
 57  FireplaceQu    770 non-null    object
 58  GarageType     1379 non-null   object
 59  GarageYrBlt    1379 non-null   float64
 60  GarageFinish   1379 non-null   object
 61  GarageCars     1460 non-null   int64
 62  GarageArea     1460 non-null   int64
 63  GarageQual     1379 non-null   object
 64  GarageCond     1379 non-null   object
 65  PavedDrive     1460 non-null   object
 66  WoodDeckSF     1460 non-null   int64
 67  OpenPorchSF    1460 non-null   int64
 68  EnclosedPorch  1460 non-null   int64
 69  3SsnPorch      1460 non-null   int64
 70  ScreenPorch    1460 non-null   int64
 71  PoolArea       1460 non-null   int64
 72  PoolQC         7 non-null      object
 73  Fence          281 non-null    object
 74  MiscFeature    54 non-null     object
 75  MiscVal        1460 non-null   int64
 76  MoSold         1460 non-null   int64
 77  YrSold         1460 non-null   int64
 78  SaleType       1460 non-null   object
 79  SaleCondition  1460 non-null   object
 80  SalePrice      1460 non-null   int64
dtypes: float64(3), int64(35), object(43)
memory usage: 924.0+ KB
```

```python
df['LotFrontage']=df['LotFrontage'].fillna(df['LotFrontage'].mean())

df.drop(['Alley'],axis=1,inplace=True)

df['BsmtCond']=df['BsmtCond'].fillna(df['BsmtCond'].mode()[0])
df['BsmtQual']=df['BsmtQual'].fillna(df['BsmtQual'].mode()[0])

df['FireplaceQu']=df['FireplaceQu'].fillna(df['FireplaceQu'].mode()
[0])
df['GarageType']=df['GarageType'].fillna(df['GarageType'].mode()[0])

df.drop(['GarageYrBlt'],axis=1,inplace=True)
```

```
df['GarageFinish']=df['GarageFinish'].fillna(df['GarageFinish'].mode()[0])
df['GarageQual']=df['GarageQual'].fillna(df['GarageQual'].mode()[0])
df['GarageCond']=df['GarageCond'].fillna(df['GarageCond'].mode()[0])
```

```
df.drop(['PoolQC','Fence','MiscFeature'],axis=1,inplace=True)
```

```
df.shape
```

```
(1460, 76)
```

```
df.drop(['Id'],axis=1,inplace=True)
```

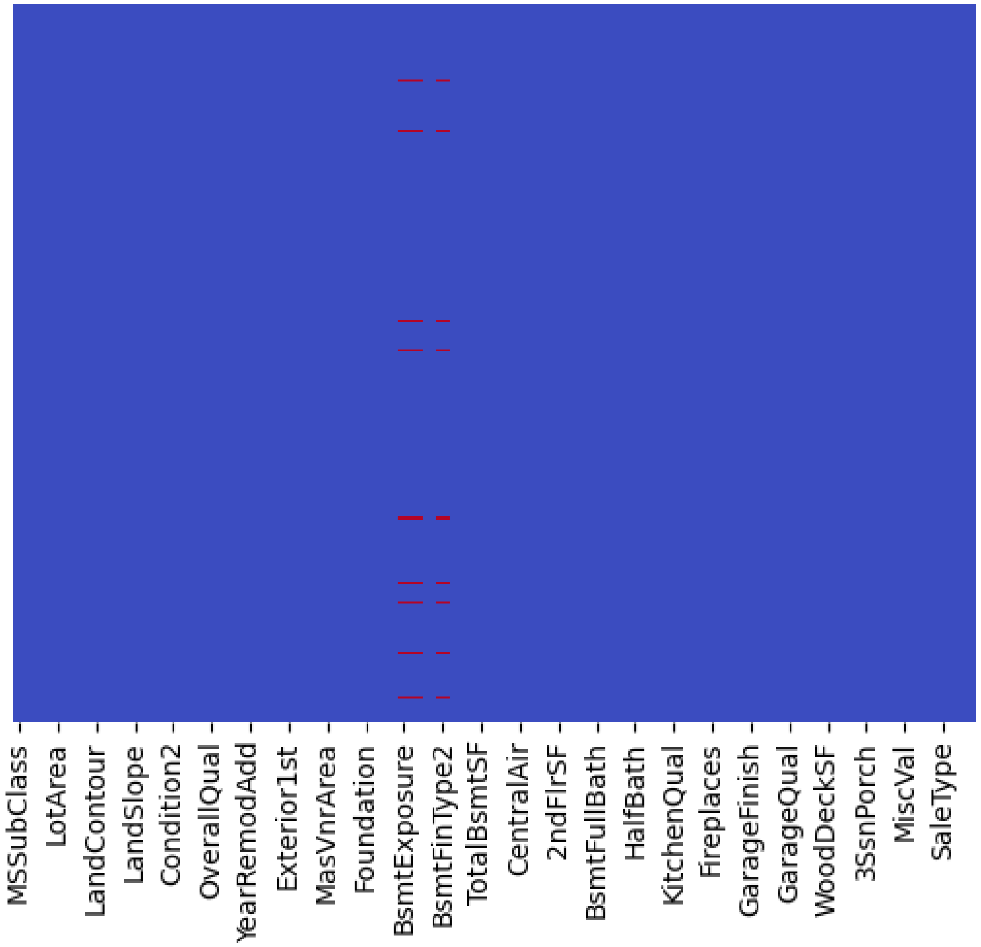
```
df.isnull().sum()
```

```
MSSubClass       0
MSZoning         0
LotFrontage      0
LotArea          0
Street           0
                ..
MoSold           0
YrSold           0
SaleType         0
SaleCondition    0
SalePrice        0
Length: 75, dtype: int64
```

```
df['MasVnrType']=df['MasVnrType'].fillna(df['MasVnrType'].mode()[0])
df['MasVnrArea']=df['MasVnrArea'].fillna(df['MasVnrArea'].mode()[0])
```

```
sns.heatmap(df.isnull(),yticklabels=False,cbar=False,cmap='coolwarm')
```

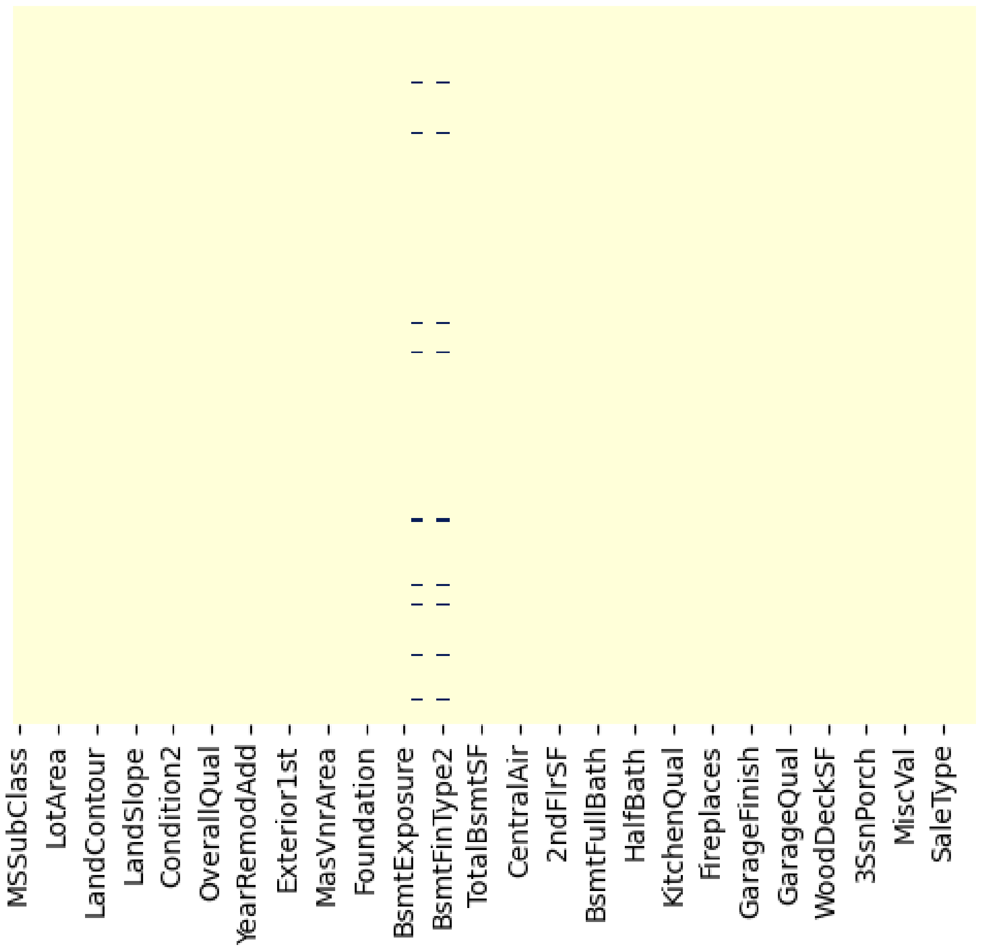
```
<Axes: >
```



```
df['BsmtExposure']=df['BsmtExposure'].fillna(df['BsmtExposure'].mode()
[0])

sns.heatmap(df.isnull(),yticklabels=False,cbar=False,cmap='YlGnBu')
```

```
<Axes: >
```



```
df['BsmtFinType2']=df['BsmtFinType2'].fillna(df['BsmtFinType2'].mode()
[0])

df.dropna(inplace=True)

df.shape

(1421, 75)

df.head()

   MSSubClass MSZoning  LotFrontage  LotArea Street LotShape
LandContour  \
0          60       RL         65.0     8450   Pave      Reg
Lvl
1          20       RL         80.0     9600   Pave      Reg
Lvl
2          60       RL         68.0    11250   Pave      IR1
Lvl
3          70       RL         60.0     9550   Pave      IR1
Lvl
```

```
4          60       RL          84.0    14260    Pave      IR1
Lvl

  Utilities LotConfig LandSlope  ... EnclosedPorch 3SsnPorch
ScreenPorch  \
0    AllPub    Inside       Gtl  ...             0         0
0
1    AllPub       FR2       Gtl  ...             0         0
0
2    AllPub    Inside       Gtl  ...             0         0
0
3    AllPub    Corner       Gtl  ...           272         0
0
4    AllPub       FR2       Gtl  ...             0         0
0

  PoolArea MiscVal  MoSold  YrSold  SaleType  SaleCondition SalePrice

0        0       0       2    2008        WD         Normal    208500

1        0       0       5    2007        WD         Normal    181500

2        0       0       9    2008        WD         Normal    223500

3        0       0       2    2006        WD        Abnorml    140000

4        0       0      12    2008        WD         Normal    250000


[5 rows x 75 columns]
```

```
cat_cols = df.select_dtypes(include='object').columns
print(cat_cols)
```

```
Index(['MSZoning', 'Street', 'LotShape', 'LandContour', 'Utilities',
       'LotConfig', 'LandSlope', 'Neighborhood', 'Condition1',
'Condition2',
       'BldgType', 'HouseStyle', 'RoofStyle', 'RoofMatl',
'Exterior1st',
       'Exterior2nd', 'MasVnrType', 'ExterQual', 'ExterCond',
'Foundation',
       'BsmtQual', 'BsmtCond', 'BsmtExposure', 'BsmtFinType1',
'BsmtFinType2',
       'Heating', 'HeatingQC', 'CentralAir', 'Electrical',
'KitchenQual',
       'Functional', 'FireplaceQu', 'GarageType', 'GarageFinish',
'GarageQual',
       'GarageCond', 'PavedDrive', 'SaleType', 'SaleCondition'],
      dtype='object')
```

```
from sklearn.preprocessing import LabelEncoder

le = LabelEncoder()
for col in cat_cols:
    df[col] = le.fit_transform(df[col])

X = df.drop('SalePrice', axis=1)
y = df['SalePrice']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)

from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
import numpy as np

lr = LinearRegression()
lr.fit(X_train, y_train)

# Predictions
y_pred = lr.predict(X_test)

# Evaluation
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
r2 = r2_score(y_test, y_pred)

print(f"□ RMSE: {rmse:.2f}")
print(f"□ R² Score: {r2:.2f}")
```

```
□ RMSE: 30606.95
□ R² Score: 0.84
```

```
# Example: Use the first row from test data
sample = X_test[0].reshape(1, -1)

# Predict price
predicted_price = lr.predict(sample)
print(f" Predicted House Price: ${predicted_price[0]:,.2f}")
```

```
 Predicted House Price: $371,907.06
```