In [30]:
```
import numpy as np
import pandas as pd
df=pd.read_csv("/content/vehicle_stolen_dataset_ with_headers.csv")
df
```

Out[30]:

	number_plate	brand	color	time	stoled
0	N001	BMW	black	night	yes
1	N002	Audi	black	night	no
2	N003	NISSAN	black	night	yes
3	N004	VEGA	red	day	yes
4	N005	BMW	blue	day	no
5	N006	Audi	black	day	yes
6	N007	VEGA	red	night	no
7	N008	Audi	blue	day	yes
8	N009	VEGA	black	day	yes
9	N010	NISSAN	blue	day	no
10	N011	BMW	black	night	yes
11	N012	NISSAN	red	day	no
12	N013	VEGA	black	night	yes
13	N014	BMW	red	day	no
14	N015	Audi	black	day	yes
15	N016	Audi	blue	night	yes
16	N017	Audi	red	day	no
17	N018	NISSAN	black	day	yes
18	N019	BMW	blue	day	yes
19	N020	BMW	red	night	yes

In [31]:
```
df.shape
```

Out[31]:
```
(20, 5)
```

In [32]:
```
df.size
```

Out[32]:
```
100
```

In [33]:
```
df.columns
```

Out[33]:
```
Index(['number_plate', 'brand', 'color', 'time', 'stoled'], dtype='object')
```

In [34]:
```
df.dtypes
```

Out[34]:
```
number_plate    object
brand           object
color           object
time            object
stoled          object
dtype: object
```

In [35]:
```
df.isna().sum()
```

Out[35]:
```
number_plate    0
brand           0
color           0
time            0
stoled          0
dtype: int64
```

In [36]:
```
# COUNT OF STOLEN VEHICLES IN THE DATASET
count=df['stoled'].value_counts()
count
```

Out[36]:
```
yes    13
no      7
Name: stoled, dtype: int64
```

In [37]:
```
# COLLECT DATA OF STOLEN CARS
df1=df.loc[df.stoled=='yes']
df1
```

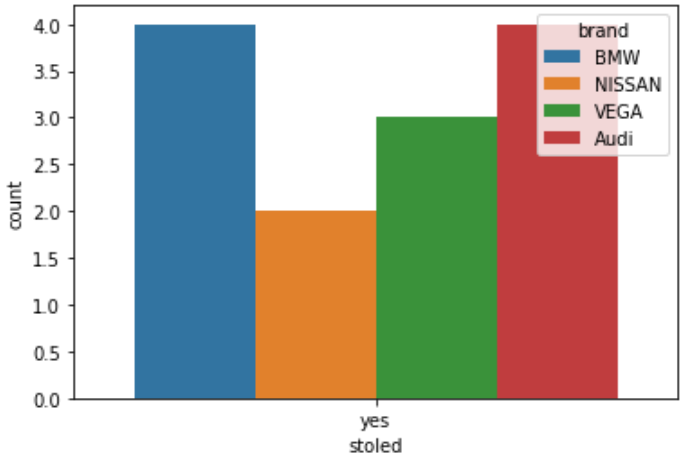
Out[37]:

	number_plate	brand	color	time	stoled
0	N001	BMW	black	night	yes
2	N003	NISSAN	black	night	yes
3	N004	VEGA	red	day	yes
5	N006	Audi	black	day	yes
7	N008	Audi	blue	day	yes
8	N009	VEGA	black	day	yes
10	N011	BMW	black	night	yes
12	N013	VEGA	black	night	yes
14	N015	Audi	black	day	yes
15	N016	Audi	blue	night	yes
17	N018	NISSAN	black	day	yes
18	N019	BMW	blue	day	yes
19	N020	BMW	red	night	yes

In [38]:
```
# VISUALIZE
import seaborn as sns
sns.countplot('stoled',data=df1,hue='brand')
```

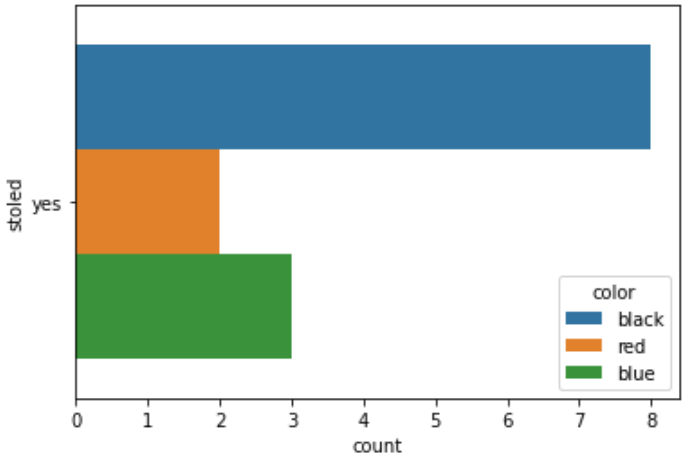
```
/usr/local/lib/python3.8/dist-packages/seaborn/_decorators.py:36: FutureWar
ning: Pass the following variable as a keyword arg: x. From version 0.12, t
he only valid positional argument will be `data`, and passing other argumen
ts without an explicit keyword will result in an error or misinterpretatio
n.
  warnings.warn(
```

Out[38]: <matplotlib.axes._subplots.AxesSubplot at 0x7f9c67eafa30>



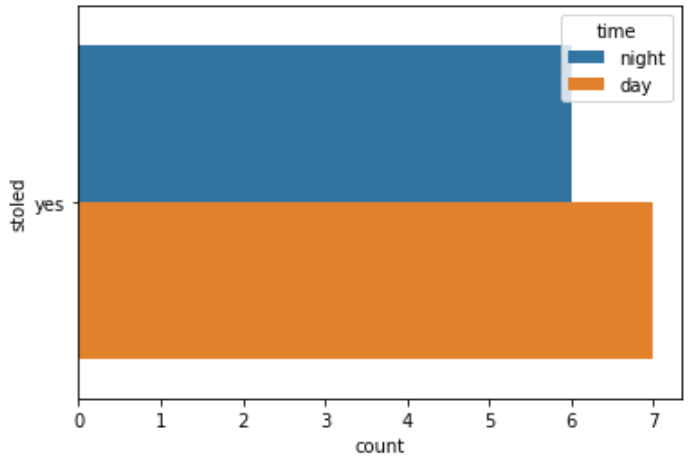
In [39]:
```
sns.countplot(y='stoled',data=df1,hue='color')
```

Out[39]: <matplotlib.axes._subplots.AxesSubplot at 0x7f9c67a46c10>



In [40]:
```
sns.countplot(y='stoled',data=df1,hue='time')
```

Out[40]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f9c67a1c6d0>
```

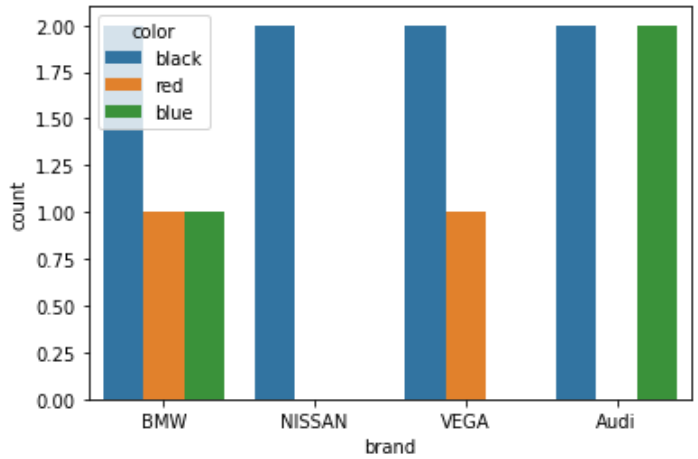


In [41]:
```
# CARS MOST LIKELY TO BE STOLEN
# TIME: DAY
# CAR COLOR: BLACK
# CAR BRAND: AUDI,BMW
```

In [42]:
```
sns.countplot('brand',data=df1,hue='color')
```

```
/usr/local/lib/python3.8/dist-packages/seaborn/_decorators.py:36: FutureWar
ning: Pass the following variable as a keyword arg: x. From version 0.12, t
he only valid positional argument will be `data`, and passing other argumen
ts without an explicit keyword will result in an error or misinterpretatio
n.
  warnings.warn(
```

Out[42]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f9c679f5c40>
```



ABOVE BAR CHART SHOWS THE PREFERRED COLOR OF EACH STOLEN CAR BRAND

In [43]:
```
#LABEL ENCODING
from sklearn.preprocessing import LabelEncoder
features=['number_plate','brand','color','time']
df[features]=df[features].apply(LabelEncoder().fit_transform)
df
```

Out[43]:

	number_plate	brand	color	time	stoled
0	0	1	0	1	yes
1	1	0	0	1	no
2	2	2	0	1	yes
3	3	3	2	0	yes
4	4	1	1	0	no
5	5	0	0	0	yes
6	6	3	2	1	no
7	7	0	1	0	yes
8	8	3	0	0	yes
9	9	2	1	0	no
10	10	1	0	1	yes
11	11	2	2	0	no
12	12	3	0	1	yes
13	13	1	2	0	no
14	14	0	0	0	yes
15	15	0	1	1	yes
16	16	0	2	0	no
17	17	2	0	0	yes
18	18	1	1	0	yes
19	19	1	2	1	yes

In [44]:
```
# SEPERATING INPUT X AND OUTPUT Y
df1=df.drop(['number_plate'],axis=1)
df1
```

Out[44]:

	brand	color	time	stoled
0	1	0	1	yes
1	0	0	1	no
2	2	0	1	yes
3	3	2	0	yes
4	1	1	0	no
5	0	0	0	yes
6	3	2	1	no
7	0	1	0	yes
8	3	0	0	yes
9	2	1	0	no
10	1	0	1	yes
11	2	2	0	no
12	3	0	1	yes
13	1	2	0	no
14	0	0	0	yes
15	0	1	1	yes
16	0	2	0	no
17	2	0	0	yes
18	1	1	0	yes
19	1	2	1	yes

In [45]:
```
x=df1.iloc[:,:-1].values
y=df1.iloc[:,-1].values
```

In [46]:
```
# SEPERATING TRAINING AND TESTING DATA
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.30,random_st
ate=42)
```

In [47]:
```
# NORMALIZATION
from sklearn.preprocessing import StandardScaler
scaler=StandardScaler()
scaler.fit(x_train)
x_train=scaler.transform(x_train)
x_test=scaler.transform(x_test)
```

In [48]:
```
# ML MODELLING
from sklearn.svm import SVC
model=SVC()
model.fit(x_train,y_train)
y_pred=model.predict(x_test)
y_pred
```

Out[48]:
```
array(['yes', 'yes', 'yes', 'yes', 'yes', 'yes'], dtype=object)
```

In [49]:
```python
# PERFROMANCE EVALUATION
from sklearn.metrics import confusion_matrix,accuracy_score,classification_report
mat=confusion_matrix(y_pred,y_test)
mat
```

Out[49]:
```
array([[0, 0],
       [1, 5]])
```

In [50]:
```python
score=accuracy_score(y_pred,y_test)
score
```

Out[50]:
```
0.8333333333333334
```

In [51]:
```python
report=classification_report(y_pred,y_test)
print(report)
```

```
              precision    recall  f1-score   support

          no       0.00      0.00      0.00         0
         yes       1.00      0.83      0.91         6

    accuracy                           0.83         6
   macro avg       0.50      0.42      0.45         6
weighted avg       1.00      0.83      0.91         6


/usr/local/lib/python3.8/dist-packages/sklearn/metrics/_classification.py:1318: UndefinedMetricWarning: Recall and F-score are ill-defined and being set to 0.0 in labels with no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.8/dist-packages/sklearn/metrics/_classification.py:1318: UndefinedMetricWarning: Recall and F-score are ill-defined and being set to 0.0 in labels with no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.8/dist-packages/sklearn/metrics/_classification.py:1318: UndefinedMetricWarning: Recall and F-score are ill-defined and being set to 0.0 in labels with no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```