Национальный исследовательский университет
«Высшая школа экономики»

Top-Rated-Lichess-Network

Social Networks project

Москва, 2025

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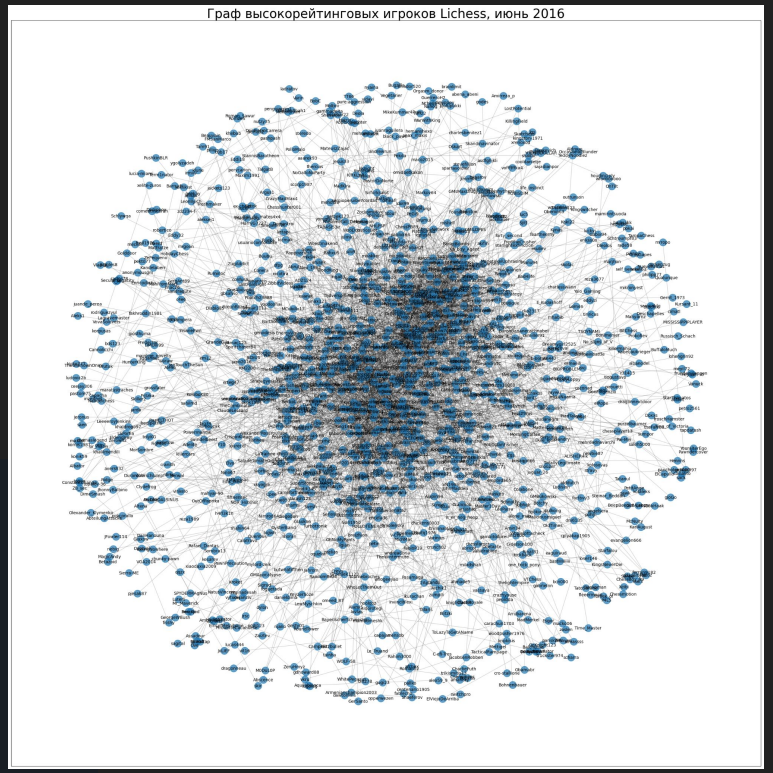
Data source

- June 2016 Lichess database dump (.pgn)
- Iterate over 300000 tuples
- Pick 1500 top-rated players – they are nodes
- Delete isolated nodes
- Dump to .gexf
- Pick largest connected part of the graph during analysis



lichess.org

open database

Network description (largest connected component)

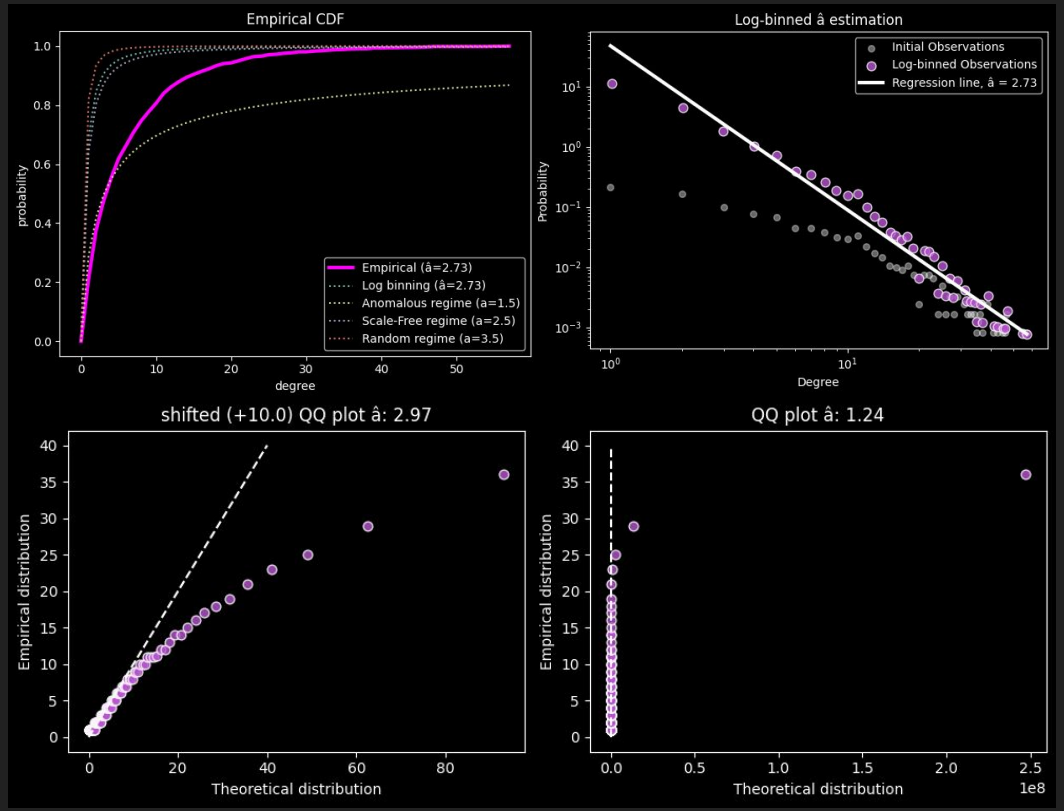
- **Nodes:** lichess playes.
  - 1231 total
  - attrs: name (‘label’); ELO (‘rating’)
  - e.g. `('bulkong', {'rating': 2413, 'label': 'bulkong'})`
- **Edges:** if two players have ever played a game together.
  - 3994 total
  - attrs: weight (amount of mutual games)
  - e.g. `('hiimgosu', 'chessstrategy', {'id': '123', 'weight': 3.0})`
- Undirected
- Weighted: edges.
- Homogeneous

Degree distribution

The network is anomalous with scale-free tendencies.

It matches power-law at higher degrees, but has fewer extreme hubs than predicted.

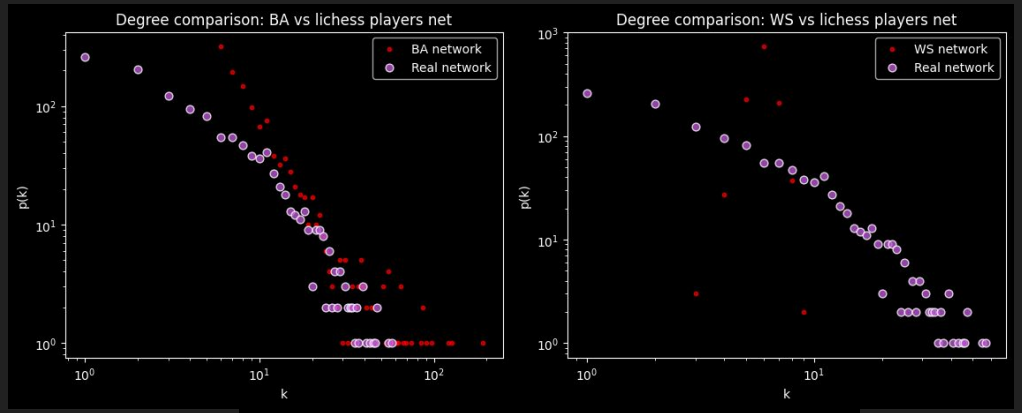
It is mostly anomalous in lower degrees, which are significantly lesser than expected within power-law.

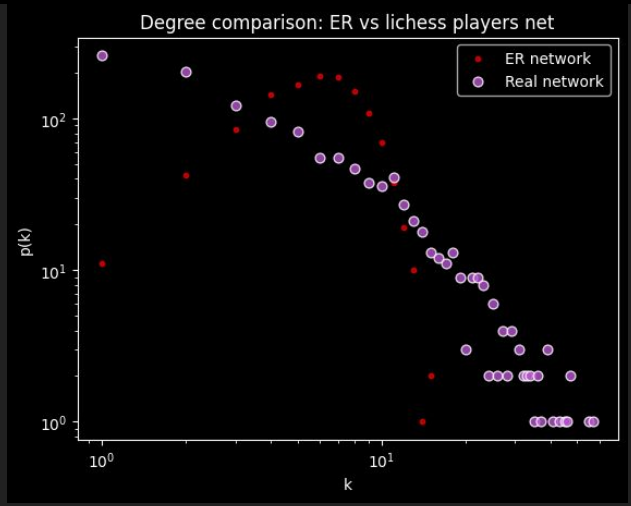


Average distance and Clustering coefficient

The network exhibits a small-world property.

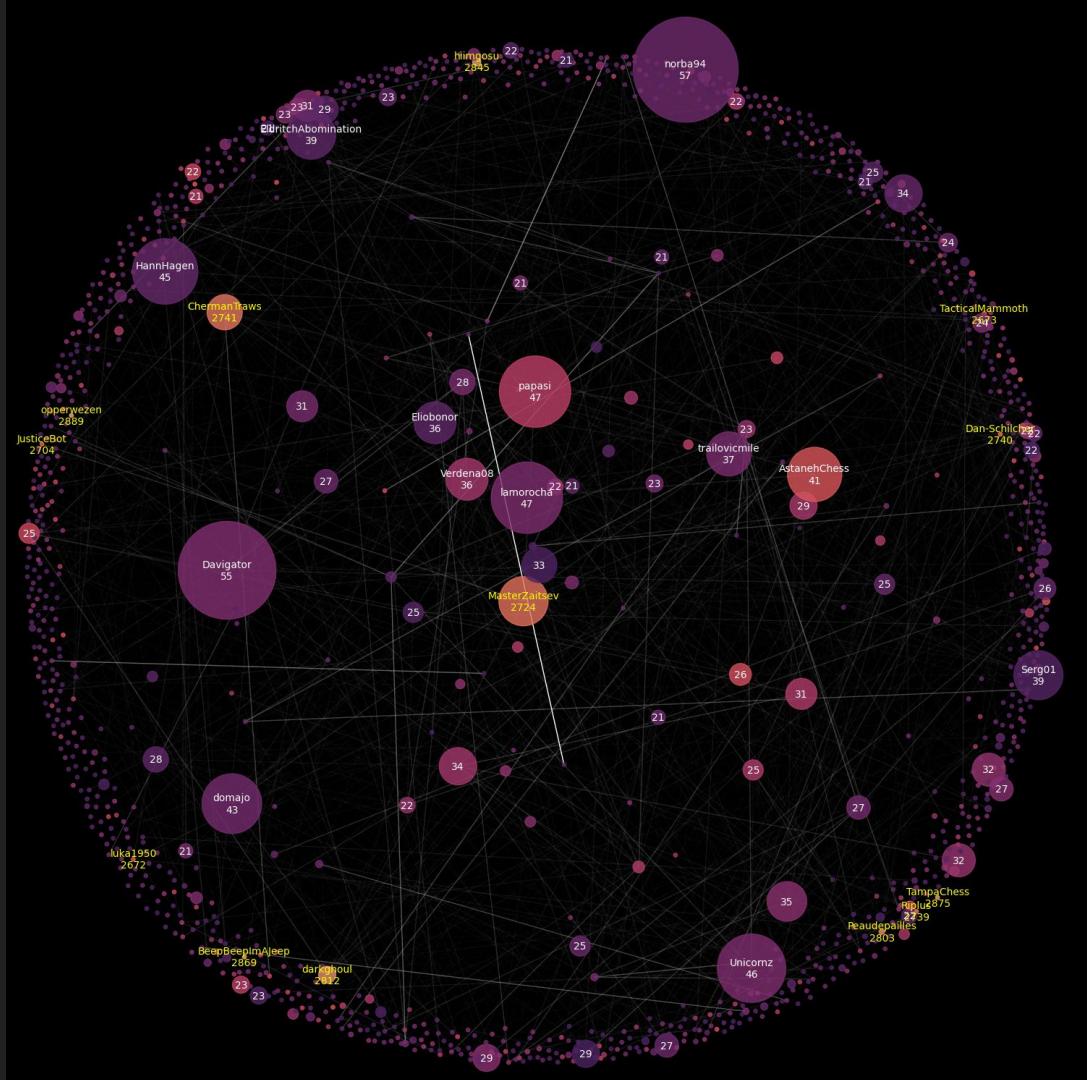
- **Avg path len: 4.228 (ER-like)**
- **Clustering coef: 0.066 (11 times higher than random)**
- **Diameter: 12 (higher than ER and BA, but lower than WS)**





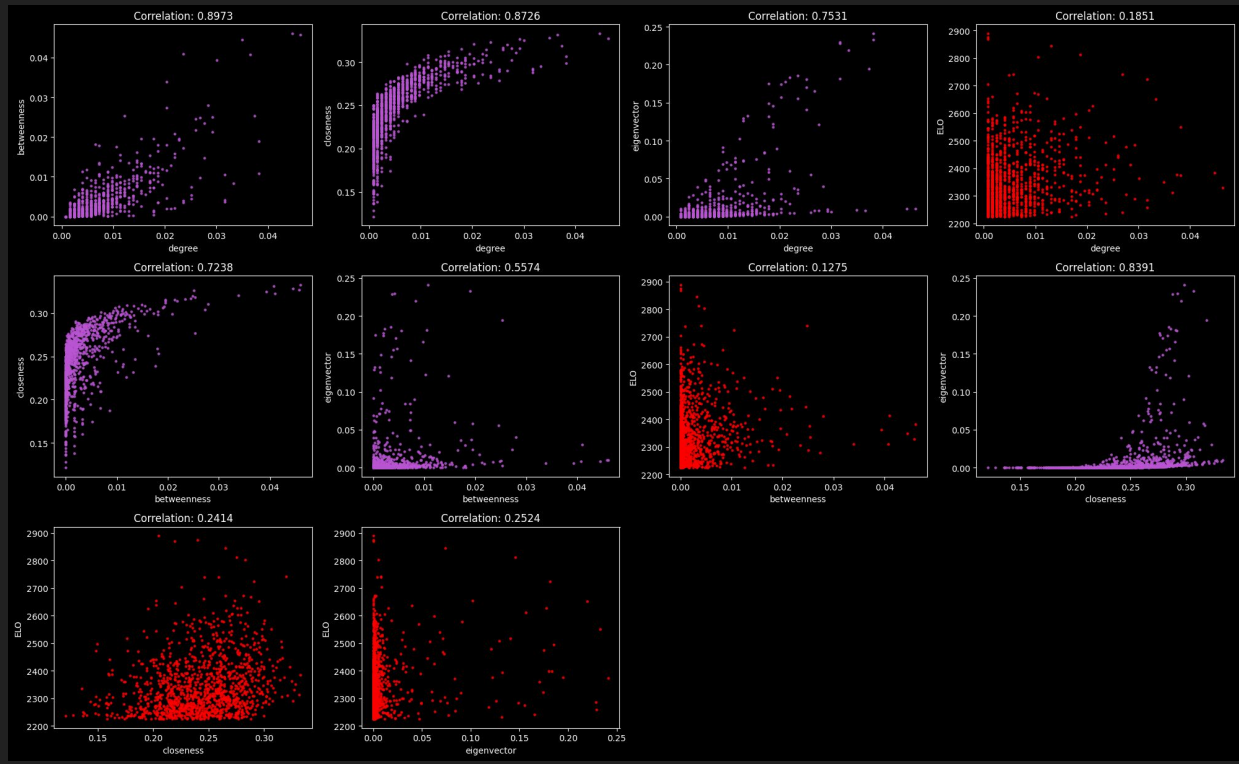
Gorgeous network layout

- Red is more rating
- Purple is less rating
- Bigger size means bigger degree
- More white edges is more mutual games
- More transparent edges is less mutual games
- yellow labels – q99 top-rated players
- white labels – q95 top-degree players



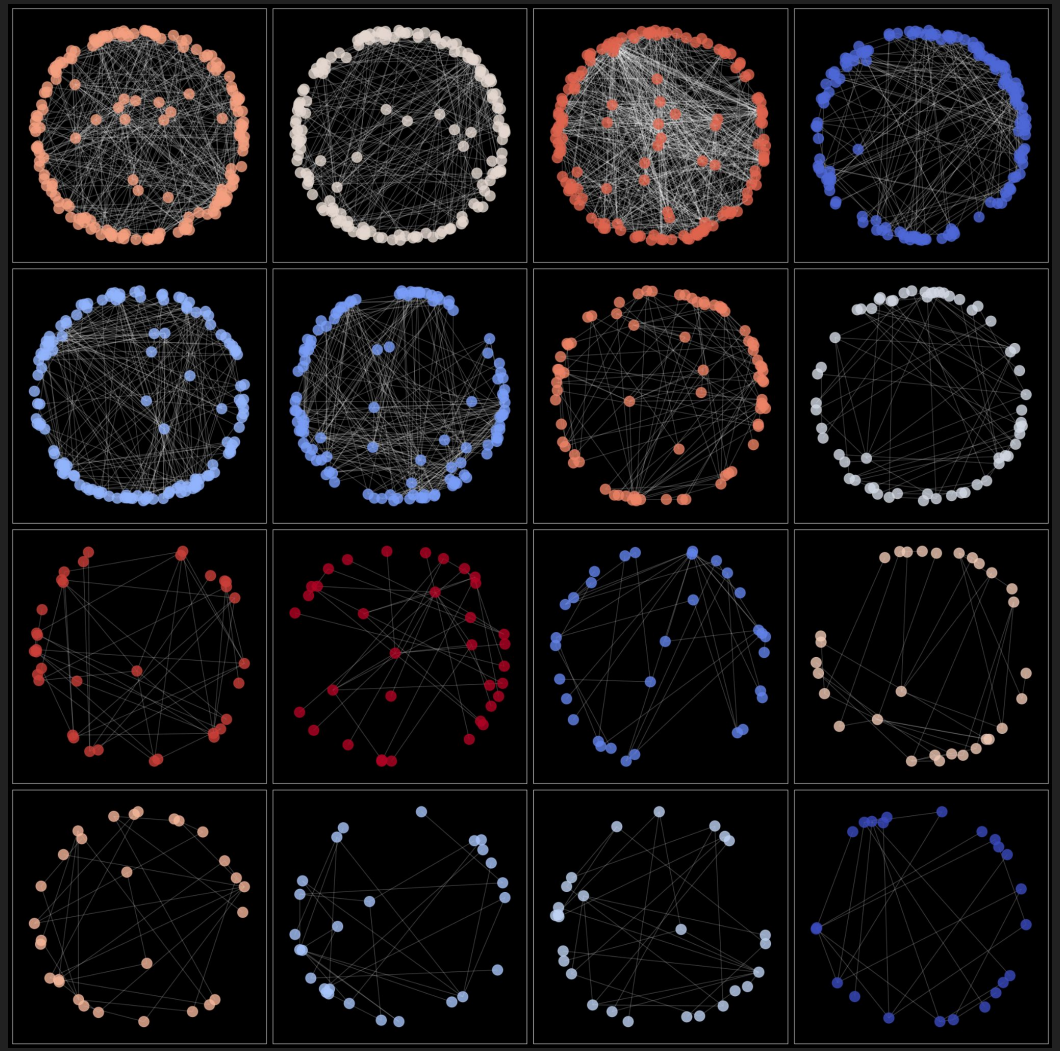
Structural analysis

- All centralities correlate heavily.
- Degree centrality is dominant.
- ELO does not correlate with centralities
- Assortativity by degree: 0.150
- Assortativity by ELO   : -0.003



Community detection

Algorythm	Modularity
Louvain	0.594
Label Prop.	0.023
Girvan-Newman	step 1 0.004, step 2 0.023



Thank you for your attention