The background of the slide is a solid blue color. Overlaid on this background is a complex network visualization. It consists of numerous small, dark blue circular nodes connected by thin, light blue lines. These nodes and lines are distributed across the entire slide, with some areas being more densely populated than others, creating a sense of a large-scale interconnected system. The overall effect is a technical and modern aesthetic.

# Structural Analysis and Visualization of Networks

**Shiryaev Vyacheslav**  
**Moscow, 2016**



# Agenda

**1** Network  
Summary

**2** Structural  
Analysis

**3** Communities  
Detection



# **Network summary**

# Network review

Network source: personal friends VK network

Network order - 583

Edges - 8 390

Clustering coefficient - 0.45

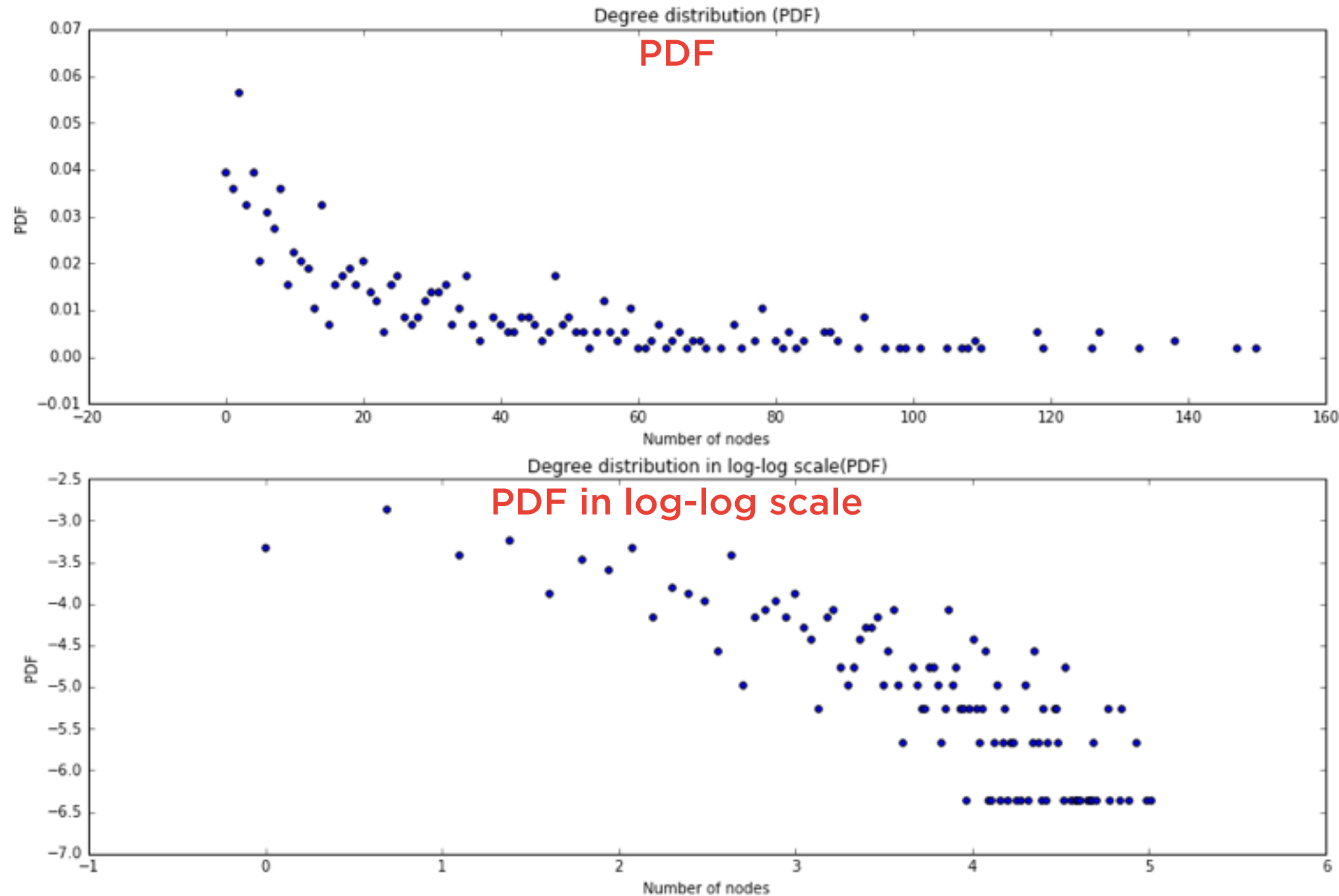
Diameter of GCC - 8

Average shortest path length - 3.12

Attributes:

- sex
- city
- name: first and second name
- birthday
- university

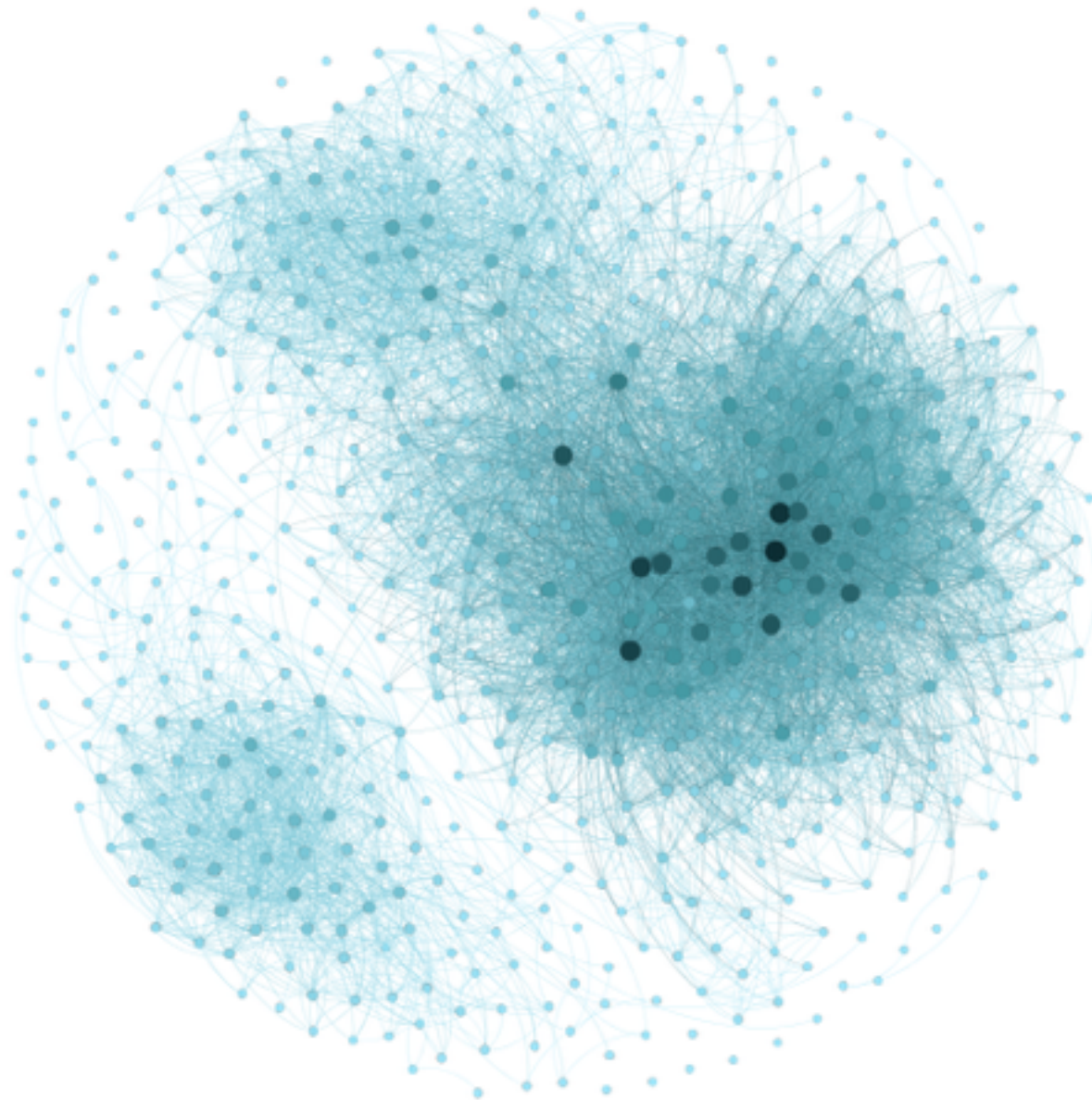
# Degree distribution



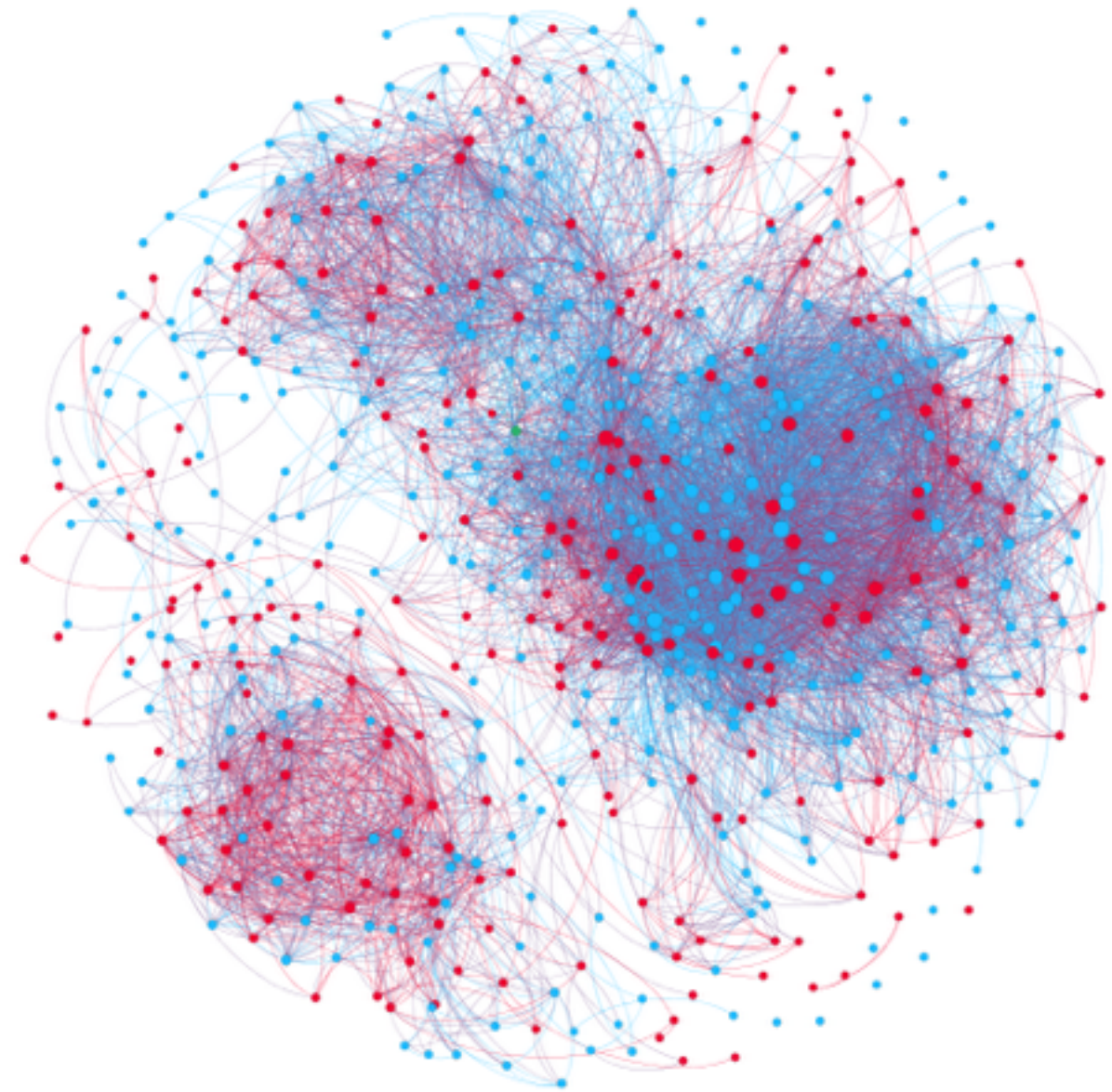
It is looks like the power law. However, it's more like as the Poisson distribution. The main reason, that this network was built by only mutual friends from my vk network.



# Network layouts



Node size and node colour by node degree



Node size by node degree  
Node colour by human gender

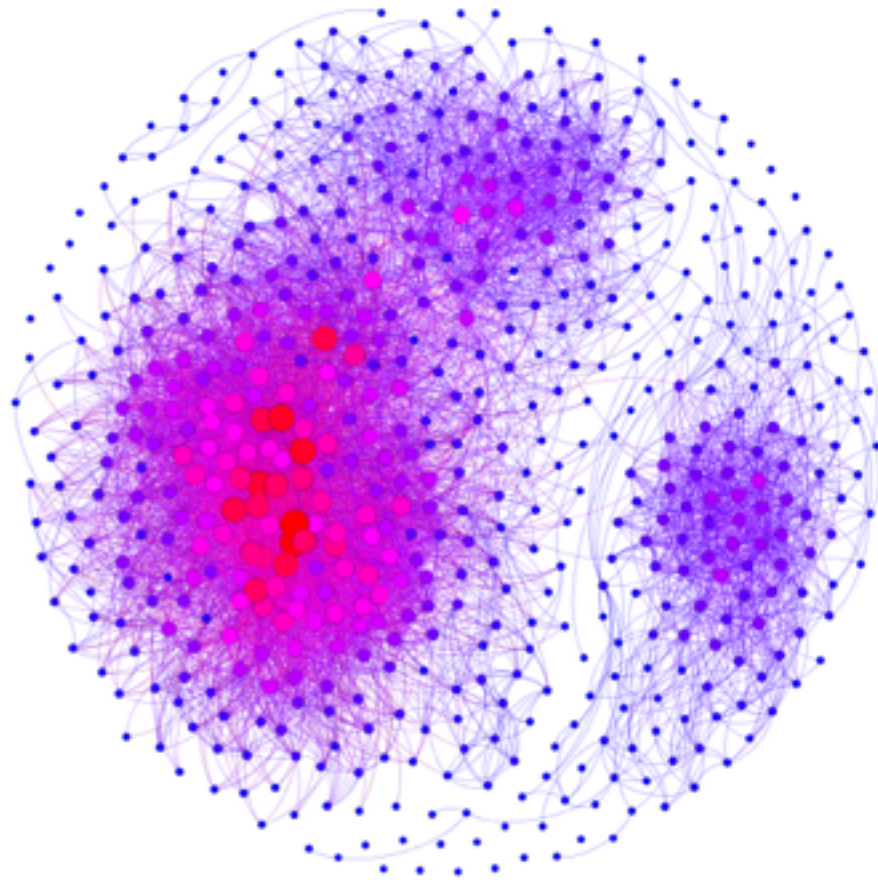
● female  
● male

# Structural analysis

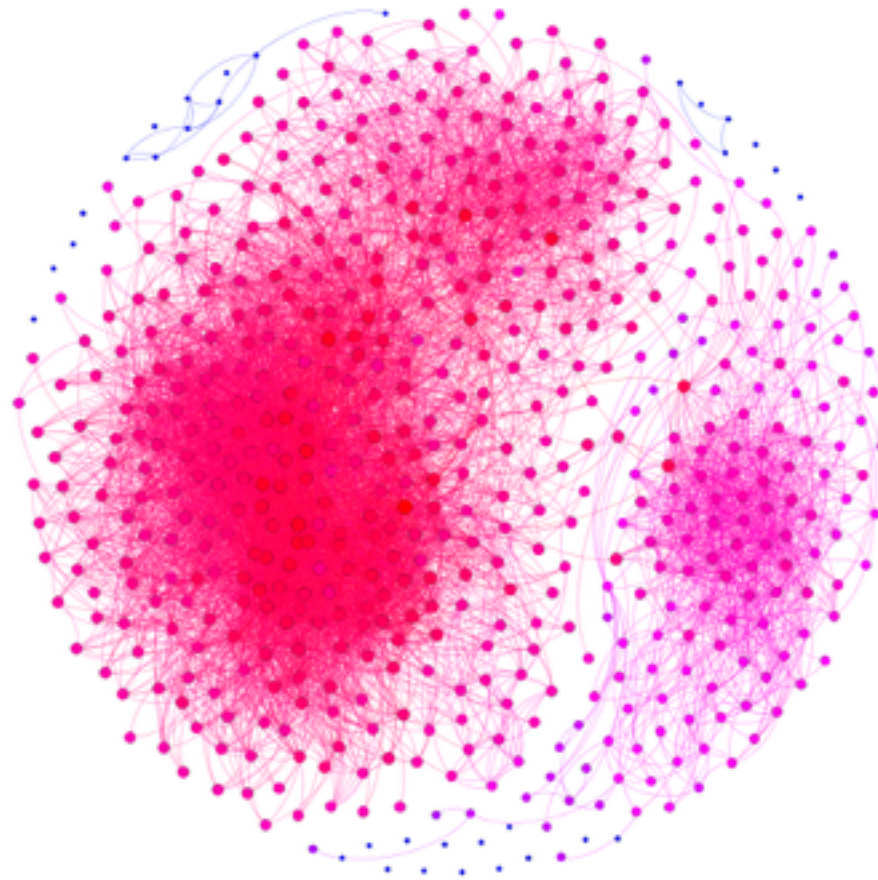


# Centralities

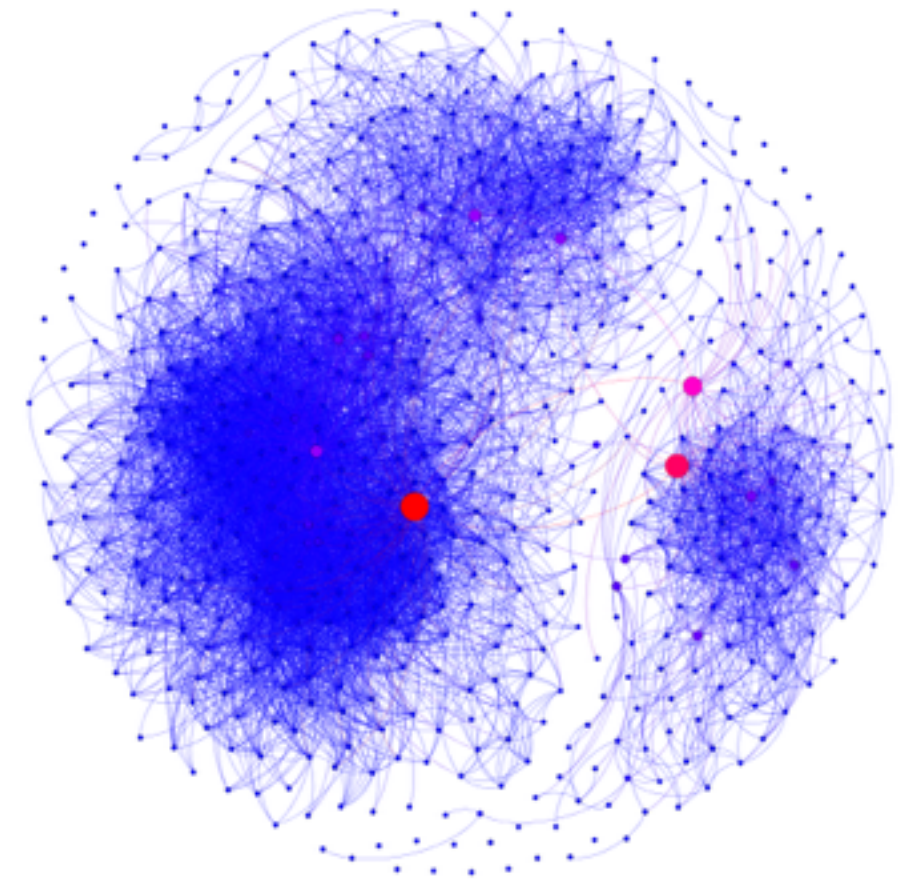
Degree centrality



Closeness centrality



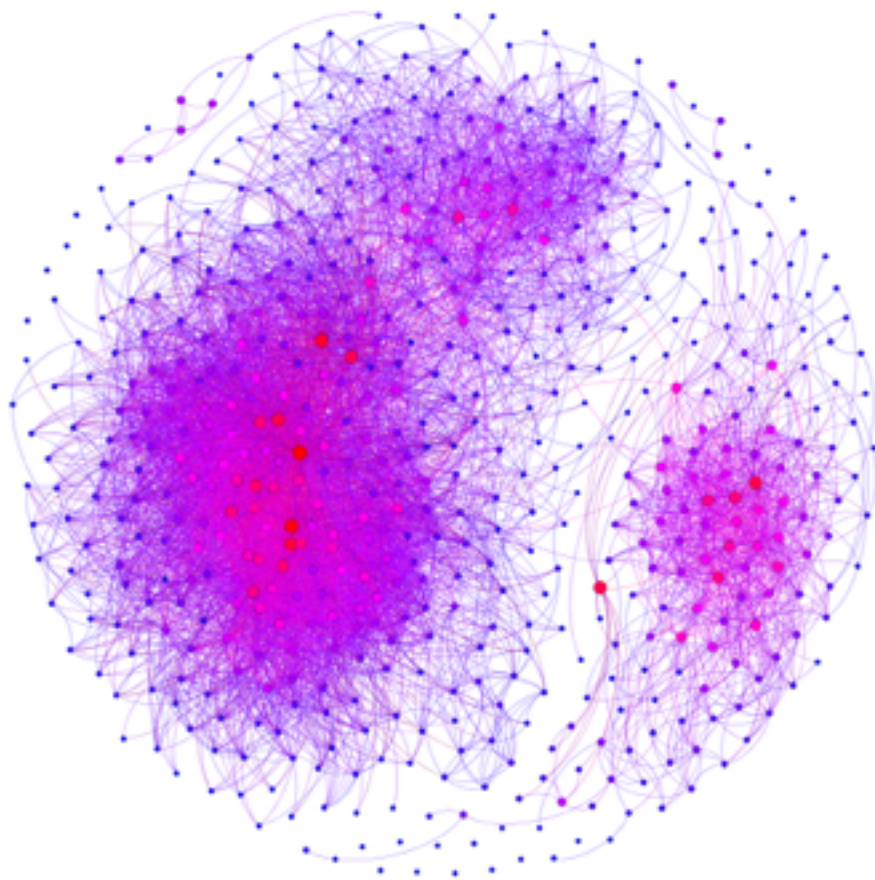
Betweenness centrality



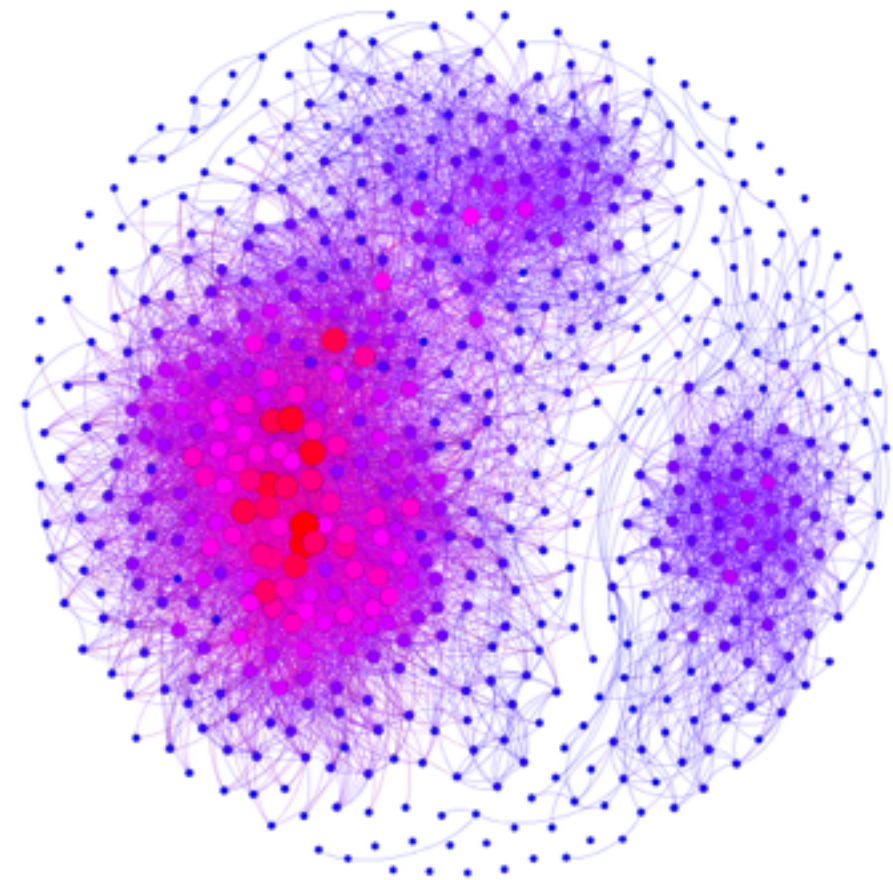


# Centralities vs PageRank

PageRank



Degree centrality



Statistics are quite similar

# Assortativity Mixing

Gender assortativity = 0.011563901371

City assortativity = -0.00796754737261

University assortativity = 0.00113795399325

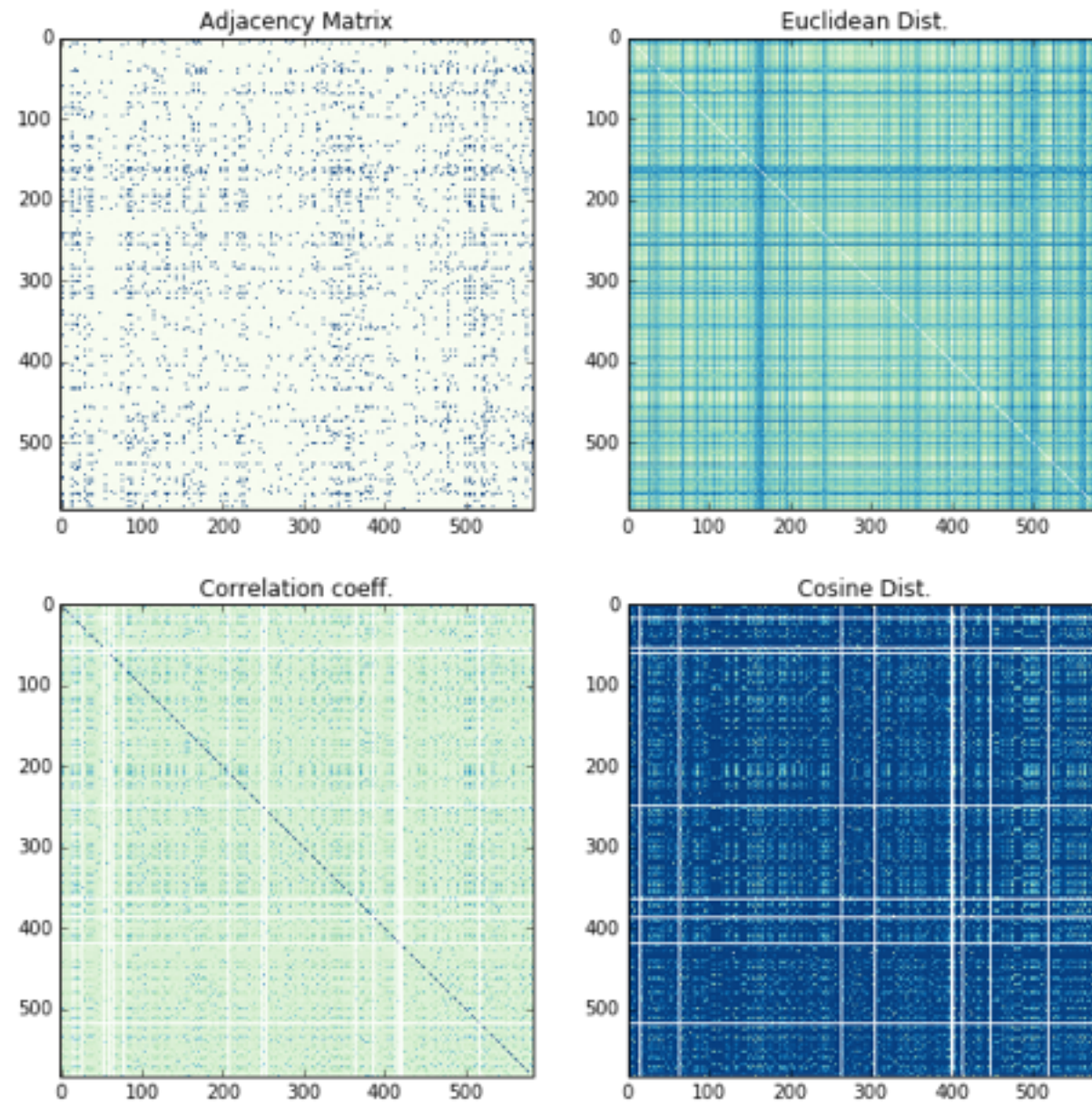
Degree assortativity = 0.161513649301

Such small values for city and university attributes can be consequence of the following:

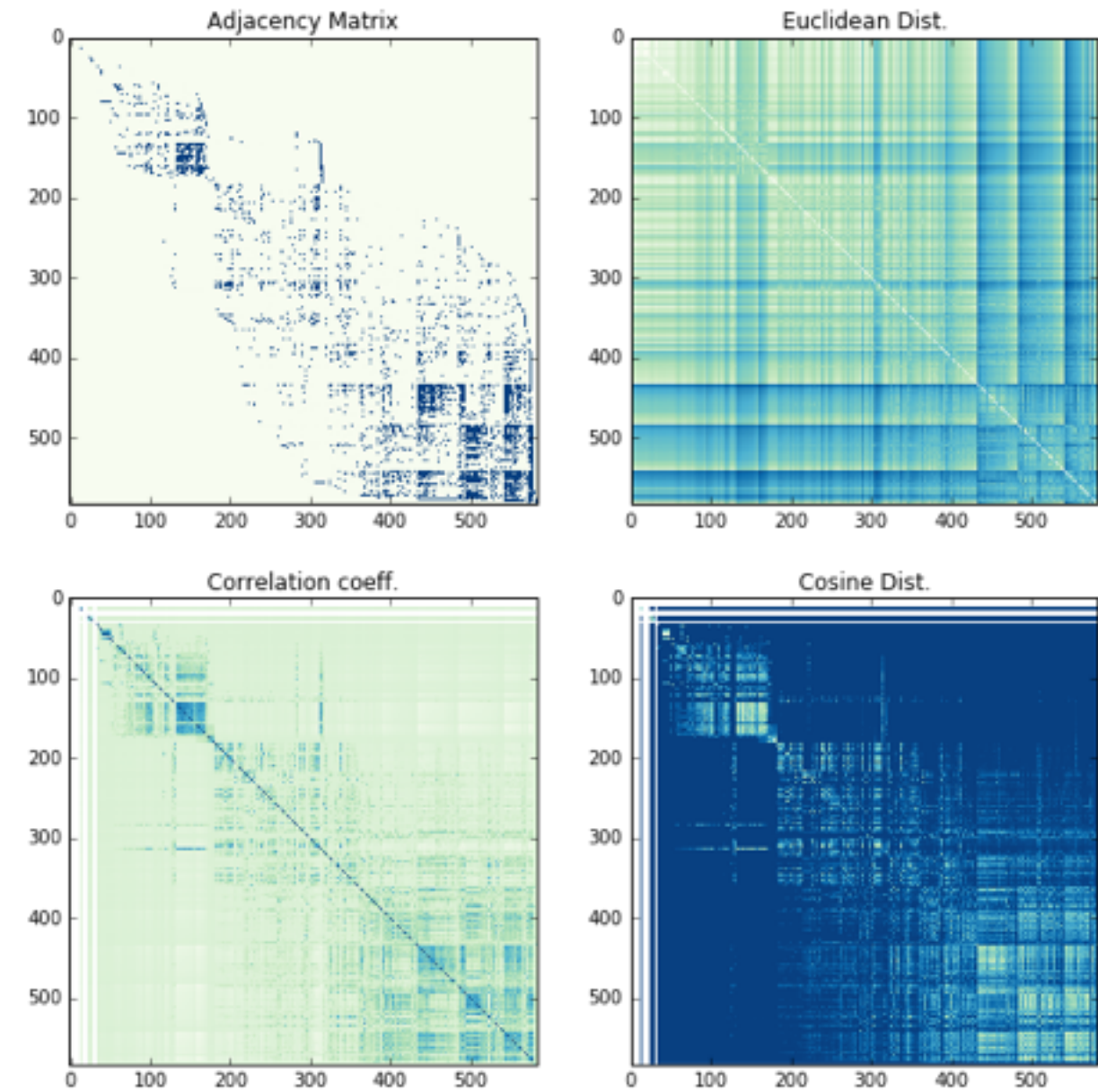
many people don't fill such specific personal information.



# Similarity



without ordering



with ordering



# Community detection

# Cliques

Number of maximal cliques = 17 080

Size of maximum clique = 29

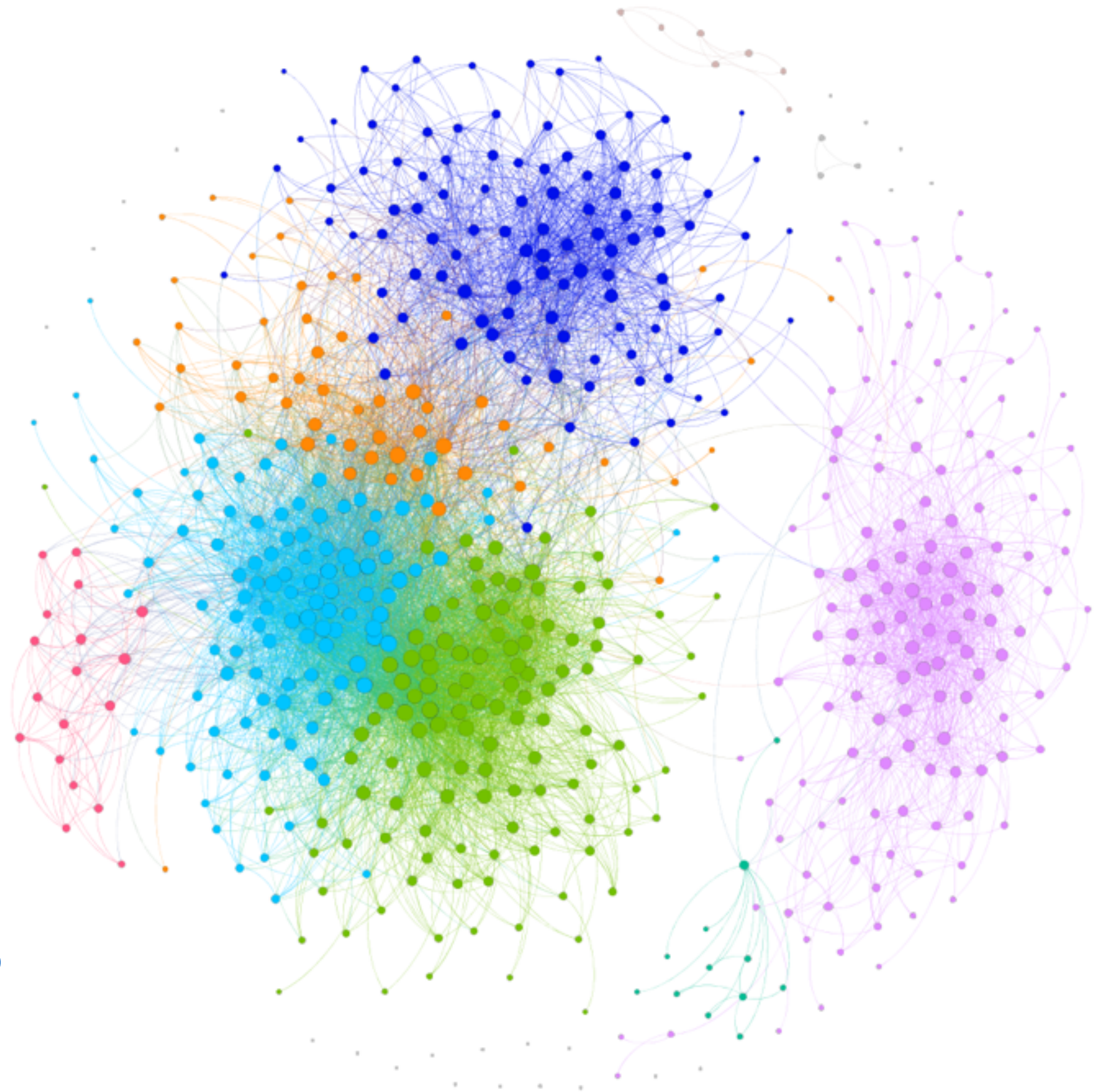
Number of maximum cliques = 16

# Communities

Community detection done  
by modularity.

## Legend

- faculty
- home city
- home city friends from summer camp
- MIPT
- HSE student organisation (ШТ)
- participants HSE camp (“Мы Вместе”)
- participants of other summer camp
- other HSE friends (dormitory in general)





# Communities

Community detection done  
by MCA ( $p = 2$ ,  $\alpha = 2$ ).

Communities is quite similar  
with previous picture.

