Network properties

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Clustering

Clustering measures how often a fighter's opponents have also fought each other.

$$C_i = \frac{2e_i}{k_i(k_i - 1)}, \qquad C = \frac{1}{|V|} \sum_i C_i$$

Interpretation. $C = 0$: opponents of a fighter never fight each other, producing tree-like local structure. $C = 1$: every fighter's opponents form a clique, yielding maximal local redundancy.

Relation to Bayesian inference. High clustering provides multiple independent comparison paths between fighters, reducing posterior uncertainty and enabling consistency checks for transitive skill differences.

Transitivity

Transitivity measures the global prevalence of triangular fight relationships.

Formula.

$$T = \frac{3 \times \text{number of triangles}}{\text{number of connected triples}}$$

Interpretation. $T = 0$: no closed triplets exist; transitive comparisons rely on long chains. $T = 1$: all connected triples are closed; comparisons are maximally redundant.

Relation to Bayesian inference. High transitivity increases the number of overlapping constraints on relative skill, stabilizing posterior estimates of win probabilities for unobserved matchups.

Efficiency

Effiency measures how short fight-path distances are across the network.

Formula

$$E = \frac{1}{n(n-1)} \sum_{i \neq j} \frac{1}{d_{ij}}$$

Interpretation $E = 0$: many fighter pairs are unreachable or separated by long paths. $E = 1$: all fighters are directly connected or separated by a single fight.

Relation to Bayesian inference Higher efficiency means fewer intermediaries (fights between opponents...) are needed to relate fighters, limiting uncertainty accumulation when inferring transitive win probabilities.

Connectivity

Connectivity measures whether all fighters belong to a single connected component.

Formula

$$\kappa = \frac{|\text{largest connected component}|}{|V|}$$

Interpretation $\kappa = 0$: the network is entirely fragmented into isolated nodes. $\kappa = 1$: the fight graph is fully connected.

Relation to Bayesian inference Only connected components allow data-driven comparisons; disconnected components force cross-group win probabilities to be driven by prior assumptions rather than evidence.

Closeness

Degree centrality

The degree centrality for a node v is the fraction of nodes it is connected to. It is normalized by dividing by the maximum possible degree in a simple graph, $n-1$ where n is the number of nodes in G.