2. Data Visualization of Youtube Dataset

Plan-
Data collected from the 200 listed trending YouTube videos every day in the US and the UK.

Description-
The dataset includes data gathered from videos on YouTube that are contained within the trending category each day.
There are two kinds of data files, one includes comments and one includes video statistics. They are linked by the unique video_id field.

The headers in the video file are:

- video_id (Common id field to both comment and video csv files)
- title
- channel_title
- category_id (Can be looked up using the included JSON files, but varies per region so use the appropriate JSON file for the CSV file's country)
- tags (Separated by | character, [none] is displayed if there are no tags)
- views
- likes
- dislikes
- thumbnail_link
- date (Formatted like so: [day].[month])

The headers in the comments file are:

- video_id (Common id field to both comment and video csv files)
- comment_text
- likes
- replies
- Extra info: The YouTube API is not effective at formatting comments by relevance, although it claims to do so. As a result, the most relevant comments do not align with the top comments at all, they aren't even sorted by likes or replies.

Inspiration-
Possible uses for this dataset could include:

Sentiment analysis in a variety of forms-
Categorising YouTube videos based on their comments and statistics.
Training ML algorithms to generate their own YouTube comments.
Analysing what factors affect how popular a YouTube video will be.
Although there are many likely many more possibilities, including analysis of changes over time etc.

Code-

1.Getting to know the data

```
import math import
pandas as pd import
numpy as np import
seaborn as sns import
json import itertools
import re import
random

import matplotlib.pyplot as plt import
matplotlib.gridspec as gridspec import
plotly.plotly as py
import plotly.graph_objs as go

from datetime import date, timedelta
from skimage.draw import ellipse
from textwrap import wrap from
plotly import __version__
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot from
IPython.display import HTML, Image
from plotly import tools from bs4 import
BeautifulSoup from nltk.corpus import stopwords
from sklearn import preprocessing from
sklearn.model_selection import train_test_split from
sklearn.metrics import matthews_corrcoef from
sklearn.metrics import hamming_loss, f1_score
from sklearn.feature_extraction.text import TfidfVectorizer

plt.style.use('seaborn-white') %matplotlib
inline
init_notebook_mode(connected=True)
columns = ['video_id', 'title', 'channel_title', 'category_id',
        'tags', 'views', 'likes', 'dislikes', 'comment_total',
        'thumbnail_link', 'date']

gb_vid_df =  pd.read_csv("../input/GBvideos.csv", usecols = columns) us_vid_df
=  pd.read_csv("../input/USvideos.csv", usecols = columns)

# find out errors in last columns print
(gb_vid_df['date'].unique()) print
```

(us_vid_df['date'].unique()) # replace
error items
gb_vid_df.loc[gb_vid_df['date'] == '24.09l7yxJDFvTRM', 'date'] = '24.09'
us_vid_df.loc[us_vid_df['date'] == '24.09xcaeyJTx4Co', 'date'] = '24.09'
gb_vid_df.loc[gb_vid_df['date'] == '26.09t2oVUxTV4WA', 'date'] = '26.09'
us_vid_df.loc[us_vid_df['date'] == '26.0903jeumSTSzc', 'date'] = '26.09'
us_vid_df.loc[us_vid_df['date'] == '100', 'date'] = '09.10'

```
['13.09' '14.09' '15.09' '16.09' '17.09' '18.09' '19.09' '20.09' '21.09'
 '22.09' '23.09' '24.09' '24.09l7yxJDFvTRM' '25.09' '26.09'
 '26.09t2oVUxTV4WA' '27.09' '28.09' '29.09' '30.09' '01.10' '02.10' '03.10'
 '04.10' '05.10' '06.10' '07.10' '08.10' '09.10' '10.10' '11.10' '12.10'
 '13.10' '14.10' '15.10' '16.10' '17.10' '18.10' '19.10' '20.10' '21.10'
 '22.10']
['13.09' '14.09' '15.09' '16.09' '17.09' '18.09' '19.09' '20.09' '21.09'
 '22.09' '23.09' '24.09' '24.09xcaeyJTx4Co' '25.09' '26.09'
 '26.0903jeumSTSzc' '27.09' '28.09' '29.09' '30.09' '01.10' '02.10' '03.10'
 '04.10' '05.10' '06.10' '07.10' '08.10' '09.10' '100' '10.10' '11.10'
 '12.10' '13.10' '14.10' '15.10' '16.10' '17.10' '18.10' '19.10' '20.10'
 '21.10' '22.10']
```

gb_vid_df['date'] = gb_vid_df['date'].apply(lambda x: pd.to_datetime(str(x).replace('.','')+"2017", format='%d%m%Y')) gb_vid_df['date'] = gb_vid_df['date'].dt.date

us_vid_df['date'] = us_vid_df['date'].apply(lambda x: pd.to_datetime(str(x).replace('.','')+"2017", format='%d%m%Y'))
us_vid_df['date'] = us_vid_df['date'].dt.date

remove duplicates for GB videos database gb_vid_df
= gb_vid_df.drop_duplicates()
us_vid_df = us_vid_df.drop_duplicates()

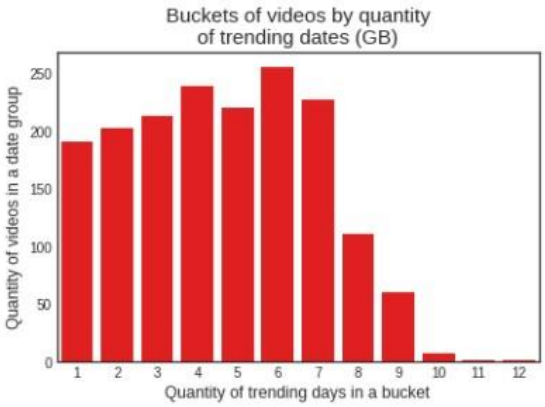
gb_vid_df.head(5)

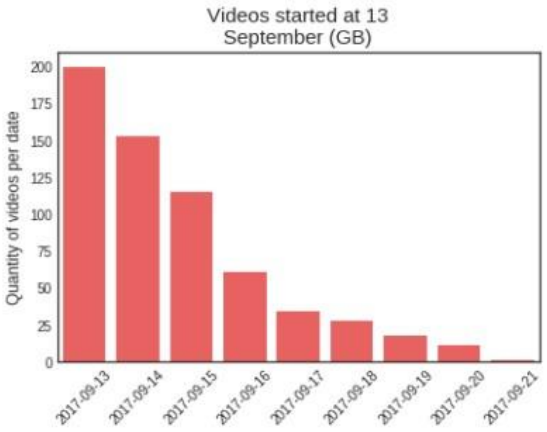
	video_id	title	channel_title	category_id	tags	views	likes
0	jt2OHQh0HoQ	Live Apple Event - Apple September Event 2017 ...	Apple Event	28	apple events|apple event|iphone 8|iphone x|iph...	7426393	782
1	AqokkXoa7uE	Holly and Phillip Meet Samantha the Sex Robot ...	This Morning	24	this morning|interview|holly willoughby|philli...	494203	265
2	YPVcg45W0z4	My DNA Test Results! I'm WHAT?!	emmablackery	24	emmablackery|emma blackery|emma|blackery|briti...	142819	131
3	T_PuZBdT2iM	getting into a conversation in a language you ...	ProZD	1	skit|korean|language|conversation|esl|japanese...	1580028	657
4	NsjsmgmbCfc	Baby Name Challenge!	Sprinkleofglitter	26	sprinkleofglitter|sprinkle of glitter|baby gli...	40592	501

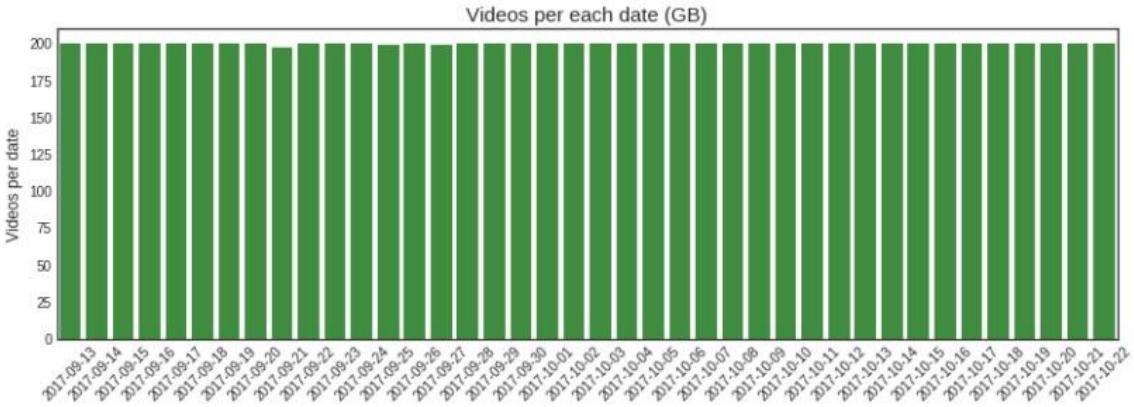
```
# dataframe to see videos per each date
def quick_insight(df, country, color):
# dataframes for videos per each date
   vid_check = df[['video_id', 'date']].copy().groupby('date', as_index = False).count()
vid_check.columns = ['Dates', 'Videos per date']

   # dataframes for
   dates_per_id = df[['video_id', 'date']].groupby('video_id', as_index = False).count()
dates_per_vids = dates_per_id.groupby('date', as_index = False).count()
   dates_per_vids.columns = ['Quantity of dates per video', 'Quantity of videos in a date group']
max_days = max(dates_per_vids['Quantity of dates per video'].values)

   # videos appeared in database as at 13 September 2017
sept_13_id = df.loc[df['date'] == date(2017,9,13), 'video_id'].tolist()
sept_13 = df.loc[df['video_id'].isin(sept_13_id), ['video_id', 'date']]
sept_13 = sept_13.groupby('date', as_index=False).count()

   # combined plot
   fig = plt.figure(figsize=(14, 10))
   gs = gridspec.GridSpec(3, 2, width_ratios=[1,1], height_ratios = [1,0.1,1])

   # plotting videos per each date
ax1 = plt.subplot(gs[2,0:2])
   ax1 = sns.barplot(x="Dates", y="Videos per date", data=vid_check, color='green', alpha=0.8)
ax1.set_ylabel('Videos per date', fontsize=12)
   ax1.set_xticklabels(vid_check['Dates'].unique(), rotation=45)
```

```
    ax1.set_xlabel('')
    ax1.set_title('Videos per each date ({})'.format(country), fontsize=15)

    # plotting buckets of videos by quantity of trending dates
ax2 = plt.subplot(gs[0,0])
    ax2 = sns.barplot(x="Quantity of dates per video",
y="Quantity of videos in a date group",
data=dates_per_vids, color=color)
    ax2.set_ylabel('Quantity of videos in a date group', fontsize=12)
ax2.set_xlabel('Quantity of trending days in a bucket', fontsize=12)
t_str = u'Buckets of videos by quantity of trending dates ({})'     title =
'\n'.join(wrap(t_str.format(country),30))     ax2.set_title(title,
fontsize=15)

    # plotting story of videos that appeared on September 13
ax3 = plt.subplot(gs[0,1])
    ax3 = sns.barplot(x='date', y="video_id", data=sept_13, color=color, alpha = 0.7)
ax3.set_ylabel('Quantity of videos per date', fontsize=12)
ax3.set_xticklabels(sept_13['date'], rotation=45)     ax3.set_xlabel('')
    t_str = u'Videos started at 13 September ({})'
title = '\n'.join(wrap(t_str.format(country),20))
ax3.set_title(title, fontsize=15)

    plt.show()

def best_survivors(df, days, country):     #
videos with selected lifetime in top 200
    dates_per_id = df[['video_id', 'date']].groupby('video_id', as_index = False).count()
long_surv_list = dates_per_id.loc[dates_per_id['date'] == days,'video_id'].tolist()     long_surv_vid
= df.loc[df['video_id'].isin(long_surv_list),
                    ['title','date','views','likes','dislikes','comment_total']]
    long_surv_vid['views'] = long_surv_vid['views'].apply(lambda x: x/1000000)
titles_list = long_surv_vid['title'].unique().tolist()

    # plotting videos views history
    views = []
likes = []
    dislikes = []
comments = []
    plots_list = [views, likes, dislikes, comments]
column_list = ['views', 'likes', 'dislikes', 'comment_total']
boolean_list = [False, False, False, True]     colors_list = []
for i in range(0,len(titles_list)):
        color =
'rgb('+str(np.random.randint(1,256))+","+str(np.random.randint(1,256))+","+str(np.random.randint(
1,256))+")"
        colors_list.append(color)
```

```
   for x in range (0,len(plots_list)):
for i in range (0, len(titles_list)):
        vt = titles_list[i]
        trace = go.Scatter(x = long_surv_vid.loc[long_surv_vid['title']== vt,'date'],
y = long_surv_vid.loc[long_surv_vid['title']== vt, column_list[x]],
name = vt,
                           line = dict(width = 2, color = colors_list[i]),
legendgroup = vt,
                           showlegend = boolean_list[x])

        plots_list[x].extend([trace])

   fig = tools.make_subplots(rows=4,
                             cols=1,
                             subplot_titles=('Views', 'Comments', 'Likes', 'Dislikes'),
vertical_spacing=0.07)

   for i in views:
      fig.append_trace(i, 1, 1)
for i in comments:
      fig.append_trace(i, 2, 1)
for i in likes:
      fig.append_trace(i, 3, 1)
for i in dislikes:
      fig.append_trace(i, 4, 1)

   fig['layout']['xaxis1'].update(title='')
fig['layout']['xaxis2'].update(title='')    fig['layout']['xaxis3'].update(title='')
fig['layout']['xaxis4'].update(title='')

   fig['layout']['yaxis1'].update(title='mln. views')
fig['layout']['yaxis2'].update(title='comments')    fig['layout']['yaxis3'].update(title='likes')
   fig['layout']['yaxis4'].update(title='dislikes')

   fig['layout'].update(width=800, height=(1000 + len(titles_list)*60))
   fig['layout'].update(title='Different metrics for videos trended in {} for {} days'.format(country,
days))
   fig['layout'].update(legend = dict(x=0.0,
                                y = -(0.1+len(titles_list)*0.007),
tracegroupgap = 1))

   iplot(fig, filename='customizing-subplot-axes')

quick_insight(gb_vid_df, "GB", 'red')
```



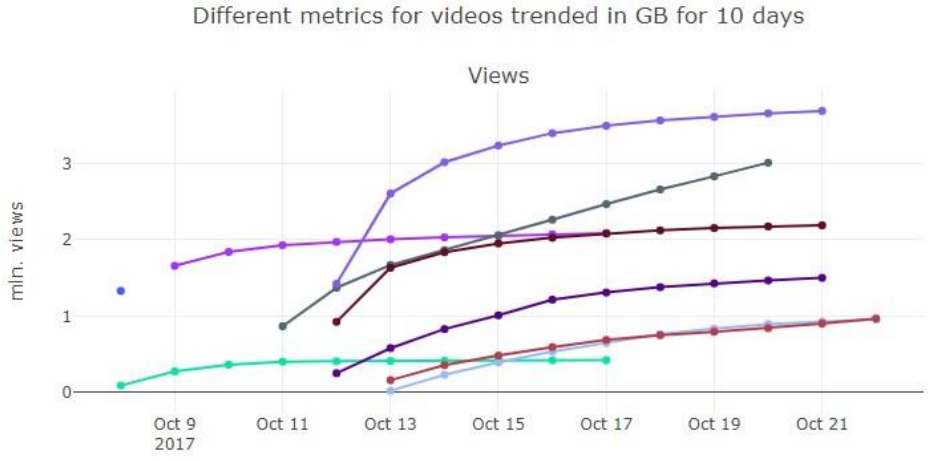


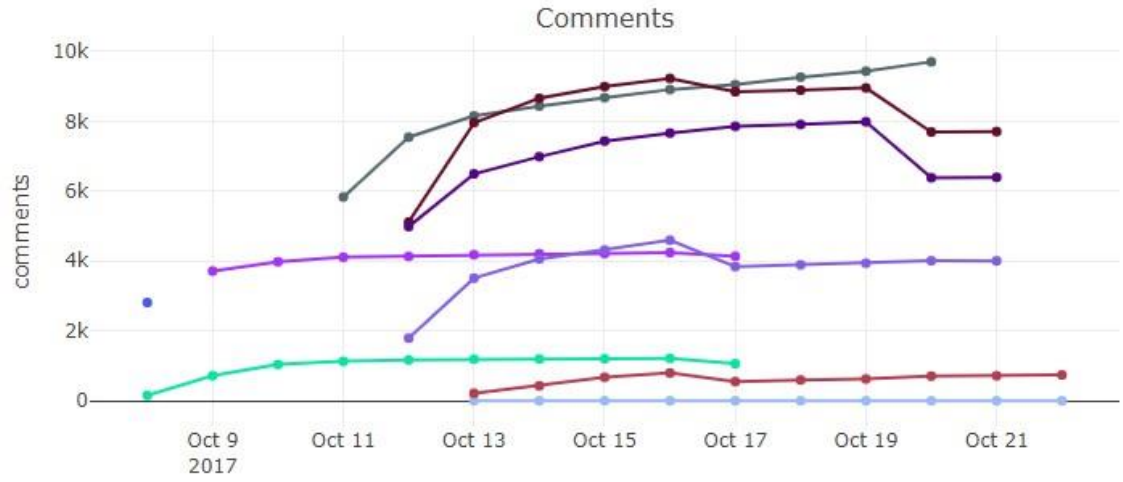


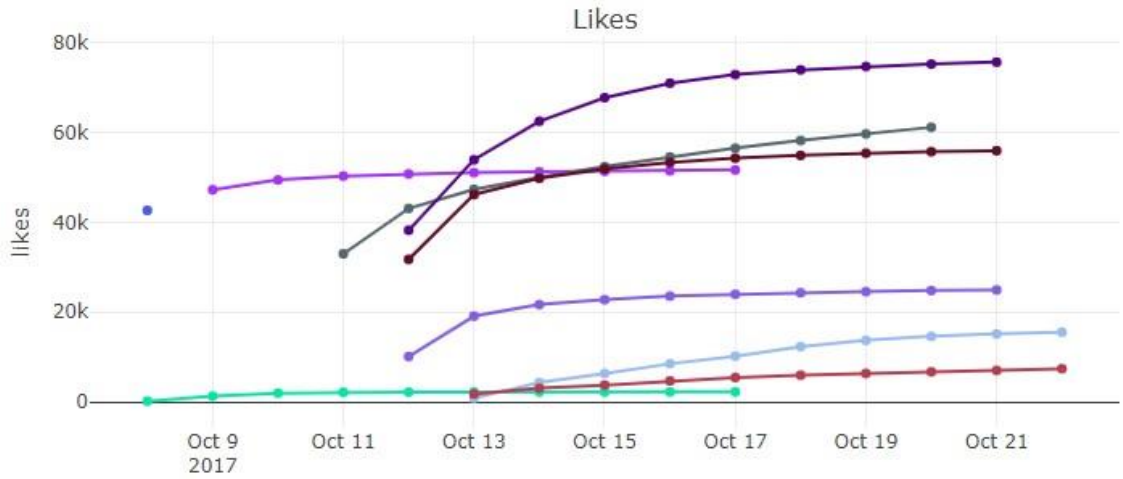
In [7]:

```
best_survivors(gb_vid_df, 10, "GB")
```

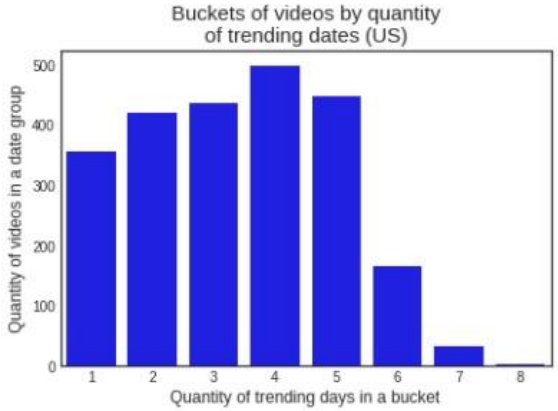
```
This is the format of your plot grid:
[ (1,1) x1,y1 ]
[ (2,1) x2,y2 ]
[ (3,1) x3,y3 ]
[ (4,1) x4,y4 ]
```

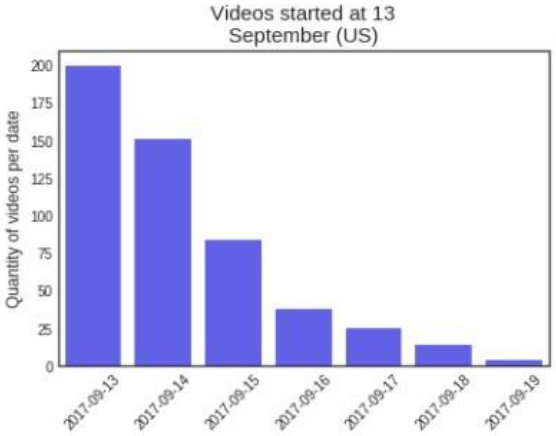


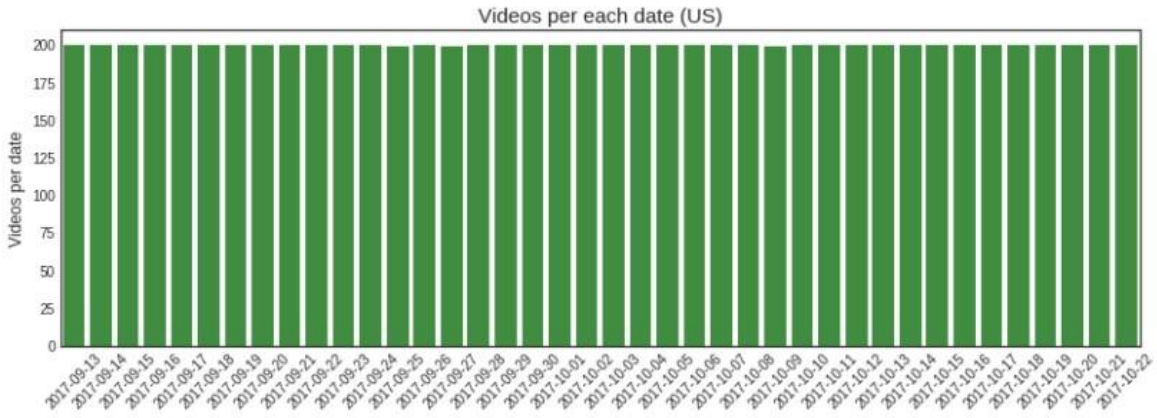




quick_insight(us_vid_df, "US", 'blue')

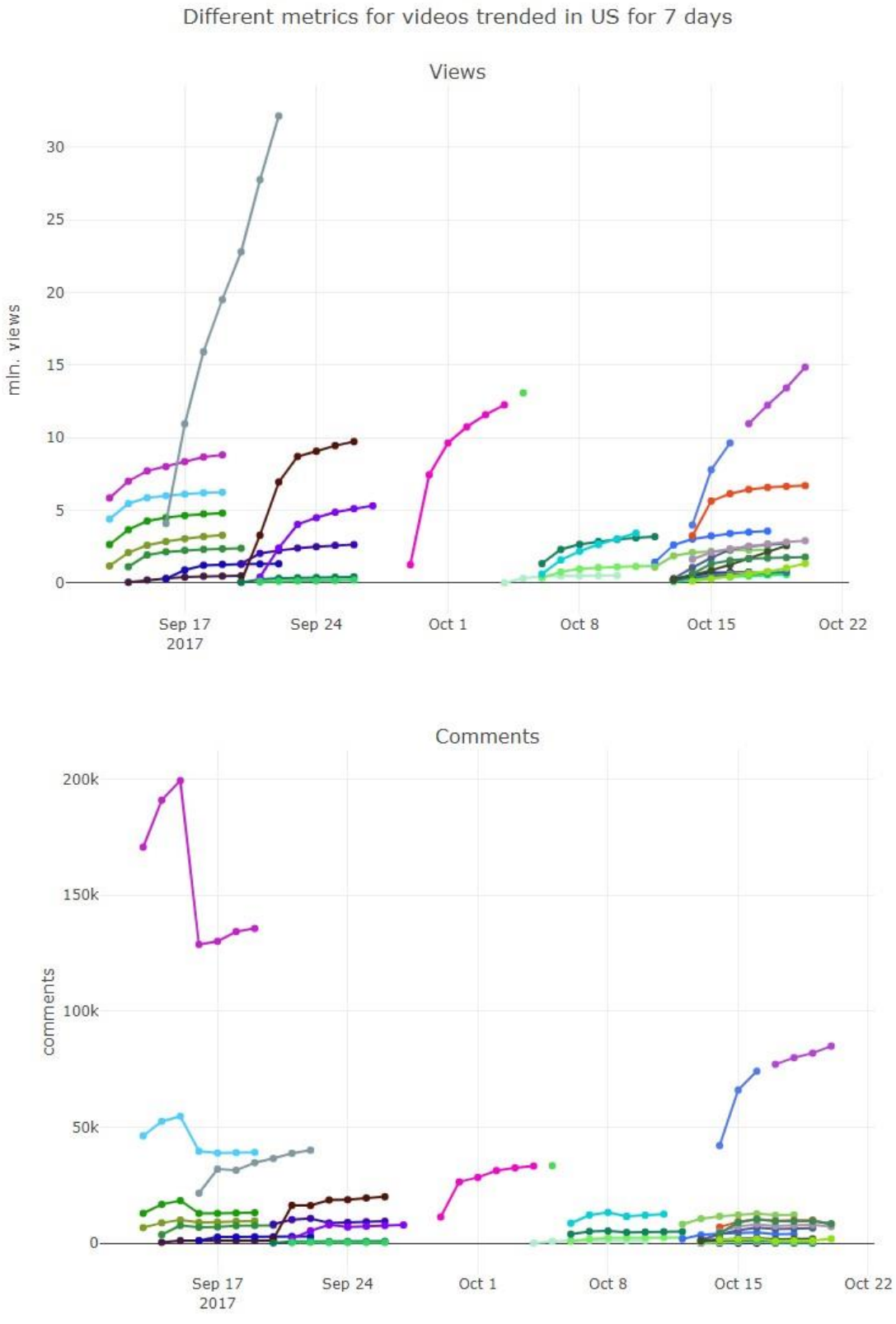


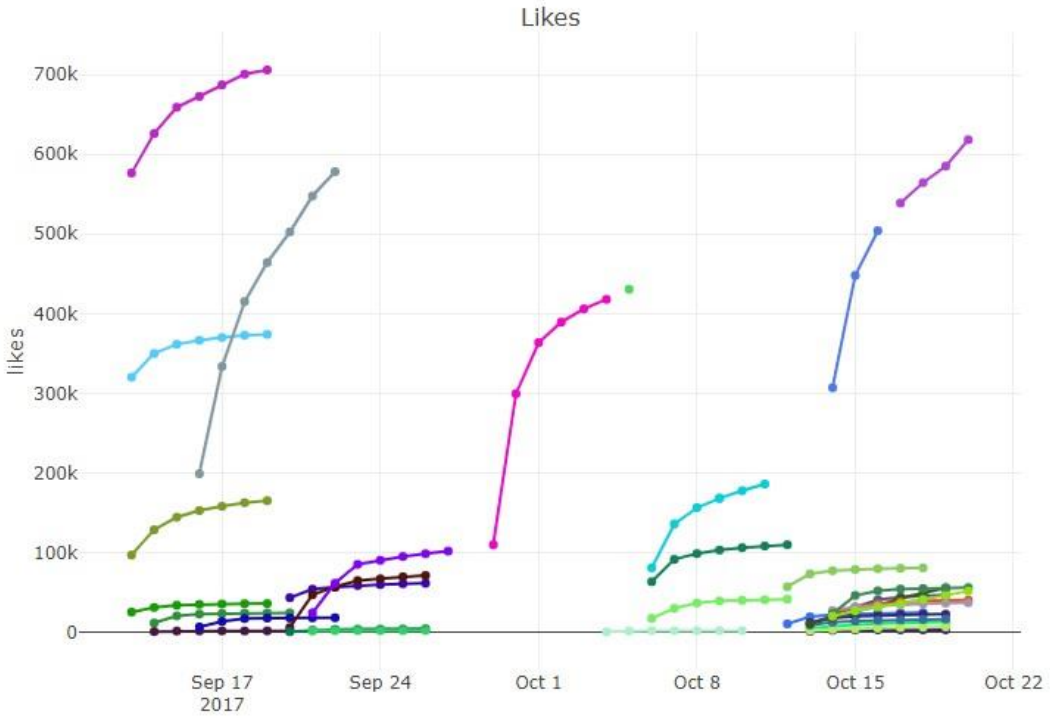


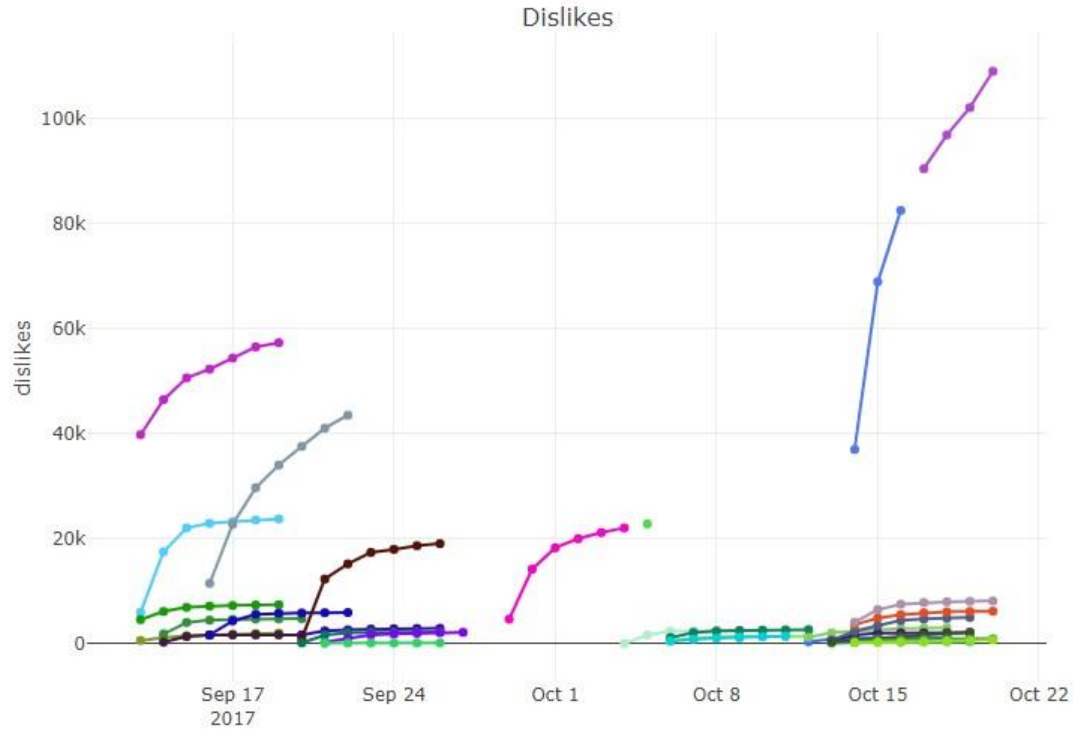


In [9]:
```
best_survivors(us_vid_df, 7, "US")
```

```
This is the format of your plot grid:
[ (1,1) x1,y1 ]
[ (2,1) x2,y2 ]
[ (3,1) x3,y3 ]
[ (4,1) x4,y4 ]
```


Different metrics for videos trended in US for 7 days
Views
mln. views
30
25
20
15
10
5
0
Sep 17
2017
Sep 24
Oct 1
Oct 8
Oct 15
Oct 22
Comments
comments
200k
150k
100k
50k
0
Sep 17
2017
Sep 24
Oct 1
Oct 8
Oct 15
Oct 22


Likes
likes
700k
600k
500k
400k
300k
200k
100k
0
Sep 17
2017
Sep 24
Oct 1
Oct 8
Oct 15
Oct 22


Dislikes
dislikes
100k
80k
60k
40k
20k
0
Sep 17
2017
Sep 24
Oct 1
Oct 8
Oct 15
Oct 22


1 YEAR OF VLOGGING -- HOW LOGAN PAUL CHANGED YOUTUBE FOREVER!
My Response
Apple iPhone X first look
iPhone X (parody)
Hello, world. Meet our baby girl: Alexis Olympia Ohanian, Jr.
Bella Hadid Roughs Up Security Roughing Up Female Photog | TMZ
Shakira - Perro Fiel (Official Video) ft. Nicky Jam
The Insane Full House Theory That Might Be True
Everything Wrong With The LEGO Batman Movie
TOMB RAIDER - Official Trailer #1
COOK OFF! (2017 Movie) – Official Trailer
Foo Fighters Carpool Karaoke
Bear in Russian traffic
J Balvin, Willy William - Mi Gente featuring Beyoncé
Donald Trump's Cringe-Worthy Attempt To Date Brooke Shields | WWHL
J Balvin, Willy William - Mi Gente featuring Beyoncé ft. Beyoncé
Every Cat At 3AM
Did You Call My Girl!? | Anwar Jibawi
Charlie Puth – How Long [Official Audio]
Seth MacFarlane Calls Out Harvey Weinstein Back In 2013
Arnold Set off to the Center of the Earth
What Americans Heard in Cuba Attacks: The Sound
Why Photos of the Eiffel Tower at Night are Illegal
Why Are You Anxious?
Kane Brown - What's Mine Is Yours
Guns N' Roses Feat. PINK! - Patience (Msg, Nyc) 10.11.17 (P!NK)
Gucci Mane - Enormous feat. Ty Dolla $ign [Official Audio]
John Legend - Penthouse Floor ft. Chance the Rapper
The New Mutants | Official Trailer [HD] | 20th Century FOX
Harvey Weinstein, Donald Trump and Systemic Sexism: A Closer Look
NO POMEGRANATES
Bebe Rexha - Meant to Be (feat. Florida Georgia Line) [Lyric Video]
Alesso & Anitta - Is That For Me (Official Video)
Alesso & Anitta - Is That For Me (Official Music Video)

2. Trending channels

The questions I have are:

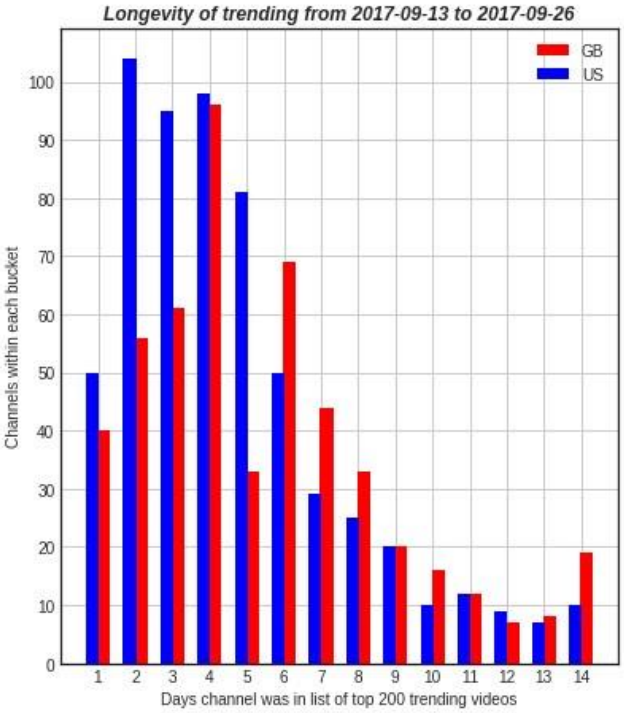
1. how US and GB trending longevity of channels compares?
2. what is the difference in lasting trends between US and GB?
3. how average trend of likes and comments for each longevity group looks like?
4. are there channels that reappear in top 200?
5. what are the features of stable-trending channels (category, tags, ratio of views to likes/comments)?

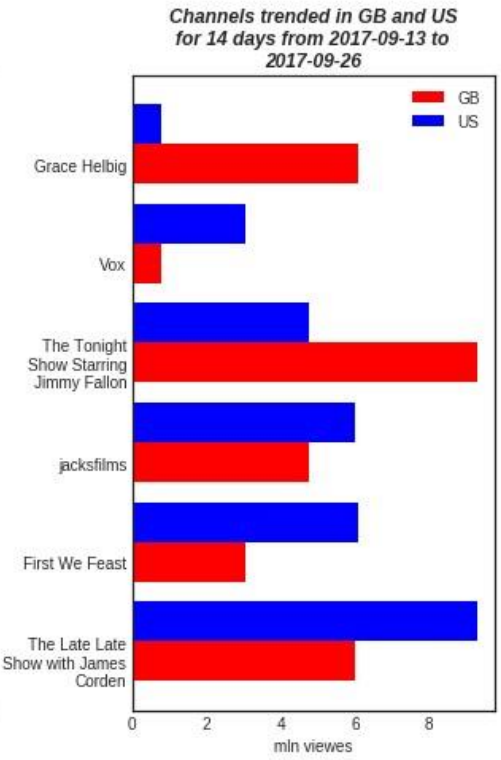
```
# function designed to plot longevity of trending def
trending_channels(gb, us, day_start, day_end, fig_height, hr_2ndRow):
   # list of selected dates
   datelist = [day_start + timedelta(days=x) for x in range((day_end-day_start).days + 1)]
   # number of days is selected time span
   tr_days = len(datelist)

   # leave only dates within selected range
gb = gb.loc[gb['date'].isin(datelist),]
   us = us.loc[us['date'].isin(datelist),]

   # Dataframes for longeivety plot ----------------------------------------------------
# group by channel title to see for how many dates channel was in trend
gb_ch_days = gb.groupby('channel_title')['date'].nunique()     gb_ch_days =
gb_ch_days.to_frame().reset_index()
   # dataframe with amount of channels per each "days in trend" bucket
gb_days_trending = gb_ch_days.groupby('date', axis=0, as_index = False).count()

   # group by channel title to see for how many dates channel was in trend
us_ch_days = us.groupby('channel_title')['date'].nunique()     us_ch_days =
us_ch_days.to_frame().reset_index()
   # dataframe with amount of channels per each "days in trend" bucket
us_days_trending = us_ch_days.groupby('date', as_index = False).count()

   # Difference in trending channels in US and GB ----------------------------------------
gb_day_tr_list = gb_ch_days.loc[gb_ch_days['date']==tr_days,
                        'channel_title'].values.tolist()
   gb_day_tr = gb.loc[gb['channel_title'].isin(gb_day_tr_list),]     gb_day_tr =
gb_day_tr.loc[gb_day_tr['date'].isin(datelist),]     gb_day_tr.sort_values('date', axis=0,
ascending=True, inplace=True)     gb_day_tr.drop_duplicates(subset='video_id',
keep='last', inplace=True)     gb_day_summary = gb_day_tr[['channel_title',
'views']].copy().groupby('channel_title',                                                    as_index =
False).sum()

   us_day_tr_list = us_ch_days.loc[us_ch_days['date']==tr_days,
                        'channel_title'].values.tolist()
```

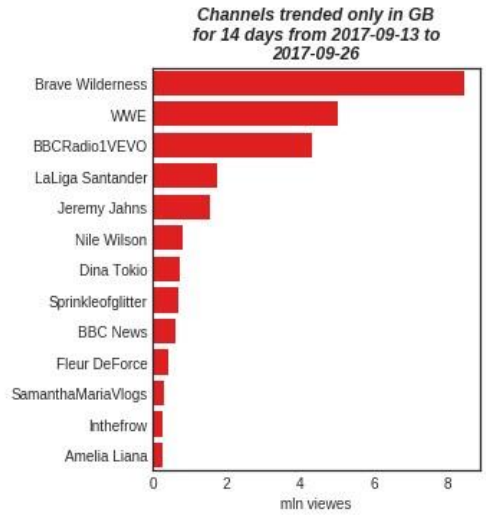
```
    us_day_tr = us.loc[us['channel_title'].isin(us_day_tr_list),]
    us_day_tr = us_day_tr.loc[us_day_tr['date'].isin(datelist),]
    us_day_tr.sort_values('date', axis=0, ascending=True, inplace=True)
    us_day_tr.drop_duplicates(subset='video_id', keep='last',
    inplace=True) us_day_summary = us_day_tr[['channel_title',
    'views']].copy().groupby('channel_title',
    as_index = False).sum()

   # make lists of channels overlap and channels for gb/us only --------------------------
gb_tr_list = gb_day_summary['channel_title'].values.tolist()     us_tr_list =
us_day_summary['channel_title'].values.tolist()
   overlaps = [x for x in gb_tr_list if x in us_tr_list]
gb_only = [x for x in gb_tr_list if x not in us_tr_list]
us_only = [x for x in us_tr_list if x not in gb_tr_list]

   # sort dataframes to make plots look nicer
   gb_day_summary.sort_values('views', axis=0, ascending=False, inplace=True)
us_day_summary.sort_values('views', axis=0, ascending=False, inplace=True)

   # make overlap database and sort them by channel_title
   gb_overlap = gb_day_summary.loc[gb_day_summary['channel_title'].isin(overlaps),]
gb_overlap = gb_overlap.sort_values('channel_title', axis=0, ascending=False)

   us_overlap = us_day_summary.loc[us_day_summary['channel_title'].isin(overlaps),]
gb_overlap = us_overlap.sort_values('channel_title', axis=0, ascending=False)

   # make us/gb only database
   gb_only_df = gb_day_summary.loc[gb_day_summary['channel_title'].isin(gb_only),]
us_only_df = us_day_summary.loc[us_day_summary['channel_title'].isin(us_only),]

   # combined plot ------------------------------------------------------------------
fig = plt.figure(figsize=(12, fig_height))
   gs = gridspec.GridSpec(3, 6, height_ratios=[1,0.1,hr_2ndRow],
                      width_ratios=[1,1,1,0.5,1,1])

   # plotting longevity of trending     ax1 =
plt.subplot(gs[0,:3])
ax1.bar(gb_days_trending['date']+0.15,
gb_days_trending['channel_title'],
         width = 0.35,
         color='r', alpha = 1)     ax1.bar(us_days_trending['date']-
0.15,           us_days_trending['channel_title'],
         width = 0.35,
         color='b', alpha = 1)

   ax1.set_title('Longevity of trending from {} to {}'.format(day_start,day_end),
fontstyle='italic', fontweight='bold')     ax1.set_ylabel('Channels within each
bucket')
```

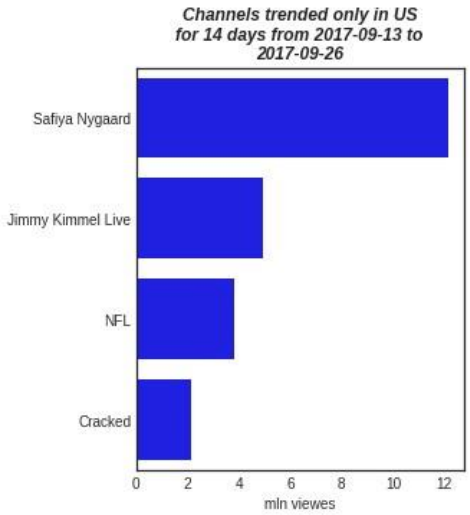
```
   ax1.set_yticks(np.arange(0, max(us_days_trending['channel_title']), 10)) ax1.set_xlabel('Days
   channel was in list of top 200 trending videos')
   ax1.set_xticks(us_days_trending['date'].unique())
   ax1.set_xticklabels(gb_days_trending['date'].unique())
   ax1.legend(('GB', 'US'))
   ax1.grid(linestyle='-', linewidth=1)

   # plotting channels trending in both GB and US
   ax2 = plt.subplot(gs[0,4:])
width = 0.4
   ax2.barh(np.arange(gb_overlap['channel_title'].shape[0]),
gb_overlap['views'].apply(lambda x: x/1000000),
         width, color='r', alpha = 1)
   ax2.barh(np.arange(us_overlap['channel_title'].shape[0])+width,
         us_overlap['views'].apply(lambda x: x/1000000),
         width, color='b', alpha = 1)
   overlaps = [ '\n'.join(wrap(l, 15)) for l in overlaps]
ax2.set_yticks(np.arange(len(overlaps)))
   yticklabels = ['\n'.join(wrap(l, 15)) for l in us_overlap['channel_title'].values.tolist()]
ax2.set_yticklabels(yticklabels, stretch = 'ultra-condensed')    ax2.set_xlabel('mln
viewes')    ax2.legend(('GB', 'US'))
   t_str = u'Channels trended in GB and US for {} days from {} to {}'
title = '\n'.join(wrap(t_str.format(tr_days,day_start, day_end),30))
ax2.set_title(title, fontstyle='italic', fontweight='bold')

   # plotting channels trending in GB only
   ax3 = plt.subplot(gs[2,:2])
width = 0.3
   ax3 = sns.barplot(x = gb_only_df['views'].apply(lambda x: x/1000000),
y = gb_only_df['channel_title'],
            color = 'red')
   gb_only = ['\n'.join(wrap(l, 15)) for l in gb_only]
ax3.set_yticks(np.arange(len(gb_only)))
   ax3.set_yticklabels(gb_only_df['channel_title'],stretch = 'ultra-condensed')
ax3.set_xlabel('mln viewes')
   ax3.set_ylabel('')
   t_str = u'Channels trended only in GB for {} days from {} to {}'
title = '\n'.join(wrap(t_str.format(tr_days,day_start, day_end),30))
ax3.set_title(title, fontstyle='italic', fontweight='bold')

   # plotting channels trending in US only
ax4 = plt.subplot(gs[2,4:])    width = 0.3
   ax4 = sns.barplot(x = us_only_df['views'].apply(lambda x: x/1000000),
y = us_only_df['channel_title'],
            color = 'blue')
   us_only = ['\n'.join(wrap(l, 15)) for l in us_only]
   ax4.set_yticks(np.arange(len(us_only)))
```

```
    ax4.set_yticklabels(us_only_df['channel_title'], stretch = 'ultra-condensed') ax4.set_xlabel('mln
    viewes')
    ax4.set_ylabel('')
    t_str = u'Channels trended only in US for {} days from {} to {}'
    title = '\n'.join(wrap(t_str.format(tr_days,day_start, day_end),30))
ax4.set_title(title, fontstyle='italic', fontweight='bold')

    plt.show()
trending_channels(gb_vid_df, us_vid_df, date(2017,9,13), date(2017,9,26), 15, 0.7)
```



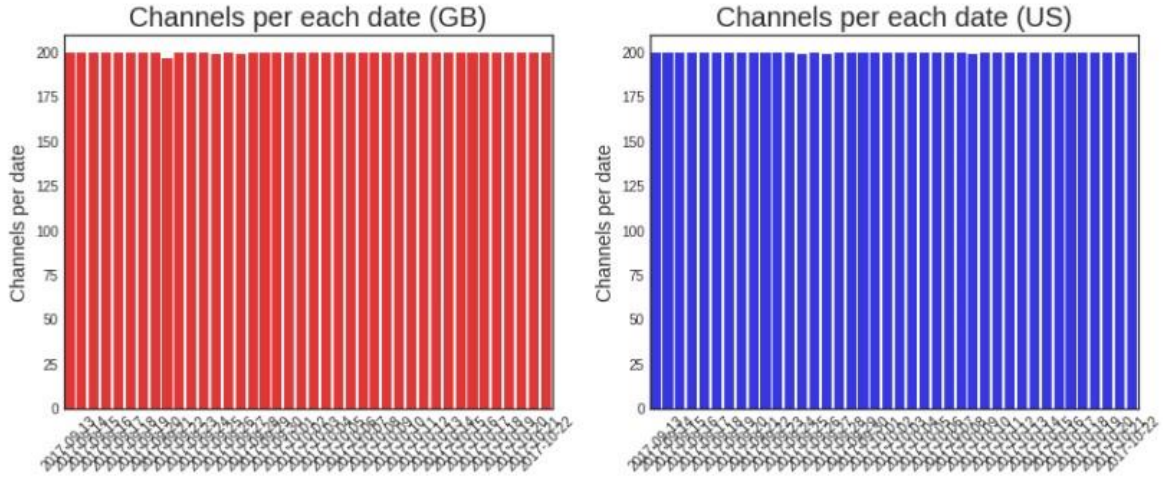







```
gb_chan_per_date = gb_vid_df[['channel_title', 'date']].groupby('date',
                                                    as_index=False).count()

us_chan_per_date = us_vid_df[['channel_title', 'date']].groupby('date',
                                                    as_index=False).count()
# plotting quantity of channels per each date
fig = plt.figure(figsize=(14, 5))
gs = gridspec.GridSpec(1, 2, width_ratios=[1,1])

ax1 = plt.subplot(gs[0,0])
```

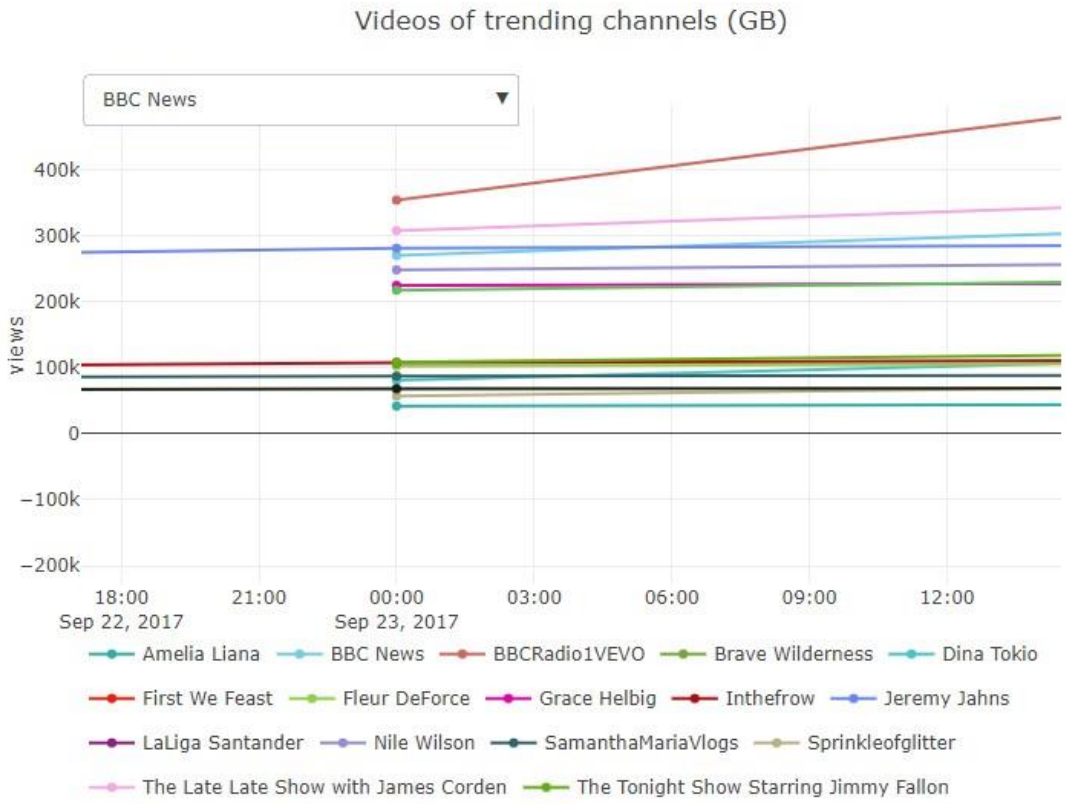
```
ax1 = sns.barplot(x="date", y="channel_title", data=gb_chan_per_date,
color='red', alpha=0.9)
ax1.set_ylabel('Channels per date', fontsize=14)
ax1.set_xticklabels(gb_chan_per_date['date'].unique(), rotation=45) ax1.set_xlabel('')
ax1.set_title('Channels per each date (GB)', fontsize=20)

ax2 = plt.subplot(gs[0,1])
ax2 = sns.barplot(x="date", y="channel_title", data=us_chan_per_date,
color='blue', alpha=0.9)
ax2.set_ylabel('Channels per date', fontsize=14)
ax2.set_xticklabels(us_chan_per_date['date'].unique(), rotation=45) ax2.set_xlabel('')
ax2.set_title('Channels per each date (US)', fontsize=20)

plt.show()
```

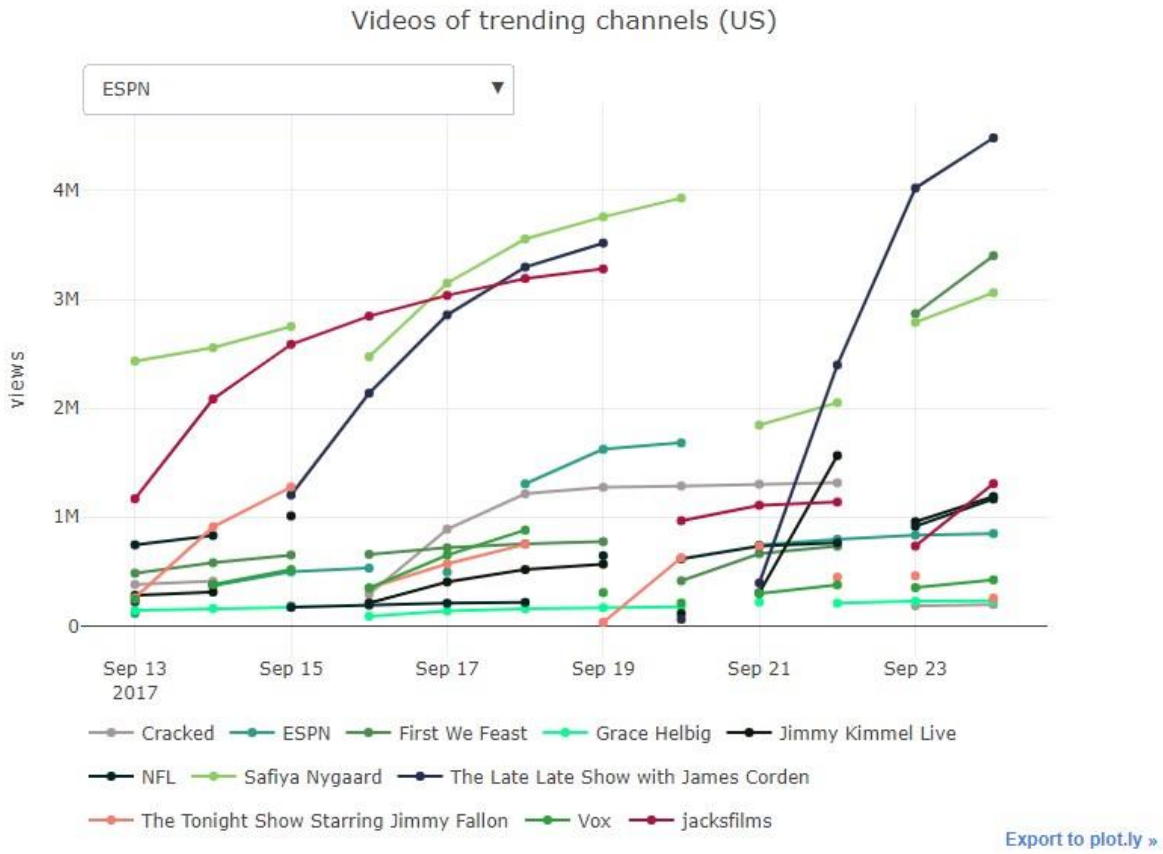



```
# function for channels analysis
# days_a must be in range between day_start and day_end def
channels_insight(df, country, day_start, day_end, days_a):
    # list of selected dates
    datelist = [day_start + timedelta(days=x) for x in range((day_end-day_start).days + 1)]
    # take part of database that included in relevant period
    df = df.copy().loc[df['date'].isin(datelist),]
    # make list of channels survived for selected days_a
```

```
   df_ch_days = df.groupby('channel_title')['date'].nunique().to_frame().reset_index()
df_ch_list = df_ch_days.loc[df_ch_days['date']==days_a, 'channel_title'].unique().tolist()

   # plotting videos per each channel (by views)
data = []     buttons = []
   buttons_list = []

   for x in df_ch_list:
      channel_videos = df.loc[df['channel_title'] == x,['title', 'date', 'views']]
videos_list = channel_videos['title'].unique().tolist()        boolean_list =
[True] + [False]*(len(videos_list)-1)        color =
'rgb('+str(np.random.randint(1,256))+","+str(np.random.randint(1,256))+","+str(np.random.randint(
1,256))+")"        for i in
range(0,len(videos_list)):
         vt = videos_list[i]
         video = channel_videos.loc[channel_videos['title']==vt, ['views', 'date']]
trace = go.Scatter(x = video['date'].values,                          y =
video['views'].values,
                     name = x,
                     line = dict(width = 2, color = color),
legendgroup = x,
                     showlegend = boolean_list[i])
         buttons_list.append(x) # this list will help identify buttons visibility
data.extend([trace])

   for x in df_ch_list:
      buttons_upd = list([dict(label = x,
method = 'update',
                      args = [{'visible': [i==x for i in buttons_list]}])])
buttons.extend(buttons_upd)

   buttons_all = list([dict(label = 'All channels',
                     method = 'update',
                     args = [{'visible': [True for x in buttons_list]}])])

   buttons.extend(buttons_all)

   update_menus = list([dict(active=1,
                     buttons = buttons,
direction = 'down',
pad = {'r': 10, 't': 10},
showactive = True,                          x
= 0.001,                        xanchor =
'left',
                     y = 1.1,
                     yanchor = 'top')])
```

```
   layout = dict(title = 'Videos of trending channels ({})'.format(country),
xaxis = dict(title = ''),
             yaxis = dict(title = 'views'),
updatemenus = update_menus,
             width=800, height=600, legend=dict(orientation="h"))

   fig = dict(data = data, layout = layout)

   iplot(fig)
```




Videos of trending channels (US)
ESPN
views
4M
3M
2M
1M
0
Sep 13
2017
Sep 15
Sep 17
Sep 19
Sep 21
Sep 23
Cracked
ESPN
First We Feast
Grace Helbig
Jimmy Kimmel Live
NFL
Safiya Nygaard
The Late Late Show with James Corden
The Tonight Show Starring Jimmy Fallon
Vox
jacksfilms
Export to plot.ly »

3. Analysis by categories

Categories will help to better understand nature of channels. They can be retreived from JSON file.

```
# dictionary for GB database with
open('../input/GB_category_id.json') as json_data:
   gb_from_json = json.load(json_data) gb_prelim_dict
= gb_from_json['items'] json_data.close()

gb_cat_dict = {} for i in range
(0,len(gb_prelim_dict)):     cat_key =
int(gb_prelim_dict[i]['id'])     cat_item =
gb_prelim_dict[i]['snippet']['title']
   gb_cat_dict[cat_key] = cat_item
gb_cat_dict[29] = 'Schools & Hospitals'

# dictionary for US database with
open('../input/GB_category_id.json') as json_data:
   us_from_json = json.load(json_data) us_prelim_dict
= us_from_json['items'] json_data.close()

us_cat_dict = {} for i in range
(0,len(us_prelim_dict)):     cat_key =
int(us_prelim_dict[i]['id'])     cat_item =
us_prelim_dict[i]['snippet']['title']
   us_cat_dict[cat_key] = cat_item
gb_cat_dict[29] = 'Schools & Hospitals'

# addition of categories to both databases
gb_vid_df['category_name'] = gb_vid_df['category_id'].apply(lambda x: gb_cat_dict[x])
gb_vid_df.head(5)
```

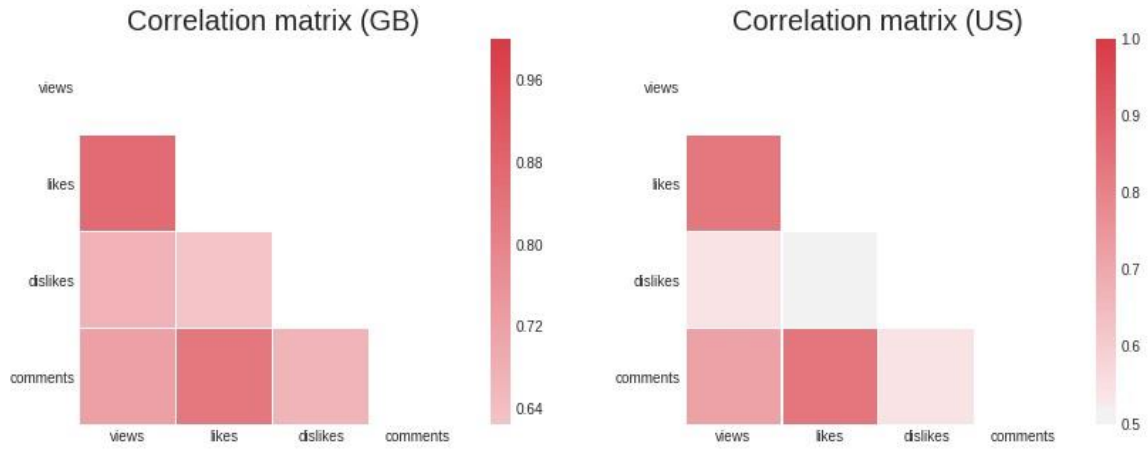
Out[16]:

	video_id	title	channel_title	category_id	tags	views	likes
0	jt2OHQh0HoQ	Live Apple Event - Apple September Event 2017 ...	Apple Event	28	apple events|apple event|iphone 8|iphone x|iph...	7426393	782
1	AqokkXoa7uE	Holly and Phillip Meet Samantha the Sex Robot ...	This Morning	24	this morning|interview|holly willoughby|philli...	494203	265
2	YPVcg45W0z4	My DNA Test Results! I'm WHAT?!	emmablackery	24	emmablackery|emma blackery|emma|blackery|briti...	142819	131
3	T_PuZBdT2iM	getting into a conversation in a language you ...	ProZD	1	skit|korean|language|conversation|esl|japanese...	1580028	657
4	NsjsmgmbCfc	Baby Name Challenge!	Sprinkleofglitter	26	sprinkleofglitter|sprinkle of glitter|baby gli...	40592	501

4. Views, likes, dislikes and comments

gb_vid_df.rename(columns={'comment_total':'comments'}, inplace=True)
us_vid_df.rename(columns={'comment_total':'comments'}, inplace=True)
There must be a strong positive correlation between views and all other feature (comments, likes, dislikes). The logic behind is simple: more views - more expression of opinion in any of its form.

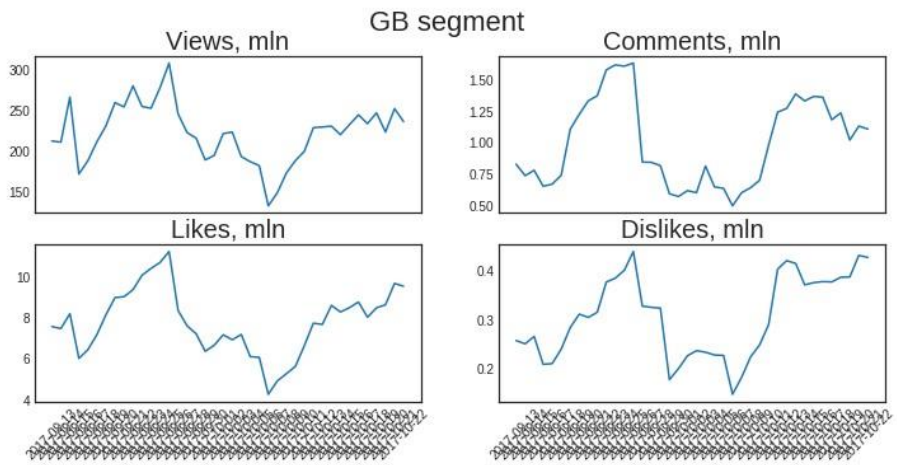
```
corr_gb = gb_vid_df.loc[:,['views', 'likes', 'dislikes', 'comments']].corr() corr_us
= us_vid_df.loc[:,['views', 'likes', 'dislikes', 'comments']].corr()

mask = np.zeros_like(corr_gb, dtype=np.bool)
mask[np.triu_indices_from(mask)] = True

fig = plt.figure(figsize=(14, 5))
gs = gridspec.GridSpec(1, 2, width_ratios=[1,1])
cmap = sns.diverging_palette(220, 10, as_cmap=True)

ax1 = plt.subplot(gs[0,0])
ax1 = sns.heatmap(corr_gb, cmap=cmap, vmax=1, center=0.5,
        square=True, linewidths=.5, mask=mask)
ax1.set_title('Correlation matrix (GB)', fontsize=20) plt.yticks(rotation=0)

ax2 = plt.subplot(gs[0,1])
ax1 = sns.heatmap(corr_us, cmap=cmap, vmax=1, center=0.5,
            square=True, linewidths=.5, mask=mask)
ax2.set_title('Correlation matrix (US)', fontsize=20) plt.yticks(rotation=0)

plt.show()
```



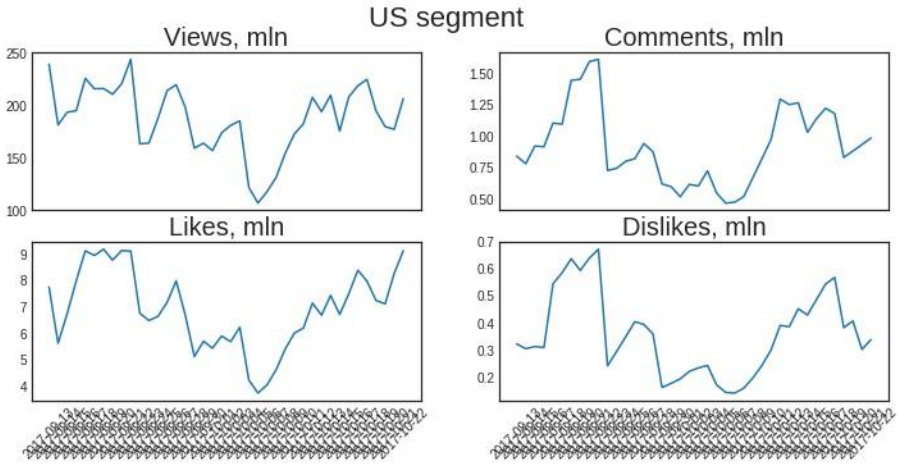

```
def vldc_plot(df_init, country):
    df = df_init[['date','views', 'likes',
```

```
        'dislikes','comments']].groupby('date', as_index = False).sum()
df[['views','likes', 'dislikes','comments']] = df[['views', 'likes',
                                        'dislikes', 'comments']].apply(lambda x: x/1000000)
fig = plt.figure(figsize=(12, 5))
   gs = gridspec.GridSpec(2, 2, width_ratios=[1,1])

   ax1 = plt.subplot(gs[0,0])
ax1.plot(df['date'], df['views'])
ax1.set_xticklabels("")
   ax1.set_title('Views, mln', fontsize=20)

   ax2 = plt.subplot(gs[0,1])
ax2.plot(df['date'], df['comments'])
ax2.set_xticklabels("")
   ax2.set_title('Comments, mln', fontsize=20)

   ax3 = plt.subplot(gs[1,0])
ax3.plot(df['date'], df['likes'])
ax3.set_xticks(df['date'].values)
ax3.set_xticklabels(df['date'], rotation=45)
   ax3.set_title('Likes, mln', fontsize=20)

   ax4 = plt.subplot(gs[1,1])
ax4.plot(df['date'], df['dislikes'])
ax4.set_xticks(df['date'].values)
ax4.set_xticklabels(df['date'], rotation=45)
   ax4.set_title('Dislikes, mln', fontsize=20)

   plt.suptitle('{} segment'.format(country), fontsize=22)

   plt.show()
vldc_plot(gb_vid_df, 'GB')
```

In [20]:
```
vldc_plot(gb_vid_df, 'GB')
```



In [21]:
```
vldc_plot(us_vid_df, 'US')
```



In [22]:
```
us_vid_df_corr_check = gb_vid_df.loc[gb_vid_df['date']!=date(2017,9,13),]
corr_us = us_vid_df_corr_check.loc[:,['views', 'likes', 'dislikes', 'comments']].corr()
corr_us
```

Out[22]:

	views	likes	dislikes	comments
views	1.000000	0.863980	0.673084	0.723835
likes	0.863980	1.000000	0.625403	0.838232
dislikes	0.673084	0.625403	1.000000	0.664547
comments	0.723835	0.838232	0.664547	1.000000

5. Predicting tags

Each video has tags. They are made by videos' authors. But maybe we can try to predict them based on comments? These are the sources of inspiration:

https://www.kaggle.com/c/transfer-learning-on-stack-exchange-tags/kernels

https://web.stanford.edu/class/cs224n/reports/2759891.pdf

https://www.kaggle.com/l3nnys/useful-text-preprocessing-on-the-datasets

The first step is to convert tags from string to list of strings.

```
gb_vid_df['tags'] = gb_vid_df['tags'].map(lambda x: x.split('|')) us_vid_df['tags']
= us_vid_df['tags'].map(lambda x: x.split('|'))
```

There are few rows that have more collumns than they should. Due to insignificant amount it is safe to exclude them.

```
# downloading the data and skip bad rows
gb_comm_df =  pd.read_csv("../input/GBcomments.csv", error_bad_lines = False) us_comm_df
=  pd.read_csv("../input/UScomments.csv", error_bad_lines = False)
```

```
b'Skipping line 113225: expected 4 fields, saw 5\n'
b'Skipping line 158379: expected 4 fields, saw 7\nSkipping line 241590: expected 4 fields, sa
w 5\nSkipping line 245637: expected 4 fields, saw 7\n'
b'Skipping line 521402: expected 4 fields, saw 5\n'
b'Skipping line 41589: expected 4 fields, saw 11\nSkipping line 51628: expected 4 fields, saw
7\nSkipping line 114465: expected 4 fields, saw 5\n'
b'Skipping line 142496: expected 4 fields, saw 8\nSkipping line 189732: expected 4 fields, sa
w 6\nSkipping line 245218: expected 4 fields, saw 7\n'
b'Skipping line 388430: expected 4 fields, saw 5\n'
/opt/conda/lib/python3.6/site-packages/IPython/core/interactiveshell.py:2717: DtypeWarning:

Columns (2,3) have mixed types. Specify dtype option on import or set low_memory=False.
```

```
# combined database on videos features (will be used for vlookup only) all_vid_df
= gb_vid_df.append(us_vid_df)
all_vid_df.sort_values('date', ascending=False, inplace=True)
# leave only most recent date for each video
all_vid_df.drop_duplicates('video_id', keep = 'first', inplace = True)
```

```
# combined database for comments
all_comm_df = gb_comm_df.append(us_comm_df)
# duplicates should be deleted
all_comm_df.drop_duplicates(['video_id', 'comment_text'], keep = 'first', inplace = True)
```

```
all_comm_df = all_comm_df.join(all_vid_df.set_index('video_id')[['tags',
                                                 'channel_title',
                                                 'title']], on = 'video_id')
# make additional column for number of tags
all_comm_df['num_tags'] = all_comm_df['tags'].apply(lambda x: len(x)) all_comm_df.shape

# function for cleaning urls def
remove_urls(x):
   return re.sub(r"http\S+", "", x)
# function for cleaning text of html tags and uris

# thanks to https://www.kaggle.com/l3nnys/useful-text-preprocessing-on-the-datasets
uri_re = r'(?i)\b((?:https?://|www\d{0,3}[.]|[a-z0-9.\-]+[.][a-
z]{2,4}/)(?:[^\s()<>]+|\(([^\s()<>]+|(\([^\s()<>]+\)))*\))+(?:\(([^\s()<>]+|(\([^\s()<>]+\)))*\)|[^\s`!()\[\
]{};:\'".,<>?«»“”‘’]))'

def stripTagsAndUris(x):    #
BeautifulSoup on content
   soup = BeautifulSoup(x, "html.parser")
   # Stripping all <code> tags with their content if any
if soup.code:
      soup.code.decompose()       #
Get all the text out of the html
text =  soup.get_text()
   # Returning text stripping out all uris
return re.sub(uri_re, "", text)
# emoji pattern (https://stackoverflow.com/questions/33404752/removing-emojis-from-a-string-
inpython)
emoji_pattern = re.compile("["
      u"\U0001F600-\U0001F64F"              #       emoticons
u"\U0001F300-\U0001F5FF"     # symbols & pictographs
u"\U0001F680-\U0001F6FF"  # transport & map symbols
      u"\U0001F1E0-\U0001F1FF"  # flags (iOS)
                  "]+", flags=re.UNICODE)

# function for removal of non-ASCII characters and emoji def
exASCII(x):
   # Lowercasing all words
   x = x.lower()
   # Removing non ASCII chars
ex_ascii = re.sub(r'[^\x00-\x7f]',r'',x)
   # remove emoji
   return emoji_pattern.sub(r'', ex_ascii)
# replace trippled+ characters
# https://stackoverflow.com/questions/43110237/replace-consecutive-repeated-characters-
withone-column-wise-operation-pand def trim_trippled(x):
```

```
   min_threshold_rep = 3
   return re.sub(r'(.)\1{%d,}'%(min_threshold_rep-1), r'\1',x)
# change shorcuts to full words, replace remains of unwanted characters
# thanks to https://www.analyticsvidhya.com/blog/2014/11/text-data-cleaning-steps-python/ apts
= {"'s": " is",
      "'ll": " will",
      "'re": " are",
      "'d": " would",
      "'t": " not",
      "'m": " am",
      "'ve": " have",
      "&": " and ",
"\*": " ",       r'\\n':
" ",
      '[%_=>#"(--)\)\(:\^~\<( - )( / )([\\\/\])]': " ",
      "[^(\d]\d+\)": " ",
      "([\d|\d\d]):([\d|\d\d])(:([\d|\d\d]))?": " "}

# exclude double spaces left after previous step rem
= {'  +': ' '}

def ex_apts_rem(x):
for i in apts:
      x = re.sub(i, apts[i], x)
for i in rem:
      x = re.sub(i, rem[i], x)
return x
# leave only those words that correspond to selected parts of speech
def nlp_filter(x):    tokens = nlp(x)    tags = []
   list_of_tags = ['CD','FW','JJ','JJR','JJS','NN','NNP','NNPS','NNS','RB','RBR','RBS']
for token in tokens:
      tags.append((token.lemma_, token.tag_))
filtered_list = [(n,y) for (n,y) in tags if y in list_of_tags]
x = " ".join([n for (n,y) in filtered_list])    return x
# function that embraces all previous text preparation process def
preprocess_functions(x):
   return (ex_apts_rem(trim_trippled(exASCII(stripTagsAndUris(remove_urls(x)))))) Now
functions above can be applied to comments column.

# prepare comments section comments_df
= all_comm_df.copy()
comments_df['comment_text'] = comments_df['comment_text'].apply(str)
comments_df['comment_text_proc'] = comments_df['comment_text'].apply(lambda x:
preprocess_functions(str(x)))
```

```
/opt/conda/lib/python3.6/site-packages/bs4/__init__.py:219: UserWarning:

"b'.'" looks like a filename, not markup. You should probably open this file and pass the fil
ehandle into Beautiful Soup.

/opt/conda/lib/python3.6/site-packages/bs4/__init__.py:219: UserWarning:

"b'..'" looks like a filename, not markup. You should probably open this file and pass the fi
lehandle into Beautiful Soup.

/opt/conda/lib/python3.6/site-packages/bs4/__init__.py:219: UserWarning:

"b'/'" looks like a filename, not markup. You should probably open this file and pass the fil
ehandle into Beautiful Soup.
```

```
# create comments column where emojis are excluded but other non-ASCII characters are preserved
comments_df['no_emo_comments'] = comments_df['comment_text'].apply(lambda x:
emoji_pattern.sub(r'', x))

# videos where most of the comments made with non-ASCII characters
vid_list = comments_df['video_id'].unique()
vid_list_nonASCII = [] for i in vid_list:
   temp_df = comments_df.loc[comments_df['video_id'] == i, ]
   nonASCII = temp_df['no_emo_comments'].str.contains(r'[^\x00-\x7f]').sum() # number of
comment with non-ASCII characters     all_com = temp_df['no_emo_comments'].count() #
total number of comments     if (nonASCII/all_com) > 0.5:        vid_list_nonASCII.append(i)

vid_list_few_comments = [] for
i in vid_list:
   temp_df = comments_df.loc[comments_df['video_id'] == i, ]
if (temp_df['video_id'].count()) < 10:
vid_list_few_comments.append(i)

del temp_df
# exclude videos selected in previous step
vid_list_prunned = [x for x in vid_list if x not in vid_list_nonASCII]
vid_list_prunned = [x for x in vid_list_prunned if x not in vid_list_few_comments]

# tags predictions tags_list
= []
for i in vid_list_prunned:
   temp_df = comments_df.loc[comments_df['video_id'] == i, ]
   n_tags = len(temp_df['tags'].values[0])
   max_ngram = max([len(n.split()) for n in temp_df['tags'].values[0]])
tfidf = TfidfVectorizer(min_df = 0.03,                max_features =
10000,                analyzer = 'word',
token_pattern = r'\w+',
```

```
                    ngram_range = (1, min(max_ngram,3)), # limit n-grams by 3 words max
use_idf = True,                 smooth_idf = True,                 sublinear_tf = True,
stop_words = 'english')
   tfidf_matrix = tfidf.fit_transform(temp_df['comment_text_proc'].values)
tags_array = np.array(tfidf.get_feature_names())    tags_sorted =
np.argsort(tfidf_matrix.toarray()).flatten()[::-1]    sel =
tags_sorted[:n_tags]    selected_tags = tags_array[sel]
tags_list.append(selected_tags.tolist())
print ("Prediction is done.") Prediction
is done.
# add predicted tags to comments dataframe
tags_df = pd.DataFrame({"video_id": vid_list_prunned, "tags_pred": tags_list})
comments_df_selected = comments_df.copy().loc[comments_df['video_id'].isin(vid_list_prunned),]
comments_df_selected = comments_df_selected.merge(tags_df, how = "left", left_on = "video_id",
right_on = "video_id") comments_df_selected.head(3)
```

Out[37]:

	video_id	comment_text	likes	replies	tags	channel_title	title	num_tags	comment_text_proc	no_emo_c
0	jt2OHQh0HoQ	It's more accurate to call it the M+ (1000) be...	0	0	[apple events, apple event, iphone 8, iphone x...	Apple Event	Live Apple Event - Apple September Event 2017 ...	8	it is more accurate to call it the m 10 becaus...	It's more a to call it t (1000) be
1	jt2OHQh0HoQ	To be there with a samsung phone\n😂😂😂	1	0	[apple events, apple event, iphone 8, iphone x...	Apple Event	Live Apple Event - Apple September Event 2017 ...	8	to be there with a samsung phone	To be the samsung
2	jt2OHQh0HoQ	Thank gosh, a place I can watch it without hav...	0	0	[apple events, apple event, iphone 8, iphone x...	Apple Event	Live Apple Event - Apple September Event 2017 ...	8	thank gosh a place i can watch it without havi...	Thank go place I ca it without

```
check_list = random.sample(vid_list_prunned,5)
print (check_list) for
i in check_list:
   temp_df = comments_df_selected.loc[comments_df_selected['video_id'] == i, ]
print ("\nVideo title:")    print (temp_df['title'].values[0])    print ("\nGround
truth tags:")    print (temp_df['tags'].values[0])    print ("\nPredicted tags:")
print (temp_df['tags_pred'].values[0])    print ("--------------------")
```

6.Emojis in comments

How popular different emojis are? It can be visualized with plotly.

```
# prepare emojis list
all_comm_df['emoji'] = all_comm_df['comment_text'].apply(lambda x: re.findall(emoji_pattern, str(x)))
all_comm_df['emoji'] = all_comm_df['emoji'].apply(lambda x: [i for sublist in x for i in sublist])
emo_list = all_comm_df['emoji'].values.tolist()
emo_list_flatten = [i for sublist in emo_list for i in sublist]

# only unique values from the list
emo_unique = list(set(emo_list_flatten))
emo_all = " ".join(emo_list_flatten) #
dictionary for emoji frequency emo_dict
= {} for i in emo_unique:
```

```
    emo_dict[i] = len(re.findall(i, emo_all))
# top 15 emoji with Plotly
emo_df = pd.DataFrame.from_dict(emo_dict, orient = 'index')
emo_df = emo_df.reset_index() emo_df.columns = ["emoji",
'frequency']
emo_df.sort_values('frequency', ascending = False, inplace = True)
emo_df_top15 = emo_df.head(15).copy()
emo_df_top15.sort_values('frequency', ascending = True, inplace = True)

# plot
data = [go.Bar(x = emo_df_top15['frequency'],
            y = emo_df_top15['emoji'],
            orientation = 'h',
            marker = dict(color = 'rgba(200, 100, 1, 0.6)',
line = dict(color = 'rgba(50, 171, 96, 1.0)',
width = 1)))]

layout = dict(title = '15 most frequent emojis') fig
= dict(data = data, layout = layout)
iplot(fig, filename='basic-bar')
```