基于Kmeans的文本聚类

github: https://github.com/cppccp/20news/

In [56]:

```
from glob import glob
from nltk.tokenize import word_tokenize
from nltk.corpus import stopwords
from tqdm import tqdm
import base64

stopwords_set = set(stopwords.words('english'))
def remove_stopwords(words):  # 删除停用词
    words = [word for word in words if word not
in stopwords_set]
    return words

def remove_digit_and_symbols(words):  # 只保留单词
    new_words = []
    for word in words:
        f = True
        for c in word:
            if c < 'A' or c > 'z' or (c < 'a' and
c > 'Z'):
                f = False
                break
        if f:
            new_words.append(word)
    return new_words
```

```
files = glob('./20_newsgroups/*/*')
print(f'共有 {len(files)} 个文件')
# 文件数量太大，只选择2000个作为测试
import random
files = random.choices(files, k=2000)
print(f"选择{len(files)}作为测试")
articles = []
ground_labels = []
first_path = [path.split('/')[-1] for path in
glob('./20_newsgroups/*')]
firstpath2id = {first_path[i]:i for i in
range(len(first_path))}
for file in tqdm(files, total=len(files)):
    with open(file, 'r', encoding='utf-8') as f:
        article = f.read().lower()
        first_path = file.split('/')[-2]

ground_labels.append(firstpath2id[first_path])
        words = word_tokenize(article)
        words = remove_stopwords(words)
        words = remove_digit_and_symbols(words)
        articles.append(words)
```

```
共有 19997 个文件
选择2000作为测试
100%|██████████| 2000/2000 [00:06<00:00, 322.04it/s]
```

In [57]:

```
# 统计所有的单词
from collections import Counter
```

```
from tqdm import tqdm
doc_counters = []
word2id = {}
wordsfreq = []
for doc in tqdm(articles, total=len(articles)):
    for word in doc:
        if word not in word2id.keys():
            word2id[word] = len(word2id)
            wordsfreq.append(0)
    counter = Counter(doc)
    for word in counter.keys():
        word_id = word2id[word]
        wordsfreq[word_id] += 1
    doc_counters.append(counter)
m = len(articles)
alpha = 0.4 * m
beta = 100
# 删除词频过低或过高的单词
new_word2id = {}

for word, word_id in word2id.items():
    if wordsfreq[word_id] <= alpha and
wordsfreq[word_id] >= beta:
        new_word2id[word] = len(new_word2id)
new_freq = [0] * len(new_word2id)
for word, word_id in new_word2id.items():
    new_freq[word_id] = wordsfreq[word_id]
```

```
print(len(new_word2id))
word2id = new_word2id
wordsfreq = new_freq
```

```
100%|██████████| 2000/2000 [00:00<00:00, 11690.35it/s]
288
```

In [58]:

```
# TF-IDF
import math
X = []  # 所有文档的特征
m = len(articles)
vocab_size = len(word2id)
for counter, doc in tqdm(zip(doc_counters,
articles),total=m):
    x = [0.] * vocab_size
    n = len(doc)
    for word in counter.keys():
        if word in word2id.keys():
            word_id = word2id[word]
            value = counter[word] / n *
math.log(m / (1 + wordsfreq[word_id]))
            x[word_id] = value
    X.append(x)
```

```
100%|██████████| 2000/2000 [00:00<00:00, 21886.37it/s]
```

In [59]:

```
# 使用 kmeans 进行聚类
from sklearn.cluster import KMeans
import numpy as np
num_cluster = 20
```

```
kmeans = KMeans(num_cluster)
kmeans.fit(X)
```

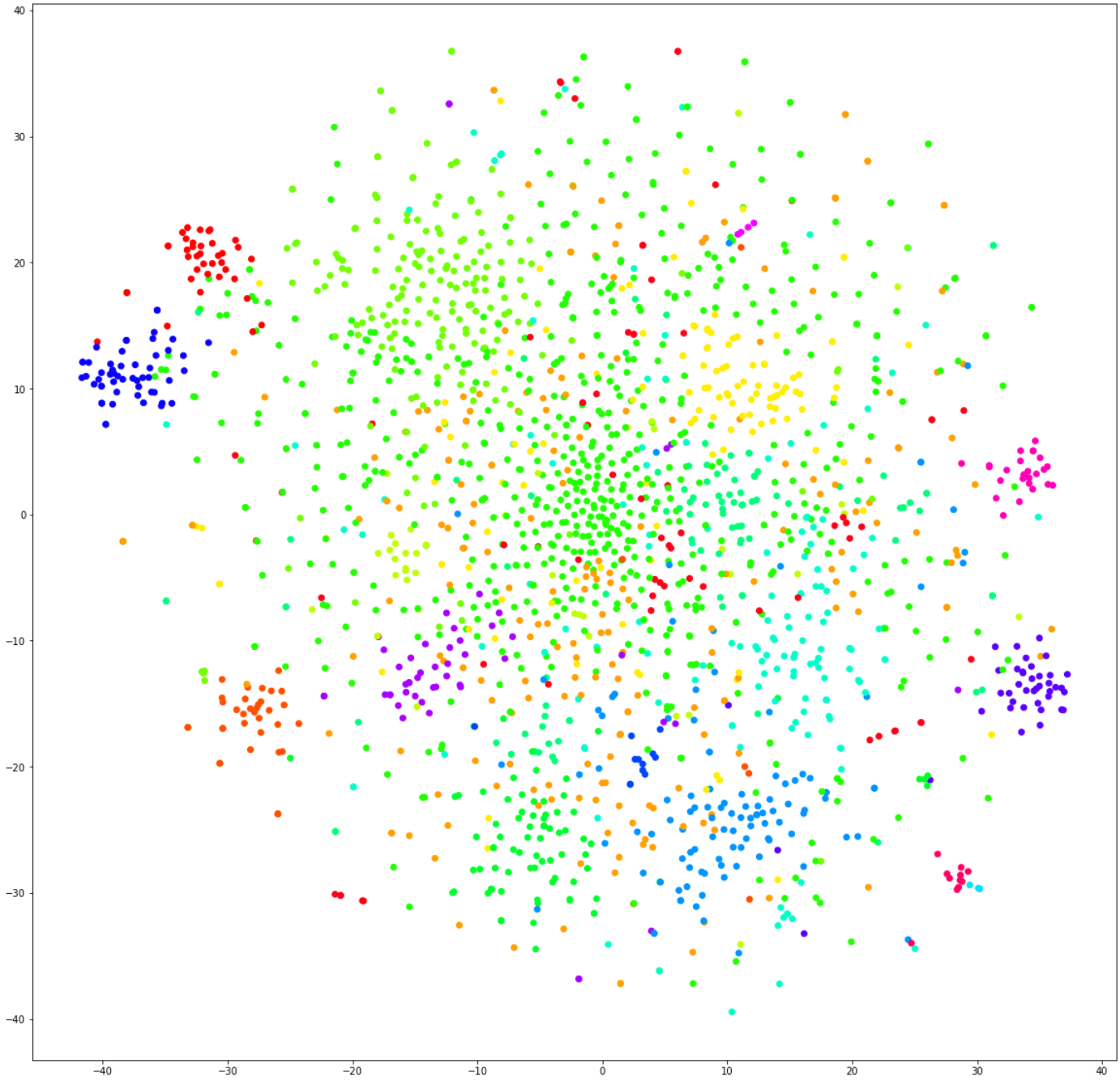
Out[59]:
```
KMeans(n_clusters=20)
```

In [60]:
```
from sklearn import metrics
score = metrics.calinski_harabasz_score(X,
kmeans.labels_)
print(f"CH系数: {score}")
```

```
CH系数: 28.607379238616343
```

In [61]:
```
# 使用 tsnet 可视化
from sklearn import manifold
import matplotlib.pyplot as plt
colors = plt.cm.get_cmap('hsv', 20)
colors = colors(np.arange(20))
print("生成tsne降维...")
tsne = manifold.TSNE(2)
print("tsne完成")
x_tsne = tsne.fit_transform(X)
labels = kmeans.labels_
c = [colors[label] for label in labels]
# c = [colors[label] for label in ground_labels]
print("绘制图形...")
plt.figure(figsize=(20,20))
plt.scatter(x_tsne[:,0], x_tsne[:,1], c=c)
plt.show()
```

```
生成tsne降维...
tsne完成
绘制图形...
```



结果分析

从tsne的结果来看，kmeans的结果一定程度上还可以。在处理过程中发现首先是文件的编码问题，最终选择了外部的转码工具才成功解决。然后是对单词的统计，如果考虑所有的单词，单词的数量将达到19000个，而TF-IDF形成的向量维度将会很大，在进行kmeans聚类的时候将会耗费非常多的时候，并且由于本身样本数量较大（19997）个样本，最终在画散点图可视化的时候无法成功，因此在处理过程中额外进行了两个操作：1.随机采样2000个样本，2.排除掉词频过高或者过低的单词。在过滤词频过低或者过高的单词之后，剩余大概4000个单词。 结果显示的一个问题是簇在图中并不是很集中，我认为造成这种现象的原因是仅仅通过TF-IDF方法提取到特征，但是特征没有经过变换，因此得到的只是初级的特征，造成可视化效果不好。