Define Importance Metric for Individual Nodes in Heterogeneous Network

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  Toy Example:

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  An individual is important if assigning it special parameters increases model fit more than model complexity.
  Can be quantified using a statistical model score.

  size of population from which individual is drawn
  Learning: Input = relational database \( D \), target individual \( t \).
  1. Learn a generic Bayes net \( B_p \) for the entire database.
  2. Restrict database to target individual. Learn Bayes net \( B_t \) for restricted database \( D_t \).

  Interpretation: Randomly draw an individual \( x \) from \( P \).
  1. \( x = t \), the target individual. Apply the individual Bayes net \( B_t \) to the data \( D_t \) for the target individual.
  2. \( x \neq t \), Apply the generic Bayes net \( B_p \) to the database \( D_t \) without the target individual.

Example: individual team = Manchester City
\( D_t \) = matches played by ManCity

Team Evaluation
• Score improvement, BIC values and actual scores driven from data for 8 teams in Premier League.

Player Evaluation
• Score improvement, BIC values and actual scores driven from data for 8 players in Manchester City.

For Teams, ranking based on score Improvement has a high correlation with actual ranking of teams (0.65).
For Players, ranking based on score Improvement has also a high correlation with salary of players (0.67).

Conclusion
• New statistical method for importance metric for individuals in networks.
• Heterogeneous networks: different node types, link features, parameters.
• Use model selection scores from statistical-relational learning.
• Team-Player problem: measure importance of individual for team result.
• On soccer data, importance metric correlates with other rankings.

References
• O. Schulte, F. Riahi, Q. Li, Identifying Important Individuals in Relational Data, AAAI late breaking papers.
• O. Schulte, A tractable pseudo-likelihood function for Bayes nets applied to relational data, SIAM SDM, 2011.