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第二个数据集：

来源： Microsoft 资讯推荐 https://learn.microsoft.com/zh-cn/azure/open-datasets/dataset-microsoft-news?tabs=azureml-opendatasets

本数据集关于Microsoft新闻关系分析

数据获取与预处理

In [ ]:
```
import os
import tempfile
import shutil
import urllib
import zipfile
import pandas as pd

temp_dir = os.path.join(tempfile.gettempdir(), 'mind')
os.makedirs(temp_dir, exist_ok=True)

base_url = 'https://mind201910small.blob.core.windows.net/release'
training_small_url = f'{base_url}/MINDsmall_train.zip'
validation_small_url = f'{base_url}/MINDsmall_dev.zip'
training_large_url = f'{base_url}/MINDlarge_train.zip'
validation_large_url = f'{base_url}/MINDlarge_dev.zip'
```

In [2]:
```
def download_url(url,
                 destination_filename=None,
                 progress_updater=None,
                 force_download=False,
                 verbose=True):
    if not verbose:
        progress_updater = None

    if destination_filename is None:
        url_as_filename = url.replace('://', '_').replace('/', '_')
        destination_filename = \
            os.path.join(temp_dir,url_as_filename)
    if (not force_download) and (os.path.isfile(destination_filename)):
        if verbose:
            print('Bypassing download of already-downloaded file {}'.format(
                os.path.basename(url)))
        return destination_filename
    if verbose:
        print('Downloading file {} to {}'.format(os.path.basename(url),
                                                 destination_filename),
              end='')
    urllib.request.urlretrieve(url, destination_filename, progress_updater)
    assert (os.path.isfile(destination_filename))
    nBytes = os.path.getsize(destination_filename)
    if verbose:
        print('...done, {} bytes.'.format(nBytes))
    return destination_filename
```

In [3]:
```
zip_path = download_url(validation_small_url, verbose=True)
with zipfile.ZipFile(zip_path, 'r') as zip_ref:
    zip_ref.extractall(temp_dir)
```

```
os.listdir(temp_dir)
```

```
Downloading file MINDsmall_dev.zip to C:\Users\Admin\AppData\Local\Temp\mind\https_m
ind201910small.blob.core.windows.net_release_MINDsmall_dev.zip...done, 30945572 byte
s.
```

Out[3]:
```
['behaviors.tsv',
 'entity_embedding.vec',
 'https_mind201910small.blob.core.windows.net_release_MINDsmall_dev.zip',
 'news.tsv',
 'relation_embedding.vec']
```

In [33]:
```
behaviors_path = os.path.join(temp_dir, 'behaviors.tsv')
impression_behaviors = pd.read_table(
    behaviors_path,
    header=None,
    names=['impression_id', 'user_id', 'time', 'history', 'impressions'])
impression_behaviors['impressions']
```

Out[33]:
```
0        N28682-0 N48740-0 N31958-1 N34130-0 N6916-0 N5...
1        N20036-0 N23513-1 N32536-0 N46976-0 N35216-0 N...
2        N36779-0 N62365-0 N58098-0 N5472-0 N13408-0 N5...
3        N6950-0 N60215-0 N6074-0 N11930-0 N6916-0 N248...
4        N5940-1 N23513-0 N49285-0 N23355-0 N19990-0 N3...
                               ...
73147    N496-0 N35159-0 N59856-0 N13270-0 N47213-0 N26...
73148    N49285-0 N31958-0 N55237-0 N42844-0 N29862-0 N...
73149    N7043-0 N512-0 N60215-1 N45057-0 N496-0 N37055...
73150    N23692-0 N19990-0 N20187-0 N5940-0 N13408-0 N3...
73151    N29862-0 N5472-0 N21679-1 N6400-0 N53572-0 N50...
Name: impressions, Length: 73152, dtype: object
```

In [43]:
```
def extract_positive_ids(record):
    parts = ''.join(record).split()
    new_record = list()
    for part in parts:
        if part.endswith('-1'):
            new_record.append(part[:-2])
    return new_record

impression_behaviors["new_impressions"] =impression_behaviors["impressions"].apply(e
impression_behaviors
```

Out[43]:

	impression_id	user_id	time	history	impressions	new_impressions
0	1	U80234	11/15/2019 12:37:50 PM	N55189 N46039 N51741 N53234 N11276 N264 N40716...	N28682-0 N48740-0 N31958-1 N34130-0 N6916-0 N5...	[N31958]
1	2	U60458	11/15/2019 7:11:50 AM	N58715 N32109 N51180 N33438 N54827 N28488 N611...	N20036-0 N23513-1 N32536-0 N46976-0 N35216-0 N...	[N23513]
2	3	U44190	11/15/2019 9:55:12 AM	N56253 N1150 N55189 N16233 N61704 N51706 N5303...	N36779-0 N62365-0 N58098-0 N5472-0 N13408-0 N5...	[N5940]
3	4	U87380	11/15/2019 3:12:46 PM	N63554 N49153 N28678 N23232 N43369 N58518 N444...	N6950-0 N60215-0 N6074-0 N11930-0 N6916-0 N248...	[N15347]
4	5	U9444	11/15/2019 8:25:46 AM	N51692 N18285 N26015 N22679 N55556	N5940-1 N23513-0 N49285-0 N23355-0 N19990-0 N3...	[N5940, N31958]
...	...	...	...	...	...	...
73147	73148	U77536	11/15/2019 8:40:16 PM	N28691 N8845 N58434 N37120 N22185 N60033 N4702...	N496-0 N35159-0 N59856-0 N13270-0 N47213-0 N26...	[N38324, N6916, N56080, N54562, N13573, N60244...
73148	73149	U56193	11/15/2019 1:11:26 PM	N4705 N58782 N53531 N46492 N26026 N28088 N3109...	N49285-0 N31958-0 N55237-0 N42844-0 N29862-0 N...	[N11390]
73149	73150	U16799	11/15/2019 3:37:06 PM	N40826 N42078 N15670 N15295 N64536 N46845 N52294	N7043-0 N512-0 N60215-1 N45057-0 N496-0 N37055...	[N60215, N54562]

	impression_id	user_id	time	history	impressions	new_impressions
73150	73151	U8786	11/15/2019 8:29:26 AM	N3046 N356 N20483 N46107 N44598 N18693 N8254 N...	N23692-0 N19990-0 N20187-0 N5940-0 N13408-0 N3...	[N20036]
73151	73152	U68182	11/15/2019 11:54:34 AM	N20297 N53568 N4690 N60608 N43709 N43123 N1885...	N29862-0 N5472-0 N21679-1 N6400-0 N53572-0 N50...	[N21679]

73152 rows × 6 columns

In [50]:
```
impression_behaviors.dtypes
```

Out[50]:
```
impression_id       int64
user_id            object
time               object
history            object
impressions        object
new_impressions    object
dtype: object
```

In [53]:
```
def extract_history_ids(record):
    new_record = record.split()
    return new_record

impression_behaviors.dropna(subset=['history'],inplace = True)
impression_behaviors["new_history"] =impression_behaviors["history"].apply(extract_h
impression_behaviors
```

Out[53]:

	impression_id	user_id	time	history	impressions	new_impressions	new_history
0	1	U80234	11/15/2019 12:37:50 PM	N55189 N46039 N51741 N53234 N11276 N264 N40716...	N28682-0 N48740-0 N31958-1 N34130-0 N6916-0 N5...	[N31958]	[N55189, N46039, N51741, N53234, N11276, N264,...
1	2	U60458	11/15/2019 7:11:50 AM	N58715 N32109 N51180 N33438 N54827 N28488 N611...	N20036-0 N23513-1 N32536-0 N46976-0 N35216-0 N...	[N23513]	[N58715, N32109, N51180, N33438, N54827, N2848...
2	3	U44190	11/15/2019 9:55:12 AM	N56253 N1150 N55189 N16233 N61704 N51706 N5303...	N36779-0 N62365-0 N58098-0 N5472-0 N13408-0 N5...	[N5940]	[N56253, N1150, N55189, N16233, N61704, N51706...
3	4	U87380	11/15/2019 3:12:46 PM	N63554 N49153 N28678 N23232 N43369 N58518 N444...	N6950-0 N60215-0 N6074-0 N11930-0 N6916-0 N248...	[N15347]	[N63554, N49153, N28678, N23232, N43369, N5851...
4	5	U9444	11/15/2019 8:25:46 AM	N51692 N18285 N26015 N22679 N55556	N5940-1 N23513-0 N49285-0 N23355-0 N19990-0 N3...	[N5940, N31958]	[N51692, N18285, N26015, N22679, N55556]
...	...	...	...	...	...	...	...
73147	73148	U77536	11/15/2019 8:40:16 PM	N28691 N8845 N58434 N37120 N22185 N60033 N4702...	N496-0 N35159-0 N59856-0 N13270-0 N47213-0 N26...	[N38324, N6916, N56080, N54562, N13573, N60244...	[N28691, N8845, N58434, N37120, N22185, N60033...
73148	73149	U56193	11/15/2019 1:11:26 PM	N4705 N58782 N53531 N46492 N26026 N28088 N3109...	N49285-0 N31958-0 N55237-0 N42844-0 N29862-0 N...	[N11390]	[N4705, N58782, N53531, N46492, N26026, N28088...
73149	73150	U16799	11/15/2019 3:37:06 PM	N40826 N42078 N15670 N15295 N64536 N46845 N52294	N7043-0 N512-0 N60215-1 N45057-0 N496-0 N37055...	[N60215, N54562]	[N40826, N42078, N15670, N15295, N64536, N4684...

	impression_id	user_id	time	history	impressions	new_impressions	new_history
73150	73151	U8786	11/15/2019 8:29:26 AM	N3046 N356 N20483 N46107 N44598 N18693 N8254 N...	N23692-0 N19990-0 N20187-0 N5940-0 N13408-0 N3...	[N20036]	[N3046, N356, N20483, N46107, N44598, N18693, ...
73151	73152	U68182	11/15/2019 11:54:34 AM	N20297 N53568 N4690 N60608 N43709 N43123 N1885...	N29862-0 N5472-0 N21679-1 N6400-0 N53572-0 N50...	[N21679]	[N20297, N53568, N4690, N60608, N43709, N43123...

70938 rows × 7 columns

In [54]:
```
news_path = os.path.join(temp_dir, 'news.tsv')
news_df = pd.read_table(news_path,
              header=None,
              names=[
                  'id', 'category', 'subcategory', 'title', 'abstract', 'url',
                  'title_entities', 'abstract_entities'
              ])
```

In [57]:
```
id_to_subcategory = dict(zip(news_df['id'], news_df['subcategory']))

def ids_to_subcategories(ids):
    return [id_to_subcategory.get(news_id, '') for news_id in ids]

impression_behaviors['new_history'] = impression_behaviors['new_history'].apply(
    ids_to_subcategories)
impression_behaviors['new_impressions'] = impression_behaviors['new_impressions'].ap
    ids_to_subcategories)
```

In [58]:
```
impression_behaviors
```

Out[58]:

	impression_id	user_id	time	history	impressions	new_impressions	new_history
0	1	U80234	11/15/2019 12:37:50 PM	N55189 N46039 N51741 N53234 N11276 N264 N40716...	N28682-0 N48740-0 N31958-1 N34130-0 N6916-0 N5...	[football_nfl]	[tvnews, newsus, tv-celebrity, newsus, finance...
1	2	U60458	11/15/2019 7:11:50 AM	N58715 N32109 N51180 N33438 N54827 N28488 N611...	N20036-0 N23513-1 N32536-0 N46976-0 N35216-0 N...	[football_nfl]	[newsus, travelnews, finance-companies, newssc...
2	3	U44190	11/15/2019 9:55:12 AM	N56253 N1150 N55189 N16233 N61704 N51706 N5303...	N36779-0 N62365-0 N58098-0 N5472-0 N13408-0 N5...	[lifestyleroyals]	[football_nfl, newscrime, tvnews, newsus, shop...
3	4	U87380	11/15/2019 3:12:46 PM	N63554 N49153 N28678 N23232 N43369 N58518 N444...	N6950-0 N60215-0 N6074-0 N11930-0 N6916-0 N248...	[football_nfl]	[traveltripideas, newsus, baseball_mlb, footba...
4	5	U9444	11/15/2019 8:25:46 AM	N51692 N18285 N26015 N22679 N55556	N5940-1 N23513-0 N49285-0 N23355-0 N19990-0 N3...	[lifestyleroyals, football_nfl]	[tv-celebrity, football_nfl, celebrity, golf, ...
...	...	...	...	...	...	...	...
73147	73148	U77536	11/15/2019 8:40:16 PM	N28691 N8845 N58434 N37120 N22185 N60033 N4702...	N496-0 N35159-0 N59856-0 N13270-0 N47213-0 N26...	[medical, celebrity, football_nfl, finance-com...	[movienews, tv-celebrity, newsus, foodnews, fi...
73148	73149	U56193	11/15/2019 1:11:26 PM	N4705 N58782 N53531 N46492 N26026 N28088 N3109...	N49285-0 N31958-0 N55237-0 N42844-0 N29862-0 N...	[newscrime]	[movies-celebrity, movies-celebrity, tv-celebr...
73149	73150	U16799	11/15/2019 3:37:06 PM	N40826 N42078 N15670 N15295 N64536 N46845 N52294	N7043-0 N512-0 N60215-1 N45057-0 N496-0 N37055...	[autosclassics, finance-companies]	[tvnews, newsus, tv-celebrity, tv-celebrity, m...

	impression_id	user_id	time	history	impressions	new_impressions	new_history
73150	73151	U8786	11/15/2019 8:29:26 AM	N3046 N356 N20483 N46107 N44598 N18693 N8254 N...	N23692-0 N19990-0 N20187-0 N5940-0 N13408-0 N3...	[shop-holidays]	[lifestyleroyals, lifestyleroyals, lifestylero...
73151	73152	U68182	11/15/2019 11:54:34 AM	N20297 N53568 N4690 N60608 N43709 N43123 N1885...	N29862-0 N5472-0 N21679-1 N6400-0 N53572-0 N50...	[football_nfl]	[football_nfl, newsworld, football_nfl, footba...

70938 rows × 7 columns

频繁模式挖掘：新闻的亚类型

In [61]:
```
dataset = impression_behaviors['new_impressions']+impression_behaviors['new_history'

import pandas as pd
from mlxtend.preprocessing import TransactionEncoder
from mlxtend.frequent_patterns import apriori

te = TransactionEncoder()
te_ary = te.fit(dataset).transform(dataset)
df = pd.DataFrame(te_ary, columns=te.columns_)
df
```

Out[61]:

	ads-latingrammys	ads-lung-health	advice	animals	autosbuying	autoscartech	autosclassics	autoscom
0	False	False	False	False	False	False	False	
1	False	False	False	False	False	False	False	
2	False	False	False	False	False	False	False	
3	False	False	False	False	False	False	False	
4	False	False	False	False	False	False	False	
...	...	...	...	...	...	...	...	
70933	False	False	False	False	False	False	True	
70934	False	False	False	False	False	False	False	
70935	False	False	False	False	False	False	True	
70936	False	False	False	False	False	False	False	
70937	False	False	True	False	False	False	False	

70938 rows × 247 columns

In [63]:
```
frequent_itemsets = apriori(df, min_support=0.2, use_colnames=True)
frequent_itemsets['length'] = frequent_itemsets['itemsets'].apply(lambda x: len(x))
```

```
frequent_itemsets
```

Out[63]:

	support	itemsets	length
0	0.230201	(autosnews)	1
1	0.253193	(baseball_mlb)	1
2	0.226945	(basketball_nba)	1
3	0.276453	(celebrity)	1
4	0.250049	(entertainment-celebrity)	1
...	...	...	...
207	0.206363	(newsus, tv-celebrity, movies-celebrity, newsw...	4
208	0.233514	(newspolitics, newsus, newscrime, newsworld)	4
209	0.228312	(newspolitics, newsus, tv-celebrity, newscrime)	4
210	0.250275	(newsus, tv-celebrity, newsworld, newscrime)	4
211	0.218994	(newspolitics, newsus, tv-celebrity, newsworld)	4

212 rows × 3 columns

对挖掘结果进行分析

In [69]:
```
from mlxtend.frequent_patterns import association_rules

ar = association_rules(frequent_itemsets, metric="confidence", min_threshold=0.9)
ar
```

Out[69]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage
0	(travelnews)	(newsus)	0.330951	0.758282	0.297993	0.900413	1.187439	0.047038
1	(football_nfl, finance-companies)	(newsus)	0.244326	0.758282	0.224971	0.920782	1.214301	0.039703
2	(finance-companies, lifestylebuzz)	(newsus)	0.245792	0.758282	0.230497	0.937772	1.236707	0.044117
3	(finance-companies, newscrime)	(newsus)	0.255279	0.758282	0.242606	0.950356	1.253302	0.049033
4	(newspolitics, finance-companies)	(newsus)	0.244044	0.758282	0.228679	0.937038	1.235738	0.043624
...	...	...	...	...	...	...	...	...
63	(tv-celebrity, movies-celebrity, newsworld)	(newsus)	0.215724	0.758282	0.206363	0.956610	1.261549	0.042784
64	(newspolitics, newscrime, newsworld)	(newsus)	0.242212	0.758282	0.233514	0.964090	1.271414	0.049849
65	(newspolitics, tv-celebrity, newscrime)	(newsus)	0.239702	0.758282	0.228312	0.952482	1.256105	0.046550
66	(tv-celebrity, newscrime, newsworld)	(newsus)	0.260566	0.758282	0.250275	0.960506	1.266688	0.052693
67	(newspolitics, tv-celebrity, newsworld)	(newsus)	0.229482	0.758282	0.218994	0.954297	1.258499	0.044982

68 rows × 10 columns

In [81]:
```
frequent_itemsets_filter = frequent_itemsets[frequent_itemsets['length'] == 2]
frequent_itemsets_filter_reset = frequent_itemsets_filter.reset_index(drop=True)
```

In [82]:
```
news_type_df = pd.DataFrame(frequent_itemsets_filter_reset['itemsets'].tolist(), col
news_type_df['weight'] = frequent_itemsets_filter_reset['support']
news_type_df
#G = nx.from_pandas_edgelist(news_type, "start_node", "end_node")
```

Out[82]:

	start_point	end_point	weight
0	newsus	autosnews	0.206659
1	football_nfl	baseball_mlb	0.203910
2	newsus	baseball_mlb	0.221066
3	celebrity	newsus	0.232668
4	celebrity	tv-celebrity	0.217598
...	...	...	...
78	newsus	weathertopstories	0.200259
79	newsworld	travelnews	0.237038
80	tv-celebrity	newsworld	0.333432
81	tv-celebrity	travelnews	0.233993
82	tv-celebrity	tvnews	0.237982

83 rows × 3 columns

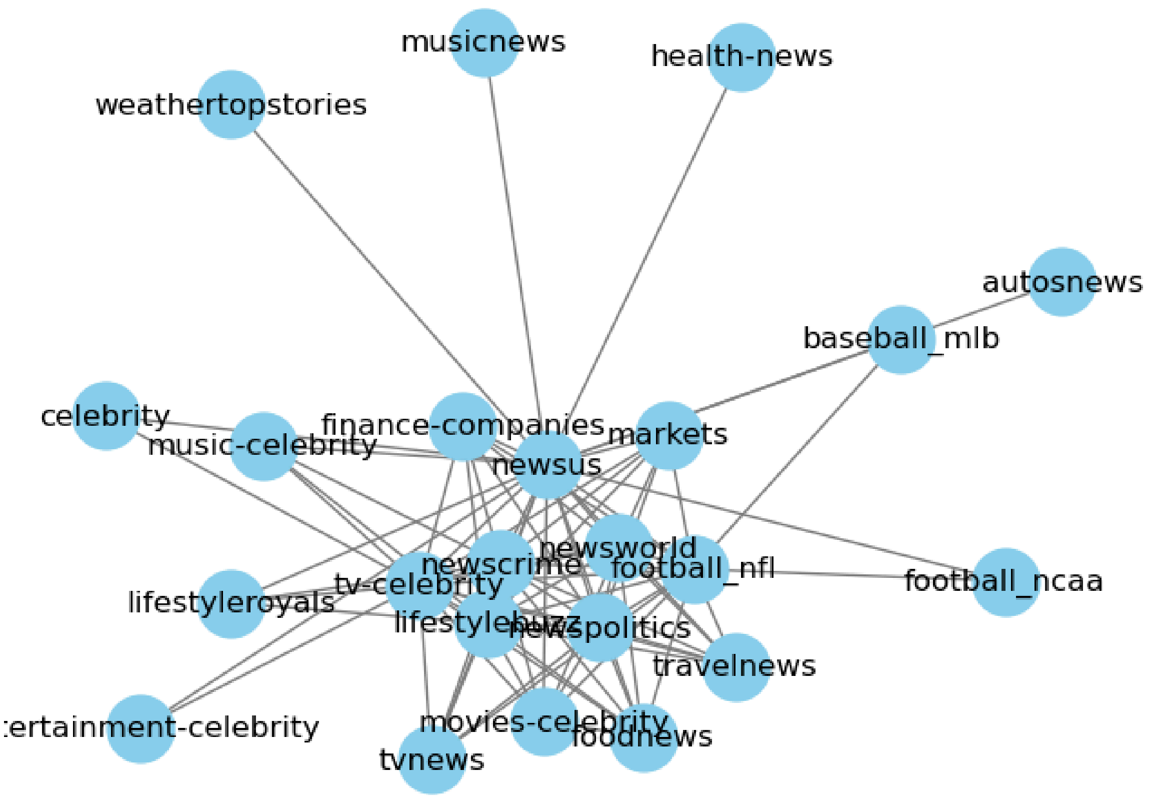
可视化展示

In [84]:
```
import networkx as nx
import matplotlib.pyplot as plt
```

In [87]:
```
G = nx.from_pandas_edgelist(news_type_df, "start_point", "end_point", edge_attr='wei

pos = nx.spring_layout(G)  # 生成节点的位置布局
edge_weights = nx.get_edge_attributes(G, 'weight')  # 获取边权重

# 绘制节点和边
nx.draw(G, pos, with_labels=True, node_color='skyblue', node_size=700, edge_color='
plt.show()
```


musicnews
health-news
weathertopstories
autosnews
baseball_mlb
celebrity
finance-companies
markets
music-celebrity
newsus
newsworld
newscrime
football_nfl
football_ncaa
tv-celebrity
lifestyleroyals
lifestylebuzz
newspolitics
travelnews
tertainment-celebrity
movies-celebrity
foodnews
tvnews