In [1]:

```
import numpy as np
import pandas as pd
import re
import nltk
import random
from nltk.corpus import stopwords
from textblob import Word, TextBlob
from wordcloud import WordCloud
import matplotlib.pyplot as plt
from nltk.sentiment import SentimentIntensityAnalyzer
from sklearn.preprocessing import LabelEncoder
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import cross_val_score, GridSearchCV, cross_validate
from sklearn.metrics import classification_report
from sklearn.ensemble import RandomForestClassifier
```

Verilere Genel Bir Bakış

In [2]:

```
df=pd.read_excel("C:\\Users\\Dell\\Desktop\\NLP\\Case Study 1\\amazon.xlsx")
df.head()
```

Out[2]:

	Star	HelpFul	Title	Review
0	5	0	looks great	Happy with it
1	5	0	Pattern did not align between the two panels.	Good quality material however the panels are m...
2	5	0	Imagery is stretched. Still fun.	Product was fun for bedroom windows. Imag...
3	5	0	Que se ven elegantes muy finas	Lo unico que me gustaria es que sean un poco ...
4	5	0	Wow great purchase	Great bang for the buck I can't believe the qu...

In [3]:

```
df.tail()
```

Out[3]:

	Star	HelpFul	Title	Review
5606	4	0	Recommend	Great product for reasonable money. Delivered...
5607	5	0	Terrible , different colors. I returned	Color is way off and panels do not match
5608	5	0	Extremely pleasing	These are great for my studio as they compleme...
5609	5	0	Perfect	Brought out the beauty in kids room. They love...
5610	4	0	Quality Curtains for the price	Very cute curtains in my sons room! Thick enou...

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5611 entries, 0 to 5610
Data columns (total 4 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   Star     5611 non-null   int64
```

```
 1   HelpFul  5611 non-null   int64
 2   Title    5559 non-null   object
 3   Review   5593 non-null   object
dtypes: int64(2), object(2)
memory usage: 175.5+ KB
```

In [5]:

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

Out[5]:

```
Star         0
HelpFul      0
Title       52
Review      18
dtype: int64
```

In [6]:

```
df["Star"].value_counts()
```

Out[6]:

```
Star
5    4126
4     588
1     368
3     315
2     214
Name: count, dtype: int64
```

In [7]:

```
df.describe().T
```

Out[7]:

	count	mean	std	min	25%	50%	75%	max
Star	5611.0	4.406166	1.170291	1.0	4.0	5.0	5.0	5.0
HelpFul	5611.0	0.984495	4.109631	0.0	0.0	0.0	1.0	124.0

Metin Ön İşleme

In [8]:

```
df["Review"]=df["Review"].str.lower() # küçük harfe çevirme
df["Review"]
```

Out[8]:

```
0                                          happy with it
1       good quality material however the panels are m...
2       product was fun for bedroom windows.<br />imag...
3        lo unico que me gustaria es que sean un poco ...
4       great bang for the buck i can't believe the qu...
                              ...
5606    great product for reasonable money.  delivered...
5607              color is way off and panels do not match
5608    these are great for my studio as they compleme...
5609    brought out the beauty in kids room. they love...
5610    very cute curtains in my sons room! thick enou...
Name: Review, Length: 5611, dtype: object
```

In [9]:

```
# noktalama işaretlerini kaldırma
df["Review"]=df['Review'].apply(lambda x: re.sub("[^\w\s]","", str(x)))
```

```
df["Review"]
```

Out[9]:

```
0                                          happy with it
1       good quality material however the panels are m...
2       product was fun for bedroom windowsbr imagery ...
3        lo unico que me gustaria es que sean un poco ...
4       great bang for the buck i cant believe the qua...
                              ...
5606    great product for reasonable money  delivered ...
5607              color is way off and panels do not match
5608    these are great for my studio as they compleme...
5609     brought out the beauty in kids room they love it
5610    very cute curtains in my sons room thick enoug...
Name: Review, Length: 5611, dtype: object
```

In [10]:

```
df["Review"][125:130]
```

Out[10]:

```
125    great i feel like ive gone to tahiti i placed ...
126    i purchased the 4 seasons print and couldnt be...
127    it does not look as vibrant and dramatic as th...
128    i wish they had wider ones but the 108 inches ...
129    really pretty design looks just like the pictu...
Name: Review, dtype: object
```

In [11]:

```
df["Review"]=df['Review'].fillna('').apply(lambda x: ''.join([i for i in x if not i.isdi
git()])) # sayısal ifadeleri kaldırma
df["Review"][125:130]
```

Out[11]:

```
125    great i feel like ive gone to tahiti i placed ...
126    i purchased the  seasons print and couldnt be ...
127    it does not look as vibrant and dramatic as th...
128    i wish they had wider ones but the  inches fit...
129    really pretty design looks just like the pictu...
Name: Review, dtype: object
```

In [12]:

```
# stopwords kelimelerini kaldırma
nltk.download("stopwords")
sw=stopwords.words("english")
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\Dell\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

In [13]:

```
df["Review"]=df["Review"].apply(lambda x: " ".join(x for x in str(x).split() if x not in
sw))
df["Review"]
```

Out[13]:

```
0                                                  happy
1          good quality material however panels mismatched
2       product fun bedroom windowsbr imagery bit stre...
3       lo unico que gustaria es que sean un poco mas ...
4       great bang buck cant believe quality material ...
                              ...
5606    great product reasonable money delivered quick...
5607                              color way panels match
5608    great studio complement entire theme studioliv...
5609                    brought beauty kids room love
5610    cute curtains sons room thick enough keep light
```

```
5610      cute curtains sons room thick enough keep light
Name: Review, Length: 5611, dtype: object
```

In [14]:

```
temp_df=pd.Series(" ".join(df["Review"]).split()).value_counts() #1000 den az olan kelim eleri df den çıkartıyoruz.
temp_df
```

Out[14]:

```
curtains        1891
love            1312
room            1116
like            1037
beautiful        943
                ...
encantarón         1
neato              1
decormatches       1
thx                1
studioliving       1
Name: count, Length: 6698, dtype: int64
```

In [15]:

```
drops=temp_df[temp_df<2]
drops
```

Out[15]:

```
vaulted         1
umph            1
reevaluated     1
grass           1
remodeling      1
               ..
encantarón      1
neato           1
decormatches    1
thx             1
studioliving    1
Name: count, Length: 3694, dtype: int64
```

In [16]:

```
df["Review"]=df["Review"].apply(lambda x: " ".join(x for x in str(x).split() if x not in drops))
df["Review"]
```

Out[16]:

```
0                                                   happy
1                    good quality material however panels
2       product fun bedroom windowsbr imagery bit stre...
3                                lo que es que un poco mas
4       great bang buck cant believe quality material ...
                              ...
5606    great product reasonable money delivered quick...
5607                               color way panels match
5608    great studio complement entire theme area phot...
5609                         brought beauty kids room love
5610      cute curtains sons room thick enough keep light
Name: Review, Length: 5611, dtype: object
```

In [17]:

```
# lemmatization
df['Review'] = df['Review'].apply(lambda x: " ".join([Word(word).lemmatize() for word in x.split()]))
df['Review']
```

Out[17]:

```
0                                                  happy
1                       good quality material however panel
2          product fun bedroom windowsbr imagery bit stre...
3                                    lo que e que un poco ma
4          great bang buck cant believe quality material ...
                                ...
5606       great product reasonable money delivered quick...
5607                                   color way panel match
5608       great studio complement entire theme area phot...
5609                           brought beauty kid room love
5610           cute curtain son room thick enough keep light
Name: Review, Length: 5611, dtype: object
```

Metin Görselleştirme

In [18]:

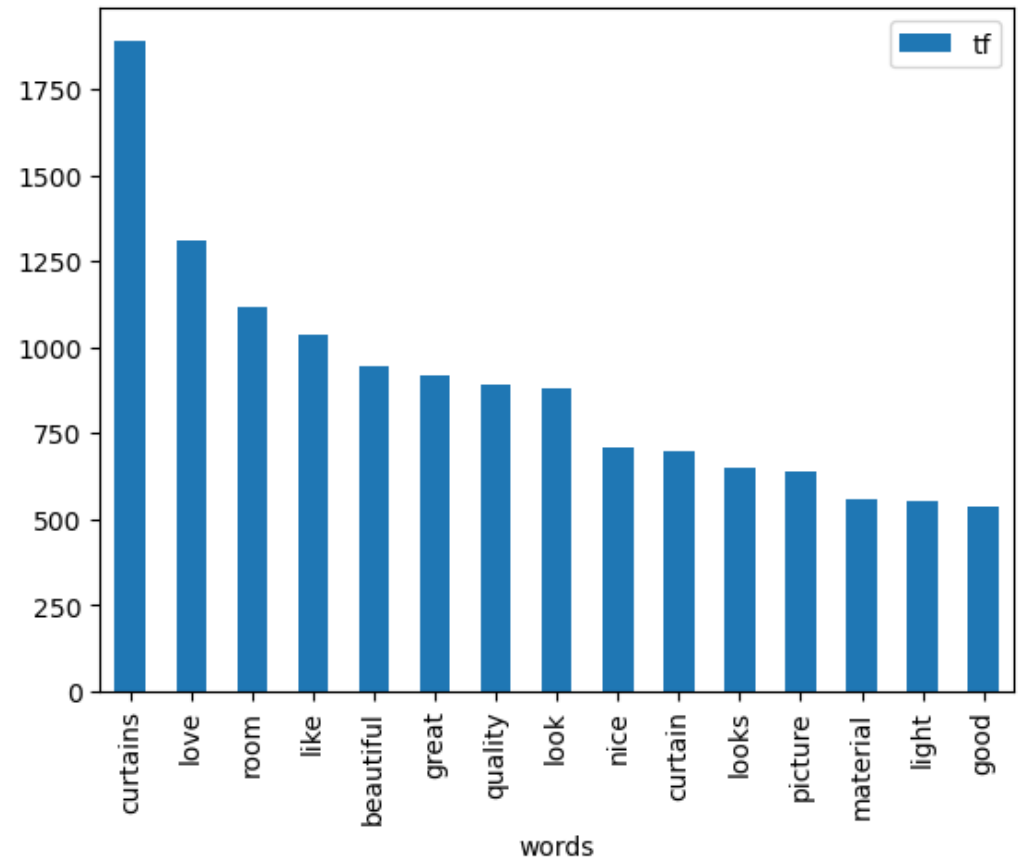
```
tf=pd.DataFrame(temp_df)
tf.reset_index(inplace=True)
tf.columns=["words","tf"]
tf.head()
```

Out[18]:

	words	tf
0	curtains	1891
1	love	1312
2	room	1116
3	like	1037
4	beautiful	943

In [19]:

```
tf[tf["tf"]>500].plot.bar(x="words",y="tf");
```

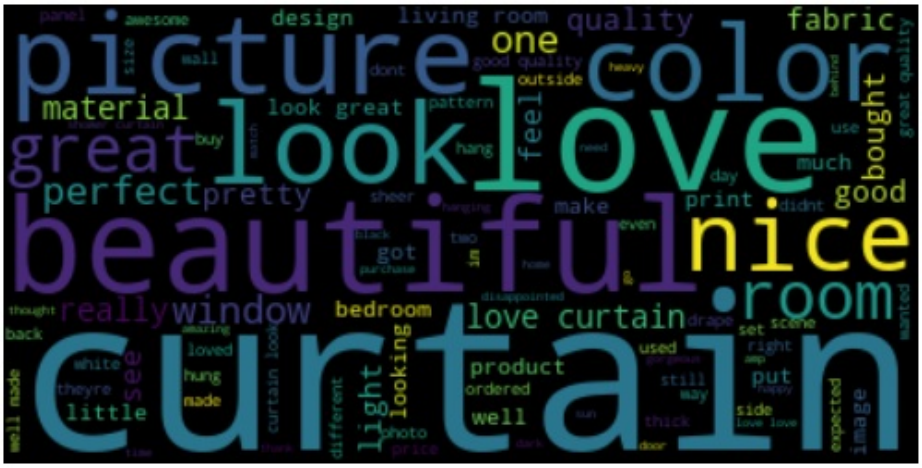


In [20]:

```
text=" ".join(i for i in df.Review)
```

In [21]:

```
wordcloud=WordCloud(max_font_size=1000, max_words=100, background_color="black").generate
(text)
plt.figure()
plt.imshow(wordcloud,interpolation="bilinear")
plt.axis("off")
plt.show()
```



SentimentIntensityAnalyzer

In [22]:

```
sia=SentimentIntensityAnalyzer()
```

In [23]:

```
df["sentiment_label"]=df["Review"].apply(lambda x: "pos" if sia.polarity_scores(x)["comp
ound"]>0 else "nef")
df.head(10)
```

Out[23]:

	Star	HelpFul	Title	Review	sentiment_label
0	5	0	looks great	happy	pos
1	5	0	Pattern did not align between the two panels.	good quality material however panel	pos
2	5	0	Imagery is stretched. Still fun.	product fun bedroom windowsbr imagery bit stre...	pos
3	5	0	Que se ven elegantes muy finas	lo que e que un poco ma	nef
4	5	0	Wow great purchase	great bang buck cant believe quality material ...	pos
5	5	0	Not for us	look different photo	nef
6	5	0	Perfect for spa room	exactly looking heavy material great price fast	pos
7	5	0	Actually better than expected	looking picture thought curtain would thinner ...	pos
8	4	0	Not what expected	much thought would wasnt really expecting want...	nef
9	5	0	Pretty as a Picture	curtain picture show rd set ambesonne curtain ...	pos

In [24]:

```
df.tail(10)
```

Out[24]:

	Star	HelpFul	Title	Review	sentiment_label
5601	5	0	Festive Addition	heavy good quality curtain image bright good f...	pos
5602	5	0	Tree life curtain	hung seam bottom even part longer others still...	pos
5603	5	0	Very pretty	using room divider privacy office much prettie...	pos
5604	5	0	Got my more than moneys worth	material way better photo provided happy purch...	pos
5605	5	0	My daughter loves these	long floor curtain rod cover short window well...	pos
5606	4	0	Recommend	great product reasonable money delivered quick...	pos
5607	5	0	Terrible , different colors. I returned	color way panel match	nef
5608	5	0	Extremely pleasing	great studio complement entire theme area phot...	pos
5609	5	0	Perfect	brought beauty kid room love	pos
5610	4	0	Quality Curtains for the price	cute curtain son room thick enough keep light	pos

In [25]:

```
df["sentiment_label"].value_counts()
```

Out[25]:

```
sentiment_label
pos    4764
nef     847
Name: count, dtype: int64
```

In [26]:

```
df.groupby("sentiment_label")["Star"].mean()
```

Out[26]:

```
sentiment_label
nef    3.409681
pos    4.583333
Name: Star, dtype: float64
```

Modeli oluşturma

In [27]:

```
df["sentiment_label"]=LabelEncoder().fit_transform(df["sentiment_label"])
y=df["sentiment_label"]
X=df["Review"]
```

In [28]:

```
x_train,x_test,y_train,y_test=train_test_split(X,y,random_state=14)
```

In [29]:

```
tf_idf=TfidfVectorizer().fit(x_train)
x_train_tf_idf=tf_idf.transform(x_train)
x_test_tf_idf=tf_idf.transform(x_test)
```

Makine Öğrenmesi

In [30]:

```
# Logistic Regression
log_model=LogisticRegression().fit(x_train_tf_idf,y_train)
cross_val_score(log_model,
                x_train_tf_idf,
```

```
                y_train,
                scoring="accuracy",
                cv=5).mean()
```

Out[30]:

```
0.8873550037987805
```

In [31]:

```
y_pred=log_model.predict(x_test_tf_idf)
print(classification_report(y_pred,y_test))
```

```
              precision    recall  f1-score   support

           0       0.28      0.94      0.43        65
           1       1.00      0.88      0.94      1338

    accuracy                           0.89      1403
   macro avg       0.64      0.91      0.68      1403
weighted avg       0.96      0.89      0.91      1403
```

In [53]:

```
number=random.randint(0,996)
data=pd.DataFrame(X[number:number+10],columns=["Review"])
data["real"]=y[number:number+10]
data["predict"]=log_model.predict(tf_idf.fit(x_train).transform(data["Review"].values))
data
```

Out[53]:

	Review	real	predict
589	cool	1	1
590	quality curtain beautiful picture	1	1
591	great quality	1	1
592	nicely made	1	1
593	really cool son red white blue bedroom love cu...	1	1
594	dont hang rod well	0	1
595	material beautiful design love	1	1
596	nice love	1	1
597	everyone love friend family	1	1
598	absolutely perfect probably order another	1	1

In [33]:

```
# Random Forest Classifier
rf_model=RandomForestClassifier().fit(x_train_tf_idf,y_train)
cross_val_score(rf_model,
                x_train_tf_idf,
                y_train,
                scoring="accuracy",
                cv=5,
                n_jobs=-1).mean()
```

Out[33]:

```
0.9089800910012682
```

In [34]:

```
y_pred=rf_model.predict(x_test_tf_idf)
print(classification_report(y_pred,y_test))
```

```
              precision    recall  f1-score   support

           0       0.64      0.84      0.73       167
           1       0.98      0.94      0.96      1236

    accuracy                           0.93      1403
   macro avg       0.81      0.89      0.84      1403
weighted avg       0.94      0.93      0.93      1403
```

In [41]:

```
number=random.randint(0,996)
data=pd.DataFrame(X[number:number+10],columns=["Review"])
data["real"]=y[number:number+10]
data["predict"]=rf_model.predict(tf_idf.fit(x_train).transform(data["Review"].values))
data
```

Out[41]:

	Review	real	predict
450	curtain better expected walk room look like oc...	1	1
451	ordered teen daughter room different term woul...	1	1
452	pretty even light behind	1	1
453	nice curtain received allot compliment	1	1
454	hang closet bedroom love	1	1
455	good	1	1
456	washed looking big hope going work disappointed	0	0
457	look fantastic especially placed true picture	1	1
458	disappointment purchase photo amazon website g...	1	1
459		0	0

In [ ]: