oversampling-undersampling

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1 Oversampling-Undersampling for Imbalanced dataset

What is imbalanced dataset? A dataset having huge difference between class distributions. For example, class A having 1,000 instances while class B having 10,000 instances

What is data oversampling? Increasing the number of instances of minority class

What is data undersampling? Decreasing the number of instances of majority class

Why perform data resampling? Most of the classification algorithms require data with equal class distribution. If imbalanced dataset is provided, they tend to give poor performance.

these techniques can be applied when dealing with imbalanced text classification problems, such as spam detection or sentiment analysis.

[103]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

import re
import nltk
from nltk.corpus import stopwords
from nltk.stem import WordNetLemmatizer, PorterStemmer
from nltk.tokenize import word_tokenize

from nltk.tokenize import RegexpTokenizer
from sklearn.feature_extraction.text import TfidfVectorizer #convert the text␣
 ↪into feature vector

from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score

from imblearn.over_sampling import RandomOverSampler
from imblearn.under_sampling import RandomUnderSampler
```

[104]:
```
df= pd.read_csv('/kaggle/input/twitter/train.csv')
df.head()
```

[104]:

	id	label	tweet
0	1	0	@user when a father is dysfunctional and is s…
1	2	0	@user @user thanks for #lyft credit i can't us…
2	3	0	bihday your majesty
3	4	0	#model i love u take with u all the time in …
4	5	0	factsguide: society now #motivation

[105]:
```
df.info()
```

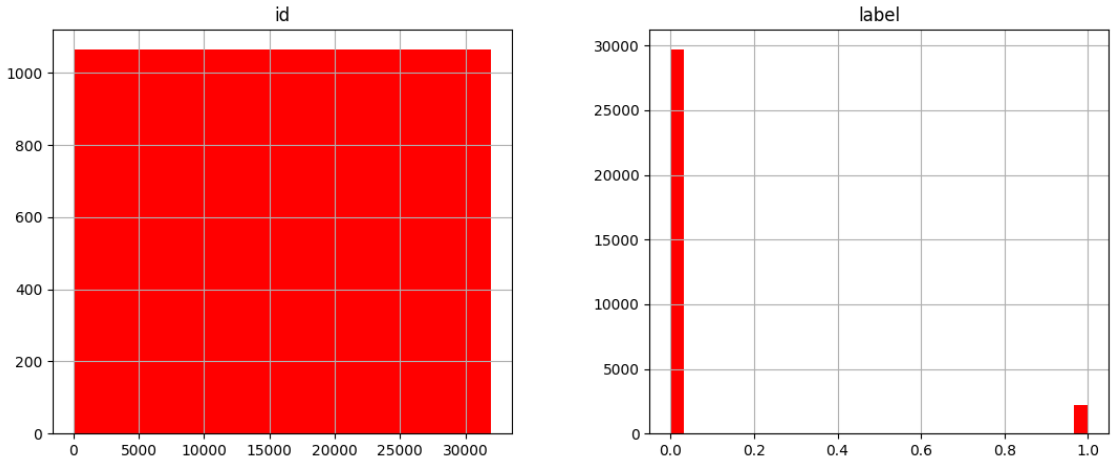
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 31962 entries, 0 to 31961
Data columns (total 3 columns):
 #   Column  Non-Null Count  Dtype 
---  ------  --------------  ----- 
 0   id      31962 non-null  int64 
 1   label   31962 non-null  int64 
 2   tweet   31962 non-null  object
dtypes: int64(2), object(1)
memory usage: 749.2+ KB
```

[106]:
```
df.shape
```

[106]: (31962, 3)

1.1 Exploring Dataset

[107]:
```
df.hist(bins = 30, figsize = (13,5), color = 'r')
plt.show()
```



1.2 Data cleaning

[109]:
```
features = df.drop(columns='label', axis=1)
targets = df['label']
```

[110]:
```
import spacy
nlp = spacy.load('en_core_web_sm')
def data_clean(data):
    # Lowercase
    data = data.lower()
    # Remove punctuation and digits
    data = re.sub(r'[^a-zA-Z\s]', '', data)
    # Lemmatization
    doc = nlp(data)
    data = ' '.join([token.lemma_ for token in doc])
    return data
```

[111]:
```
features['tweet'][1]
```

[111]:
```
"@user @user thanks for #lyft credit i can't use cause they don't offer
wheelchair vans in pdx.    #disapointed #getthanked"
```

[112]:
```
features['tweet'].head()
```

[112]:
```
0     @user when a father is dysfunctional and is s…
1    @user @user thanks for #lyft credit i can't us…
2                                   bihday your majesty
3    #model   i love u take with u all the time in …
4                 factsguide: society now    #motivation
Name: tweet, dtype: object
```

[113]:
```
features['tweet'] =features['tweet'].apply(data_clean)
```

[114]:
```
features['tweet'].head(1)
```

[114]:
```
0      user when a father be dysfunctional and be s…
Name: tweet, dtype: object
```

[115]:
```
data=features['tweet'].values
```

1.3 TF-IDF vector

[116]:
```
Vector = TfidfVectorizer()
Vector.fit(data)
data = Vector.transform(data)
```

[117]:
```
X_train, X_test, y_train, y_test = train_test_split(data, targets, test_size=0.
↪2, stratify=targets, random_state=42)
```

2 Model: Random Forest Classifier

[118]:
```
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
rf_classifier = RandomForestClassifier()
# Fit the model on the training data
rf_classifier.fit(X_train, y_train)
# Predictions on the training set
predTrain_rf = rf_classifier.predict(X_train)
```

[119]:
```
# Calculate accuracy on the training set
accuracyTrain_rf = accuracy_score(predTrain_rf, y_train)
print('Accuracy score for the training data: ', accuracyTrain_rf)
```

```
Accuracy score for the training data:  0.9998435605616176
```

[120]:
```
# Predictions on the test set
predTest_rf = rf_classifier.predict(X_test)

# Calculate accuracy on the test set
accuracyTest_rf = accuracy_score(predTest_rf, y_test)
print('Accuracy score for the test data: ', accuracyTest_rf)
```

```
Accuracy score for the test data:  0.9618332551227905
```

3 Undersampling and Oversampling

3.1 Undersampling

[121]:
```
# define undersample strategy
undersample = RandomUnderSampler(sampling_strategy='majority')
newdata, newtargets = undersample.fit_resample(data, targets)
```

[122]:
```
from collections import Counter
print(Counter(newtargets))
```

```
Counter({0: 2242, 1: 2242})
```

[123]:
```
print(len(newtargets))
```

```
4484
```

[124]:
```
X_train, X_test, y_train, y_test = train_test_split(newdata, newtargets,␣
↪test_size=0.2, stratify=newtargets, random_state=42)
```

[125]:
```
rf_classifier = RandomForestClassifier()
rf_classifier.fit(X_train, y_train)
predTrain_rf = rf_classifier.predict(X_train)
```

[126]:
```
# Calculate accuracy on the training set
accuracyTrain_rf = accuracy_score(predTrain_rf, y_train)
print('Accuracy score for the training data: ', accuracyTrain_rf)
```

```
Accuracy score for the training data:  1.0
```

[127]:
```
# Predictions on the test set
predTest_rf = rf_classifier.predict(X_test)
# Calculate accuracy on the test set
accuracyTest_rf = accuracy_score(predTest_rf, y_test)
print('Accuracy score for the test data: ', accuracyTest_rf)
```

```
Accuracy score for the test data:  0.8272017837235228
```

3.2 Oversampling

[128]:
```
# define oversample strategy
oversample = RandomOverSampler(sampling_strategy='minority')
newdata, newtargets = oversample.fit_resample(data, targets)
```

[129]:
```
from collections import Counter
print(Counter(newtargets))
```

```
Counter({0: 29720, 1: 29720})
```

[130]:
```
X_train, X_test, y_train, y_test = train_test_split(newdata, newtargets,␣
↪test_size=0.2, stratify=newtargets, random_state=42)
```

[131]:
```
rf_classifier = RandomForestClassifier()
rf_classifier.fit(X_train, y_train)
predTrain_rf = rf_classifier.predict(X_train)
```

[132]:
```
# Calculate accuracy on the training set
accuracyTrain_rf = accuracy_score(predTrain_rf, y_train)
print('Accuracy score for the training data: ', accuracyTrain_rf)
```

```
Accuracy score for the training data:  0.9999579407806191
```

[133]:
```
# Predictions on the test set
predTest_rf = rf_classifier.predict(X_test)
```

```
# Calculate accuracy on the test set
accuracyTest_rf = accuracy_score(predTest_rf, y_test)
print('Accuracy score for the test data: ', accuracyTest_rf)
```

```
Accuracy score for the test data:  0.9977288021534321
```

3.3 Comparison

[135]:
```
import pandas as pd
results = {
    'Scenario': ['Original Data', 'Random Undersampling', 'Random␣
 ↪Oversampling'],
    'Train Accuracy': [0.9998, 1.0, 0.9999],
    'Test Accuracy': [0.9618, 0.827, 0.9979]
}
results_df = pd.DataFrame(results)
print(results_df)
```

```
                Scenario  Train Accuracy  Test Accuracy
0          Original Data          0.9998         0.9618
1  Random Undersampling           1.0000         0.8270
2   Random Oversampling           0.9999         0.9979
```