In [1]:
```
import pandas as pd
import numpy as np
from sklearn.decomposition import TruncatedSVD
import seaborn as sns
import random
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import cross_val_score
from sklearn.metrics import roc_auc_score
from sklearn.model_selection import train_test_split
```

In [2]:
```
!pip install -U -q PyDrive
import os
from pydrive.auth import GoogleAuth
from pydrive.drive import GoogleDrive
from google.colab import auth
from oauth2client.client import GoogleCredentials
```

In [3]:
```
auth.authenticate_user()
gauth = GoogleAuth()
gauth.credentials = GoogleCredentials.get_application_default()
drive = GoogleDrive(gauth)
fileDownloaded = drive.CreateFile({'id':'https://drive.google.com/file/d/1uTHL59_tid1T
file_list = drive.ListFile({'q': "'1ATVDsYj_YhpzSmYhV5X-q21CYzujQ2As' in parents and t
for file1 in file_list:
  print('title: %s, id: %s' % (file1['title'], file1['id']))
data_downloaded_user_likes = drive.CreateFile({'id': '1uTHL59_tid1Tu4O9_T2zHZYIYu0D6bi
data_downloaded_user_likes.GetContentFile('users-likes.csv')
data_downloaded_users = drive.CreateFile({'id': '1XRppHA9JDYGw1gio1Y5XpzxT9uwmJiU1'})
data_downloaded_users.GetContentFile('users.csv')
data_downloaded_likes = drive.CreateFile({'id': '1cHKEtaDRtQBFC6MCDcFMP_Wu8AgrwK4D'})
data_downloaded_likes.GetContentFile('likes.csv')

users=pd.read_csv('users.csv')
likes=pd.read_csv('likes.csv')
ul=pd.read_csv('users-likes.csv',error_bad_lines=False,engine='python')
```

```
title: likes.csv, id: 1cHKEtaDRtQBFC6MCDcFMP_Wu8AgrwK4D
title: users.csv, id: 1XRppHA9JDYGw1gio1Y5XpzxT9uwmJiU1
title: users-likes.csv, id: 1uTHL59_tid1Tu4O9_T2zHZYIYu0D6bit
```

In [4]:
```
#users=pd.read_csv('./sample_dataset/users.csv')
#likes=pd.read_csv('./sample_dataset/likes.csv')
#ul=pd.read_csv('./sample_dataset/users-likes.csv')
users.head()
```

Out[4]:

	userid	gender	age	political	ope	con	ext	agr	neu
0	54f34605aebd63f7680e37ffd299af79	0	33	0.0	1.26	1.65	1.17	-1.76	0.61
1	86399f8c44ba54224b2e60177ca89fa9	1	35	0.0	1.07	0.17	-0.14	1.49	0.30
2	84fab50f3c60d1fdc83aa91b5e584a78	1	36	0.0	0.89	1.28	0.86	1.07	0.99
3	f3b8fdaccce12ef6352bfad4d6052fe9	0	39	NaN	0.33	-1.01	-0.33	-0.68	0.92
4	8b06ea5e9cb87c61da387995450607f7	0	31	NaN	0.15	0.47	1.17	-1.01	-0.32

In [5]:
```
ul.head()
```

Out[5]:

	userid	likeid
0	71bc7c0901488aec6d30f0add257e7c5	3c1636c878e6eb2acfd00c6b61086e38
1	978ab8e90c4d6ad1a48ef5c973b62f4d	feca46ddb8ef04f86172ace0cb7e004c
2	85123b0e358907725cf19a2cb0ec3983	b65f46d64c688fe98bdbcf93a76a71fc
3	ce110562b3e2f7e5cad3775b32d9caa5	b65f46d64c688fe98bdbcf93a76a71fc
4	8188d20745471273fa69ba44a5b28473	b65f46d64c688fe98bdbcf93a76a71fc

In [6]:
```
likes.head()
```

Out[6]:

	likeid	name
0	3c1636c878e6eb2acfd00c6b61086e38	REIGN by Paul Gibson
1	feca46ddb8ef04f86172ace0cb7e004c	Cupcake Wishes & Birthday Dreams
2	b65f46d64c688fe98bdbcf93a76a71fc	Yo también me rei de la caída de otro jejeje
3	9c5c8bb82d2cd46fbd7582f944fe370e	Abraham Joshua Heschel Day School- Alumni Network
4	2d82fa84ad79b085dc516dde154327a2	Kennesaw Farmer's Market

In [7]:
```
df=ul.iloc[:50957]
```

In [8]:
```
sparse_matrix=df.groupby(['userid', 'likeid']).size().unstack(fill_value=0)
```

In [9]:
```
sparse_matrix.head()
```

Out[9]:

likeid	0002d0025b6a8d31e15a4365340fd45b	00039ce02d551a4ea92a10faf108d452
userid		
0002abedba29d5a7fc1d34834b8846d7	0	0
00035a29fa913610d9dfd1c6d6a15fd6	0	0
000769fb960a5900187f6631c4bb7264	0	0
0007ef89a1a6d9440c3863bad4202f21	0	0
00082a96ca78b2883a3e24b9e8823567	0	0

5 rows × 7062 columns

In [10]:
```
user_ids=sparse_matrix.index.values.tolist()
```

In [11]:
```
sparse_matrix_n=np.array(sparse_matrix)
```

In [12]:
```
#Trimming
sparse_matrix_n1=sparse_matrix_n[:,np.sum(sparse_matrix_n, axis=0)>1]
print(sparse_matrix_n1.shape)
sparse_matrix_n2=sparse_matrix_n1[np.sum(sparse_matrix_n, axis=1)>1]
print(sparse_matrix_n2.shape)
```

```
(25257, 2342)
(9992, 2342)
```

In [13]:
```
#print(user_ids.shape)
user_ids=np.array(user_ids)
user_ids=user_ids[np.sum(sparse_matrix_n, axis=1)>1]
```

In [14]:
```
sparse_matrix_n2
```

Out[14]:
```
array([[0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       ...,
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0]])
```

In [15]:
```
random.seed(68)
```

In [16]:
```
n_components=5
svd = TruncatedSVD(n_components=5)
X_reduced = svd.fit_transform(sparse_matrix_n2)
df_svd = pd.DataFrame(data=X_reduced, index=[i for i in range(len(user_ids))], columns
df_svd['userid']=user_ids
df_svd.head()
```

Out[16]:

	svd_1	svd_2	svd_3	svd_4	svd_5	userid
0	1.576169	0.202196	0.460868	-0.335003	-0.079080	00035a29fa913610d9dfd1c6d6a15fd6
1	0.834194	-0.528804	-0.372666	0.003381	-0.114872	00082a96ca78b2883a3e24b9e8823567
2	0.056317	-0.017725	0.082691	0.780414	-0.204151	00217ff065b47f79902cb8b57b897608
3	0.005412	0.004482	0.005724	0.006332	0.010378	0026109987824beae6d0251ff52f093e
4	0.004538	0.000962	-0.004915	0.007960	-0.006291	002cff3e5a5e1e3a4874d3768dd5e6be

In [17]:
```
left = users.set_index('userid')
right = df_svd.set_index('userid')
combined_table=left.join(right, how='inner')
combined_table.head()
```

Out[17]:

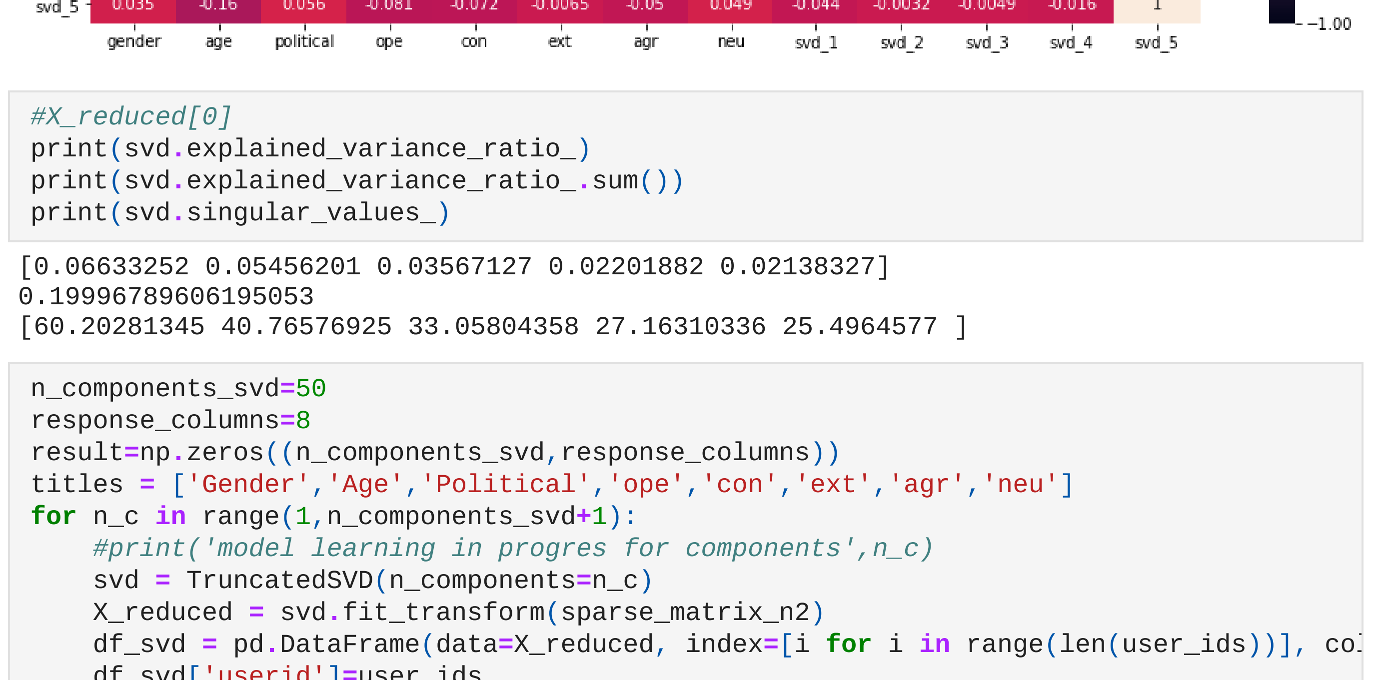
	gender	age	political	ope	con	ext	agr	neu	svd_1	sv
userid										
c6a9a43058c8cc8398ca6e97324c0fae	0	47	NaN	-0.31	-0.57	-0.89	0.41	1.17	0.000000	-0.000
172e5d8611cb33a8b466a29705bb1bda	0	28	NaN	0.79	1.06	-0.89	-1.01	-0.01	0.003406	0.002
f9ed42fd1c0e0e1ecd2ba3fdb54ce6fa	1	29	0.0	-0.31	-0.94	-0.77	-1.76	1.05	0.084353	-0.009
eca69bfad8f4f2b193b2592248101b7f	1	28	0.0	-0.68	0.54	-0.52	-1.01	-0.51	0.835180	-0.528
c045fd40e4e1dfdd0dfcd9c30f690f84	1	30	0.0	1.53	1.65	-0.14	1.41	-0.38	0.004506	0.002

In [18]:
```
combined_table.corr()
```

Out[18]:

	gender	age	political	ope	con	ext	agr	neu	svd_1	
gender	1.000000	0.006989	-0.026141	-0.021108	-0.000021	-0.013182	0.033783	0.225765	-0.062500	-0
age	0.006989	1.000000	-0.025313	0.073102	0.164837	0.043922	0.091851	-0.074951	-0.163858	0
political	-0.026141	-0.025313	1.000000	-0.419679	0.142928	0.026795	0.036373	-0.088177	0.048995	-0
ope	-0.021108	0.073102	-0.419679	1.000000	0.089158	0.236131	0.120279	-0.115254	-0.047349	0
con	-0.000021	0.164837	0.142928	0.089158	1.000000	0.259246	0.258072	-0.394704	-0.026646	-0
ext	-0.013182	0.043922	0.026795	0.236131	0.259246	1.000000	0.250768	-0.444976	0.061324	0
agr	0.033783	0.091851	0.036373	0.120279	0.258072	0.250768	1.000000	-0.435083	0.004109	-0
neu	0.225765	-0.074951	-0.088177	-0.115254	-0.394704	-0.444976	-0.435083	1.000000	-0.029401	-0
svd_1	-0.062500	-0.163858	0.048995	-0.047349	-0.026646	0.061324	0.004109	-0.029401	1.000000	-0
svd_2	-0.095983	0.048733	-0.034834	0.027041	-0.010614	0.031871	-0.037772	-0.012849	-0.058391	1
svd_3	0.089164	-0.090183	0.037325	-0.031276	-0.037400	-0.041914	-0.041975	0.058966	-0.090121	-0
svd_4	0.178241	-0.001163	-0.018295	-0.025144	0.025299	-0.010348	0.001294	0.098115	-0.289917	-0
svd_5	0.034980	-0.158644	0.056226	-0.081085	-0.072351	-0.006450	-0.049853	0.049106	-0.043586	-0

In [19]:
```
plt.figure(figsize=(16, 6))
heatmap = sns.heatmap(combined_table.corr(), vmin=-1, vmax=1, annot=True)
heatmap.set_title('Correlation Heatmap', fontdict={'fontsize':18}, pad=12);
# save heatmap as .png file
# dpi - sets the resolution of the saved image in dots/inches
# bbox_inches - when set to 'tight' - does not allow the labels to be cropped
plt.savefig('heatmap.png', dpi=300, bbox_inches='tight')
```



In [20]:
```
#X_reduced[0]
print(svd.explained_variance_ratio_)
print(svd.explained_variance_ratio_.sum())
print(svd.singular_values_)
```

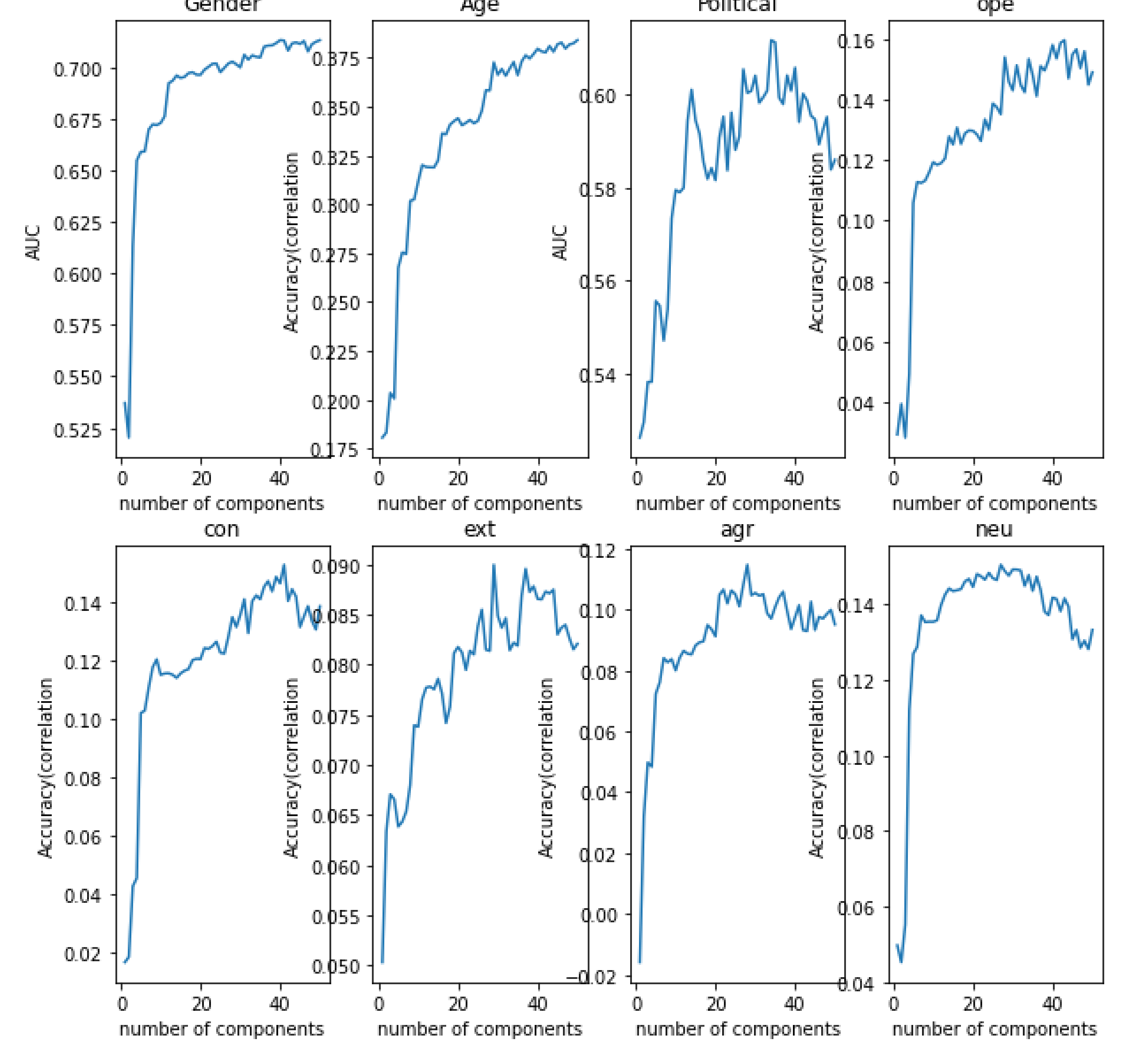
```
[0.06633252 0.05456201 0.03567127 0.02201882 0.02138327]
0.19996789606195053
[60.20281345 40.76576925 33.05804358 27.16310336 25.4964577 ]
```

In [42]:
```
n_components_svd=50
response_columns=8
result=np.zeros((n_components_svd,response_columns))
titles = ['Gender','Age','Political','ope','con','ext','agr','neu']
for n_c in range(1,n_components_svd+1):
    #print('model learning in progres for components',n_c)
    svd = TruncatedSVD(n_components=n_c)
    X_reduced = svd.fit_transform(sparse_matrix_n2)
    df_svd = pd.DataFrame(data=X_reduced, index=[i for i in range(len(user_ids))], co
    df_svd['userid']=user_ids
    left = users.set_index('userid')
    right = df_svd.set_index('userid')
    combined_table=left.join(right, how='inner')
    #for all y response variable except political one
    c_t=np.array(combined_table)
    X,y=c_t[:,response_columns:],c_t[:,:response_columns]
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33, random_s
    #for political response variable
    c_t1=np.array(combined_table.dropna())
    X1,y1=c_t1[:,response_columns:],c_t1[:,2]
    X_train1, X_test1, y_train1, y_test1 = train_test_split(X1, y1, test_size=0.33, ra
    for y_col in range(response_columns):
        #for categorical columns
        if y_col in [0,2]:
            if y_col==2:
                clf = LogisticRegression().fit(X_train1, y_train1)
                auc=roc_auc_score(y_test1, clf.predict_proba(X_test1)[:, 1])
                result[n_c-1,y_col]=auc
                if(n_c==50):
                    print('no of component',n_c,'Political response variable auc',auc
            else:
                clf = LogisticRegression().fit(X_train, y_train[:,y_col])
                auc=roc_auc_score(y_test[:,y_col], clf.predict_proba(X_test)[:, 1])
                result[n_c-1,y_col]=auc
                if(n_c==50):
                    print('no of component',n_c,'Gender response variable auc',auc)

        else:
            reg = LinearRegression().fit(X_train, y_train[:,y_col])
            y_pred=reg.predict(X_test)
            r=np.corrcoef(y_test[:,y_col],y_pred)[0][1]
            result[n_c-1,y_col]=r
            if(n_c==50):
                print('Number of component:',n_c,' y_col:',titles[y_col],'Accuracy(co
```

```
no of component 50 Gender response variable auc 0.7130780795947227
Number of component: 50  y_col: Age Accuracy(correlation) 0.3841129040422152
no of component 50 Political response variable auc 0.585892264305858
Number of component: 50  y_col: ope Accuracy(correlation) 0.14891999258020333
Number of component: 50  y_col: con Accuracy(correlation) 0.1383674364366912
Number of component: 50  y_col: ext Accuracy(correlation) 0.08209152468220343
Number of component: 50  y_col: agr Accuracy(correlation) 0.09505173136741513
Number of component: 50  y_col: neu Accuracy(correlation) 0.13329111452542114
```

In [43]:
```
titles = ['Gender','Age','Political','ope','con','ext','agr','neu'] #title
fig, axs = plt.subplots(2,4,figsize=(10, 10))
fig.suptitle('AUC, Accuracy(Correlation) vs Number of components used', fontsize=16)
for kk, (ax,yy) in enumerate(zip(axs.reshape(-1),zip(*result))):
    #print(yy)
    ax.plot([i+1 for i in range(50)],yy)
    ax.set_title(titles[kk])
    ax.set_xlabel('number of components')
    if kk in [0,2]:
      ax.set_ylabel('AUC')
    else:
      ax.set_ylabel('Accuracy(correlation')
#fig.delaxes(axs[1][1])
plt.show()
plt.savefig('result.png', dpi=300, bbox_inches='tight')
```




```
<Figure size 432x288 with 0 Axes>
```