Analysis on patent collaborative patterns for emerging technologies:

a case study of Nano-Enabled Drug Delivery

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Introduction

- Collaborative networks accelerate the knowledge flow and technology diffusion. This can improve innovation efficiency and the development of industry.
- Over 50% of NEDD patenting organisations have some co-patenting. This implies that study of such collaboration is becoming more important than previously presumed.
- How to analyse a co-patenting network and benefit from it? For organisations, whether they can find some ideal partners from the existing network to get involved with some advanced target research achievement or technologies?
- We show methods to analyse the evolution of collaboration patterns, to gain insight into relationships between co-patenting and provide valuable information as a leading indicator of partner selecting and future mergers.

Questions

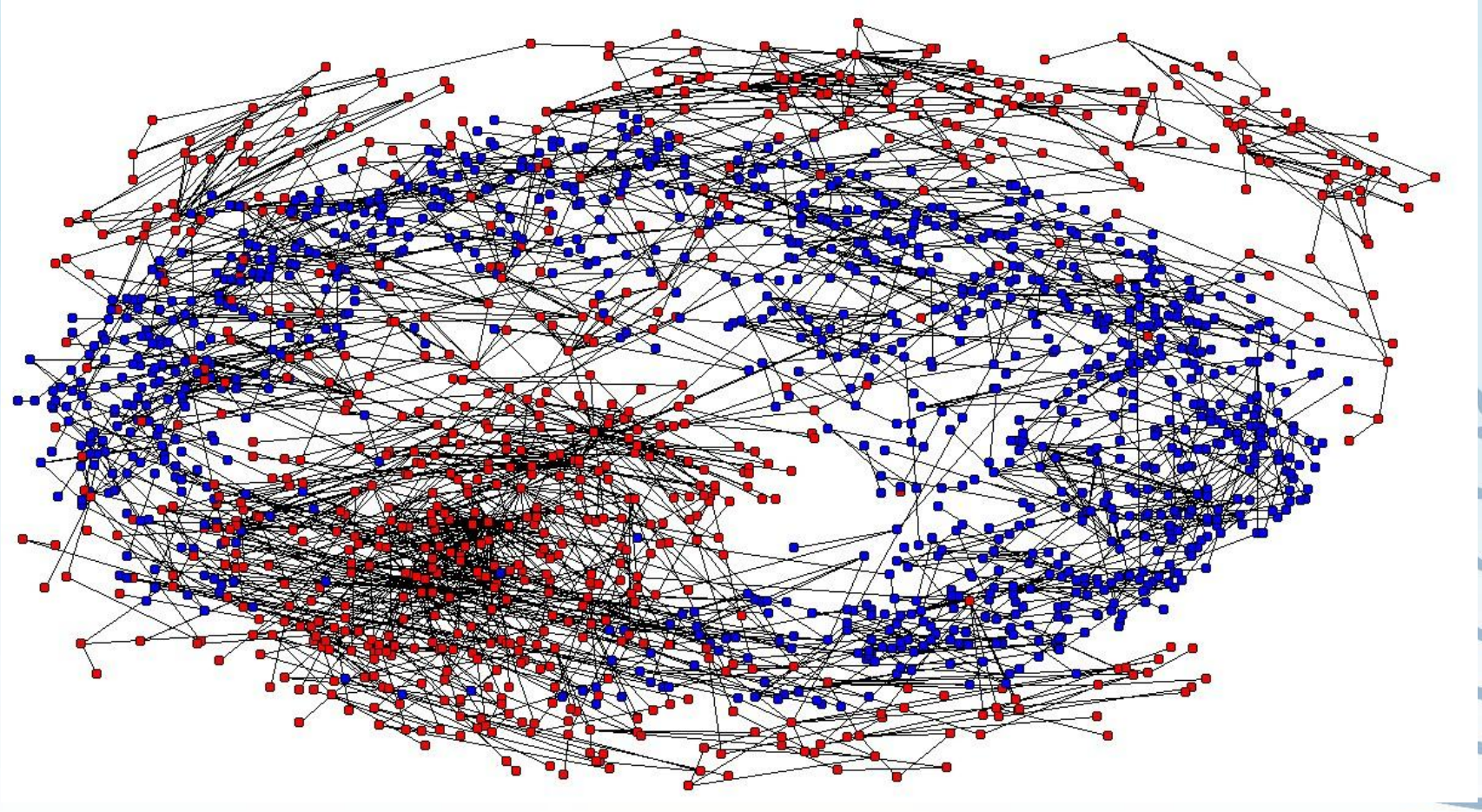
We construct the network by using co-occurrence of assignees (DII data). For these collaborative patents, they are assigned to at least two organisations. To explore this network and achieve our purposes, we present three detailed questions and answer them by using Social Network Analysis.

Q1: who are the key players in this network and what are their characteristics?

Q2: how does this network evolve?

Q3: why some assignees repeat their collaboration?

Collaborative Network of NEDD



Q1: Key Assignees

Number of Records

Table 1

Assignee	DII Code	Records	Co-assignee patents	Country	Type
TAKEDA PHARM CO LTD	TAKE	125	**13**	JP	C
MONSANTO TECHNOLOGY LLC	MONS	124	**114**	US	C
UNIV CALIFORNIA	REGC	118	22	US	A
STINE SEED FARM INC	STIN-N	109	**109**	US	C
INCYTE GENOMICS INC	INYT	106	**0**	US	C
US DEPT HEALTH&HUMAN SERVICES	USSH	95	37	US	G
SMITHKLINE BEECHAM CORP	SMIK	88	17	UK	C
BRISTOL-MYERS SQUIBB CO	BRIM	74	14	US	C
CNRS CENT NAT RECH SCI	CNRS	73	54	FR	A
BAYER AG	FARB	67	13	DE	C

Notes: Country stands for where headquarter is.

For type, C is company, A is academic or research institute and G is government department.

Q1: Key Assignees

Degree Centrality—Direct partners

Assignee	DII Code	Degree	Country	Type
CNRS CENT NAT RECH SCI	CNRS	59	FR	A
INSERM INST NAT SANTE&RECH MEDICALE	INRM	33	FR	A
US DEPT HEALTH&HUMAN SERVICES	USSH	33	US	G
MASSACHUSETTS INST TECHNOLOGY	MASI	26	US	A
UNIV CALIFORNIA	REGC	21	US	A
NAT AGRIC&FOOD RES ORG	IASC	20	JP	A
NAT INST ADVANCED IND SCI & TECHNOLOGY	NIIT	20	JP	A
INST PASTEUR	INSP	18	FR	A
UNIV TOKYO	UYTY	17	JP	A
UNIV WASHINGTON	UNIW	16	US	A

Notes: Country stands for where headquarter is.

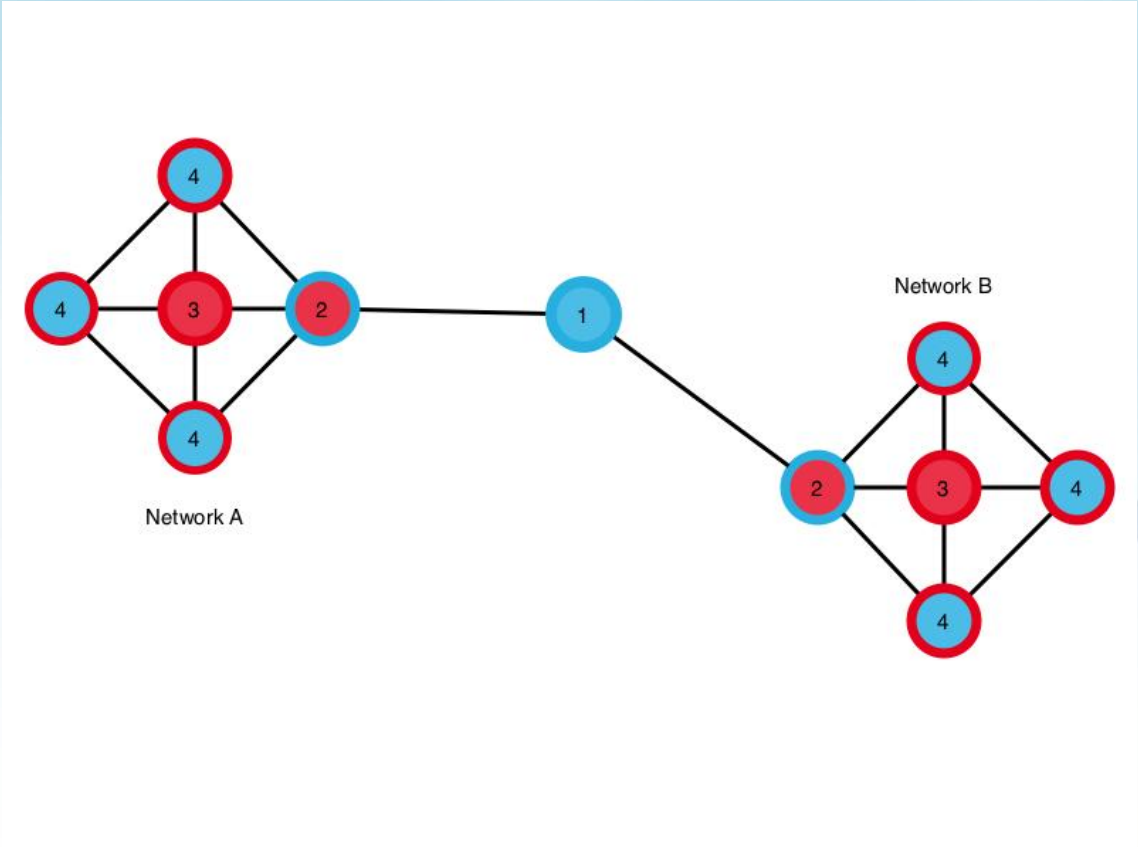
For type, C is company, A is academic or research institute and G is government department.

In NEDD, research institutes and universities are the basis of constructing the whole network.

Q1: Key Assignees

Betweenness Centrality—power and influence all over the network

number of shortest paths passing through an actor



Q1: Key Assignees

Betweenness Centrality—Brokers and Gatekeepers

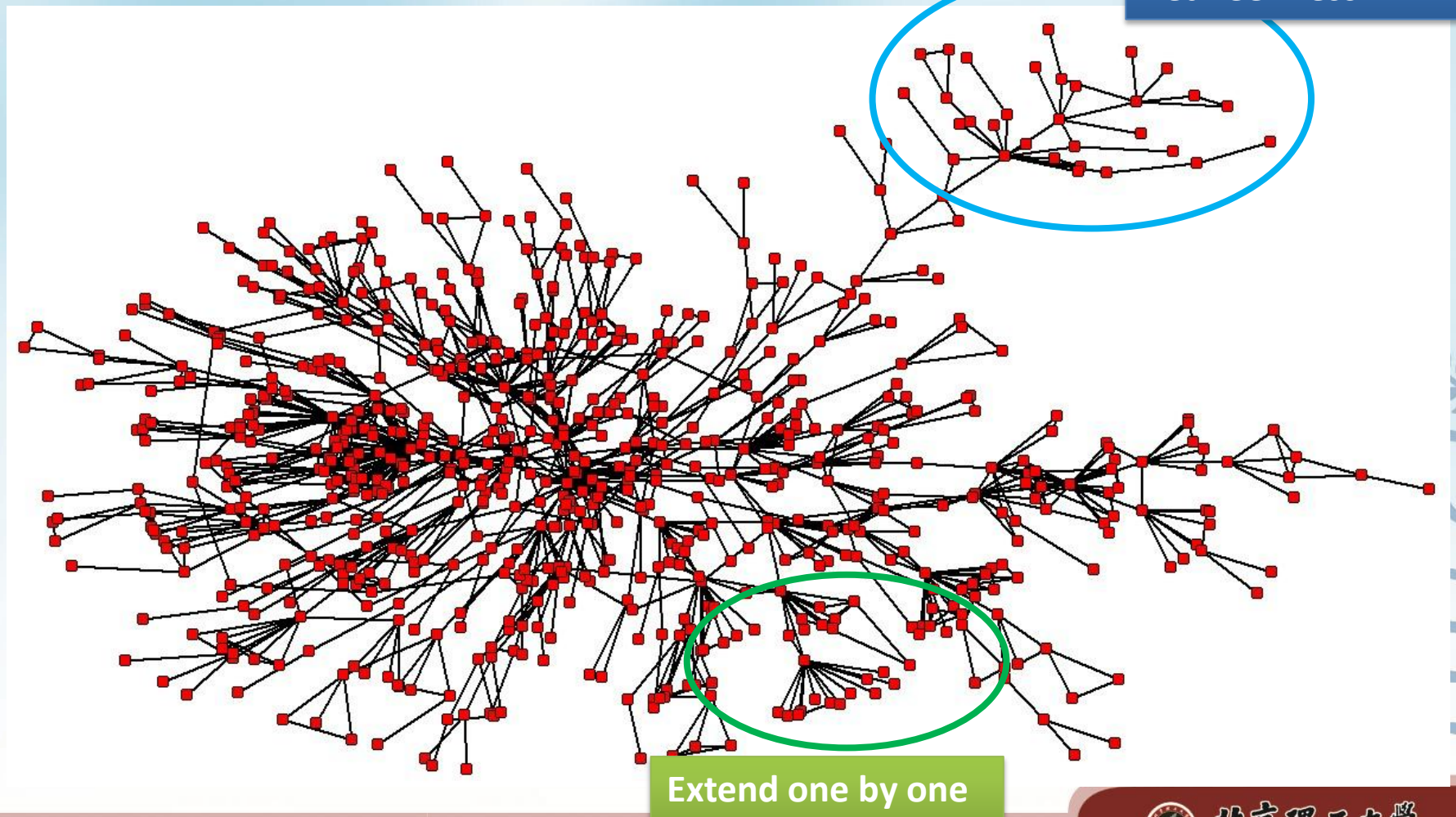
Assignee	DII Code	Betweenness	Country	Type
US DEPT HEALTH&HUMAN SERVICES	USSH	126420.53	US	G
ASTRAZENECA AB	ASTR	66882.63	UK	C
CNRS CENT NAT RECH SCI	CNRS	66809.07	FR	A
UNIV CALIFORNIA	REGC	64513.78	US	A
TAKEDA PHARM CO LTD	TAKE	55216.70	JP	C
MASSACHUSETTS INST TECHNOLOGY	MASI	45831.59	US	A
WYETH	AMHP	41993.03	US	C
SUMITOMO PHARM CO LTD	SUMU	39462.73	JP	C
CURAGEN CORP	CRGE	34736.15	US	C
GENENTECH INC	GETH	31186.00	US	C

Notes: Country stands for where headquarter is.

For type, C is company, A is academic or research institute and G is government department.

Companies chiefly play the busy role of brokers and gatekeepers. Companies are better at obtaining technology and knowledge from various sources for commercial and practical purposes. Institutional type doesn't show a decisive effect.

Q2: Evolution



Q2: Evolution

Year	Active nodes	Ties	Density
2000	105	152	0.05%
2002	262	592	0.21%
2004	378	964	0.34%
2006	488	1378	0.49%
2008	601	1718	0.61%
2010	692	2094	0.75%
2012	750	2370	0.84%

Q3: Repeated Collaboration

Industry-Industry	Merger, shareholding and other commercial relations

Q3: Repeated Collaboration

Industry-Academic	Location proximity

Q3: Repeated Collaboration

Academic-Academic	Location proximity

Q3: Repeated Collaboration

Others	Government

Conclusions

Answering the three questions, we analyse the topological properties and characteristics of the co-patenting network in NEDD, figure out the key organisations from different perspectives and give clues for organisations to select their partners or future merger.

- figure out their position in the network
- to achieve basic research achievements, academic or research institutes from the same country
- better if academic organisations have high degree centrality but no long-term industrial cooperation
- establish a co-patenting group with other companies or academic organisations firstly, to get a better insight to exam their future merger candidates or partners

Further Study

- more attributes of assignees should be taken into consideration to explore motivations for the observed network growth
- to examine differences in co-patenting from different regions
- whether they join their research strength or just purchase the intellectual properties
- whether some specific characteristics influence their partner selection and if this process can be modelled

THANK YOU!

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