Lecture Notes week 1

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Contents

1 Lecture 1

There were no notes made during lecture one, because I had no idea that it was a lecture.

2 Lecture 2 Strenght of weak ties Chapter 3 and 4

2.1 Triadic closure

Definition 1. $\#wedges(A) = \binom{d(A)}{2} = \frac{d(A)*(d(A)-1)}{2}$

Definition 2. *Clustering coefficients* $c(A) = \frac{\#\ \Delta\ with\ A}{\#\ wedges\ through\ A}$

Examples from the slides:
The triangles with A are: CAO, OAF, CAB, CAD, DAB, BAF, FAG *and* BAG (8 in total) and the triangle with H is: LHM (1 in total).
$d(A) = 6 \Rightarrow c(A) = \frac{8}{6 \cdot 5/2} = \frac{8}{15}$
$d(H) = 4 \Rightarrow c(A) = \frac{1}{4 \cdot 3/2} = \frac{1}{6}$

2.2 Bridges

Definition 3. *Bridge: An edge between u and v is a bridge if deleting this edge results in u and v lying in different components.*

Definition 4. *Local bridge: Edge uv is a local bridge if deleting this edge results in a path ¿ 2 between u and v.*

Question: Let uv be a local bridge. How many friends do u and v have in common?
Click here to show answer
Answer: None. If u and v have a friend in common, the path from u and v would be 2 ($u \rightarrow friend \rightarrow v$). Thus it is not be a bridge anymore.

2.3 Strong and weak ties

Definition 5. *A violates the strong triadic closure property (STC), if it has strong ties to 2 other nodes b and c and there exists no (strong or weak) tie between b and c.*

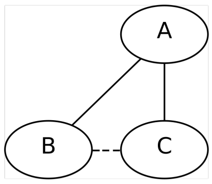
See slides for and exercise on strong and weak ties.

Theorem 1. *If A satisfies the STC and has* ≥ 2 *strong ties, then any local bridge incolving A is a weak tie.*

Example in the slides: Question: FI is a local bridge. Proof that FI is weak.

Informal answer: If FI was strong, the edge GI would exist. If the edge GI existed, FI would not be a local bridge anymore. Thus a contradiction $\perp$.

Formal answer: $\exists$ c such that the edge AC is a strong tie (A has at least one more string tie). The STC implies that CB must now be a tie. This means AB is not a local bridge, because the path $(A \to C \to B)$ is of length two.

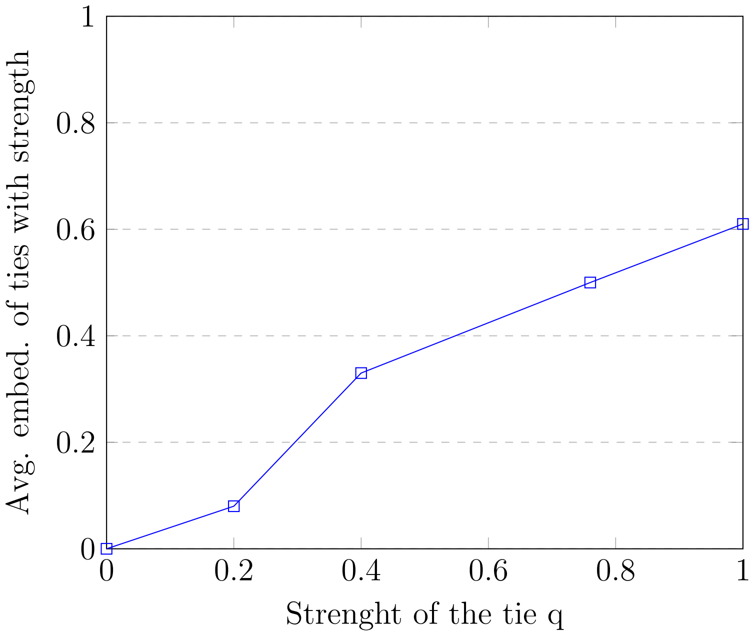


2.4 Embeddedness of an edge

Definition 6. *Embeddedness of an edge AB* $=$ *# common neighbours of A and B*

Definition 7. *Neighbourhood overlap of AB* $= \frac{Embeddednes\ of\ AB}{\#\ nodes\ that\ are\ neighbours\ of\ A\ or\ B}$

Examples on the slides:
Neighbourhood overlap AB $= \frac{4}{6} = \frac{2}{3}$
Neighbourhood overlap FI $= \frac{0}{6} = 0$ (FI is a local bridge)
Neighbourhood overlap FG $= \frac{2}{5}$



$q = fraction of edges with strengh \leq w$

2.5 Linked prediction using number of common friends

Base_line: each common friend given probability p to meet, independent of other common friends.

$P(meet on given day | k common friends) = 1 - (1-p)^k$
Since p is small: $1 - (1-p)^k = \sum_{i=0}^{k} \binom{k}{i} \cdot (-1)^k \cdot p^k = 1 - kp + O(p^2) = 1 - kp$

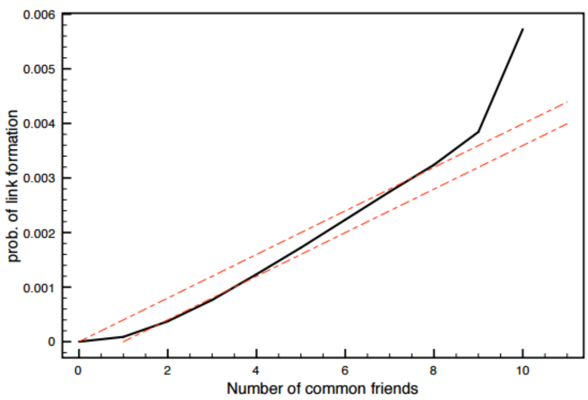


Figure 4.9: Quantifying the effects of triadic closure in an e-mail dataset [259]. The curve determined from the data is shown in the solid black line; the dotted curves show a comparison to probabilities computed according to two simple baseline models in which common friends provide independent probabilities of link formation.

2.6 Homophily

Due to incomprehensible notes, this section is ommited. Voor zover ik het herinner was dit stuk ook niet verplicht. Ze had haat aan dit stukje van het boek en dat wou ze uiten.