

Bibliographically Coupled Patents: Their Temporal Pattern and Combined Relevance

C.-H. Max Kuan

National Taiwan University of
Science and Technology (NTUST)



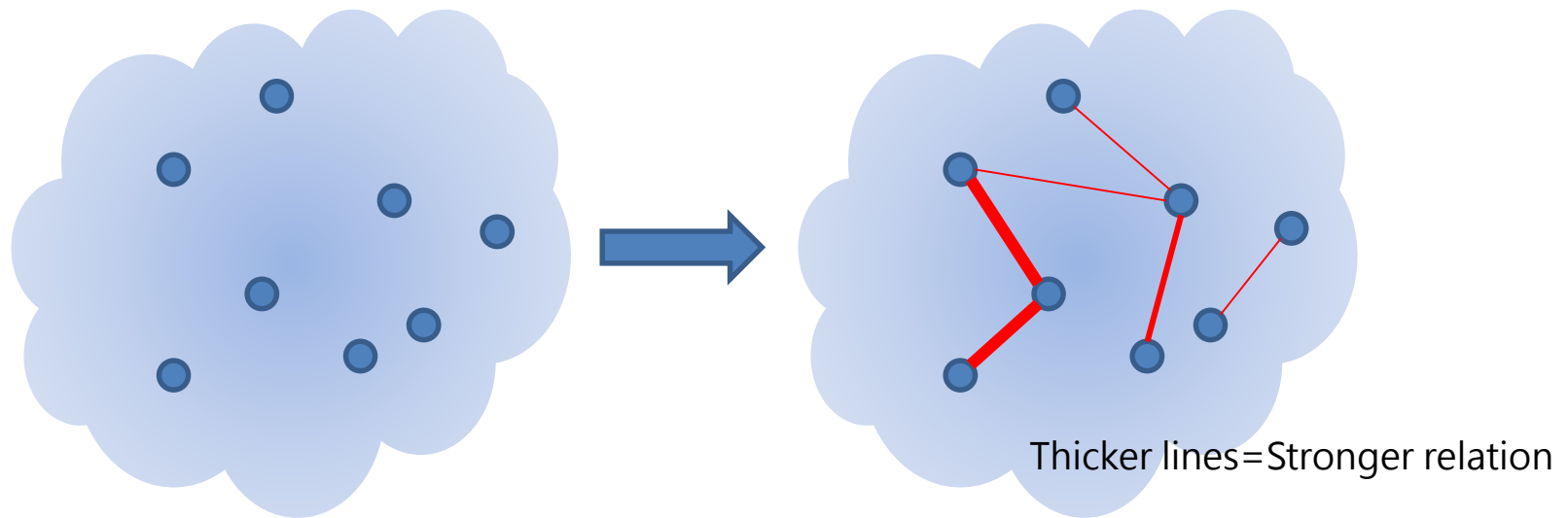
Outlines

- **Relatedness between patents**
- **Temporal pattern of BCed patents**
- **Patent and Reference Expansion**
- **Combined Relevance**



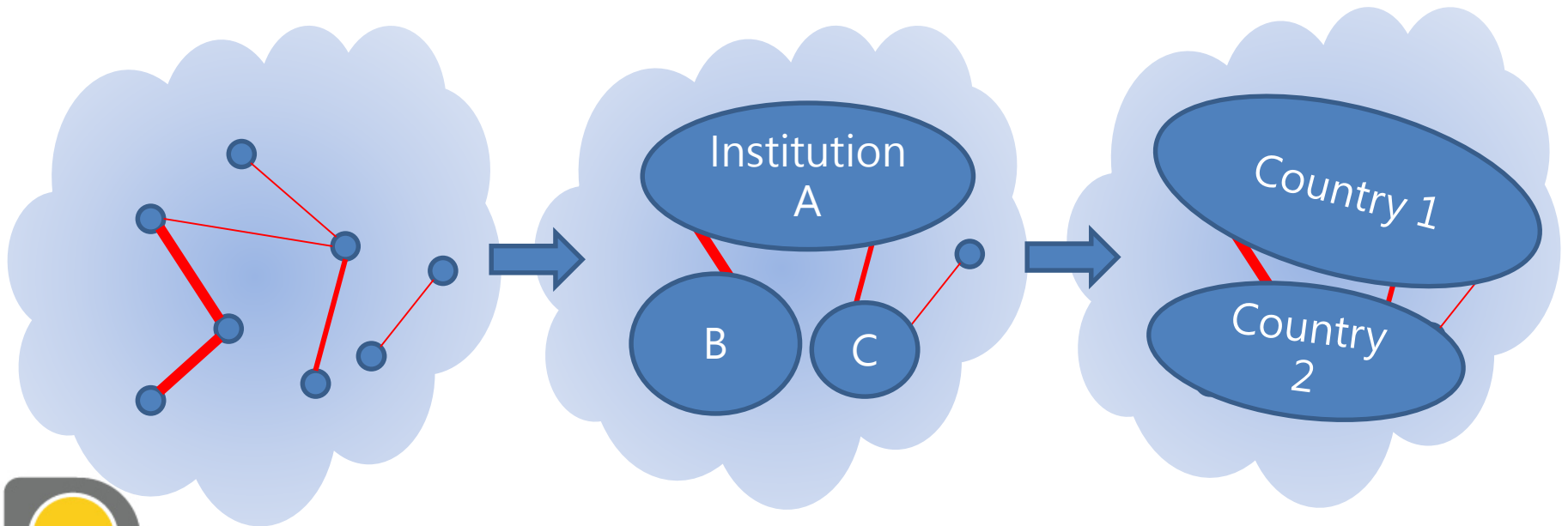
Relatedness between patents

- Patent bibliometric works often involve the detection and measurement of relatedness between patents



Relatedness between patents

- Then, we may observe cooperation/competition relationship, knowledge exchange, ...between entities



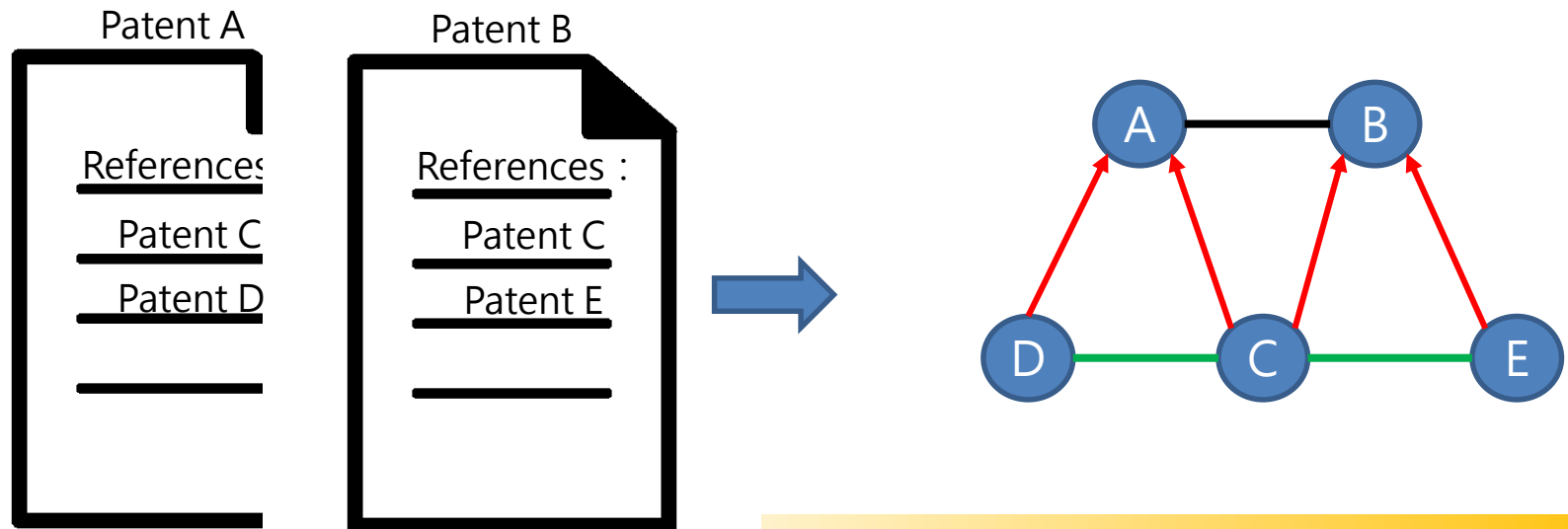
Approaches in detecting and measuring patent relatedness

- Text-based
- Classification-based
- **Citation-based**



Citation-based approaches

- **Direct citation (DC)**
- **Co-citation (CC)**
- **Bibliographic coupling (BC)**

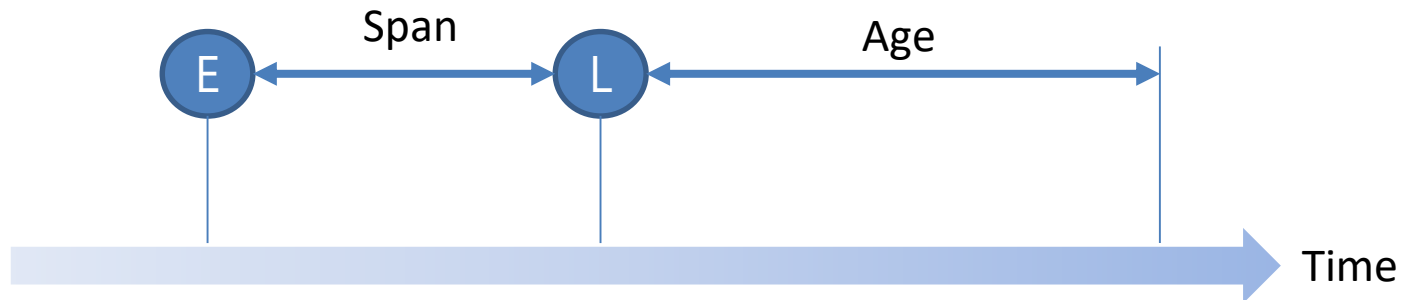


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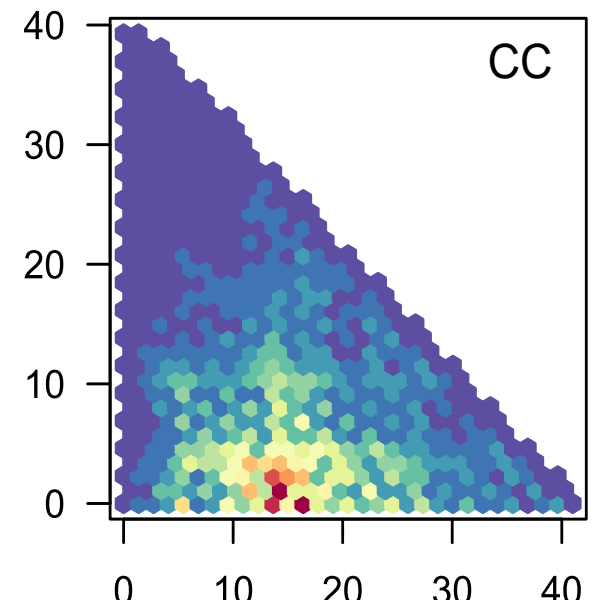
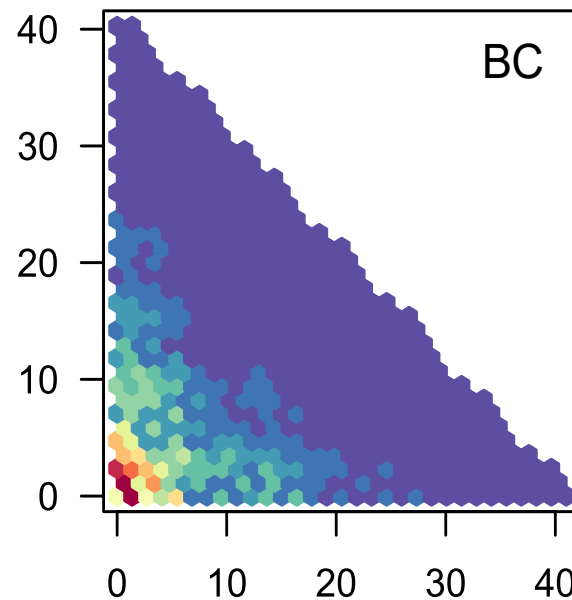
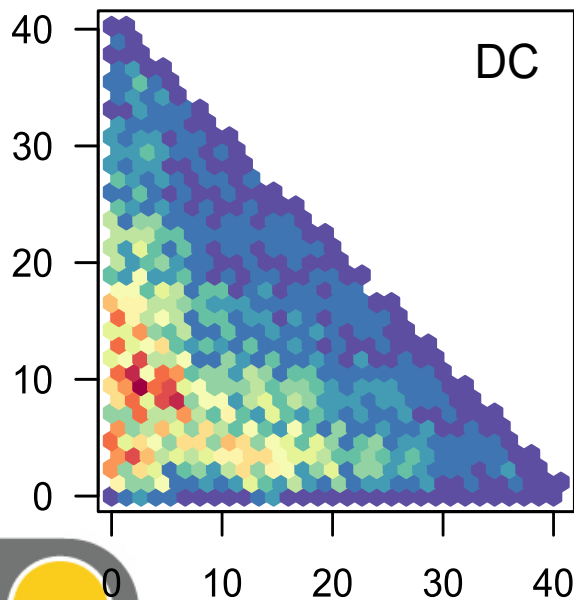
Temporal pattern of BCed patents

- Age and Span of Patent Pairs
 - Age: how long ago the later patent (P_L) is issued
 - Span: P_E and P_L 's distances in time



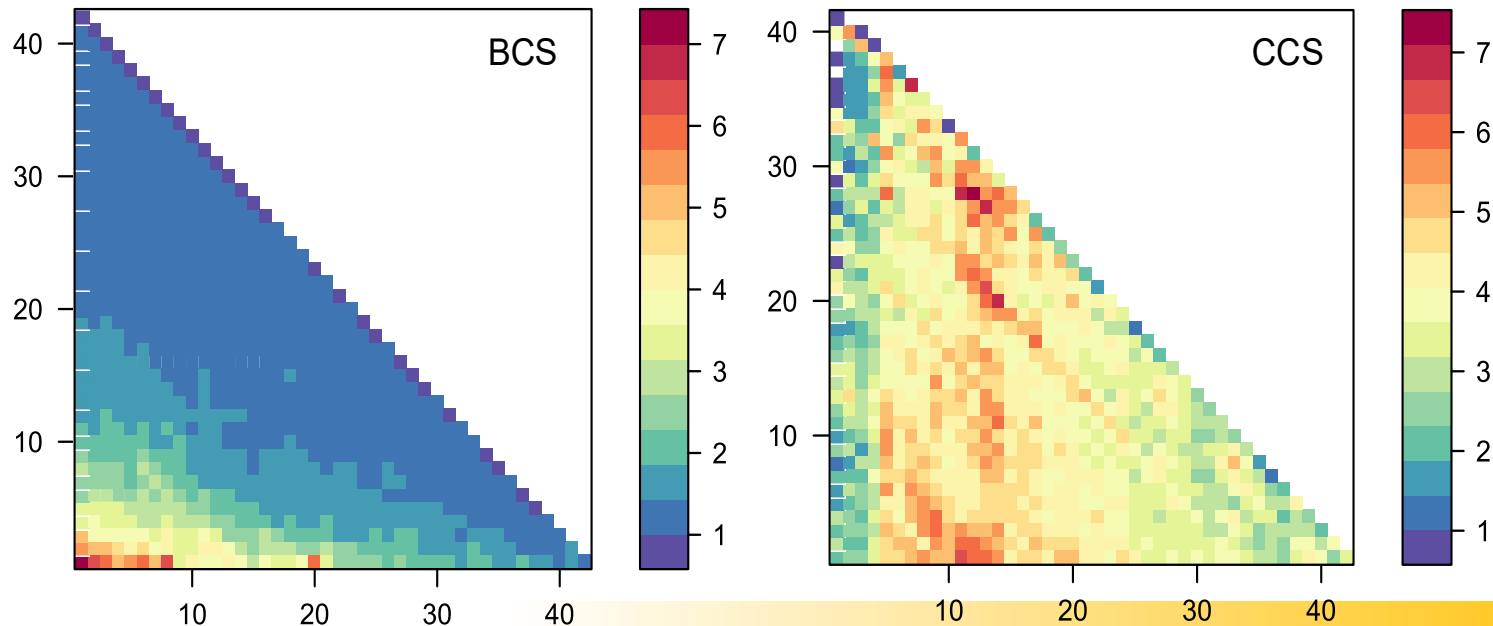
Temporal pattern of BCed patents

- Frequency distributions
 - X axis: age in years; Y axis: span in years
 - More **reddish** or **bluish** points reflect higher or lower counts



Temporal pattern of BCed patents

- Average BCS and average CCS
 - X axis: age in years; Y axis: span in years
 - More reddish or bluish points reflect higher or lower values

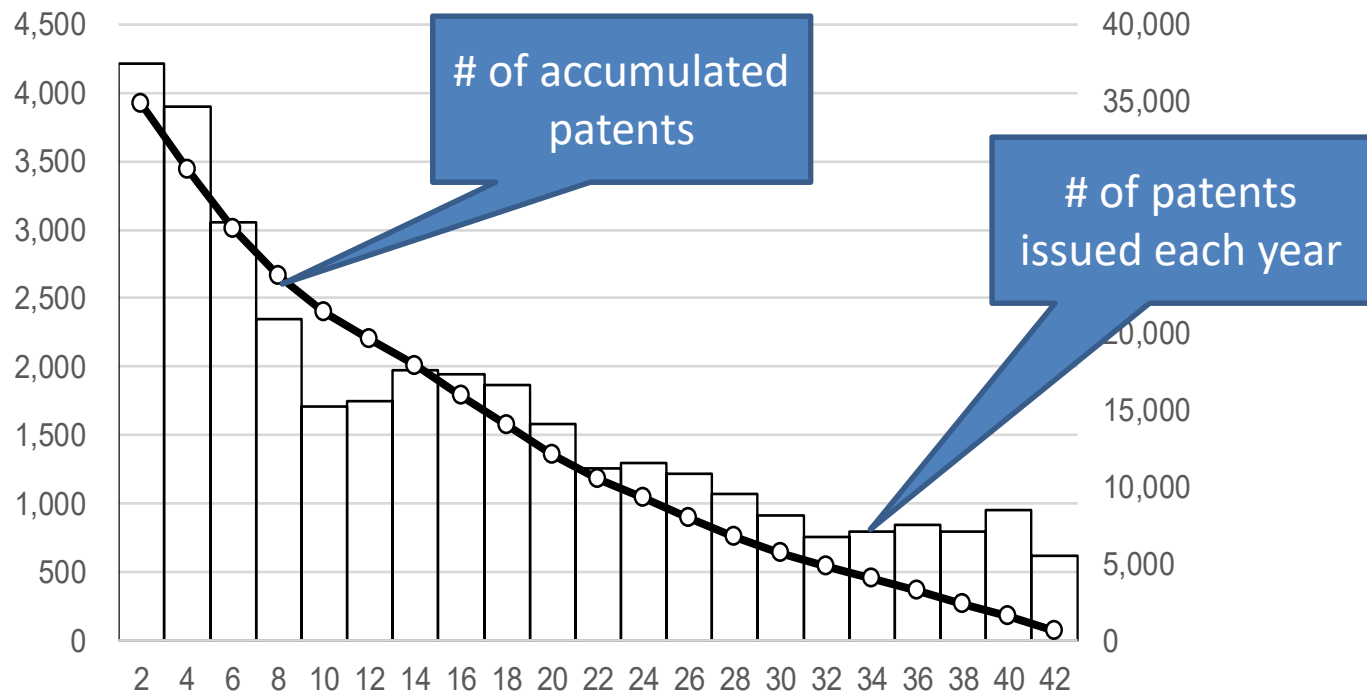


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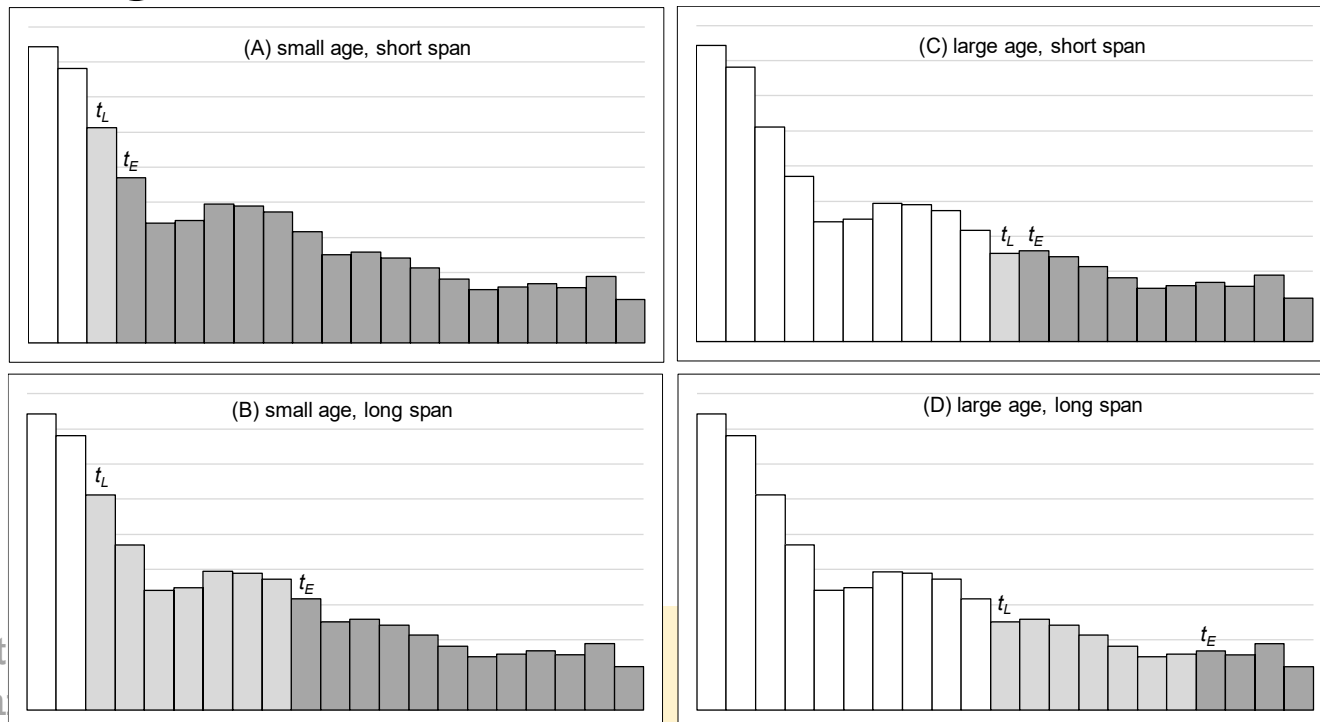
Patent and Reference Expansion

- A field's continuously increasing numbers of accumulated patents



Patent and Reference Expansion

- BC is more frequently found between patents issued more recently and closer in time, and their BCS also tends to be stronger



Implication to BCS threshold

- Conventional Methods

- P_E and P_L have references REF_E and REF_L respectively

- Jaccard coefficient

- $\frac{|REF_E \cap REF_L|}{|REF_E \cup REF_L|} \leq \frac{|REF_E|}{|REF_E \cup REF_L|} \leq |REF_E|$

- Coupling angle (cosine similarity)

- $\frac{\overrightarrow{REF_E} \cdot \overrightarrow{REF_L}}{|\overrightarrow{REF_E}| |\overrightarrow{REF_L}|} = \frac{|REF_E \cap REF_L|}{|\overrightarrow{REF_E}| |\overrightarrow{REF_L}|} \leq \frac{|REF_E|}{|\overrightarrow{REF_E}| |\overrightarrow{REF_L}|} \leq |REF_E|$

- Aged or long-spanned patent pairs are not only fewer but also inherently limited in their coupling strength



Limitation

- Citable patent expansion and cited reference expansion contribute to the temporal pattern.
 - The cited reference expansion is particularly applicable to U.S. patents, as U.S. requires full and obligatory disclosure from patent applicants.
 - There is a lack of evidence that non-U.S. patents would undergo cited reference expansion of comparable degree.



Implication to BCS threshold

- Bibliometric researchers had noticed the age and span problem.
 - “an increase of the distance in time between bibliographically coupled articles leads to a diminishing pool of shared references as there is a tendency to cite the more current articles” (Jarneving, 2007b)
 - Usually an observation window is set up so that bibliographically coupled research articles
 - published closer (i.e., about the same age)
 - within the window (i.e., within limited span)are collected and compared together (cf. Jarneving, 2007b; Glänzel, & Czerwon, 1996).



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Combined Relevance

- To observe the knowledge flow or to develop a representative trajectory among patents across a long period of time
- a BCS measure as much immune to their ages and spans as possible would be desirable



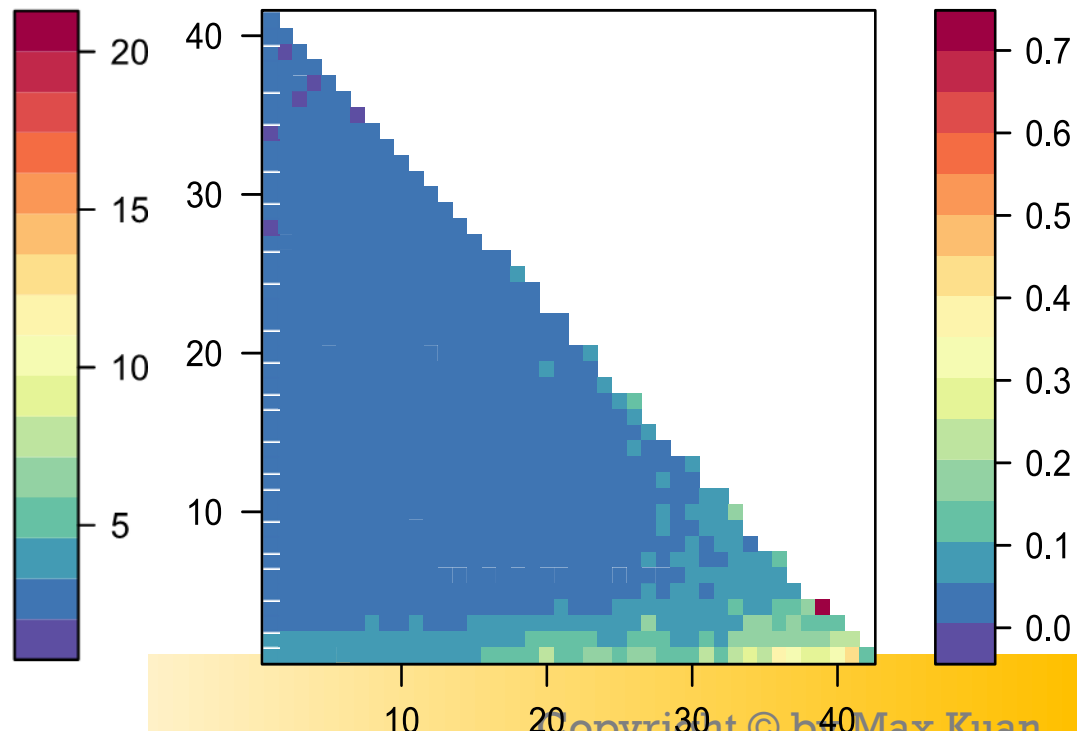
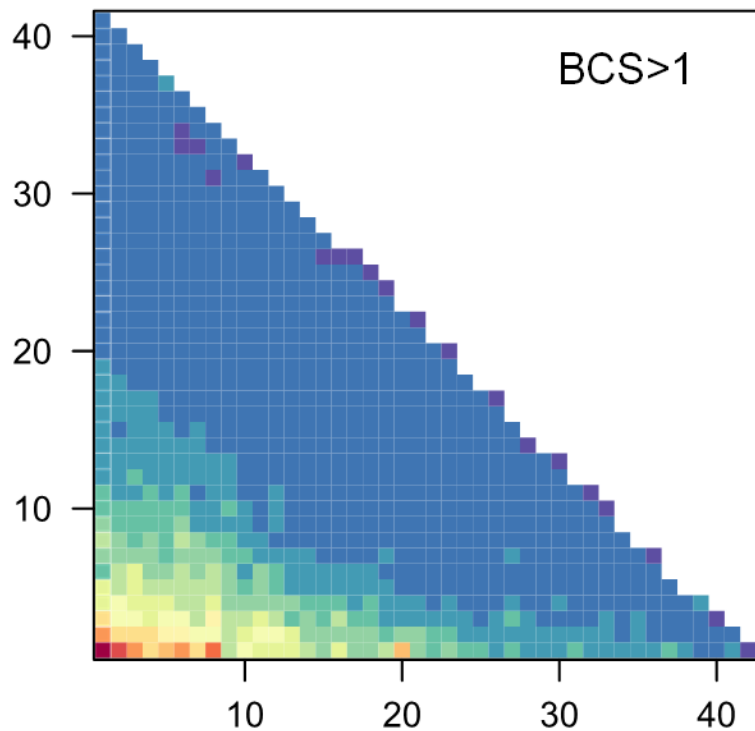
Combined Relevance

- $\left(\frac{|REF_E \cap REF_L|}{|REF_E|} \right) \left(\frac{|REF_E \cap REF_L|}{|REF_L|} \right) = \frac{|REF_E \cap REF_L|^2}{|REF_E| |REF_L|}$
 - $REF_E \cap REF_L$ is the information shared between P_E and P_L
 - Left factor: how much this shared information relevant to P_E
 - Right factor: how much this shared information relevant to P_L



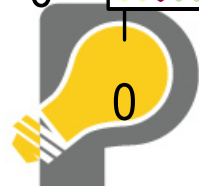
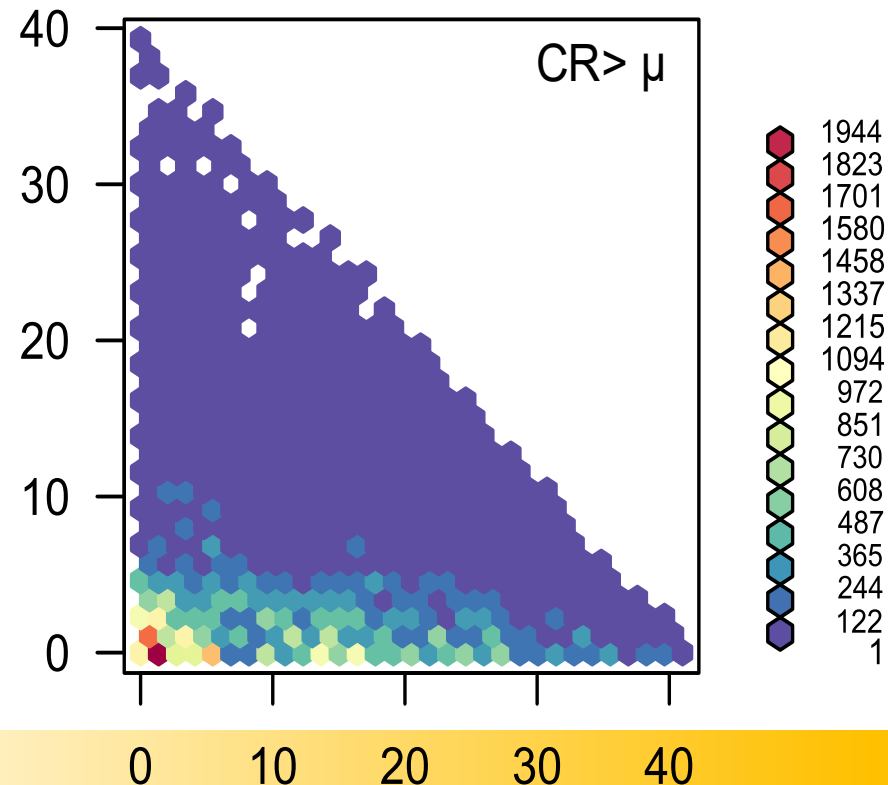
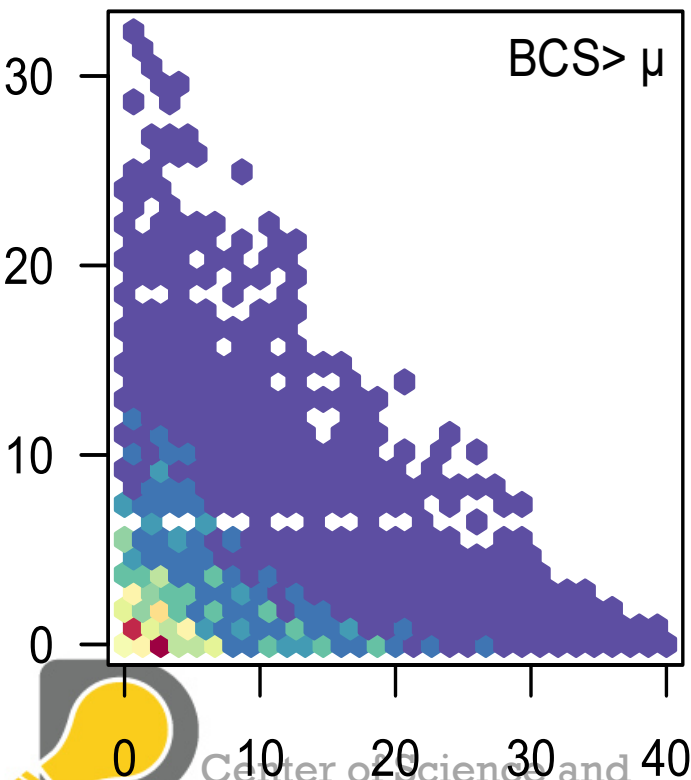
Combined Relevance

- Average BCS vs. average CR
 - CR's is relatively more uniform distributed across ages and span



Combined Relevance

- Frequency distribution
 - CR also retains more aged and long-spanned pairs



Combined Relevance

- CR is not ideal as observed above, but it is as simple as the conventional measures, both conceptually and computationally.
- For observing long-term knowledge dissemination or tracing overall development trajectory, CR may be an alternative.



Thank You