Revisiting Date and Party Hubs: Novel Approaches to Role Assignment in Protein Interaction Networks

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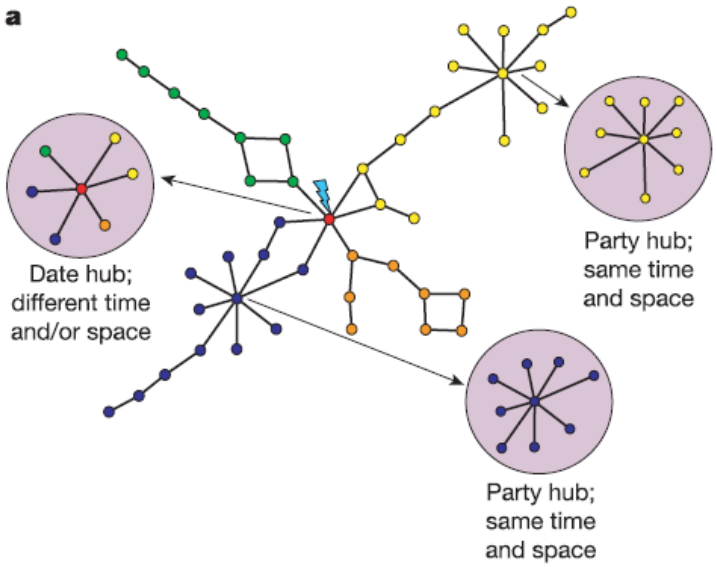
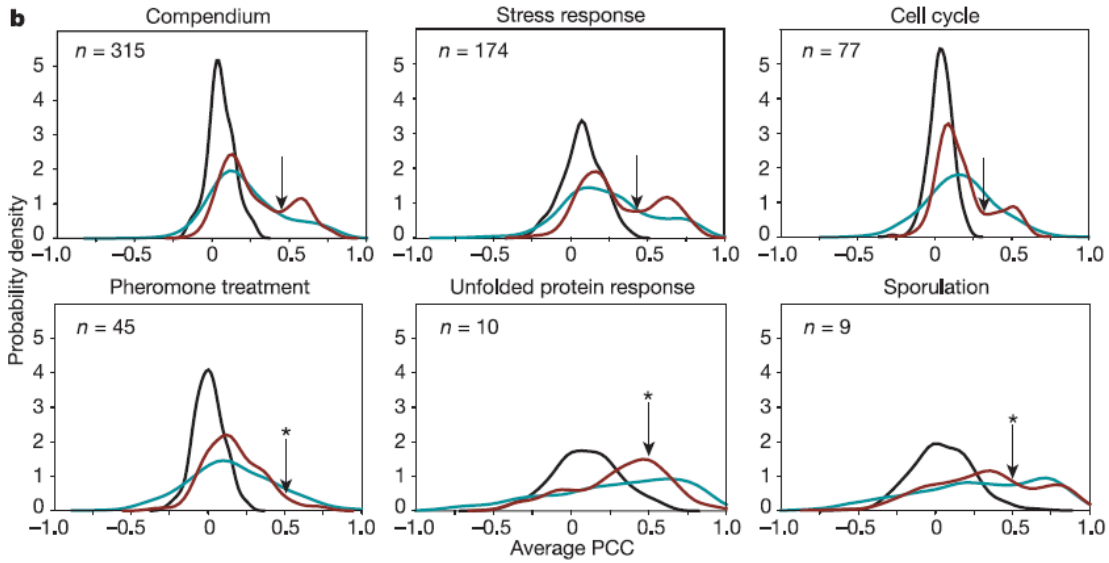
Date and Party Hubs in the Interactome

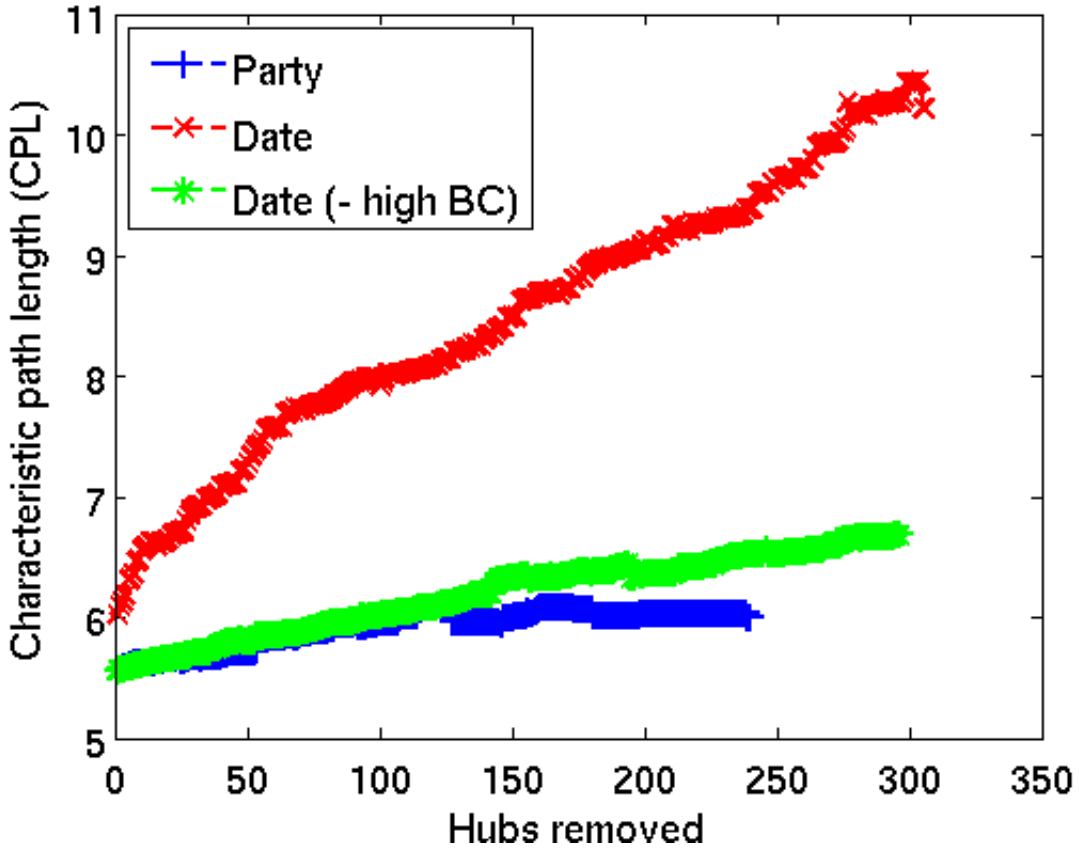
- The Interactome, which can be represented as a network, is the set of all physical protein-protein interactions inside a cell
- Hubs, defined as nodes with degree 5 or greater, were found to fall into two classes based on average co-expression with their interaction partners (Han *et al*. 2004): *date hubs*, which have low co-expression, and *party hubs*, which have high co-expression





Only a Few Hubs are Critical to Connectivity

- Are date hubs really more central to network connectivity than party hubs?
- We used betweenness centrality (BC) to identify significant hubs



High BC Hubs

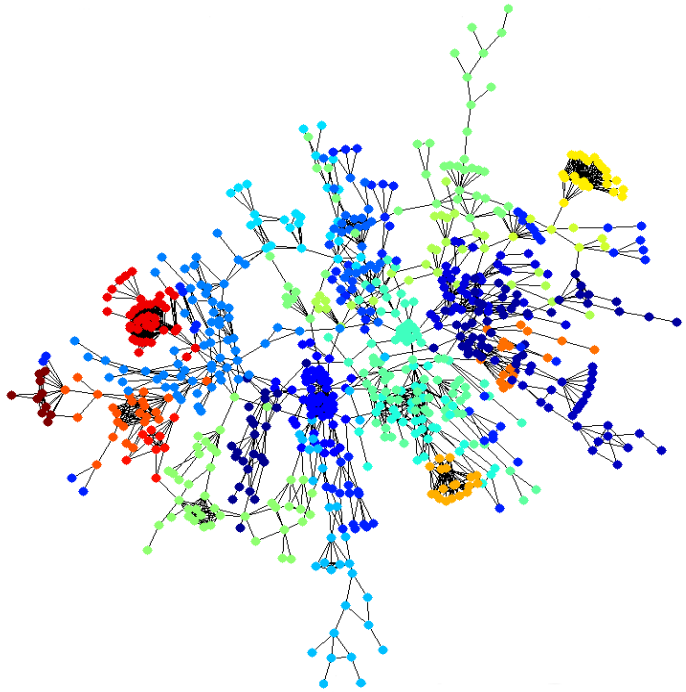
Protein	Degree	AvPCC
CDC28	202	0.06
RPO21	58	0.05
SMT3	42	0.08
ACT1	35	0.13
HSP82	37	0.19
SPT15	50	0.12
CMD1	46	0.05
PAB1	25	0.28
PSE1	24	0.28
GLC7	35	-0.01

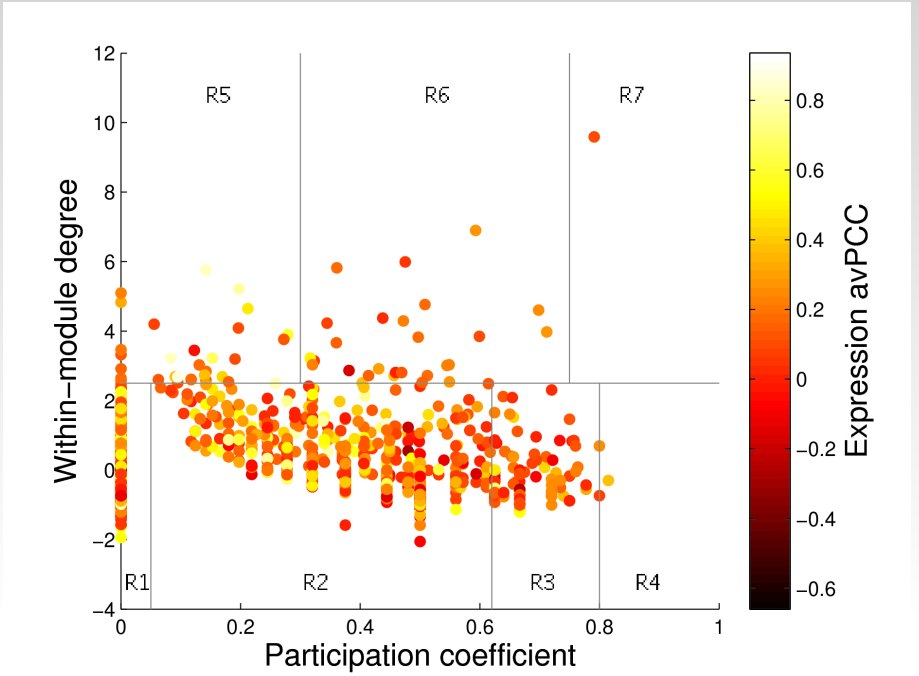
Node Roles do Not Correspond to Date/Party Hubs

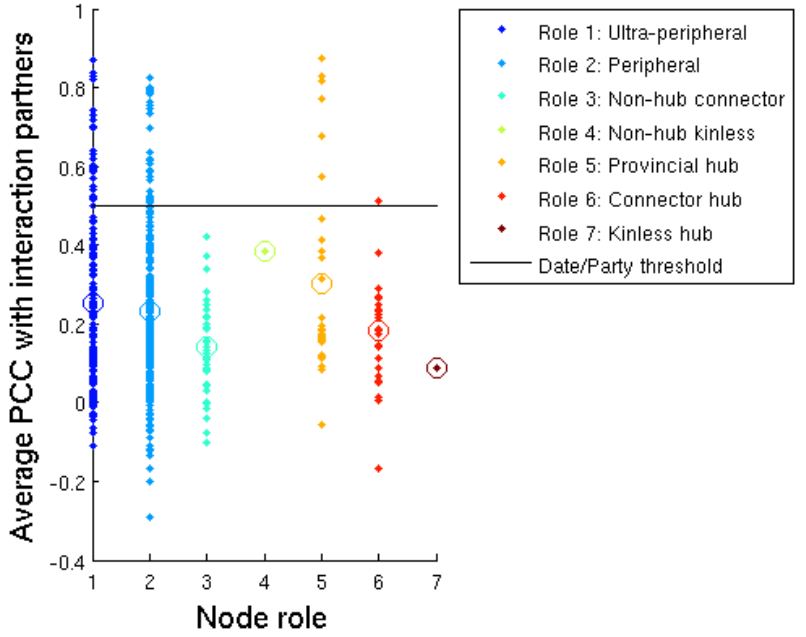
- We partition the network into communities by maximising modularity

$$Q = \frac{1}{2m} \sum_{l=1}^{N} \sum_{i,j \in C_l} \left(A_{ij} - \frac{k_i k_j}{2m} \right)$$

- We use communities to compute within-module degree and participation coefficient (a measure of link spread across communities)
- We assign ‘node roles’ and compare with the date/party classification







Link-centric Approaches May be Useful

- We look at the similarity in the functions of interacting proteins, based on Gene Ontology (Cellular Component) annotations, for each interaction in two datasets
- Fairly strong correlation of betweenness centrality with functional similarity of the interactors, though little correlation with expression correlation. Also, *N-1* value of betweenness seems to act approximately as a threshold