DS2_Zecai_Liang_User_Engagement_

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0.1 Investigating a Drop in User Engagement

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0.1.1 Problem:

rapid drop of weekly_active_user counts around 2014-08-01

0.1.2 Hypothesis:

1. drop of new users (NO)

2. drop of active user of certain type(s) (YES)

- language:
  - (major) English
  - (minor) French, Japanese, German
- company:
  - (major) company_id 1.0
  - (minor) company_id 4.0

3. drop of certain type(s) of event (YES)

- login (major major)
- message (major)
- like (minor)
- search (minor)
- signup (no)

0.1.3 Conclusion:

- Major drops in **login** and **message** related activities (so lacking the basic engagement)
- Majorly affect **company_id 1.0 and 4.0**
- Majorly affect following language: **English, French, Japanese, German**

0.1.4 Future Direction:

- study the relationship between email sending and engagement (especially login activity)

```
In [3]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        import seaborn as sns
        import warnings
        warnings.filterwarnings('ignore')
        %matplotlib inline
```

0.2 Hypothesis 1: Drop of New Users (No)

- New uers between 2014-05-01 and 2014-08-31 doesn't share the same trend with weekly_active_users
- so the drop is due to engagement patterns of existing users

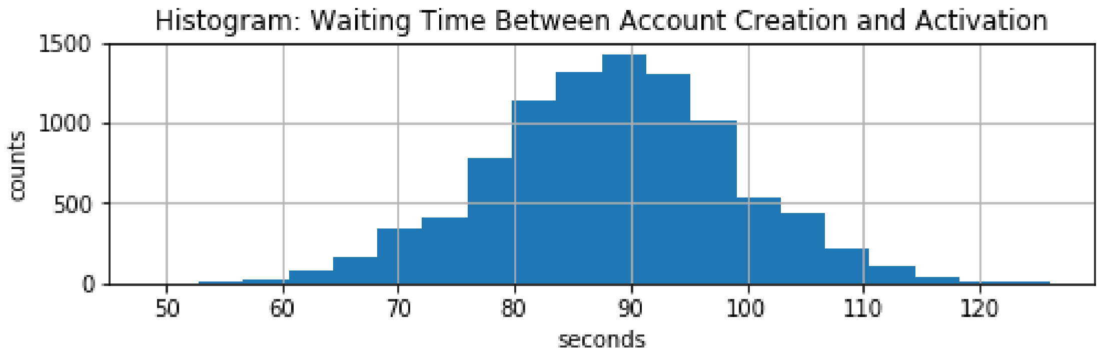
```
In [94]: ### load user data
         df_user = pd.read_csv("data/yammer_users.csv")
         ## convert time to timestamp
         df_user["created_at"] = pd.to_datetime(df_user["created_at"])
         df_user["activated_at"] = pd.to_datetime(df_user["activated_at"])
```

0.2.1 Accounts (if activated) are created and activated within the same day.

The average waiting time between account creation and activation is 88.5 second (see below). So when considering new users, we can consider account activation only. (between 2013-01-01 and 2014-08-31)

```
In [145]: ((df_user["activated_at"] - df_user["created_at"]).dropna() / pd.Timedelta(seconds=1
                                                                     .hist(bins = 20, figsize = (8,2)
          plt.title("Histogram: Waiting Time Between Account Creation and Activation"),
          plt.xlabel("seconds"), plt.ylabel("counts")

Out[145]: (Text(0.5, 0, 'seconds'), Text(0, 0.5, 'counts'))
```

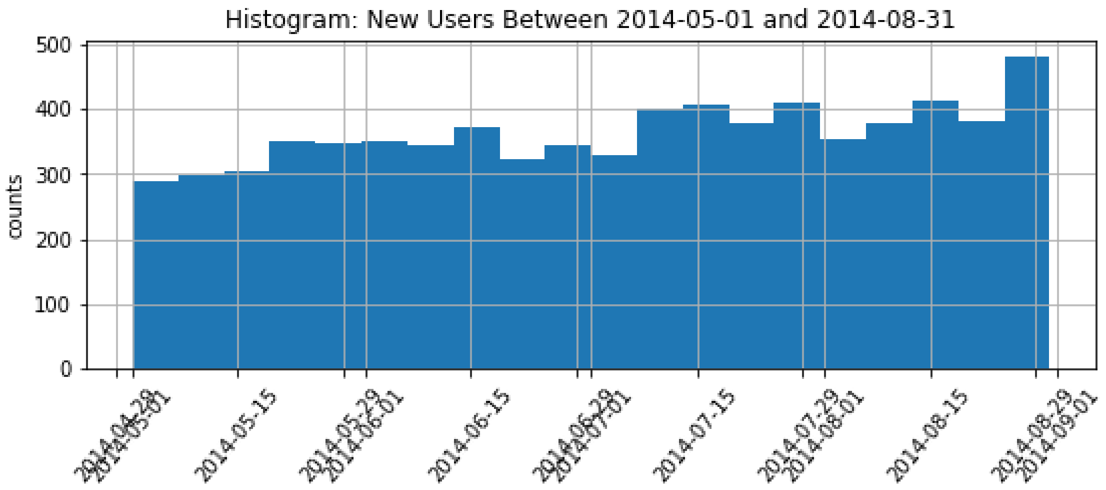


0.2.2 New user counts don't share the same trend with weekly_active_users

New users are stable with gradual increasing, so the fluctuation of weekly_active_users is not due to change of new users. (for the 18 weeks between 2014-05-01 and 2014-08-31)

```
In [156]: df_user["created_at"].hist(range = ("20140501", "20140831"), bins = 20, xrot = 50, f
          plt.title("Histogram: New Users Between 2014-05-01 and 2014-08-31"),
          plt.ylabel("counts")
```

```
Out[156]: Text(0, 0.5, 'counts')
```



0.3 Hypothesis 2: Drop of Active Users in Certain Segments

```
In [4]: ### load events data
        df_event = pd.read_csv("data/yammer_events.csv")
        ## convert to timestamp
        df_event["occurred_at"] = pd.to_datetime(df_event["occurred_at"])
```

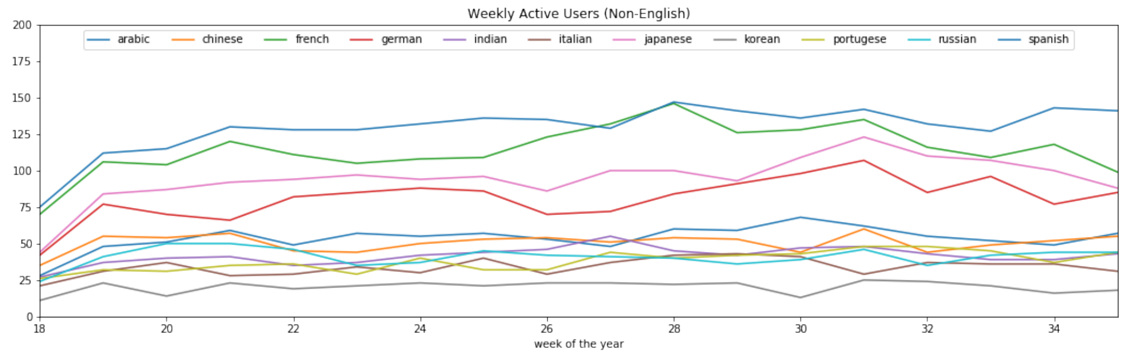
```
In [137]: ## event_count: count event per week per user_id
          df_week_event = df_event[["occurred_at", "user_id"]].groupby([df_event["occurred_at"
                                        .count().reset_index(name="event_count")
          ## add user company_id and language info (from df_user data)
          df_week_user = df_week_event.join(df_user[["user_id", "company_id", "language"]], ho
                                  lsuffix = "_df_event", rsuffix = "_df_user")
```

0.3.1 2.1 drop of active users in language segments

- major drop in english, also majority of active users in english
- also drop in french, japanese, german(some)
- not drop in arabic

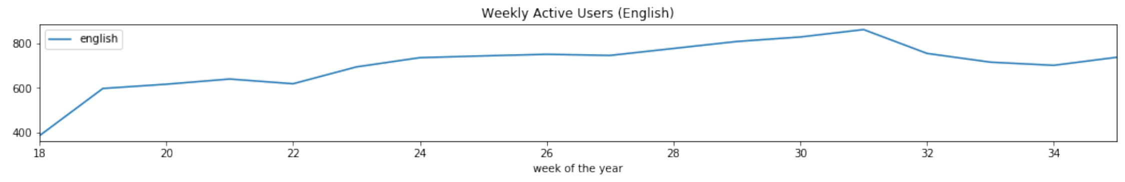
```
In [384]: ## weekly active users (non-english)
          df = df_week_user.groupby(["occurred_at","language"])["user_id_df_event"].count().uns
          df.loc[:, df.columns != 'english'].plot(kind='line', stacked=False, figsize = (18,5)
          plt.legend(loc = "upper center", ncol = 12), plt.xlabel("week of the year")
          plt.title("Weekly Active Users (Non-English)")

Out[384]: Text(0.5, 1.0, 'Weekly Active Users (Non-English)')
```



```
In [385]: ## english active users per week
          df.loc[:, 'english'].plot(kind='line', stacked=False, figsize = (18,2))
          plt.legend(loc = "upper left"), plt.xlabel("week of the year")
          plt.title("Weekly Active Users (English)")

Out[385]: Text(0.5, 1.0, 'Weekly Active Users (English)')
```

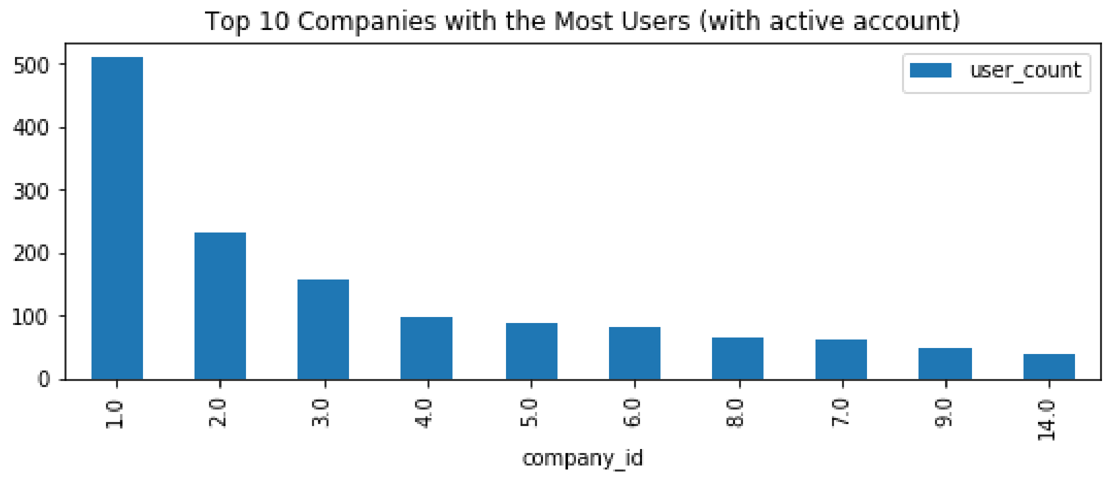


0.3.2 2.2 drop of active users in company segments

- Select top 5 companies with the most users (status: active), since there are 6950 unique company ids in total.
- the major decline comes from company_id 1.0, and some from company_id 4.0

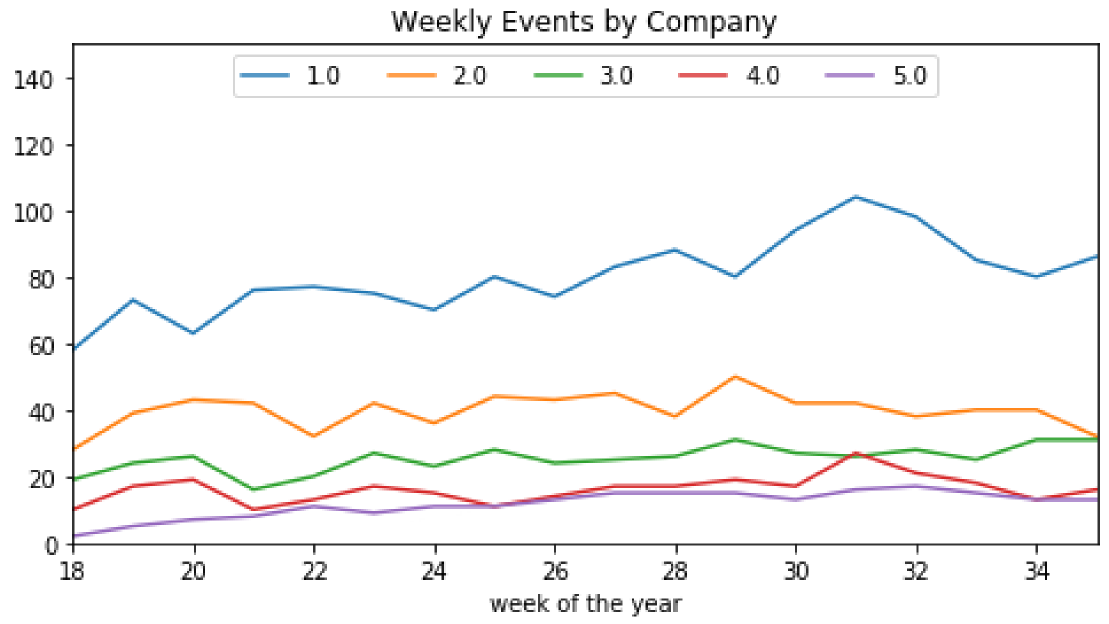
```
In [220]: df = df_user[df_user["state"] == "active"].groupby("company_id")["user_id"].count().
          df.sort_values("user_count", ascending = False).head(10).plot(x = "company_id", y = 
                                                                        kind = "bar", figsize =
                                                         title = "Top 10 Companies with the Mos
          top5_company_id = df["company_id"].head(5) # save company_id of top 5 companies with
```

```
Out[220]: <matplotlib.axes._subplots.AxesSubplot at 0x1a38dd76a0>
```



```
In [386]: df = df_week_user[df_week_user["company_id"].isin(top5_company_id)]\
                                                    .groupby(["occurred_at","company_id"])["
                                                    .count().unstack().plot(ylim = (0,150), 
          plt.legend(loc = "upper center", ncol = 5), plt.xlabel("week of the year")
          plt.title("Weekly Events by Company")

Out[386]: Text(0.5, 1.0, 'Weekly Events by Company')
```



0.4 Hypothesis 3: Drop of Events in Certain Segments

0.4.1 3.1 drop of events by event type

- Further devide the event into 5 category by event_name:
- signup: "create_user", "enter_email", "enter_info", "complete_signup"
- login: "home_page", "login"
- like: "like_message"
- message: "send_message", "view_inbox"
- search: "search_autocomplete", "search_run", "search_click_result_X"
- Major drop in "login" and "message"
- minor drop in "like" and "search"

```
In [367]: ## re-define event_type by event_name
          event_name = {"signup": ["create_user", "enter_email", "enter_info", "complete_signu
                        "login": ["home_page", "login"],
                        "like": ["like_message"],
                        "message": ["send_message", "view_inbox"]
                        #"search": ["search_autocomplete", "search_run", "search_click_result_
          }

          for i in event_name:
              df_event.loc[df_event["event_name"].isin(event_name[i]),"event"] = i
          df_event["event"] = df_event["event"].fillna("search") # the rest is "search"
```

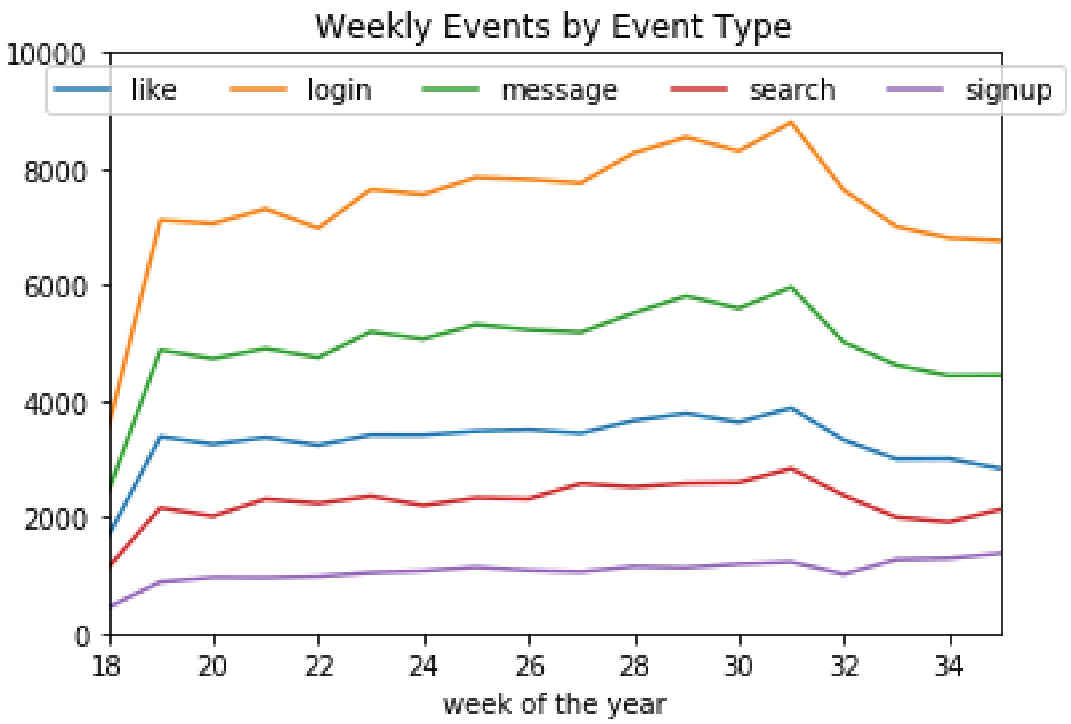
```
In [371]: df_event["event"].value_counts()
```

```
Out[371]: login      132675
          message     89041
          like        59248
          search      40611
          signup      19257
          Name: event, dtype: int64
```

```
In [375]: ## count event per week per event type
          df_event_type = df_event[["occurred_at", "event"]].groupby([df_event["occurred_at"].
                                     .count().reset_index(name="event_count")
```

```
In [387]: df_event_type.groupby(["occurred_at", "event"])["event_count"].sum().unstack() \
                      .plot(kind = "line", title = "Weekly Events by Event Type", ylim = (0,10
          plt.legend(loc = "upper center", ncol = 5), plt.xlabel("week of the year")
```

```
Out[387]: (<matplotlib.legend.Legend at 0x1a5fd2c908>, Text(0.5, 0, 'week of the year'))
```


Weekly Events by Event Type
like
login
message
search
signup
10000
8000
6000
4000
2000
0
18
20
22
24
26
28
30
32
34
week of the year