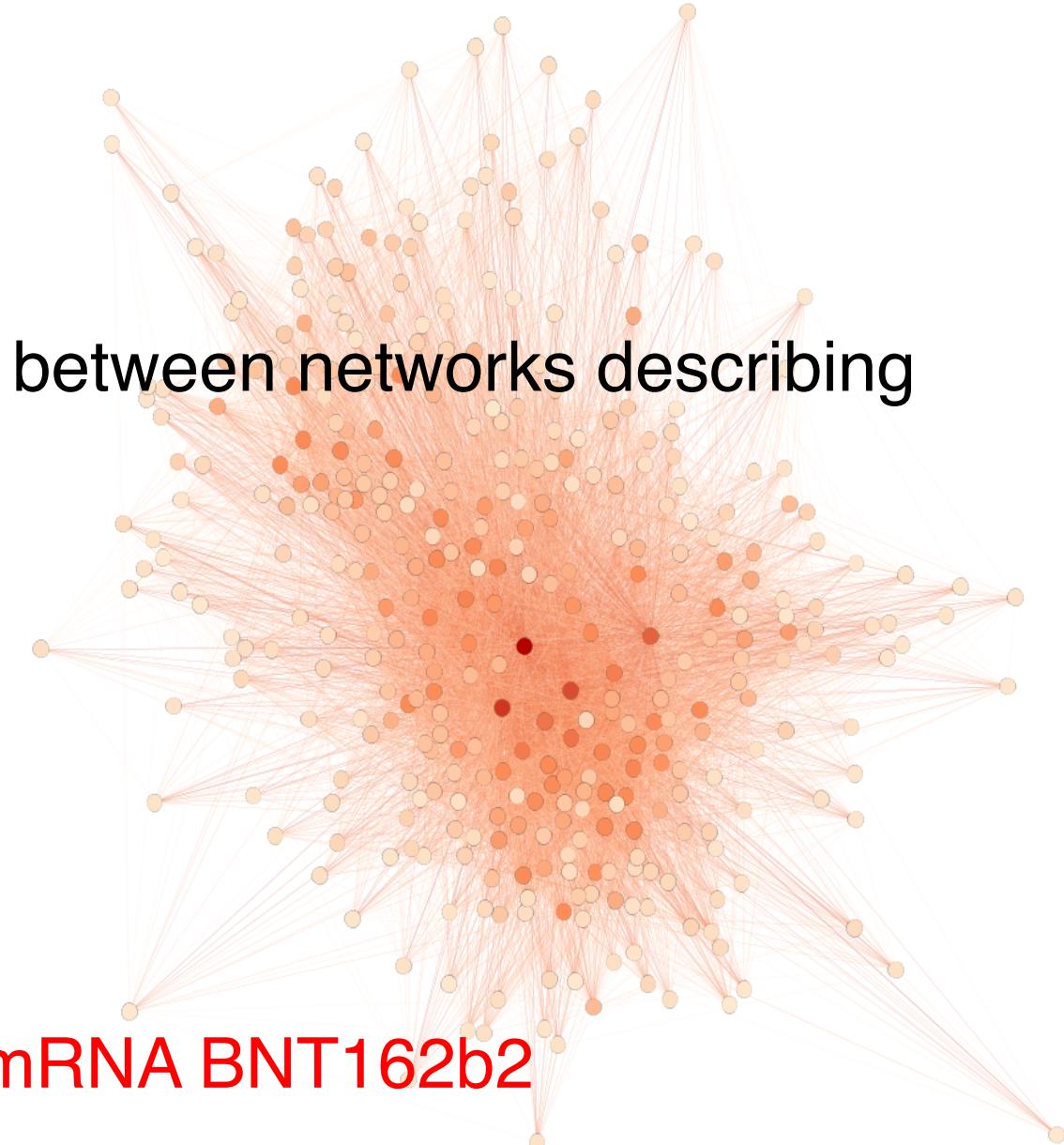


# NETWORK MODEL FOR PRODUCTS

Does the world care the same?

# AIM OF THE PROJECT:

- analyze **analogies** and **differences** between networks describing news spread about new products
  - 1. structure
  - 2. contents
  - 3. sentiment
- PlayStation 5 vs Pfizer CoViD-19 mRNA BNT162b2



# DATASET:

- Twitter API, 5 Sandbox accounts, 1.5 M tweets, first 10 days, bias-number trade-off
  - PlayStation 5 release: November 12, 2020
    - ((#ps5) lang:en, then ((#ps5 #sony) OR #playstation5) lang:en
  - Pfizer CoViD-19 mRNA BNT162b2 effectiveness: November 9, 2020
    - (#pfizer OR #pfizervaccine) lang:en, then ((#pfizer #vaccine) OR #pfizervaccine) lang:en
- undirected weighted hashtags networks + sentiment attributes
- Python + NetworkX , LIWC, Gephi

# OVERVIEW:

\* 25% vs 50% original tweets

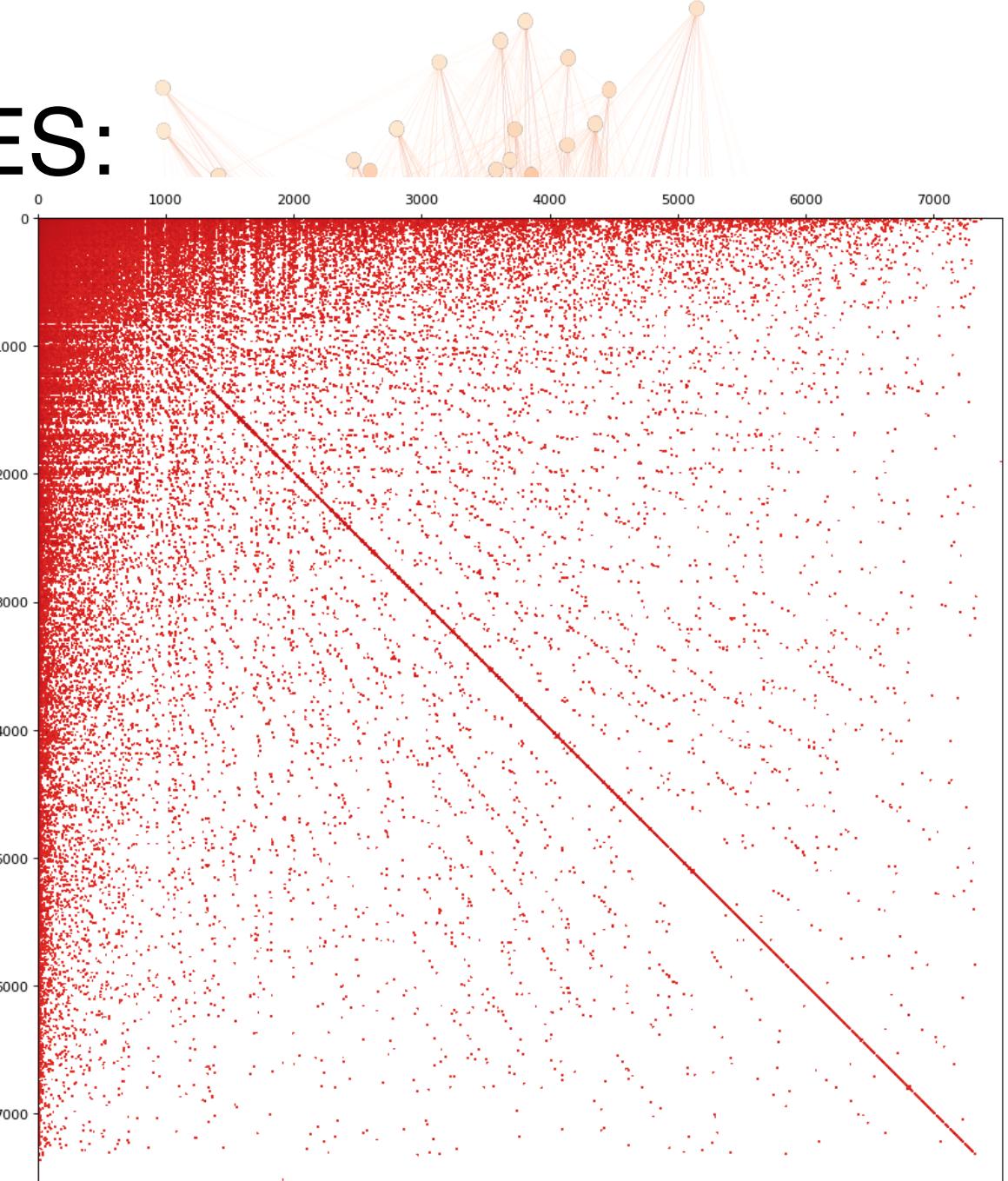
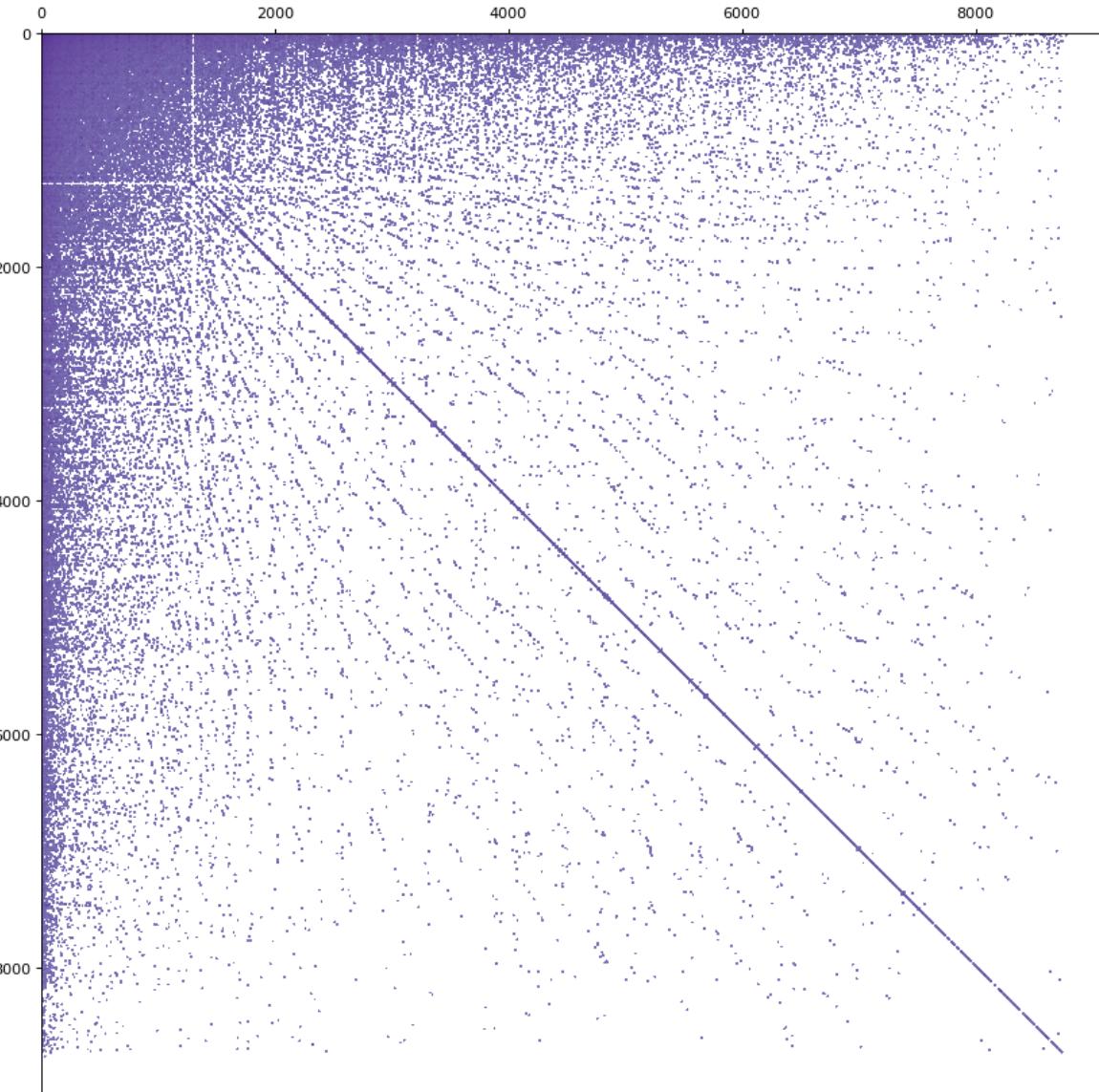
\* 2.9 vs 3.5 average #s per

	Number of nodes	Number of links	Density	Power law
<i>PS-network</i>	$ V  = 9082$	$ E  = 102155$	$\rho = 0.002$	$\gamma = 2.34$
<i>PS-network</i>	$ V  = 7538$	$ E  = 71634$	$\rho = 0.003$	$\gamma = 2.26$

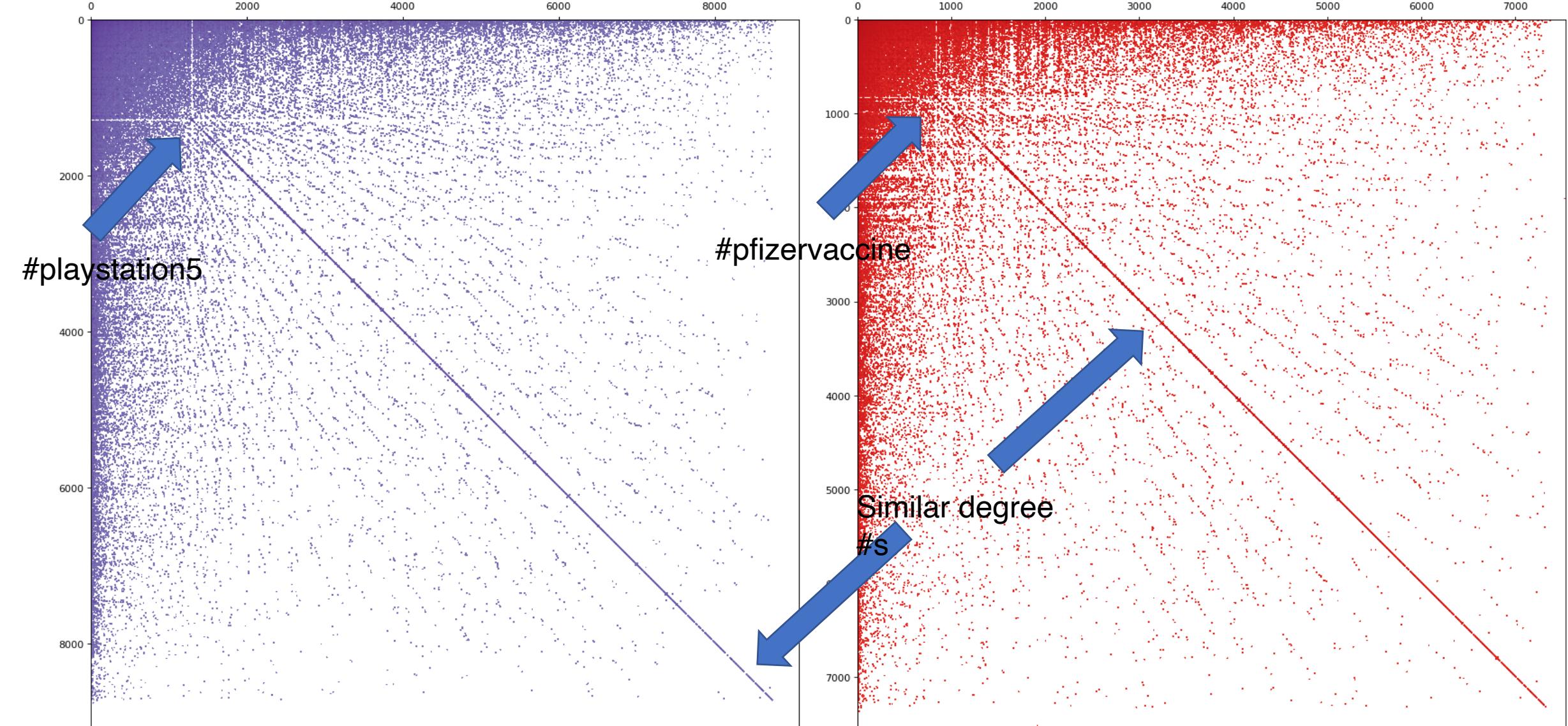
	Momenta	Distance
<i>PS-network</i>	$\langle k \rangle = 22, \langle k^2 \rangle = 14828, \langle k^3 \rangle = 69626523$	$\text{dist}=4, \langle d \rangle = 2.15, \langle d \rangle_{\text{exp}} = 2.21$
<i>V-network</i>	$\langle k \rangle = 19, \langle k^2 \rangle = 11544, \langle k^3 \rangle = 48307846$	$\text{dist}=5, \langle d \rangle = 2.16, \langle d \rangle_{\text{exp}} = 2.19$

	Clustering	Assortativity	Robustness
<i>PS-network</i>	$\langle C \rangle = 0.85, \langle C \rangle_{\text{exp}} = 0.01$	$\mu = -0.15, \mu_{\text{rand}} = -0.024$	$f_{\text{rand}} = 0.97, f_{\text{attack}} = 0.31$
<i>V-network</i>	$\langle C \rangle = 0.86, \langle C \rangle_{\text{exp}} = 0.01$	$\mu = -0.16, \mu_{\text{rand}} = -0.023$	$f_{\text{rand}} = 0.98, f_{\text{attack}} = 0.22$

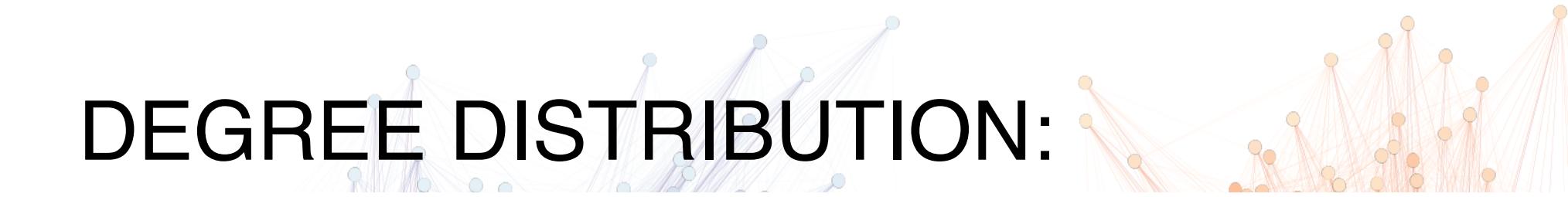
# ADJACENCY MATRICES:



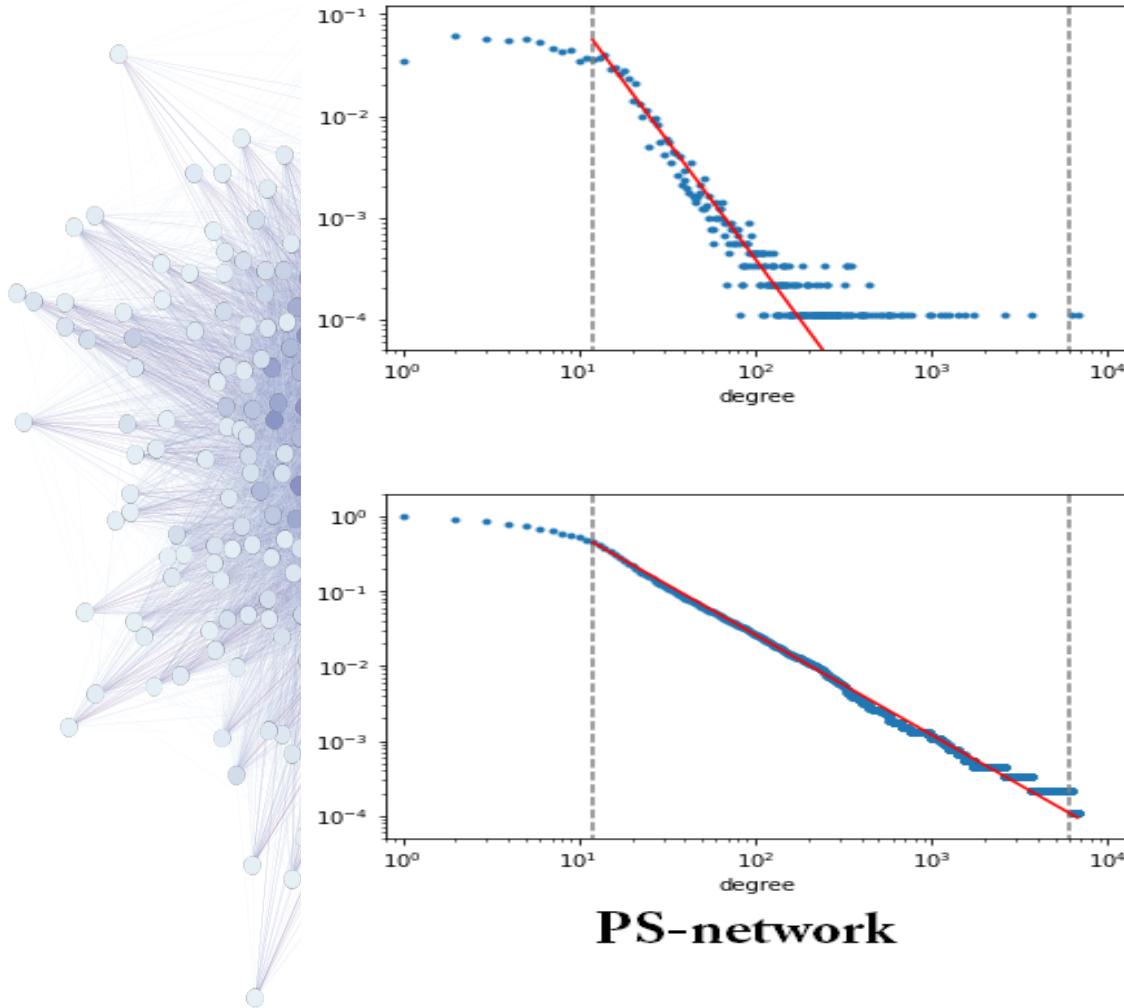
# ADJACENCY MATRICES:



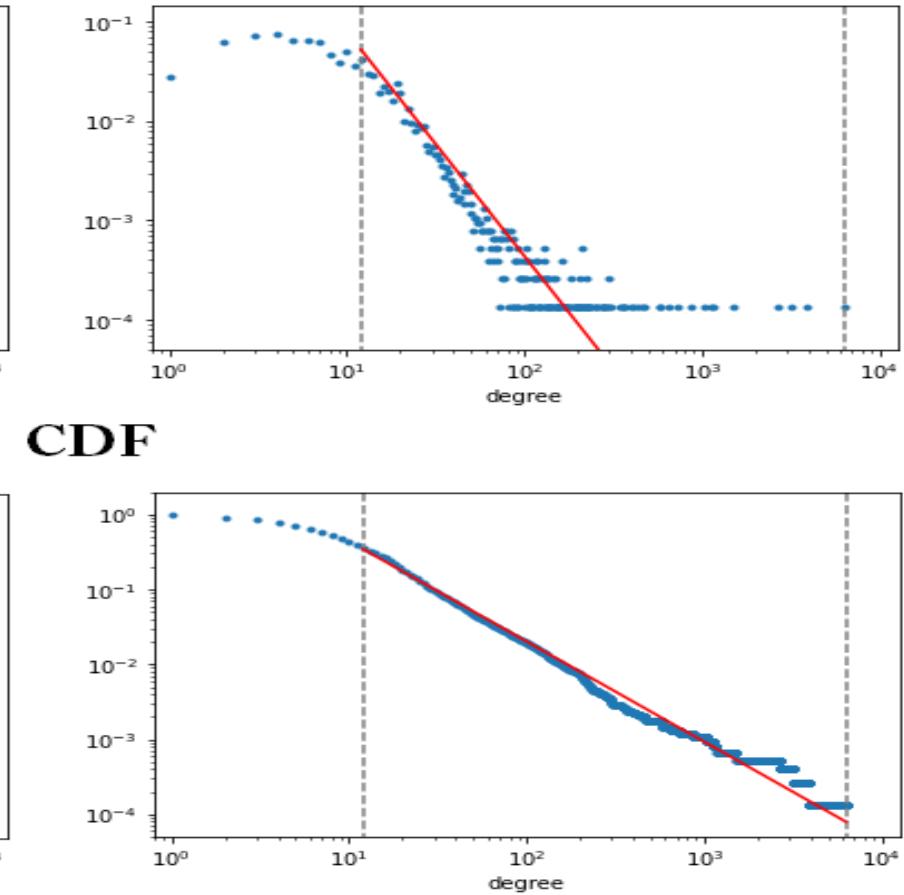
# DEGREE DISTRIBUTION:



PDF

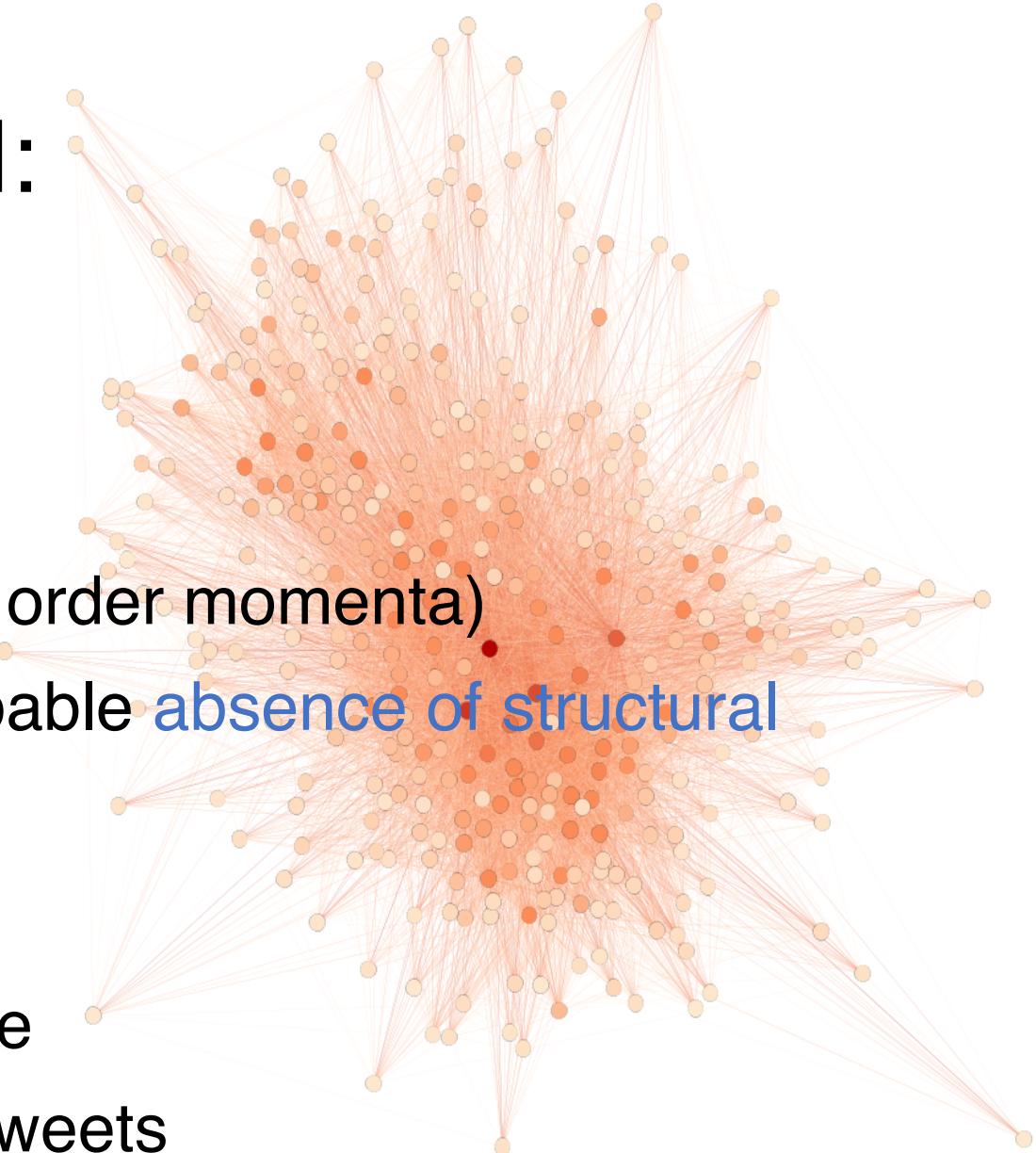


CDF



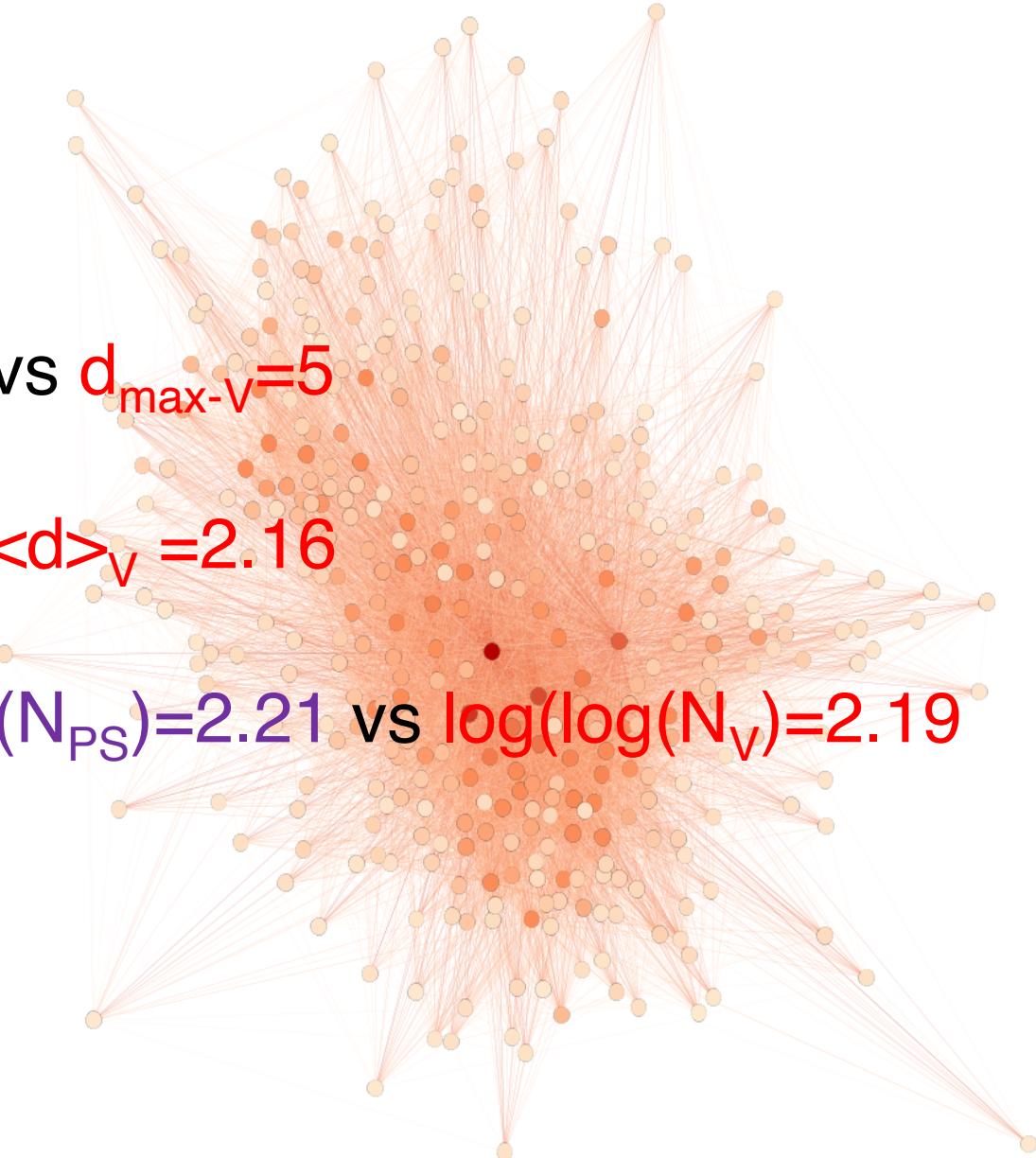
# DEGREE DISTRIBUTION:

- Power law:  $p(k_i) = C k_i^{-\gamma}$
- $k_{\min} = 12$
- $\gamma = 2.34$  vs  $\gamma = 2.26$ , scale-free (higher order momenta)
- natural cut-off  $k_{\max} = k_{\min} N^{1/(1-\gamma)}$  => probable absence of structural disassortativity
- $C = (\gamma-1)k_{\min}^{\gamma-1}$
- Hubs also due to the queries structure
- Small nodes <-> rare and unrelated tweets



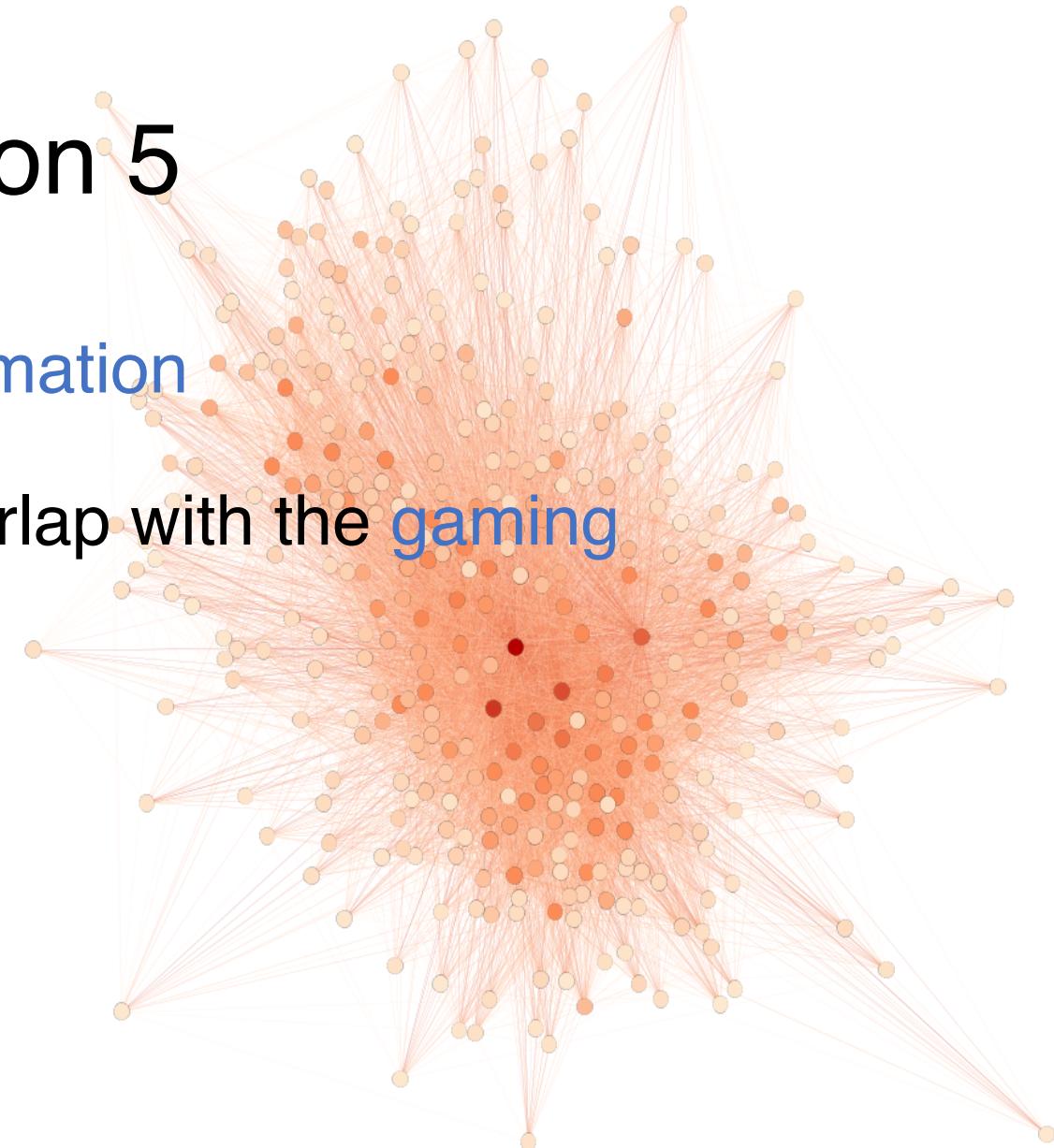
# Ultra-Small World:

- Diameter (BF algorithm):  $d_{\max-PS}=4$  vs  $d_{\max-v}=5$
- Average distance:  $\langle d \rangle_{PS}= 2.15$  vs  $\langle d \rangle_v = 2.16$
- Expected average distance:  $\log(\log(N_{PS}))=2.21$  vs  $\log(\log(N_v))=2.19$
- Queries structure

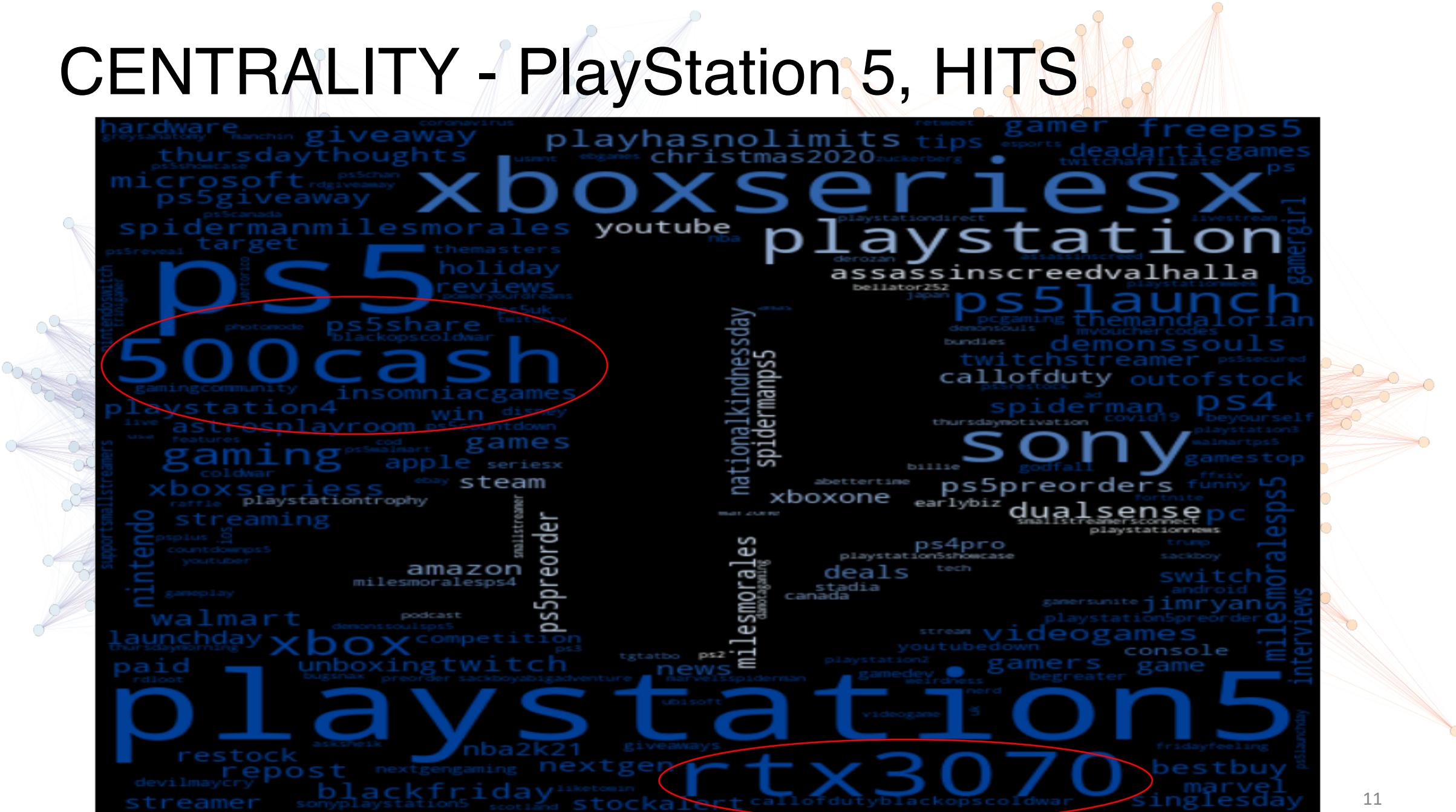


# CENTRALITY - PlayStation 5

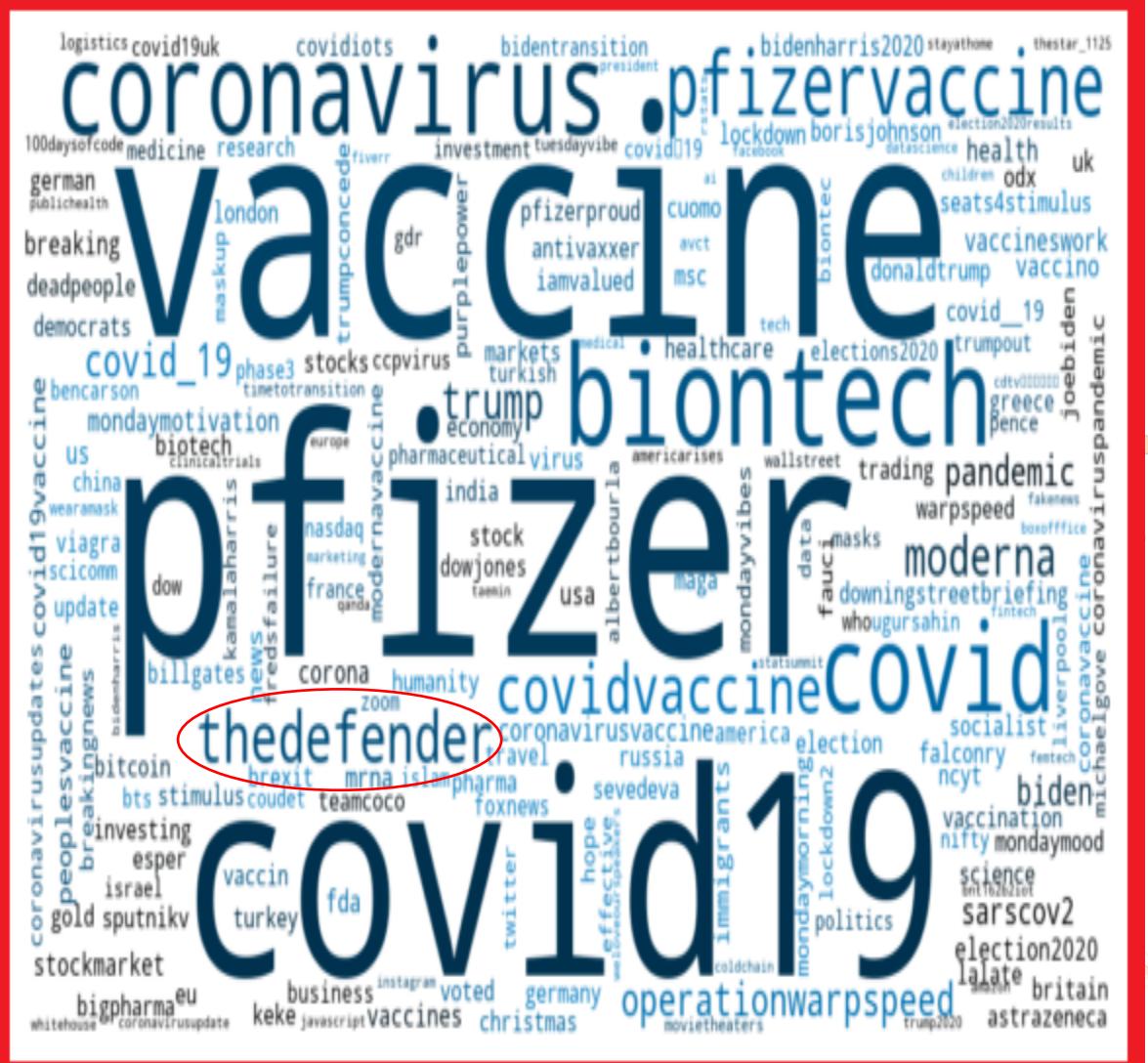
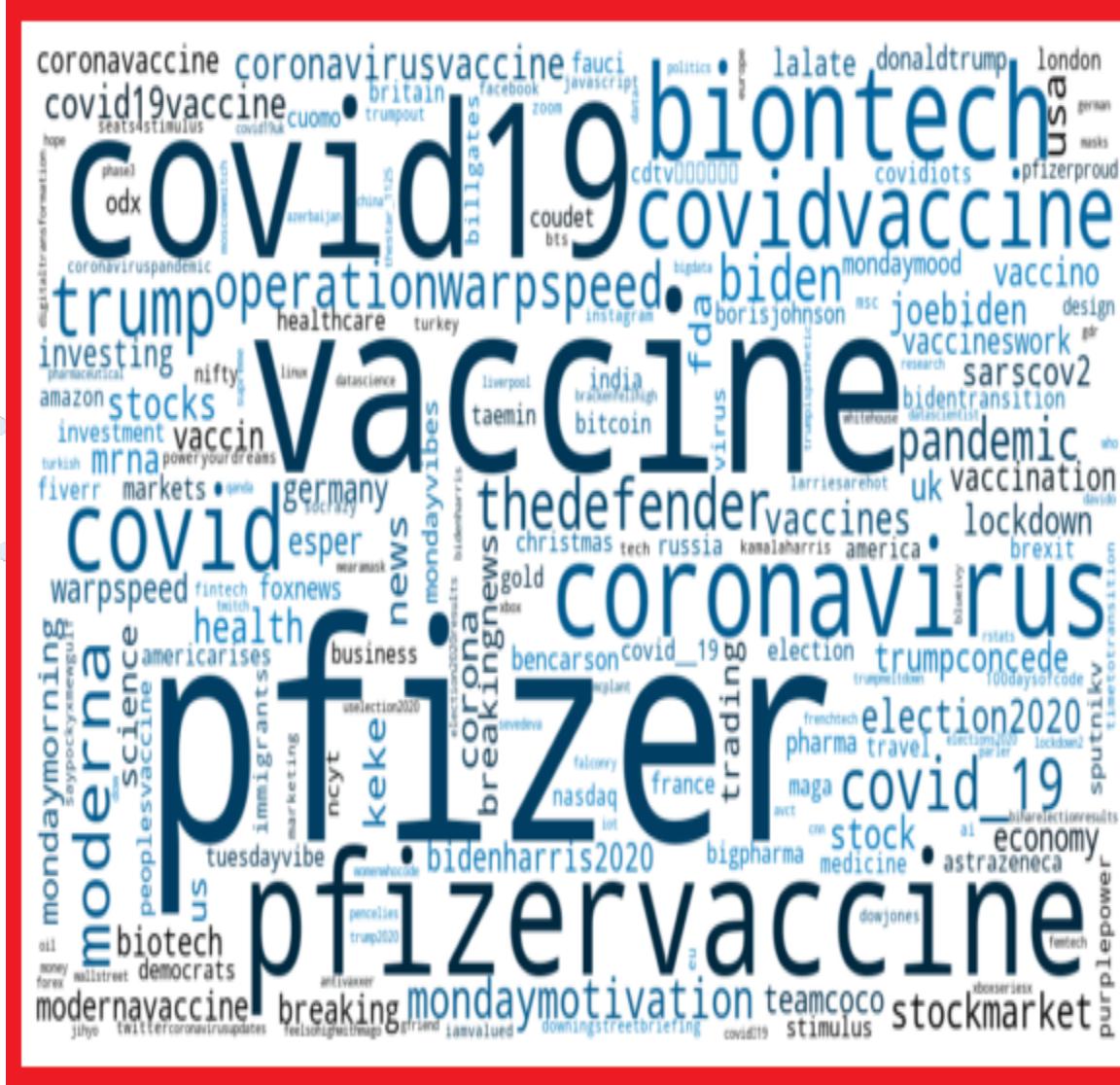
- Closeness: #twitch to spread information
- Betweenness: #youtubedown, overlap with the gaming community
- HITS more effective



# CENTRALITY - PlayStation 5, HITS



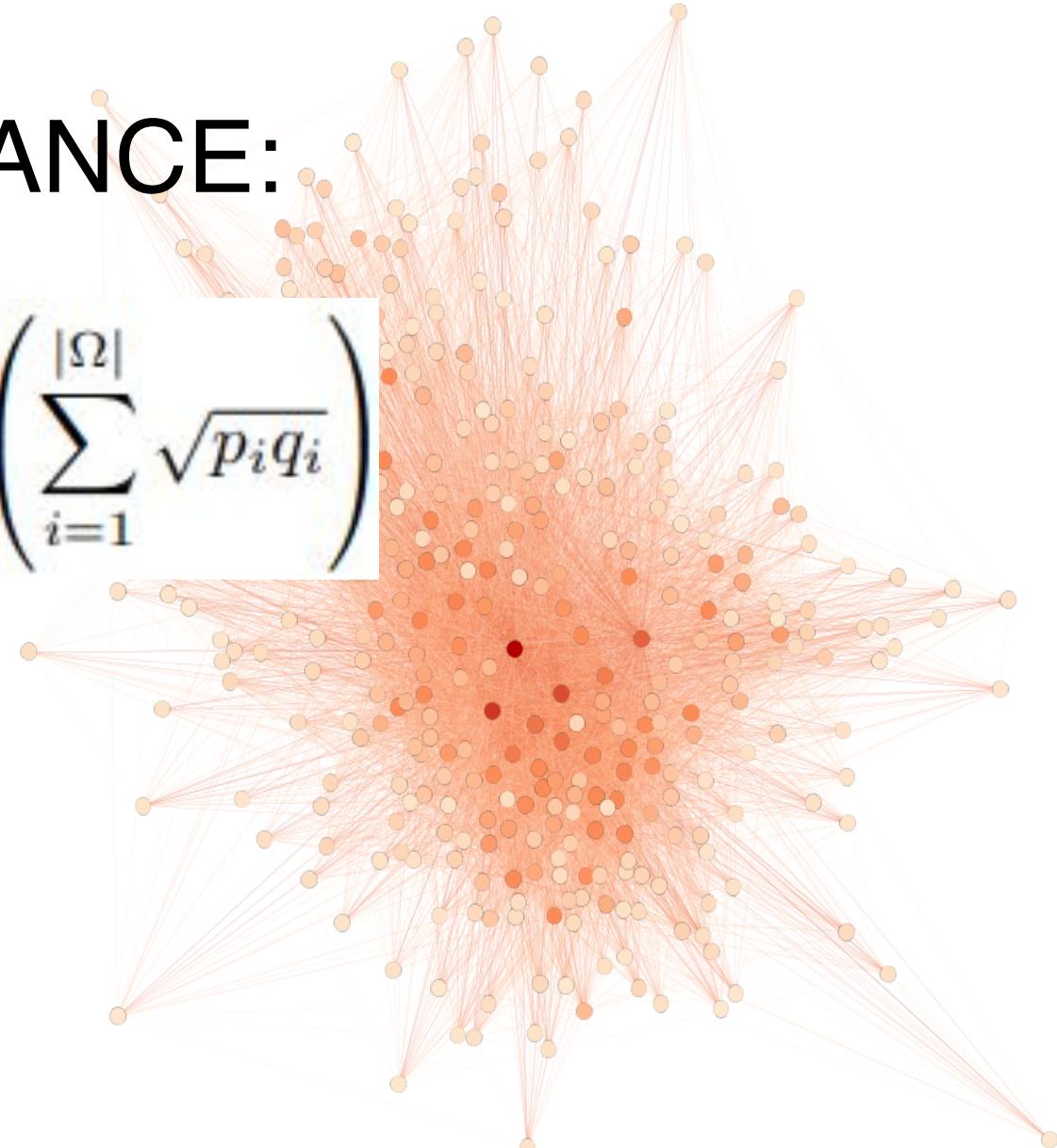
# CENTRALITY – Pfizer vaccine, PR vs HITS



# BHATTACHARYYA DISTANCE:

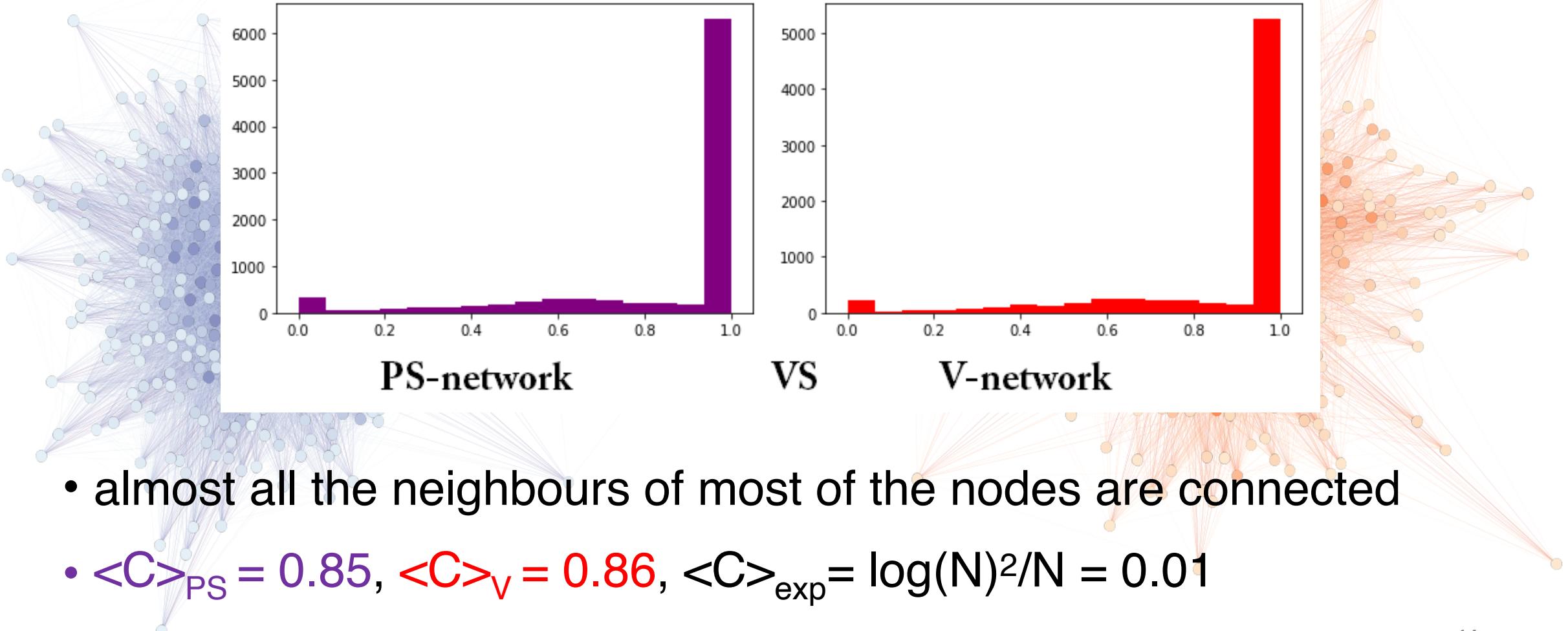
$$d_B(p, q) = -\log \left( \sum_{i=1}^{|\Omega|} \sqrt{p_i q_i} \right)$$

- Similarity between two distribution
- $[0, +\infty[$ , the lower the better
- $d_B(\text{PR}_{\text{PS}}, \text{PR}_{\text{V}}) = 1,69$
- $d_B(\text{HITS}_{\text{PS}}, \text{HITS}_{\text{V}}) = 2,23$

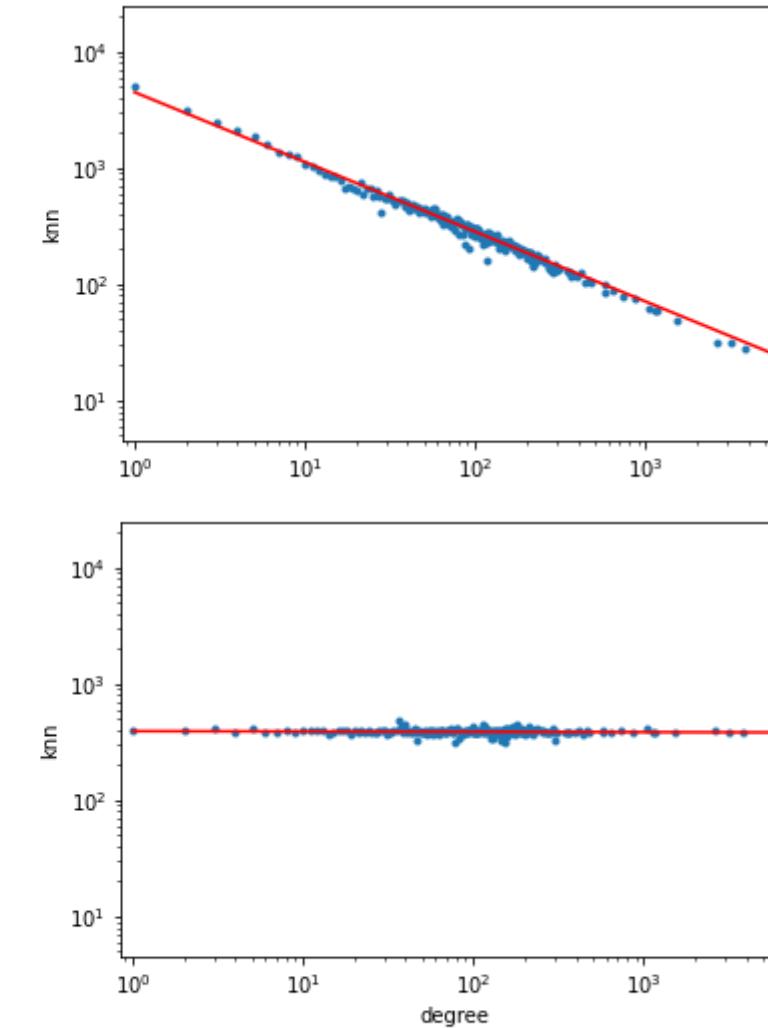
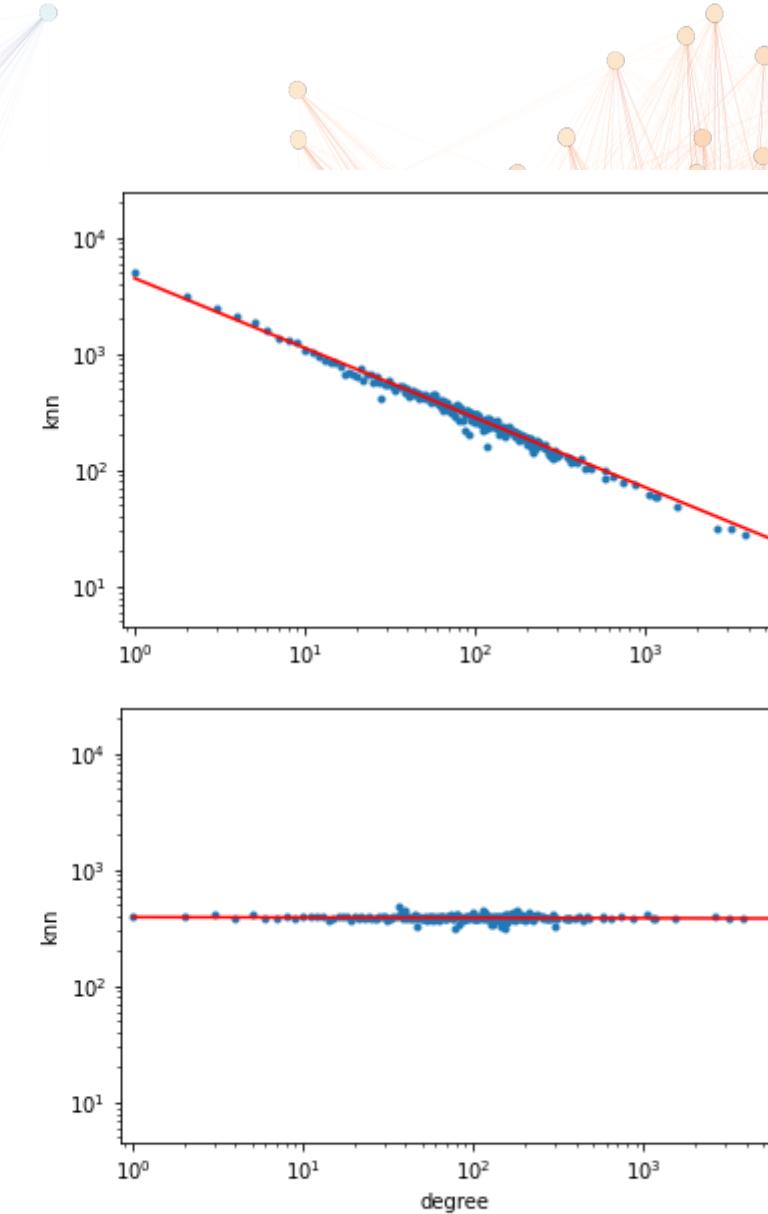
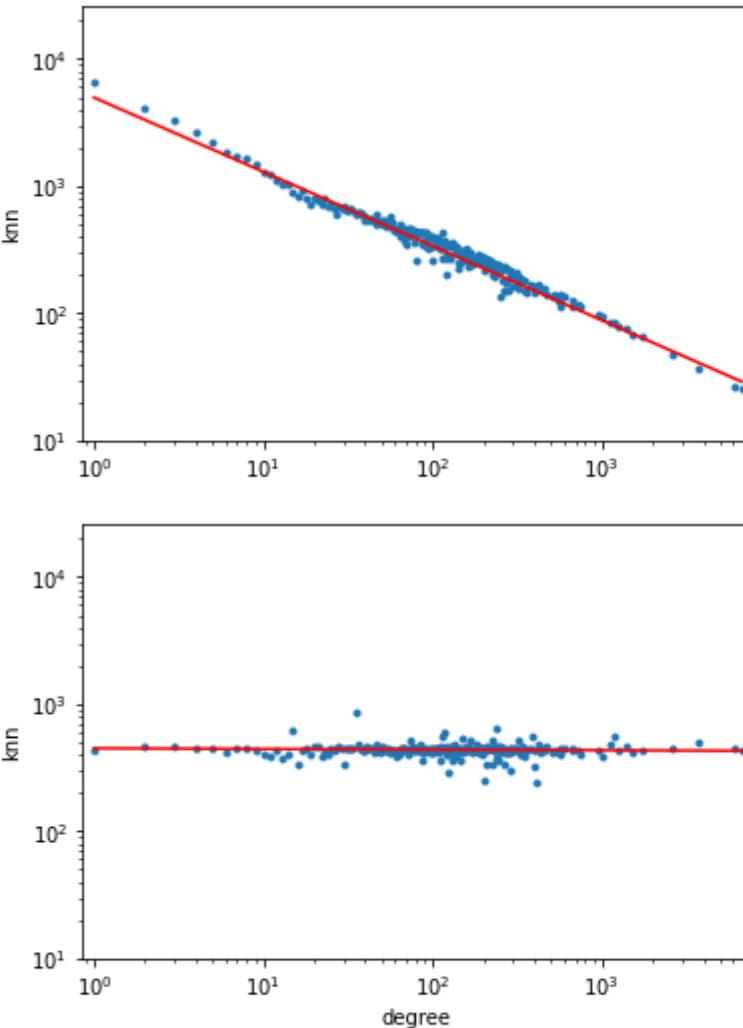
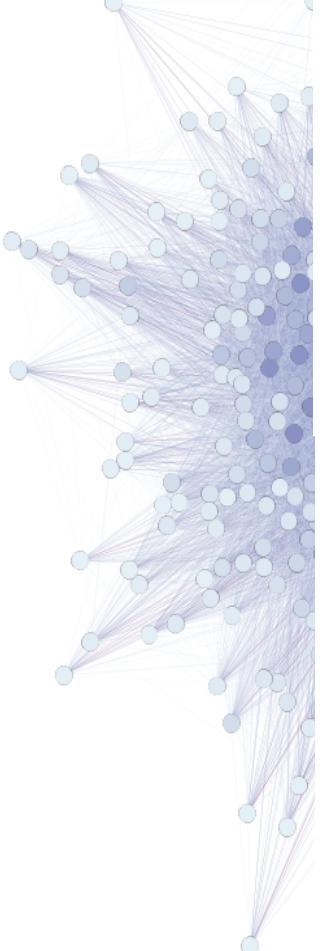


# CLUSTERING COEFFICIENTS:

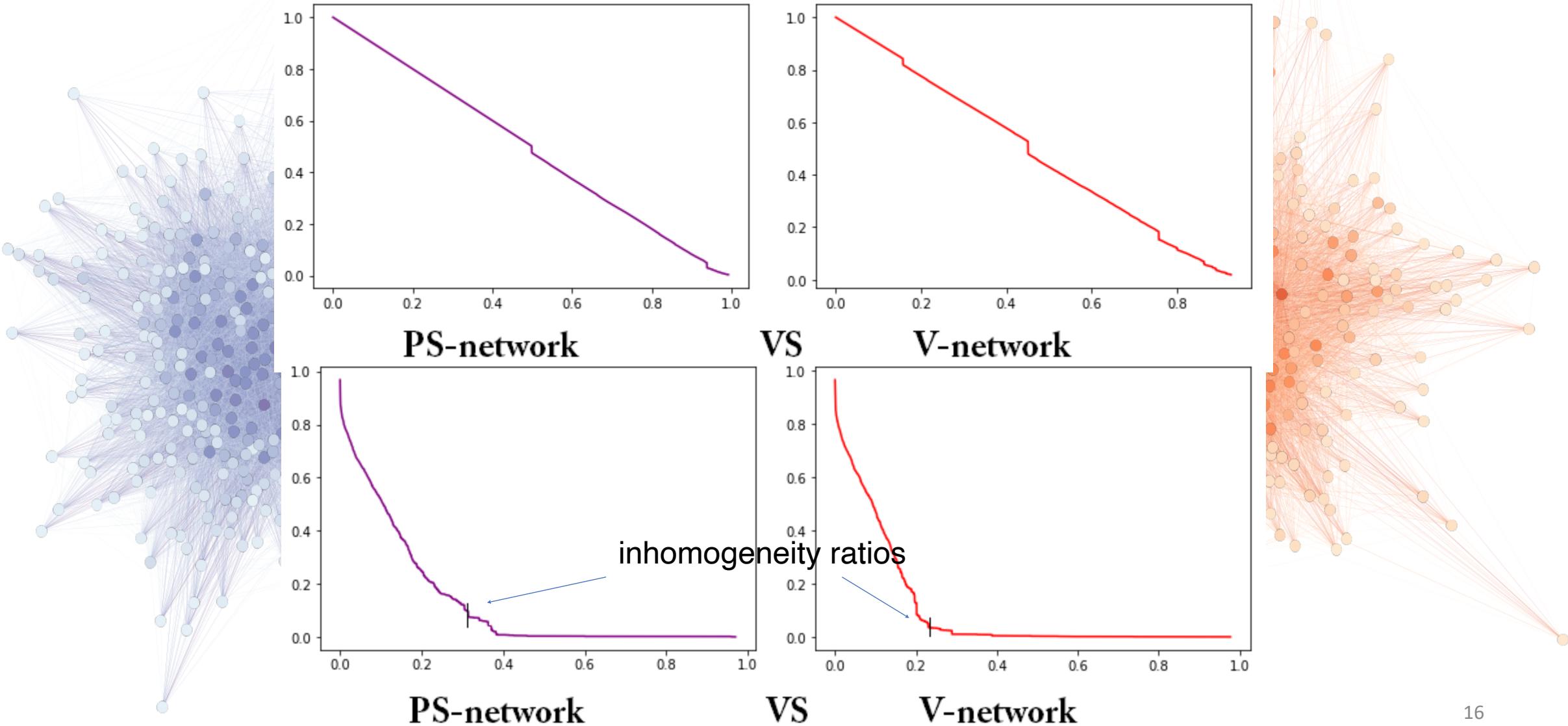
Clustering coefficients distribution



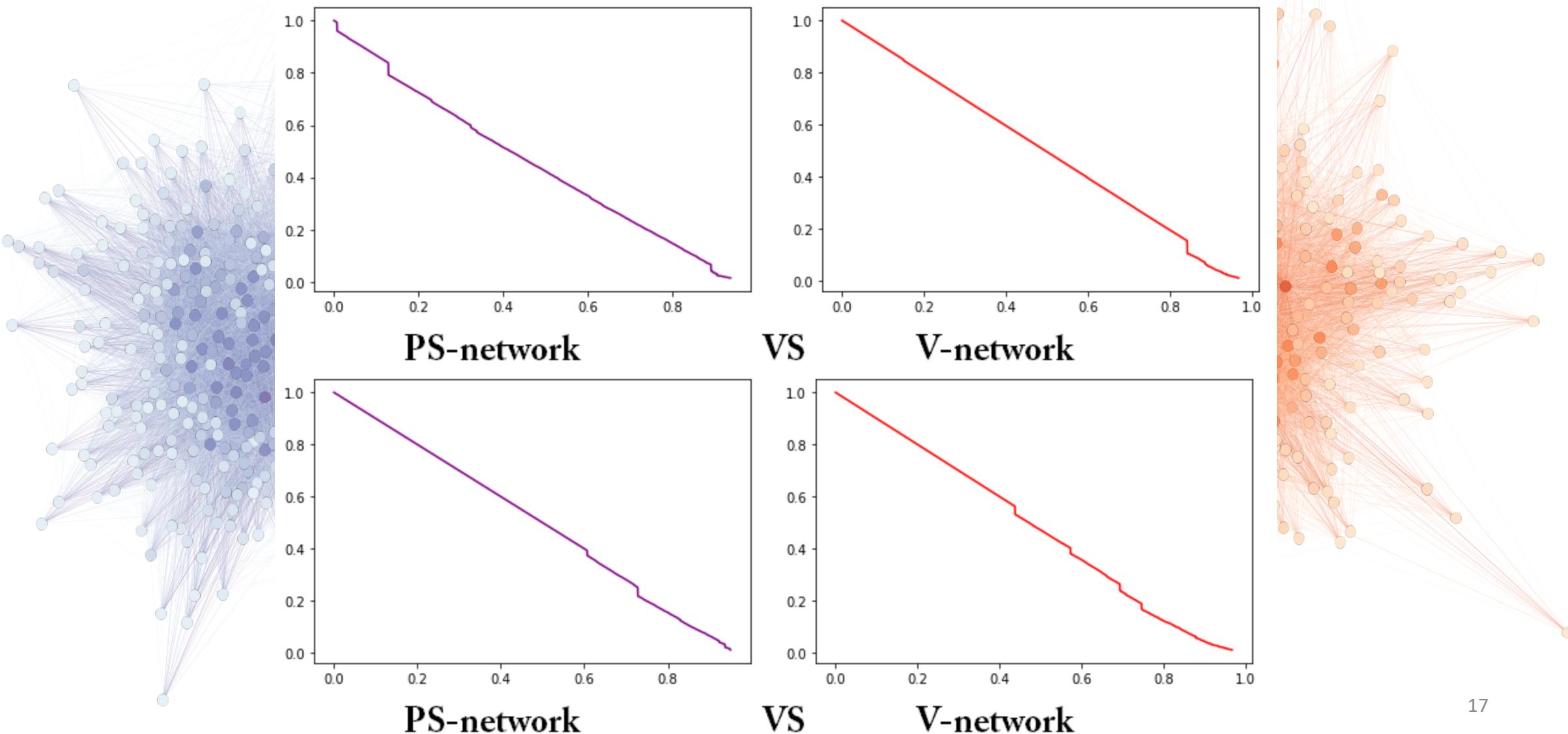
# ASSORTANTIVITY



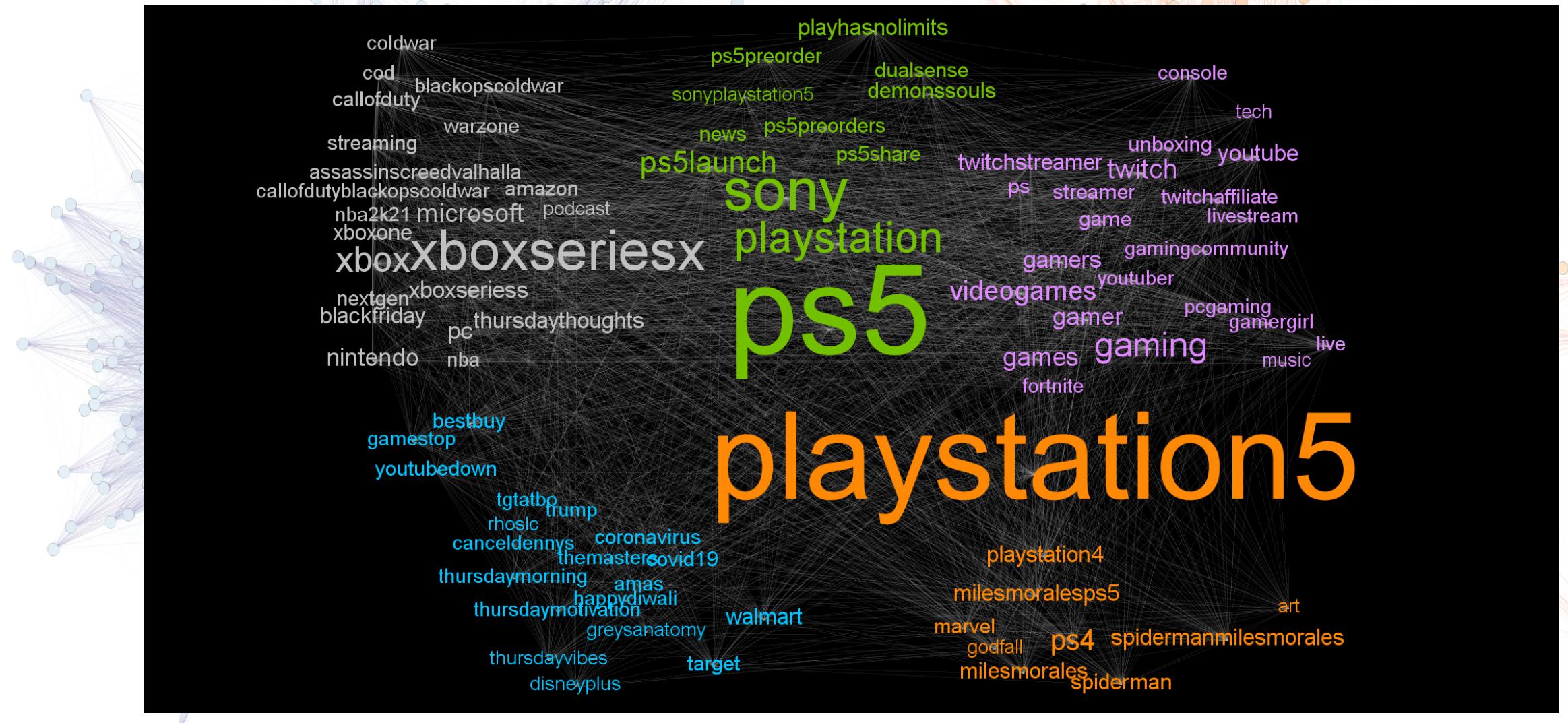
# ROBUSTNESS – RANDOM vs ATTACK (50 executions):



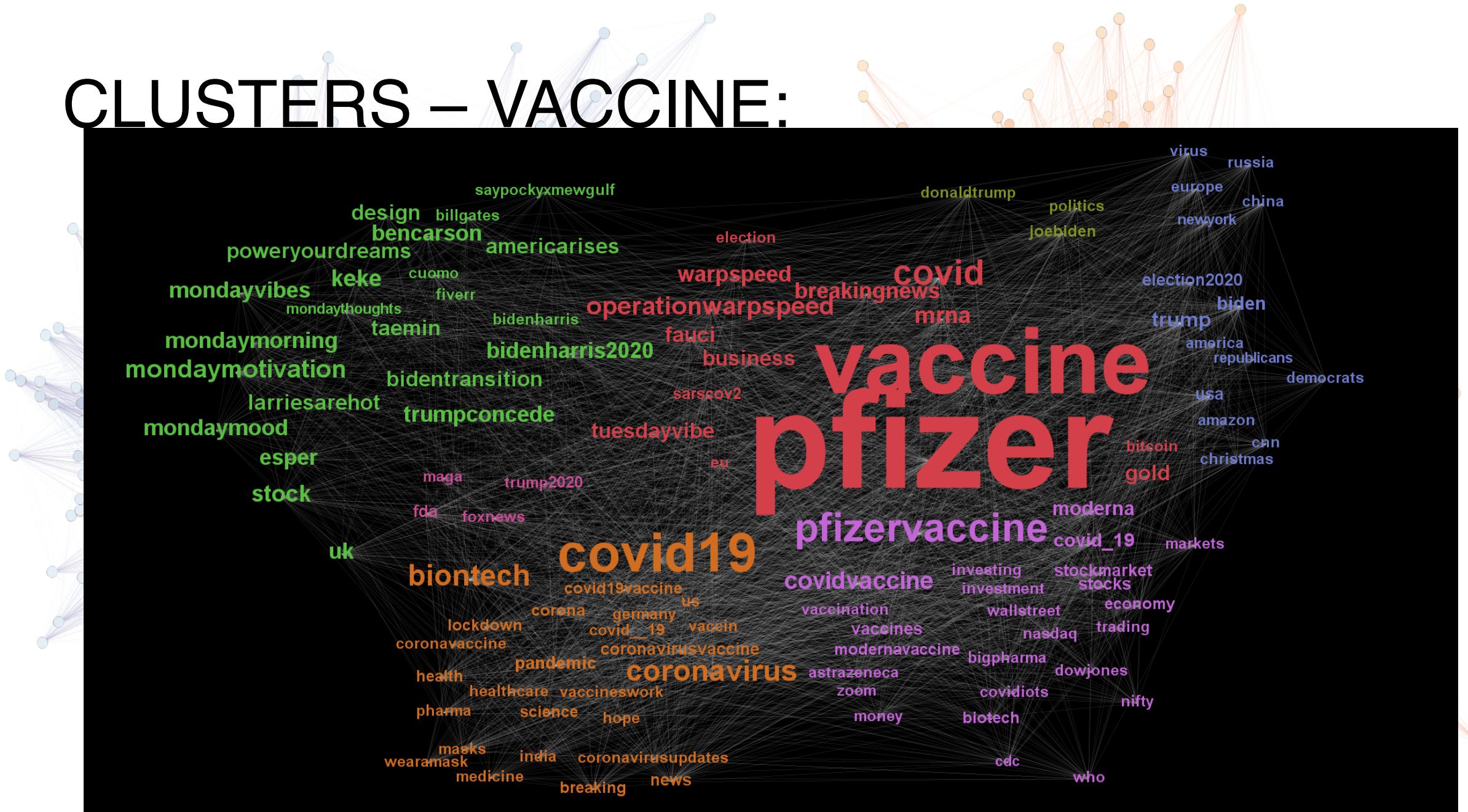
# ROBUSTNESS – RANDOM by SENTIMENT (50 executions):



# CLUSTERS – PLAYSTATION 5



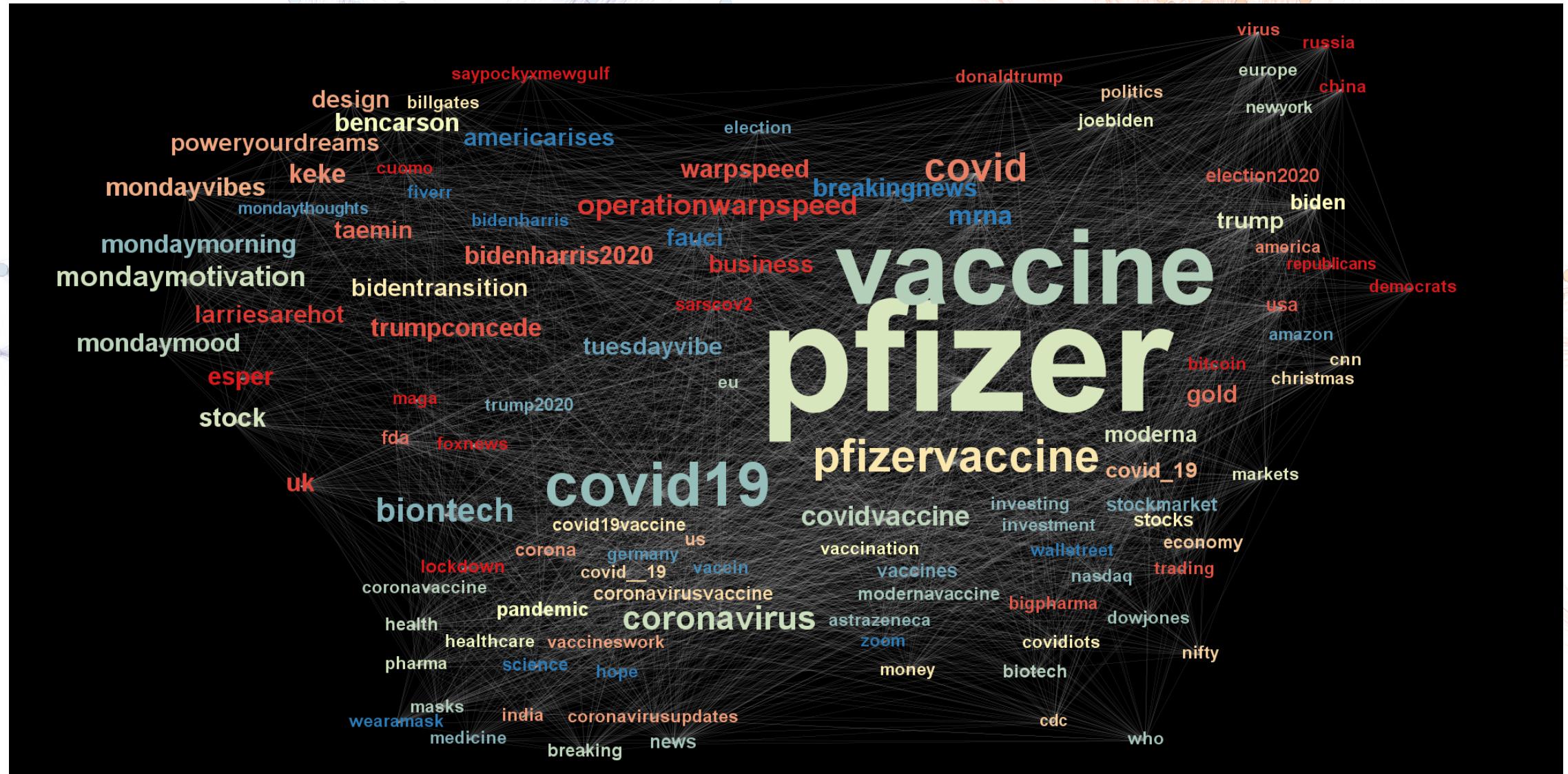
# CLUSTERS – VACCINE:



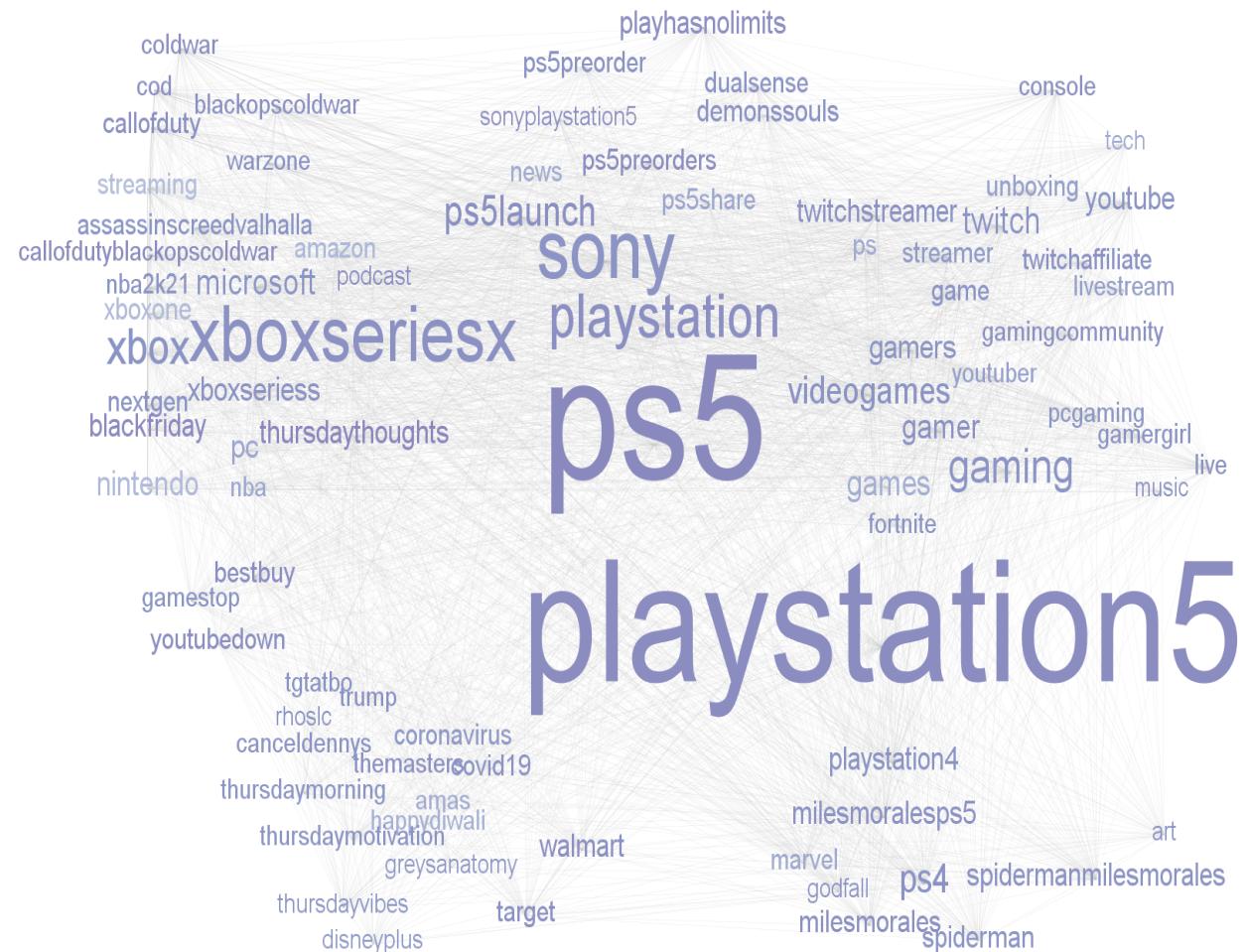
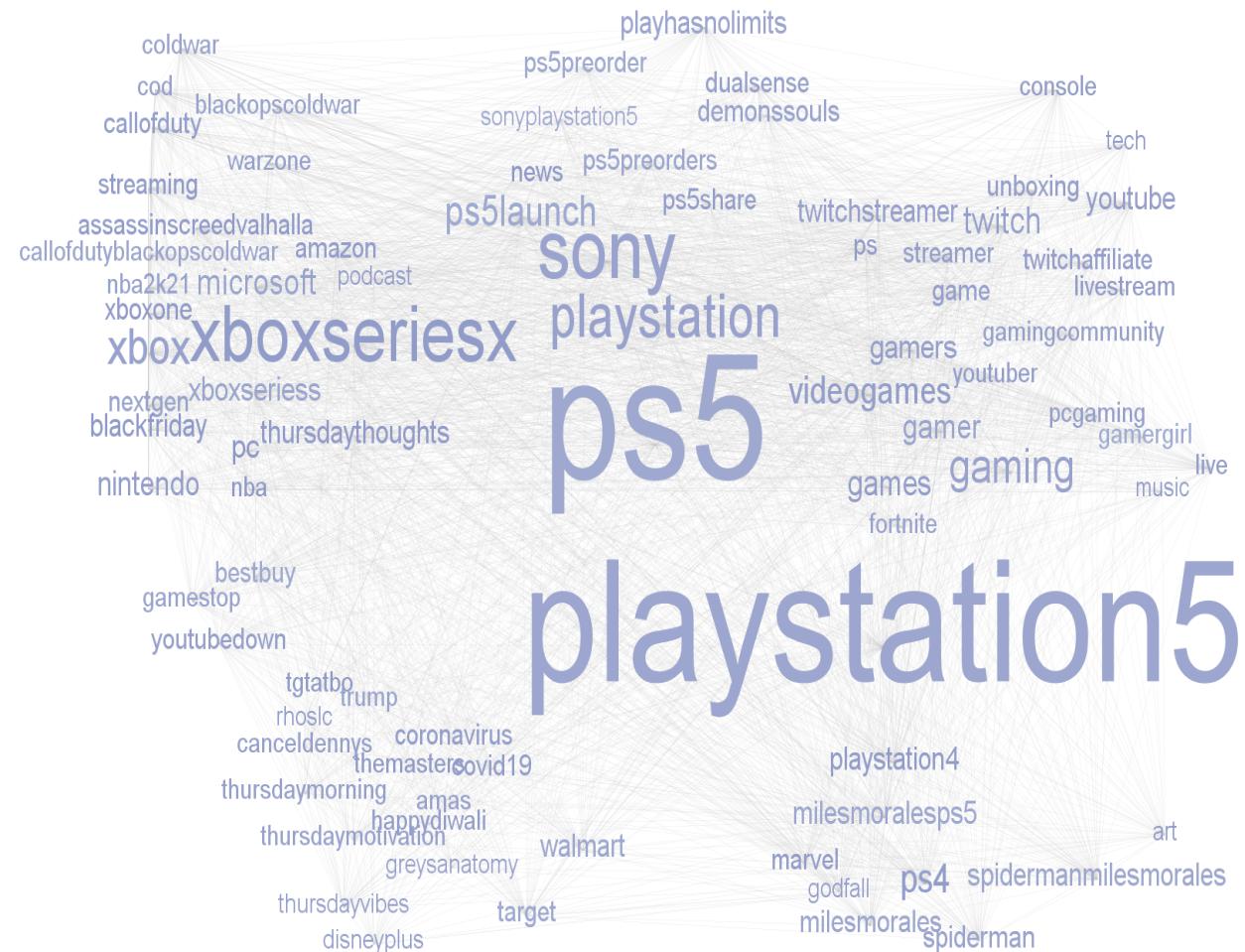
# SENIMENT - PLAYSTATION 5:



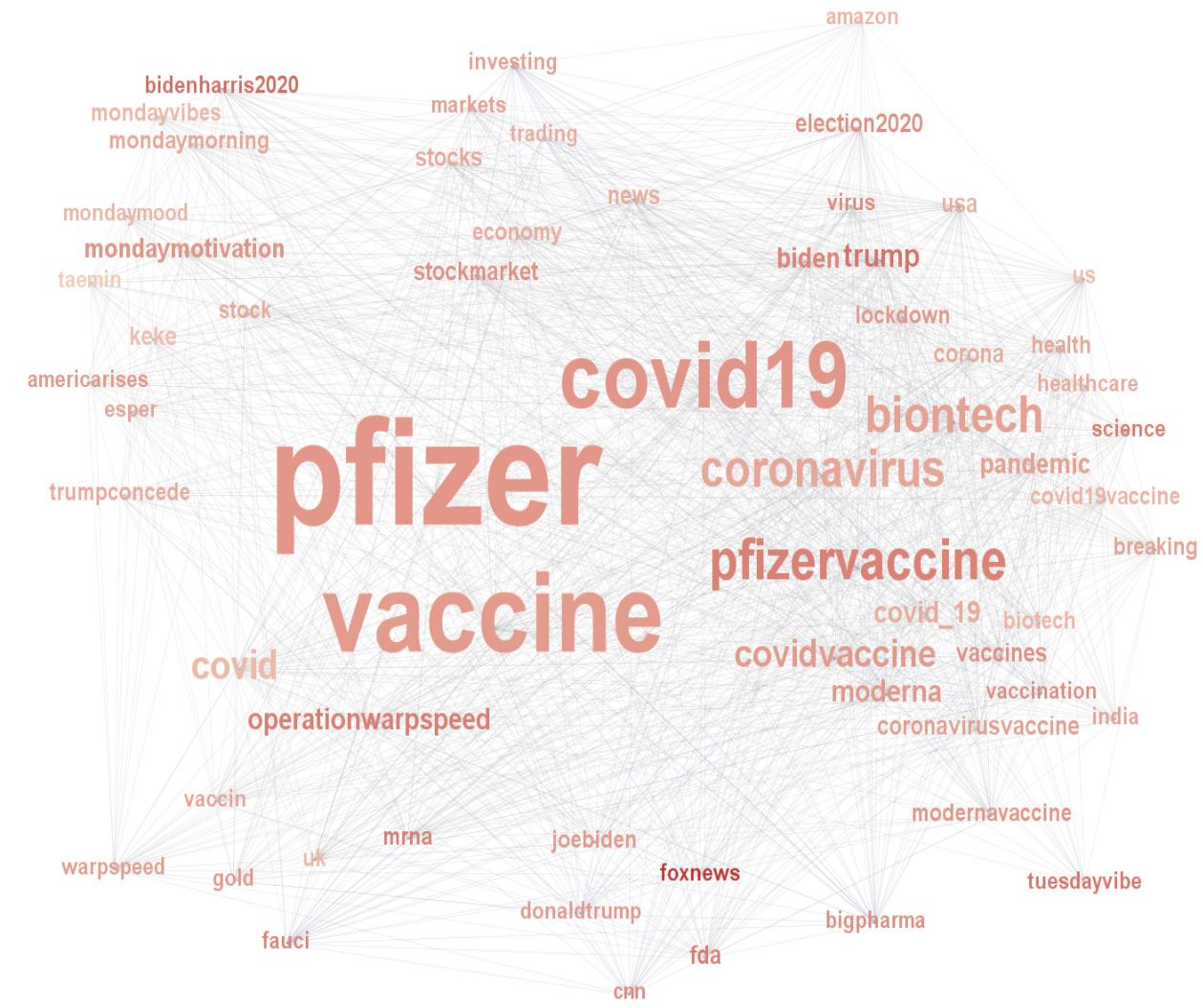
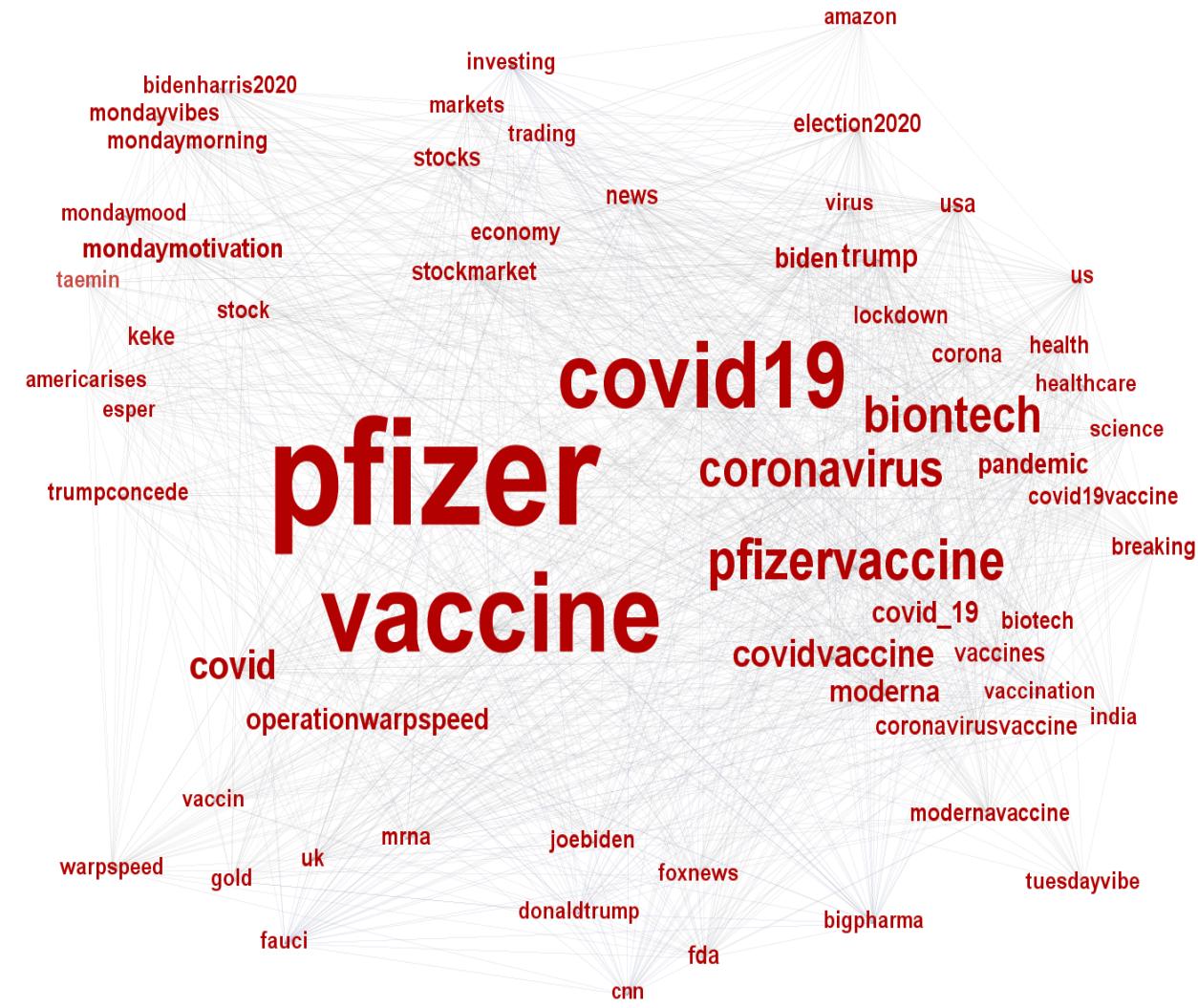
# SENTIMENT - SENTIMENT:



# PLAYSTATION 5 – ANALYTICAL vs EMOTIONAL:



## VACCINE – ANALYTICAL vs EMOTIONAL:





THANK YOU FOR YOUR ATTENTION

