Patent Citation Analysis for Technology Management

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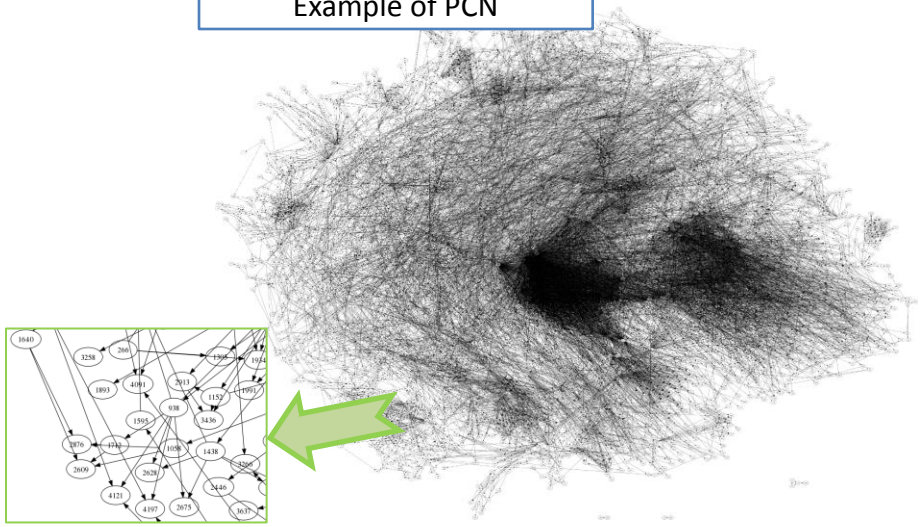
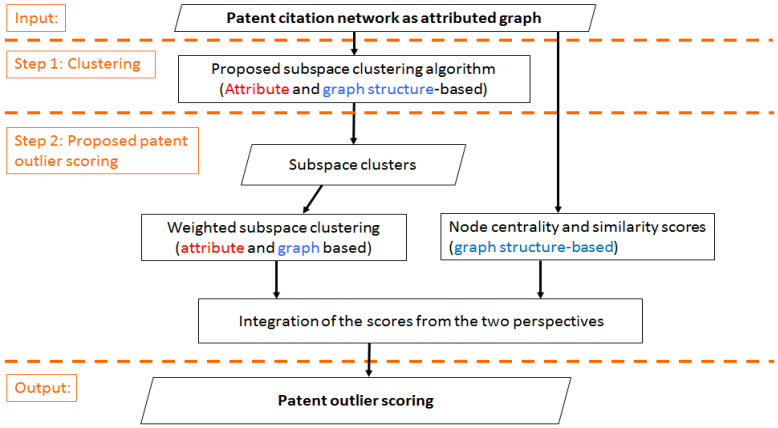
- Mine valuable information from complex network
  - –Identify core technologies and identify new technology opportunities
  - –Focus research and development investment and follow technological trends over time
- Patent citation networks (PCN) have specialized characteristics
  - –Graph structure contains important citation relationship information
  - –Nodes can be seen as individual objects described by carefully assigned multivariate attribute data
  - –No existing approach for node outlier ranking in PCN that considers both graph structure and attribute data for patents

Example of PCN



- Objective
  - –Outlier ranking method for patents in patent citation networks based on both graph structure data and patent attribute data

Flowchart of Outlier Scoring Method



- Proposed integrated outlier function

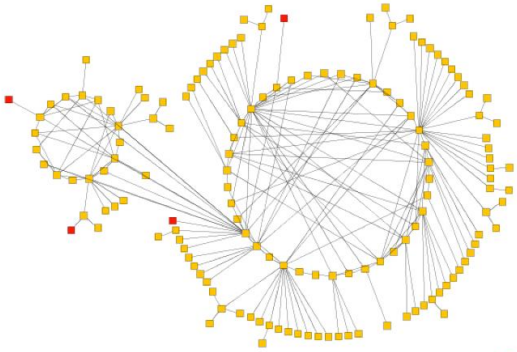
$$OS_I(o) = (w_C \times OS_C(o)) + (w_G \times OS_G(o))$$

$$= w_C \times \sum_{o \in (C_i, S_i)} w_i^o \left[\alpha \times \left(\frac{|C_i|}{C_{max}} \right) + (1-\alpha) \times \left(\frac{|S_i|}{S_{max}} \right) \right] + w_G \times \frac{c(o)}{c_{max}},$$

where $$OS_C(o) = \sum_{o \in (C_i, S_i)} w_i^o \left[\alpha \times \left(\frac{|C_i|}{C_{max}} \right) + (1-\alpha) \times \left(\frac{|S_i|}{S_{max}} \right) \right]$$

$$OS_G(o) = \frac{c(o)}{c_{max}} \quad \text{where} \quad c(o) = \sum_{k=1}^{N} [A_{ok} + C_{ok}],$$

Experiment on a real-life PCN



Outlier rank	Patent
1	US-6216183
2	US-5930767
3	US-6026193
4	US-6038564
5	US-6041412

- "Patent clustering and outlier ranking methodologies for attributed patent citation networks for technology opportunity discovery", *IEEE Transactions on Engineering Management* (Under review)