CA4

November 19, 2017

1 CA4

1.1 Introduction

The fourth assignment is based on transforming a large dataset into text format (over 5000 lines of text)

Dataset consist of the GitHup updates by different users.

I scrubed (cleaned) the data and placed it into the relevant objects.

After srubing dataset I gained 422 different sets of commit objects.

In this report I will analyse 422 commit objects that are stored in the list by using Python and will come up with an interesting statistics.

My code for calculating the analysis will be documented and tested.

1.2 Python sript preparation

```
In [1]: #set a directory
        import os
        os.chdir('D://DBS//5.Programming_for_big_data//github//pz_pbd//CA4')

        #create a function which would read file
        def read_file(changes_file):
            # use strip to strip out spaces and trim the line
            #strip each line in the inserted file, and
            #return after for loop have checked all file
            return [line.strip() for line in open(changes_file, 'r')]
```

```
In [2]: #create commit class
        class Commit (object):

            #create commit instance variables
            def __init__ (self, revision, author, date, time, \
                          number_of_lines, change_path = '', comment = ''):
                self.revision = revision
                self.author = author
                self.date = date
                self.time = time
                self.number_of_lines = number_of_lines
                self.change_path = change_path
                self.comment = comment

            #create instance which return commits as a dictionary
            def to_dic(self):
                return {'revision': self.revision, \
                        'author': self.author, 'date': self.date, \
                        'time': self.time, \
                        'number of lines': self.number_of_lines , \
                        'changed path': self.change_path, 'comment': self.comment}

            #return instance variable
            #return number of lines as a string, and join comments
            #the reason why we need to join comments is
            #because we can have multiple lines comments)
            def __repr__ (self):
                return self.revision+ ',' + self.author + ',' + self.date + \
            ',' + self.time + ',' + str(self.number_of_lines) + ',' \
            + ' '.join(self.change_path) + ',' + ' '.join(self.comment) + '\n'
```

```
In [3]: import pandas as pd
        #create function which returns data frame of commits
        def to_df(data):
            commits = []
            for commit in data:
                commits.append(commit.to_dic())
            return pd.DataFrame(commits)


        #get commits function will help us to break inforamtion from each commit
        def get_commits(data):
            #each commit is separated by 72 hifins
            sep = 72*'-'
            #create a list to store each commit
            commits = []
            #first index starts in the line 0
            index = 0
            #while our index is less than data lenght
            while index < len(data):
                try:
                    # find each line of the commit
                    #and split by the separator |
                    #index + 1 because line starts one line lower than index line
                    details = data[index + 1].split('|')
                    #call class commit and add details to the variable
                    #commit as per class
                    commit = Commit(details[0].strip(),
                        details[1].strip(),
                        details[2].strip().split(' ')[0],
                        details[2].strip().split(' ')[1],
                        #get number of lines and return as int
                        int(details[3].strip().split(' ')[0]))
                    #set file end index
                    #build in function looks for empty line index and
                    #return that index (use build in index function)
                    #look foe empty lien and stop looking once found
                    change_file_end_index = data.index ('', index + 1)
                    #chnaged path line starts from the third line
                    commit.change_path = data[index +3 : change_file_end_index]
                    #get comments
                    commit.comment = data [change_file_end_index + 1:
                        change_file_end_index + 1 + commit.number_of_lines]
                    # add details to the list of commits
                    commits.append(commit)
                    #find for a next 72 hifins
                    #look for next index in the file which starts with
                    #72 hifins, and update index possition
                    index = data.index(sep, index + 1)
                except IndexError:
                    #then index equal to len of data program stops
                    index = len(data)
            #return all commits
            return commits
```

1.2.1 Test Functions

To make sure that my functions work, I am going to test each of them separately.
Going to check:

- Lenght of the dataset
- Lenght of commit objects
- Who is the author at index 420 possition in commits list
- Revision number at index 0 possition in commits list
- Comments at index 23 possition in commits list
- Chanegd paths at index 40 possition in commits list
- Who is the author at index 9 position in the the data frame

```
In [4]: if __name__ == '__main__':
            #open the file - and read all lines.
            changes_file = 'changes_python.log'
            #assigne all lines to data variable
            data = read_file(changes_file)
            #get commits from get_commits function and insert data variable
            commits = get_commits(data)
            #assign commits, to the data_frame variable by using to_df function
            data_frame = to_df(commits)
```

```
In [5]:    #print number of lines from the dataset
           print(len(data))
```

```
5255
```

```
In [6]:    #print lenght of commit objects
           #from this commits variable I will start forming my dataframe
           print(len(commits))
```

```
422
```

```
In [7]:    #print author at the 420 index possition from the commit list
           print(commits[420].author)
```

```
Jimmy
```

```
In [8]:    #print revision at the 0 index possition from the commit list
           print(commits[0].revision)
```

```
r1551925
```

```
In [9]:    #print comment at the 23 index posstion from the commit list
           print (commits[23].comment)
```

```
['SFR-108 : Create bilingual French/English translated Android application for SFR', '--------
```

```
In [10]:    #print changed paths at the 40 index possition from the commit list
            print (commits[40].change_path)
```

```
['A /cloud/personal/client-international/android/branches/android-15.2-solutions/libs/ui/res/la
```

```
In [11]:    #print author at the 9 index possition from the data frame
            print (data_frame['author'][9])
```

```
Vincent
```

1.3 Analysis by using Python

I will analyse dataset by using Python language.

To find ineteresting statistics in 422 commit objects I will use following libraries:

- Pandas
- Numpy

- Matplotlib (visualization)
- Seaborn (visualization)

In this report I will explain step by step how I got my results.

```
In [12]:    #import required libraries
            import pandas as pd
            import numpy as np
            import matplotlib.pyplot as plt
            %matplotlib inline
            #Seaborn is a Python visualization library based on matplotlib.
            #It provides a high-level interface for drawing attractive statistical graphics.
            import seaborn as sns
            plt.style.use('fivethirtyeight')
            import warnings
            warnings.filterwarnings('ignore')
```

Once I have imported all required libraries for my analysis I can start to analyse and explore data.
Build in function **.info()** shows that data frame have 422 entries and display all 7 column names.
Below we can see that data frame doesn't have any missing values.

```
In [13]:    #display information about a dataset
            data_frame.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 422 entries, 0 to 421
Data columns (total 7 columns):
author             422 non-null object
changed path       422 non-null object
comment            422 non-null object
date               422 non-null object
number of lines    422 non-null int64
revision           422 non-null object
time               422 non-null object
dtypes: int64(1), object(6)
memory usage: 23.1+ KB
```

To get more familiar with a dataset I will view first 5 lines by using build in function **.head()**

```
In [14]:    #display data frame 5 lines
            data_frame.head()

Out[14]:                                              author  \
         0                                            Thomas
         1                                            Thomas
         2                                           Vincent
```

```
3                                            Thomas
4  /OU=Domain Control Validated/CN=svn.company.net

                                       changed path  \
0  [A /cloud/personal/client-international/androi...
1  [M /cloud/personal/client-international/androi...
2  [M /cloud/personal/client-international/androi...
3  [M /cloud/personal/client-international/androi...
4  [M /cloud/personal/client-international/androi...

                                            comment        date  \
0              [Renamed folder to the correct name]  2015-11-27
1  [Removed unused webview.plan.management and we...  2015-11-27
2                             [enable all clients]  2015-11-27
3                       [Chnaged jira url to htps]  2015-11-27
4  [[gradle-release] prepare for next development...  2015-11-27

   number of lines  revision      time
0                1  r1551925  16:57:44
1                1  r1551575  09:46:32
2                1  r1551569  09:38:09
3                1  r1551558  09:13:26
4                1  r1551504  07:05:41
```

Now once data frame is prepared for analysis I am going to check for unique futures within the data frame.

First off all I will investigate, how many unique authors are in the dataset by using **unique()** function.

```
In [15]:    #print unique authors
            data_frame['author'].unique()
```

```
Out[15]: array(['Thomas', 'Vincent',
                '/OU=Domain Control Validated/CN=svn.company.net', 'Jimmy',
                'Freddie', 'Dave', 'ajon0002', 'murari.krishnan', 'Nicky', 'Alan'], dtype=obje
```

Once the list with unique authors are known, I can see that one of the authors name is **/OU=Domain Control Validated/CN=svn.company.net** and I am going to replace this name into **DCV** as a very long name can cause difficulties for further data exploration and visualisation.

```
In [16]:    #replace author /OU=Domain Control Validated/CN=svn.company.net into DCV
            #this creates new series of values, so we need to
            #assign this new column to the correct column
            data_frame['author'] = data_frame['author']. \
            replace(['/OU=Domain Control Validated/CN=svn.company.net'], 'DCV')
```

```
In [17]:    #print unique authors
            data_frame['author'].unique()
```

```
Out[17]: array(['Thomas', 'Vincent', 'DCV', 'Jimmy', 'Freddie', 'Dave', 'ajon0002',
                'murari.krishnan', 'Nicky', 'Alan'], dtype=object)
```

1.3.1 The biggest amount of commit objects by Author

Once I have a list of authors ready, I am going to investigate which author was the most active and had created a biggest number of commit objects in the dataset.

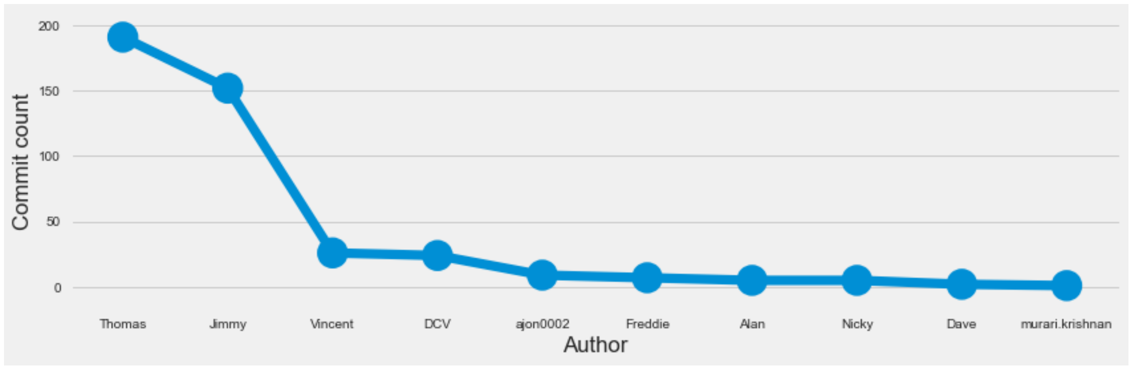
By using matplotlib and seaborn I will display authors who have generated the biggest amount of commit objects.

```
In [18]:    #count how many different authors have commit objects and groub by author
            log_in_per = data_frame[['author' ,'date']].groupby(['author'], \
                                                         as_index = False).count()
            #rename column names and print
            log_in_per = log_in_per.rename(columns = {'author': 'Author', \
                                                    'date': 'Commit count'})
            #sort values
            log_in_per = log_in_per.sort_values(['Commit count'], ascending = [False])
            log_in_per
```

```
Out[18]:            Author  Commit count
        6           Thomas           191
        4            Jimmy           152
        7          Vincent            26
        1              DCV            24
        8         ajon0002             9
        3          Freddie             7
        0             Alan             5
        5            Nicky             5
        2             Dave             2
        9   murari.krishnan            1
```

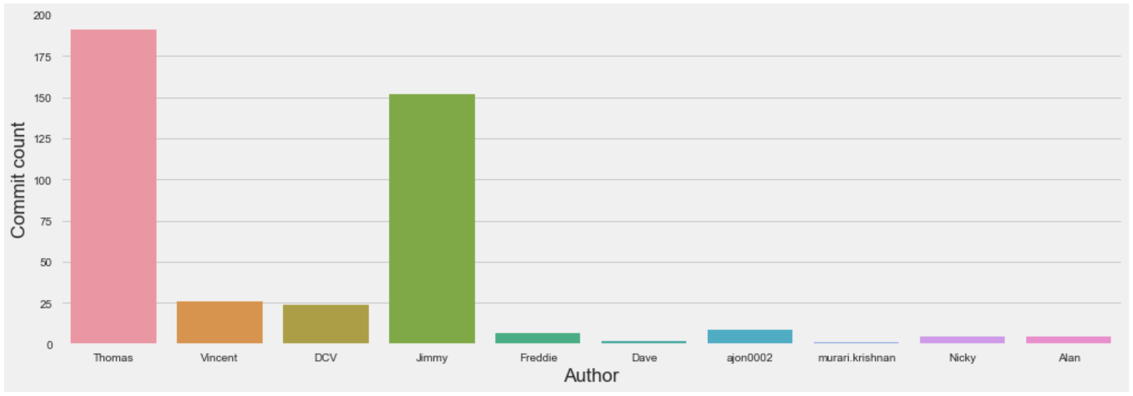
```
In [19]:    #create a factor plot
            sns.factorplot('Author', 'Commit count', data = log_in_per, size = 4, \
                           aspect = 3)
```

```
Out[19]: <seaborn.axisgrid.FacetGrid at 0x9e724a8>
```



```
In [20]:    #create an axe for a plot
            fig, (axis1) = plt.subplots(1,1,figsize=(15,5))

            #display as a bar chart
            ax = sns.barplot('Author', 'Commit count', data = log_in_per, order = \
                             ['Thomas', 'Vincent', \
                            'DCV', 'Jimmy','Freddie', 'Dave', 'ajon0002', \
                            'murari.krishnan', 'Nicky', 'Alan'], ax = axis1)
            ax.set (xlabel = 'Author', ylabel = 'Commit count')
            plt.show
```

```
Out[20]: <function matplotlib.pyplot.show>
```



Once data visualisation are completed, we can see that author Thomas have the biggest amount of commit objects (191) and the smallest number of commit objects (1) belongs to author murari.krishnan.

To better understand data I created pivot table to dispaly percentage of commit objects belonging to each author and will display visualisation in the pie chart.

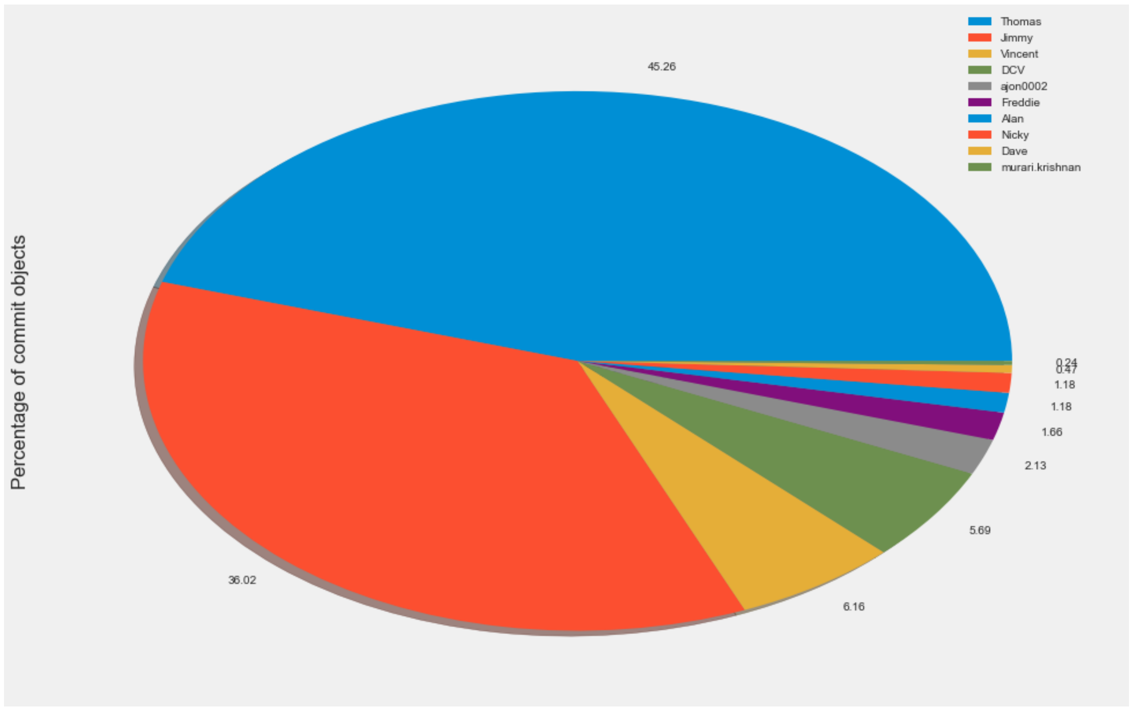
```
In [21]:    #display overall percentage of commits by author
            commits = int(data_frame['date'].count())
            #add new column to the data frame, and calculate percentage
            log_in_per['Percentage'] = pd.Series.round \
                                       (((log_in_per['Commit count']*100)/commits),2 )
            log_in_per
```

```
Out[21]:            Author  Commit count  Percentage
         6          Thomas           191       45.26
         4           Jimmy           152       36.02
         7         Vincent            26        6.16
         1             DCV            24        5.69
         8        ajon0002             9        2.13
         3         Freddie             7        1.66
         0            Alan             5        1.18
         5           Nicky             5        1.18
```

```
2              Dave              2        0.47
9   murari.krishnan              1        0.24
```

```
In [22]:     #create and axis for the pie chart
             fig, (axis1) = plt.subplots(1,1,figsize=(15,10))
             #plot relevant data frame
             ax = log_in_per.plot.pie(y='Percentage', shadow = True, ax = axis1, \
                                      labels = log_in_per['Percentage'])
             #set a y label
             ax.set ( ylabel = 'Percentage of commit objects')
             #set a possition of the legend to the left top corner
             plt.legend(labels = log_in_per['Author'], bbox_to_anchor=(0.85,1.025), \
                                                        loc="upper left")
             plt.show
```

```
Out[22]: <function matplotlib.pyplot.show>
```



1.4 Number of comments per author and average number of comments per commit object

Once we know that author Thomas is the most active author and that to him belongs the highest number of commit objects, now will be interesting to see if Thomas generated the biggest number of commet lines and if his average number of comments lines per commit object will be a highest.

I am going to analyse:

- How many comment lines each user have created

- Average number of comments per commit object grouped by author
- If user with a biggest amount of commit objects (Thomas) will have a highest average of commented lines per commit object

```
In [23]:    #check how many comment lines each author has created
            number_of_lines = data_frame[['author' ,'number of lines']].groupby(['author'],\
                                                                          as_index = False).sum()
            #rename columns
            number_of_lines= number_of_lines.rename(columns = \
                        {'author': 'Author', 'number of lines': 'Commented lines'})
            #sort values in descending order
            number_of_lines = number_of_lines.sort_values(['Commented lines'], \
                                                              ascending = [False])
            number_of_lines
```

```
Out[23]:            Author  Commented lines
         6          Thomas              234
         4           Jimmy              154
         7         Vincent               80
         1             DCV               24
         8        ajon0002               24
         3         Freddie               14
         5           Nicky               14
         0            Alan                8
         2            Dave                2
         9  murari.krishnan               1
```

```
In [24]:    #merge two different data frames
            #1 log in count & Commented lines
            mergged_df = pd.merge( left = log_in_per, right = number_of_lines, \
                                  left_on = 'Author', right_on = 'Author' )
            mergged_df
```

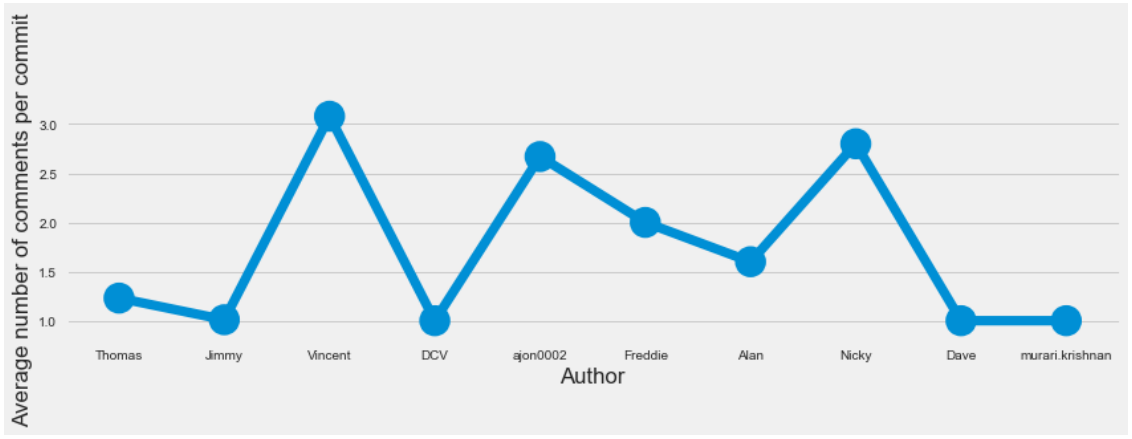
```
Out[24]:            Author  Commit count  Percentage  Commented lines
         0          Thomas           191       45.26              234
         1           Jimmy           152       36.02              154
         2         Vincent            26        6.16               80
         3             DCV            24        5.69               24
         4        ajon0002             9        2.13               24
         5         Freddie             7        1.66               14
         6            Alan             5        1.18                8
         7           Nicky             5        1.18               14
         8            Dave             2        0.47                2
         9  murari.krishnan            1        0.24                1
```

```
In [25]:    #add new column to the data frame
            mergged_df['Average number of comments per commit'] = \
            pd.Series.round(mergged_df['Commented lines'] / mergged_df['Commit count'], 2)
            mergged_df
```

```
Out[25]:            Author  Commit count  Percentage  Commented lines  \
         0          Thomas           191       45.26              234
         1           Jimmy           152       36.02              154
         2         Vincent            26        6.16               80
         3             DCV            24        5.69               24
         4        ajon0002             9        2.13               24
         5         Freddie             7        1.66               14
         6            Alan             5        1.18                8
         7           Nicky             5        1.18               14
         8            Dave             2        0.47                2
         9  murari.krishnan            1        0.24                1

            Average number of comments per commit
         0                                   1.23
         1                                   1.01
         2                                   3.08
         3                                   1.00
         4                                   2.67
         5                                   2.00
         6                                   1.60
         7                                   2.80
         8                                   1.00
         9                                   1.00
```

```
In [26]:     #create a factor plot
             sns.factorplot('Author', \
                           'Average number of comments per commit', data = mergged_df, \
                           size = 4, aspect = 3)
```

```
Out[26]: <seaborn.axisgrid.FacetGrid at 0x492c6a0>
```



Visualisation of the average number of comments per commit object represents that author Vincent has highest average of 3.08 (comments per commit object) while author Thomas who have a largest number of commit objects (191) has average of 1.23 comments per one commit object.

1.5 The favourit part of the day to create a commit object

We have investigated that the highest amount of commit objects not nescessary going to lead author to a highest average of comments per one commit object.

Now we can have a look into time frame, when the most commit objects have been generated (In the first part of the day (Morning) between 00:00AM and 12:00PM or in the second part of the day (Evening) between 12:00PM - 00:00AM).

```
In [27]:    #strip time into hours minutes and seconds
            data_frame['hours'], data_frame['minutes'], data_frame['seconds'] = \
                                            data_frame['time'].str.split(':',2).str

            #add additional column in the dataframe,
            #0 = first half of the day, 1 = second half of the day
            data_frame['day_time'] = data_frame['hours']

            #repalce first half of the day values to 0
            data_frame['day_time'] = data_frame['day_time'].replace(['00', '01', \
            '02', '03', '04', '05','06','07','08','09','10','11'], '0')

            #repalce second half of the day values to 1
            data_frame['day_time'] = data_frame['day_time'].replace(['12', '13', \
            '14', '15', '16','17', '18','19','20','21','22','23', '24'], '1')
```

```
In [28]:    #count how many commits done in the morning and in the evening
            count_daytime = data_frame[['day_time' ,'revision']].groupby(['day_time'], \
                                                        as_index = False).count()
            #Replace value 0 into str Morning
            count_daytime['day_time'] = count_daytime['day_time'].replace(['0'], 'Morning')
            #replace value 1 into str Evening
            count_daytime['day_time'] = count_daytime['day_time'].replace(['1'], 'Evening')
            #connect two values for visualisation purpose
            count_daytime['visual'] = count_daytime[['day_time' , \
            'revision']].apply(lambda x : '{} = {}'.format(x[0],x[1]), \
                                                        axis=1)
            #display
            count_daytime
```

```
Out[28]:   day_time  revision          visual
        0  Morning        138  Morning = 138
        1  Evening        284  Evening = 284
```

```
In [29]:    #count how many comments made in the morning and howe many in the evening
            number_of_lines_time = data_frame[['day_time' , \
            'number of lines']].groupby(['day_time'], as_index = False).sum()
            #Replace value 0 into str Morning
            number_of_lines_time['day_time'] = \
                number_of_lines_time['day_time'].replace(['0'], 'Morning')
            #replace value 1 into str Evening
```

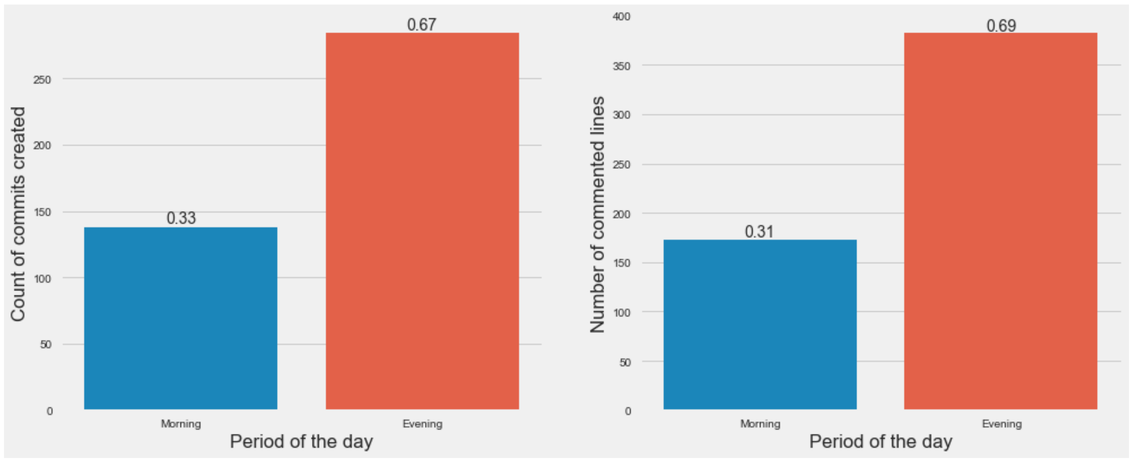
```
        number_of_lines_time['day_time'] = \
            number_of_lines_time['day_time'].replace(['1'], 'Evening')
        #connect two values for visualisation purpose
        number_of_lines_time['visual'] = number_of_lines_time[['day_time' , \
        'number of lines']].apply(lambda x : '{} = {}'.format(x[0],x[1]), \
                                                                  axis=1)
        #display
        number_of_lines_time
```

```
Out[29]:   day_time  number of lines          visual
        0  Morning               173  Morning = 173
        1  Evening               382  Evening = 382
```

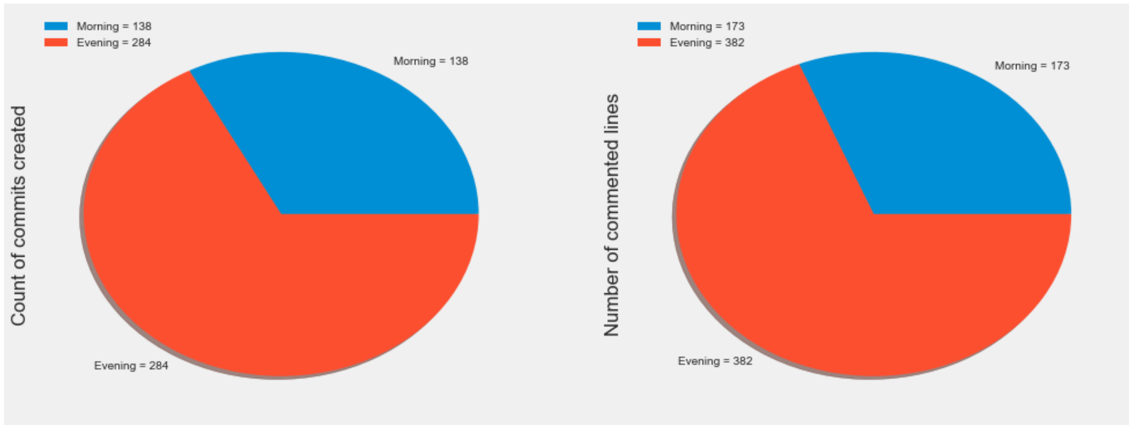
In [30]:

```
        #create sub plots
        fig, (axis1,axis2) = plt.subplots(1,2,figsize=(15,6))

        #create sns barplot
        ax = sns.barplot(x='day_time', y='revision', \
                         data=count_daytime, ax=axis1, order=['Morning','Evening'])
        ax.set (xlabel = 'Period of the day', ylabel = 'Count of commits created')


        #total is the lenght of the commits
        total = len(data_frame['revision'])
        for p in ax.patches:
            height = p.get_height()
            ax.text(p.get_x()+p.get_width()/2.,
                height + 3,
                '{:1.2f}'.format(height/total),
                ha="center")
        plt.show


        #create sns barplot
        ax = sns.barplot(x='day_time', y='number of lines', \
                         data=number_of_lines_time, ax=axis2, \
                         order=['Morning','Evening'])
        ax.set (xlabel = 'Period of the day', ylabel = 'Number of commented lines')

        #total is a sum of commented liens in a dataframe
        total = sum(number_of_lines_time['number of lines'])
        for p in ax.patches:
            height = p.get_height()
            ax.text(p.get_x()+p.get_width()/2.,
                height + 3,
                '{:1.2f}'.format(height/total),
                ha="center")
        plt.show
```

```
Out[30]: <function matplotlib.pyplot.show>
```



```
In [31]:    #create sub plots
            fig, (axis1,axis2) = plt.subplots(1,2,figsize=(15,6))

            ax = count_daytime.plot.pie(y='revision', shadow = True, ax = axis1, \
                                        labels = count_daytime['visual'])
            ax.set ( ylabel = 'Count of commits created')
            plt.show

            ax = number_of_lines_time.plot.pie(y='number of lines', shadow = True, \
                                    ax = axis2, labels = number_of_lines_time['visual'])
            ax.set ( ylabel = 'Number of commented lines')
            plt.show

Out[31]: <function matplotlib.pyplot.show>
```



Visualisation represent that authors are more active and create more commit objects in the evenign time. Overall 67 % of commit objects were created between 12:00PM and 00:00AM, while 69 % of comment lines were created as well in the same time frame.

Interesting to see if all authors have been more creative in the evening time. Lets check proportion of generated commit object and commented lines by each author in the evening and morning time.

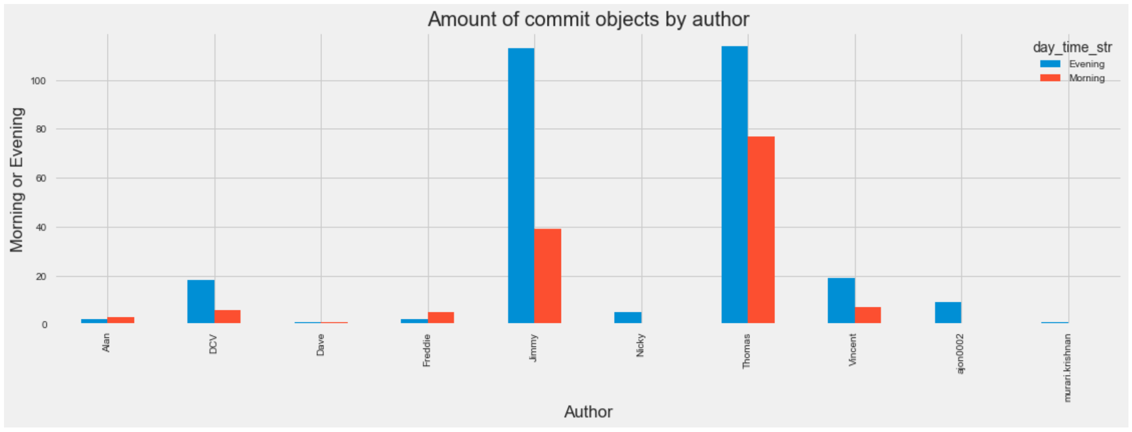
```
In [32]:     #add additional column to the data frame
             data_frame['day_time_str'] =  \
             data_frame['day_time']
             #replace int 0 to str Morning
             data_frame['day_time_str'] = \
             data_frame['day_time_str'].replace(['0'], 'Morning')
             #replace int 1 to str Evening
             data_frame['day_time_str'] = \
             data_frame['day_time_str'].replace(['1'], 'Evening')


             #look for a size of each option (Evening, Morning) grouped by author
             #and str and make a count
             authors_time_commits = \
             data_frame.groupby(['author' ,'day_time_str']).count()


             #with out hierachi, we need to unstack grouped data frame
             authors_time_commits = \
             data_frame.groupby(['author' ,'day_time_str']).count().unstack()
             authors_time_commits = authors_time_commits['revision']
             authors_time_commits
```

```
Out[32]: day_time_str     Evening  Morning
         author
         Alan                 2.0      3.0
         DCV                 18.0      6.0
         Dave                 1.0      1.0
         Freddie              2.0      5.0
         Jimmy              113.0     39.0
         Nicky                5.0      NaN
         Thomas             114.0     77.0
         Vincent             19.0      7.0
         ajon0002             9.0      NaN
         murari.krishnan      1.0      NaN
```

```
In [33]:     #create an ax for the plot
             fig, (axis1) = plt.subplots(1,1,figsize=(17,5))
             plot = authors_time_commits.plot.bar(stacked=False, \
                          title="Amount of commit objects by author", ax = axis1)
             plot.set_xlabel("Author")
```

```
        plot.set_ylabel("Morning or Evening")
```

```
Out[33]: <matplotlib.text.Text at 0xe47ce48>
```

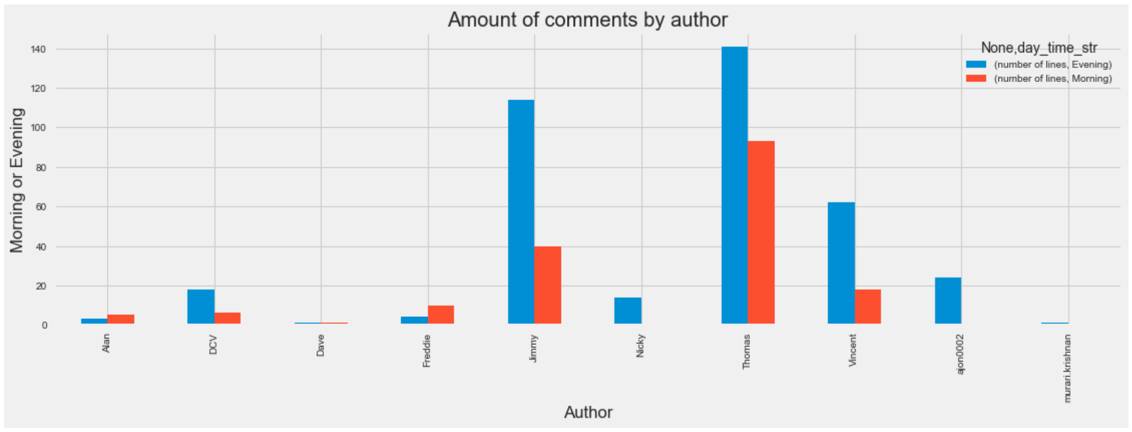


```
In [34]:  #data frame grouped by author and sum of commetns
          authors_time_comments = \
          data_frame.groupby(['author' ,'day_time_str']).sum()
          #with out hierachi
          authors_time_comments = \
          data_frame.groupby(['author' ,'day_time_str']).sum().unstack()
          authors_time_comments
```

```
Out[34]:                number of lines
         day_time_str           Evening Morning
         author
         Alan                       3.0     5.0
         DCV                       18.0     6.0
         Dave                       1.0     1.0
         Freddie                    4.0    10.0
         Jimmy                    114.0    40.0
         Nicky                     14.0     NaN
         Thomas                   141.0    93.0
         Vincent                   62.0    18.0
         ajon0002                  24.0     NaN
         murari.krishnan            1.0     NaN
```

```
In [35]:  #create an ax for the plot
          fig, (axis1) = plt.subplots(1,1,figsize=(17,5))
          plot = authors_time_comments.plot.bar(stacked=False, \
          title="Amount of comments by author", ax = axis1)
          plot.set_xlabel("Author")
          plot.set_ylabel("Morning or Evening")
```

```
Out[35]: <matplotlib.text.Text at 0xe6f6eb8>
```



Visualisations illiustrate that from 10 authors only two (Alan & Freddie) have craeted more commit objects and generated more comment lines durring the morning time than a night time. For this reason we can assume that the biggest amount of commit opbjects and comments were generated durring the evening time between 12:00PM and 00:00AM.