

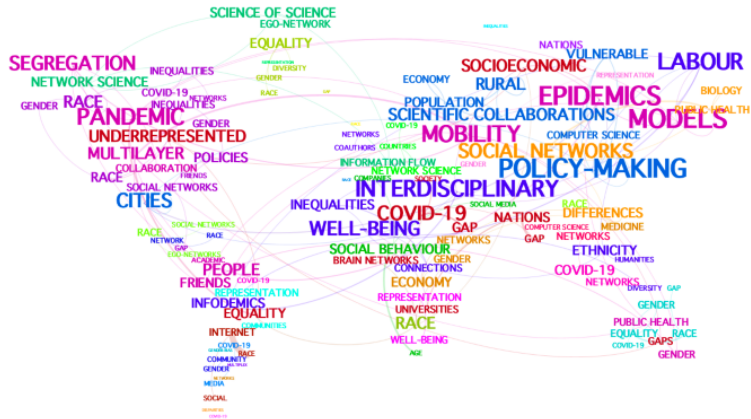
Comparison of network complexity measures

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Network Science



Complexity measures

- ▶ Different subgraph measures
 - ▶ $C_{1e.st}$
 - ▶ $C_{1e,spec}$
 - ▶ $C_{2e,spec}$
- ▶ Product measures
 - ▶ MA_g
 - ▶ MA_{RI}
 - ▶ Cr
 - ▶ Ce
- ▶ Entropy measure
 - ▶ OdC

A product measure that is based on the idea of MA_g .

- ▶ Redundancy of a graph: $R = \frac{1}{m} \sum_{i,j>i} \ln(d_i d_j)$
- ▶ Mutual information of a graph: $I = \frac{1}{m} \sum_{i,j>i} \ln(\frac{2m}{d_i d_j})$
- ▶ An alternative way to state the mutual information:
 $I = \ln(2m) - R$
- ▶ Highest redundancy: $R_{clique} = 2\ln(n-1)$
- ▶ Lowest redundancy: $R_{path} = 2(\frac{n-2}{n-1})\ln(2)$
- ▶ Highest mutual information: $I_{path} = \ln(n-1) - (\frac{n-3}{n-1})\ln 2$
- ▶ Lowest mutual information: $I_{clique} = \ln(\frac{n}{n-1})$

We can define the complexity to be $C = (R - R_{path})(I - I_{clique})$.

MA_{RI} continue

To compare different complexity measures, they need to be normalised: $0 < C < 1$.

The complexity measure can be rewritten as:

$$C = (R - R_{path})(\ln(2m) - R - I_{clique}).$$

$$C = -R^2 + (\ln(2m) - I_{clique} + R_{path})R + (-R_{path}\ln(2m) + R_{path}I_{clique})$$

$$R_{max} = \frac{\ln(2m) - I_{clique} + R_{path}}{2}$$

$$C_{max} = \frac{(\ln(2m) - I_{clique} - R_{path})^2}{4}$$

$$MA_{RI} = \frac{4(R - R_{path})(I - I_{clique})}{(\ln(2m) - I_{clique} - R_{path})^2}$$

Result

Conclusion

Reference

1. <https://appliednetsci.springeropen.com/networked-inequality-studies-on-diversity-and-marginalization>