

Research on China's Urban Network Based on the Relations between Micro-blog Users: a Case Study of Sina Micro-blog

Feng Zhen Professor
Nanjing University, China
zhenfeng@nju.edu.cn

Outline

- **Introduction**
- **Research methods**
- **China's Urban Network Characteristics from the Perspective of Micro-blog Social Space**
- **Conclusions and Discussions**

Introduction

- Spatial relationship between cities has always been a key research topic of urban and economic geography. Since 1990s, information technology has developed rapidly and globally, which not only changed the human social system and economic structure, but also reconstructed the structure of the global physical and virtual space (Graham S, Marvin S., 1996).
- Seeing from the existing research results, the way of employing users' communication information to carry out studies on urban structure is in its infancy and has a relatively single method. Although its data acquisition is difficult, the research results are found to be accurate and thus should be paid more attention to.

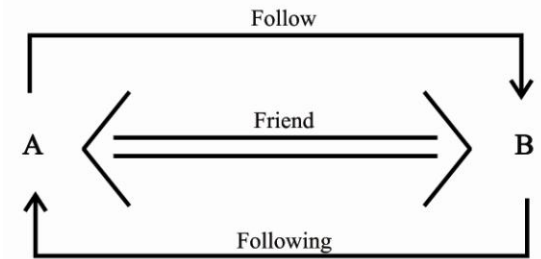
Introduction

- Since 2000, Chinese scholars also have become concerned about the urban network system and achieved lots of results. The exist studies explained the changes in Chinese urban network system under the influence of globalization and informatization.
- However, in the research literature of world and national urban network, the power of social network space is seemingly ignored, while it is playing an increasingly large spatial influence. Currently, the research on China's urban network from the perspective of interpersonal networks is rare.
- The emergence of social network sites like micro-blog not only enriches and expands the social relation network, but also provides a new perspective for the interpretation and analysis of urban network structure. this paper tries to study China's urban network architecture and its spatial characteristics with the help of this emerging network media and interactive platform of micro-blog.

Research Methods

- **Research ideas**

- In Sina Micro-blog, the relationships between users include three types, namely, follower, following and friend. As we can see in Figure 1, follower and following reflect the unidirectional information transfer between users.



The relationship between users

- From the geographical perspective, the cities can be understood as the nodes in the network communities, and the friend relation between cities can be interpreted as the information flow between nodes in the network communities.

- **Data collection**

- The selection of urban network nodes in social network space. we finally select 51 node cities and build a urban network framework in social network space.
- The selection of micro-blog users of each node city in urban network. With the selected 51 representative cities as the strongholds, we choose 20 users from each city as the research samples.
- The acquisition of friend relation of the micro-blog research sample. we collected the micro-blog IDs of the followers and follow users of the 1020 research samples through the establishment of a crawler program, find out the micro-blog users with friend relations and recorded their geographic information data.

Research methods

- **Data calculation**

- The first step: standardize the collected friend relations data of the 51 note cities.

$$V'_{ij} = V_{ij} / \sum_j V_{ij}$$

- The second step: on the basis of the above calculation, calculate the city's external connectivity index in the network system.

$$N_i = \sum_j V'_{ij} - V'_{ii}$$

- The third step: calculate the network connectivity between cities to reflect the closeness of contact information between cities in the network.

$$R_{ij} = V'_{ij} * V'_{ji}$$

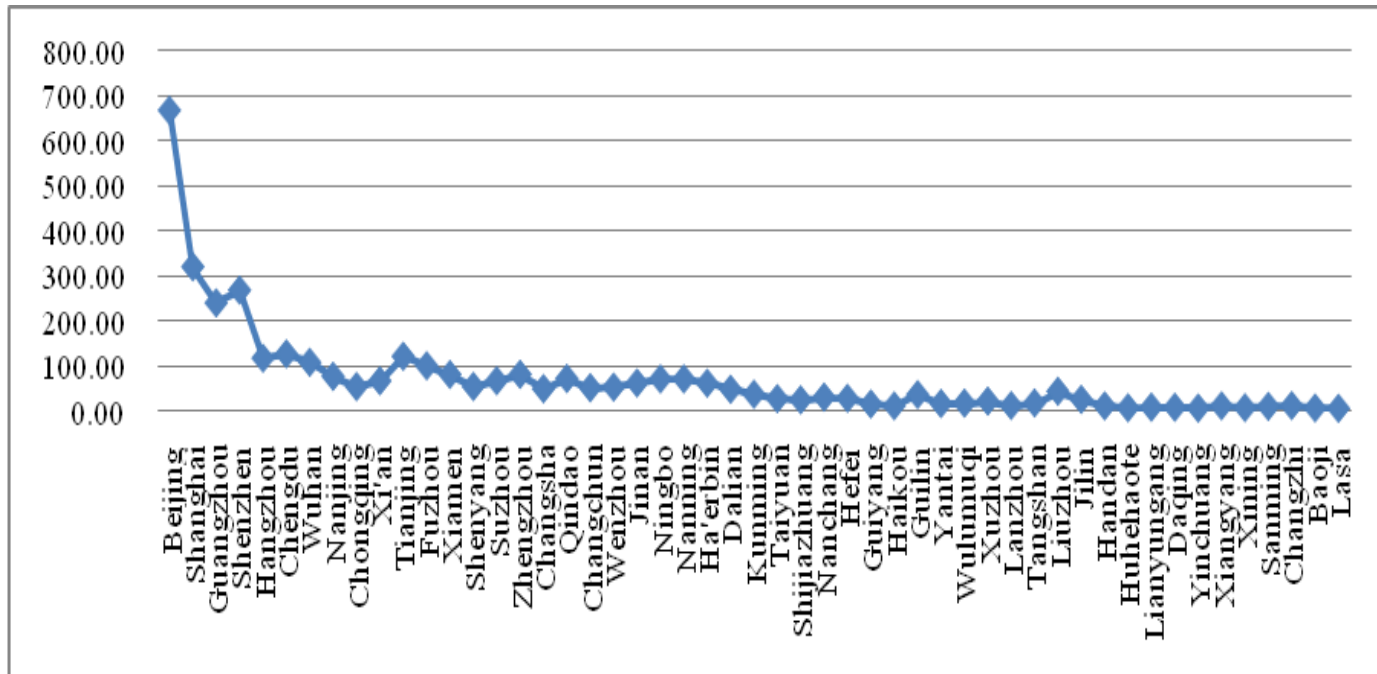
- The fourth step: calculate the network connectivity of each city to reflect the contact intensity of the city in the network system.

$$M_i = \sum_j R_{ij} - R'_{ii}$$

Analysis of the Overall Structure of Urban Network System

- **The relative consistency of network connectivity and urban structure in the network**

the abscissa is the city ranking based on its external connectivity index with a descending order and a lower ranking suggests a lower hierarchy in the network system:

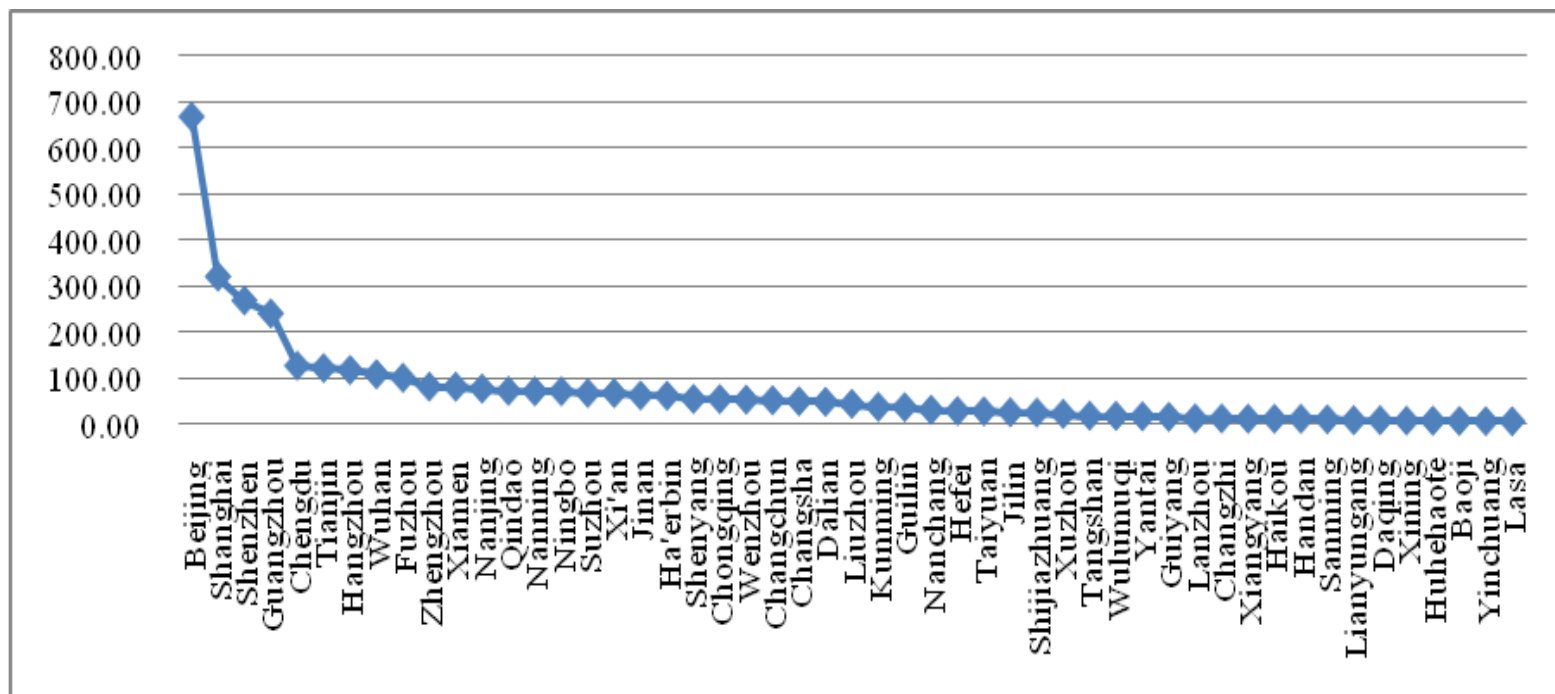


The relationship between the connection rate and the hierarchy system of the cities

Analysis of the Overall Structure of Urban Network System

- City-level distribution in urban network**

In order to further subdivide the city level, we sequenced the cities' network connectivity. The lower the ranking is, the weaker the city's contact role in the network will be.



The rank of the connection rate of cities in the network

Analysis of the Overall Structure of Urban Network System

- **City-level distribution in urban network**

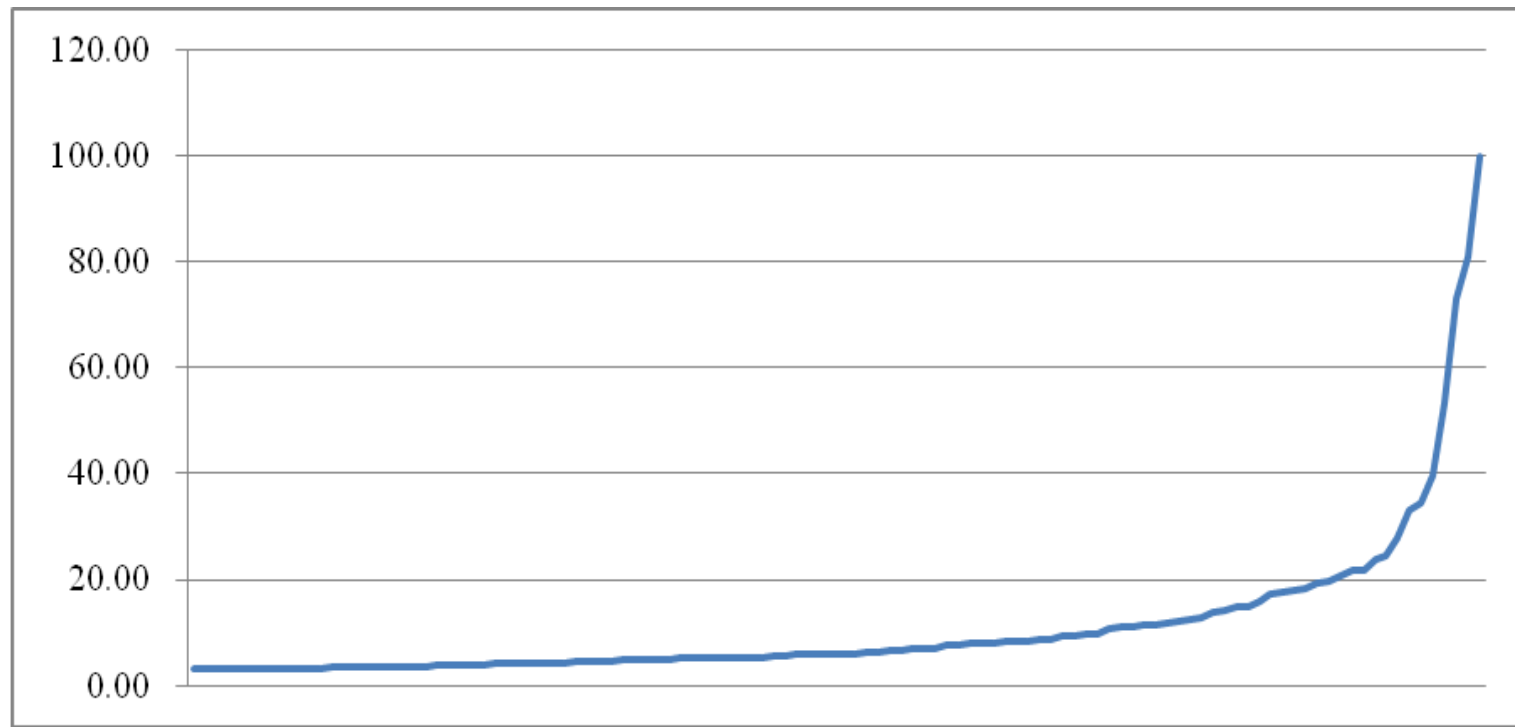
Level distribution of the city network

Level	Network connectivity	Cities
Center of the national network	> 600	Beijing
Sub-center of the national network	200-600	Shanghai, Guangzhou, Shenzhen
Center of the regional network	100-200	Chengdu, Tianjin, Hangzhou, Wuhan, Fuzhou
Sub-center of the regional network	50-100	Zhengzhou, Xiamen, Nanjing, Qindao, Nanning, Ningbo, Suzhou, Xi'an, Jinan, Haer'bin, Shenyang, Chongqing, Wenzhou, Changchun
Center of the local network	10-50	Changsha, Dalian, Liuzhou, Kunming, Guilin, Nanchang, Hefei, Taiyuan, Jilin, Shijiazhuang, Xuzhou, Tangshan, Wulumuqi, Yantai, Guiyang, Lanzhou, Changzhi, Xiangyang, Haikou, Handan, Sanming
Node of the local network	< 10	Lianyungang, Daqing, Xining, Huhehaote, Baoji, Yinchuang, Lasa

Analysis of the Overall Structure of Urban Network System

- **City contact intensity partition in urban network system**

The network intensity between cities shows a growth trend similar to an index.

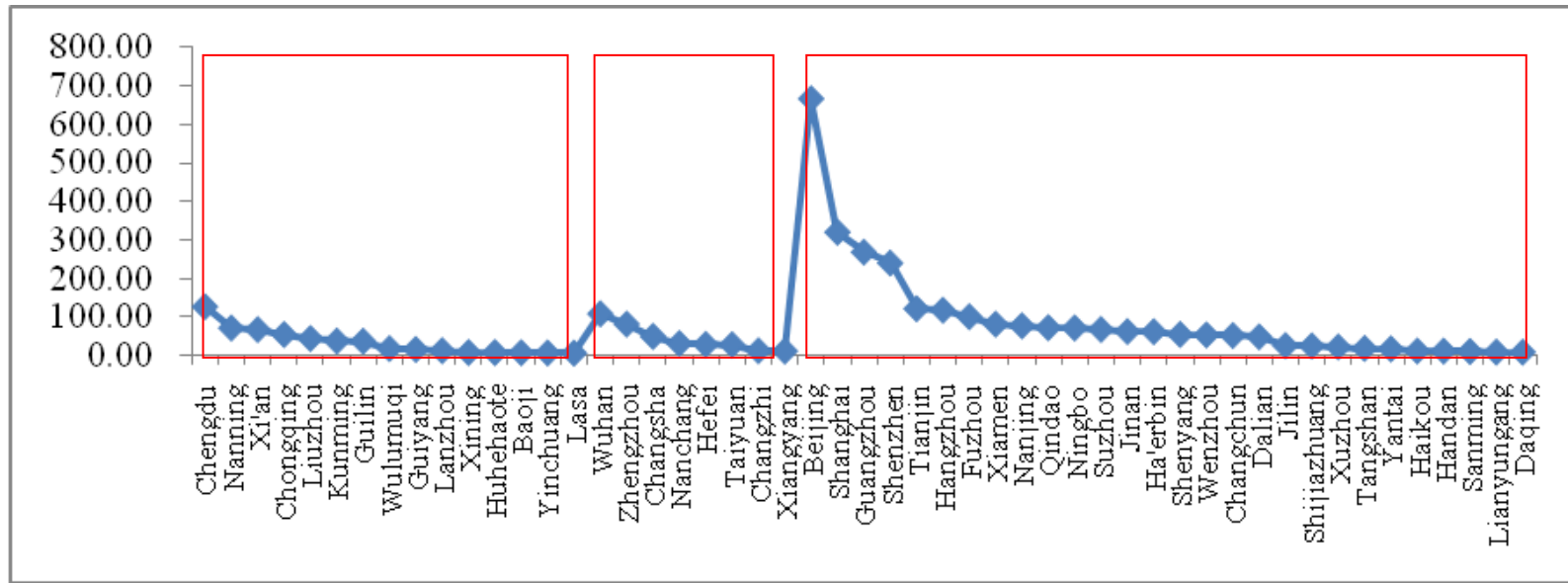


The rank of the connection rate(> 3) between cities

Spatial Analysis of Urban Network System

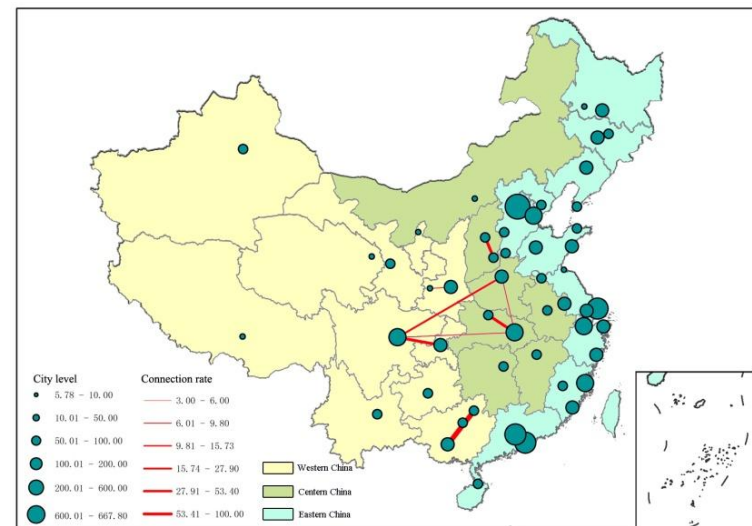
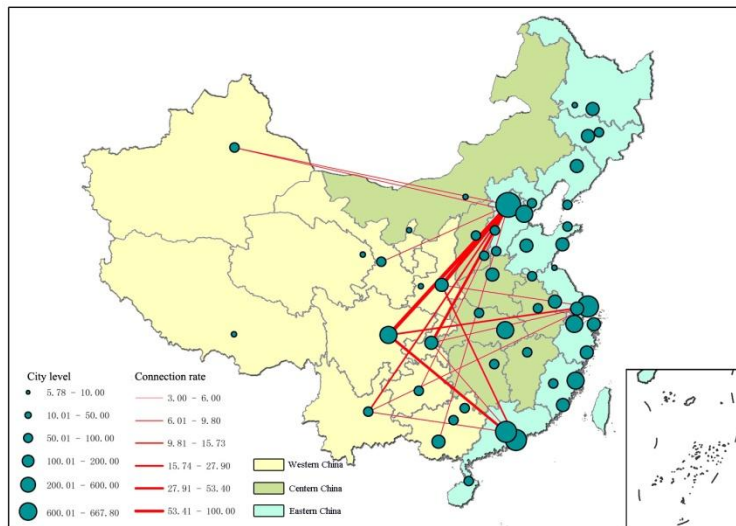
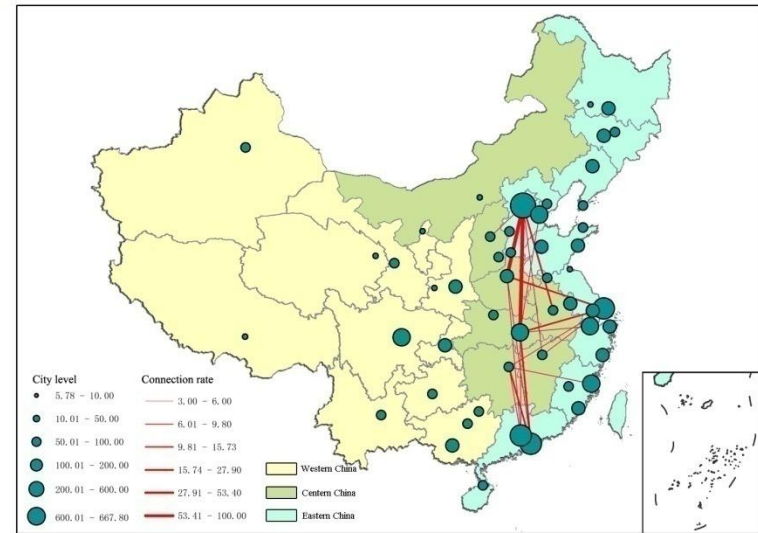
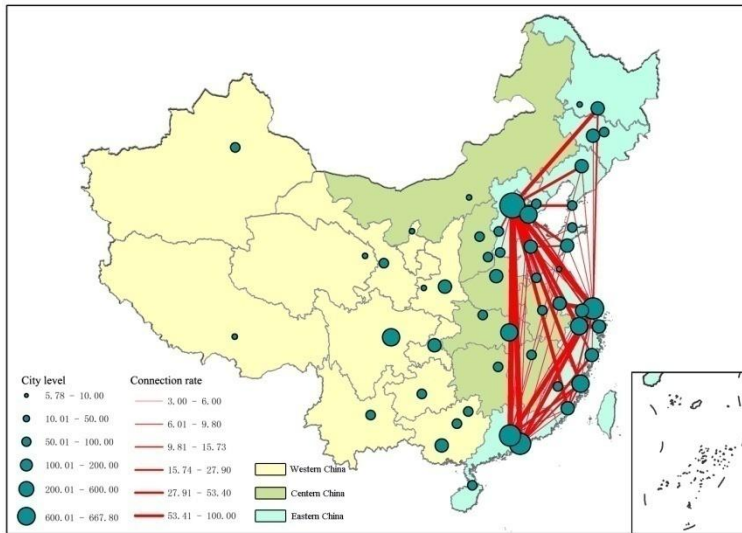
- **Significant difference between Eastern China and Midwest China**

Cities with higher city levels also exist in Western China and Central China, the average city level in Eastern China is significantly higher than those of Central China and Western China.



The rank of city level distribution in the Western, Central, Eastern China

Spatial Analysis of Urban Network System



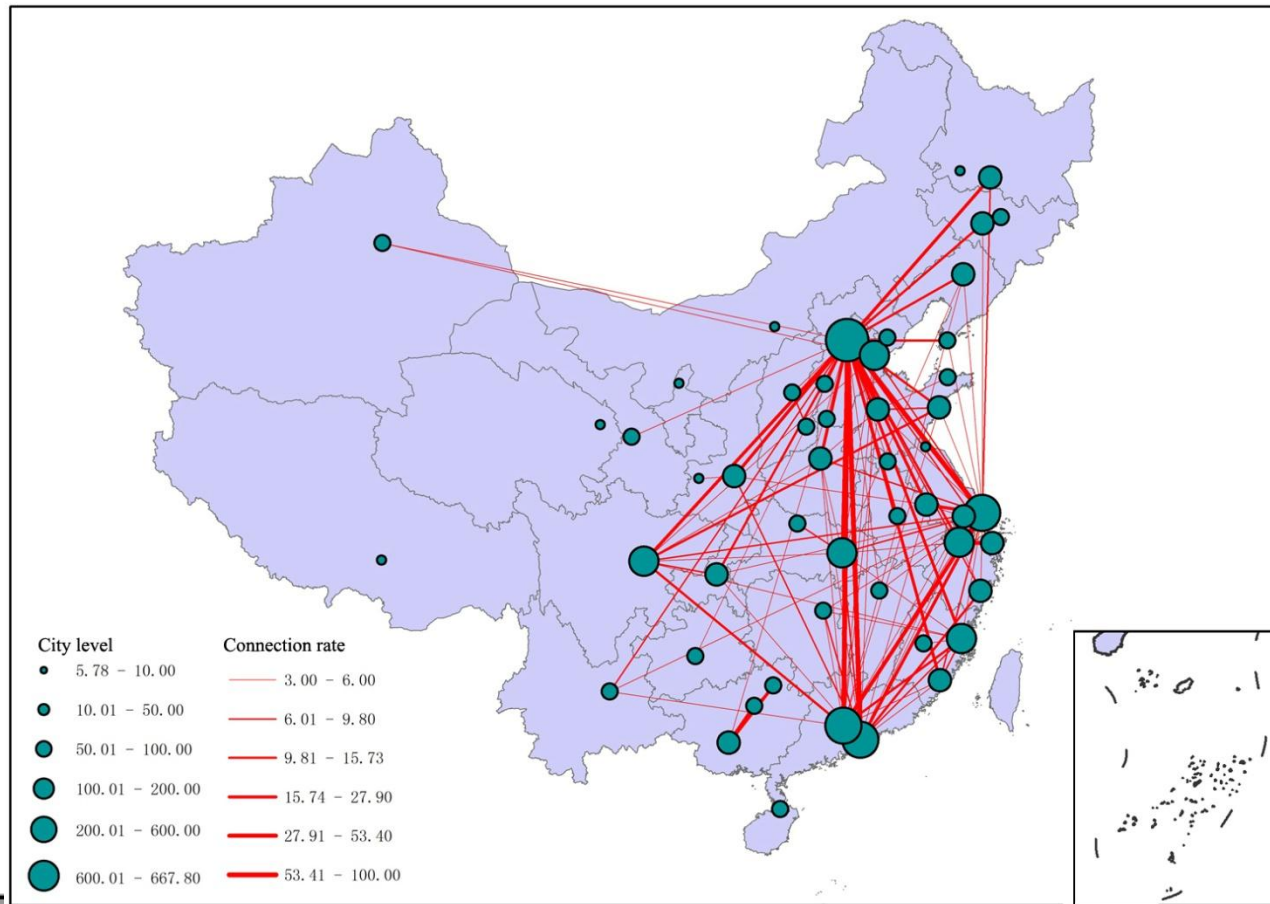
The network connection among Western, Central, Eastern China

Spatial Analysis of Urban Network System

- **Hierarchical agglomeration in urban network**

Hierarchical agglomeration exists in China's urban network system, the specific performance of which is the spatial pattern of "Three Majors and Four Smalls".

The pattern of
China's cities
network based on
the social network
space



Spatial Analysis of Urban Network System

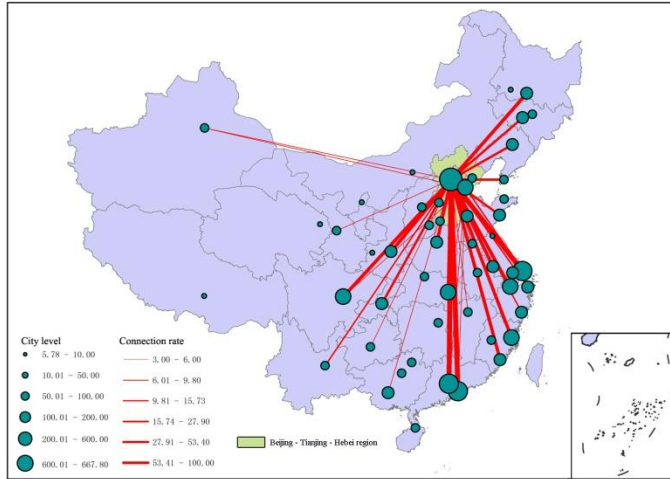
- **Hierarchical agglomeration in urban network**

Specifically speaking, the “three majors” include the Beijing-Tianjin-Hebei region (Beijing, Tianjin, Shijiazhuang, Tangshan), the Pearl River Delta (Guangzhou, Shenzhen), the Yangtze River Delta (Shanghai, Hangzhou, Nanjing, Ningbo, Suzhou, Wenzhou);

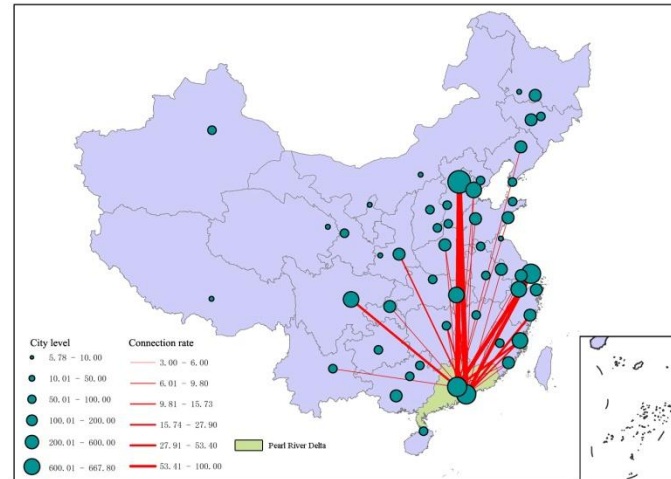
the “Four Smalls” include Chengdu-Chongqing region (Chengdu, Chongqing), Hercynian region (Fuzhou, Xiamen, Sanming), Wuhan (central) region (Wuhan, Changsha, Nanchang, Hefei, Changzhi, Xiangyang), Northeast China (Shenyang, Harbin, Changchun).

Spatial Analysis of Urban Network System

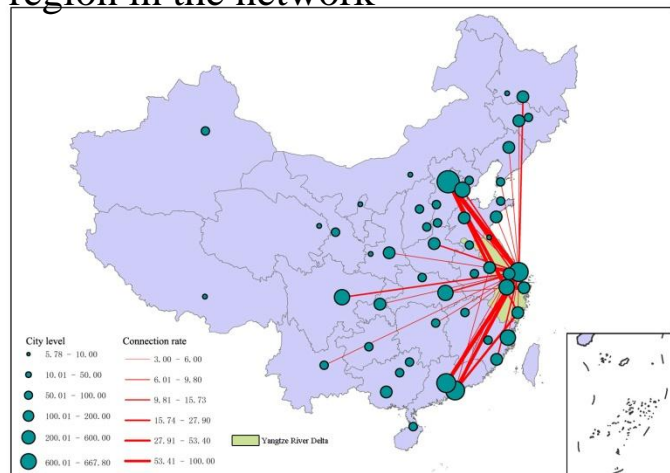
- Hierarchical agglomeration in urban network**



The connection of Beijing-Tianjin-Hebei region in the network



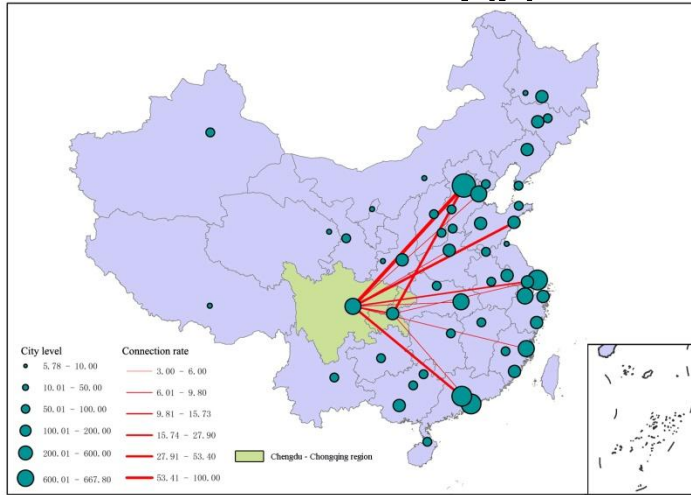
The connection of Pearl River Delta in the network



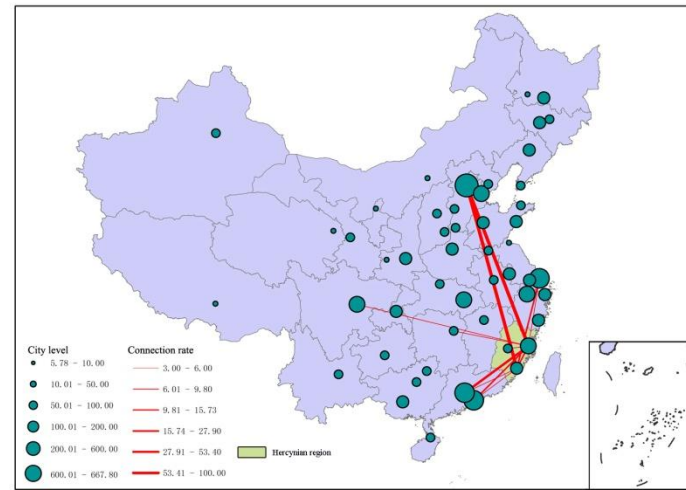
**the “three major”
regions in China**

Spatial Analysis of Urban Network System

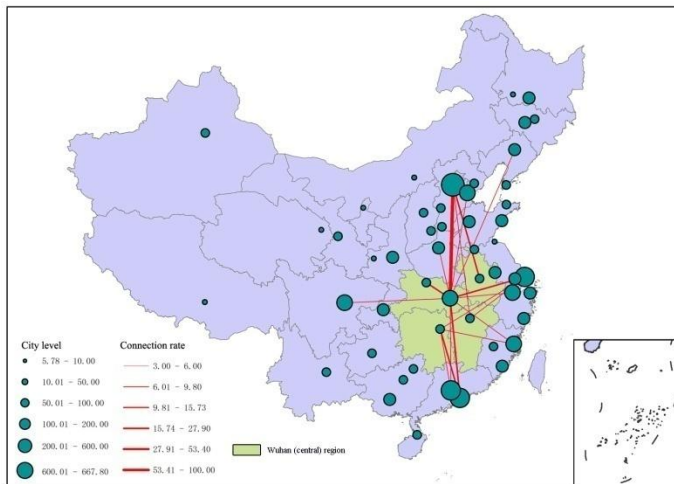
- Hierarchical agglomeration in urban network



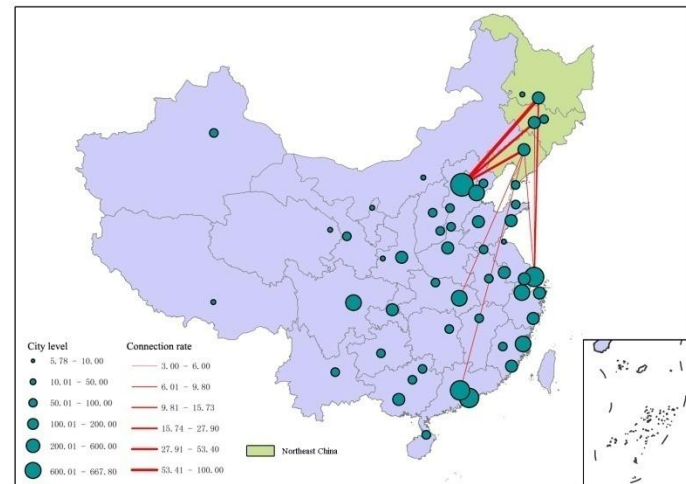
The connection of Chengdu-Chongqing region



The connection of Hercynian region



The connection of Wuhan (central) region



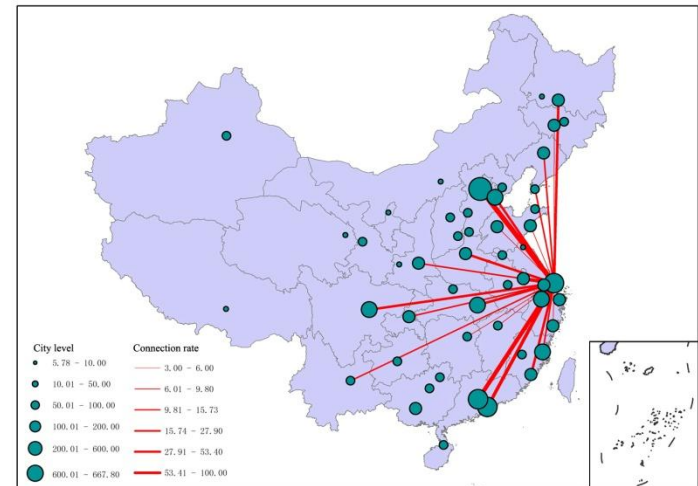
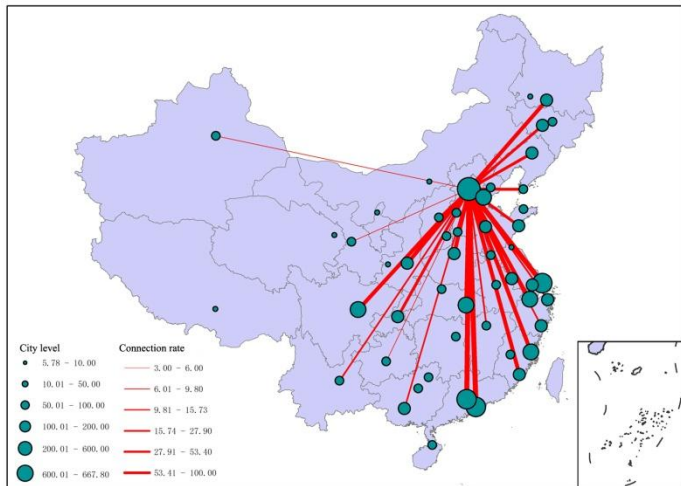
The connection of Northeast China

the “four
small”
regions in
China

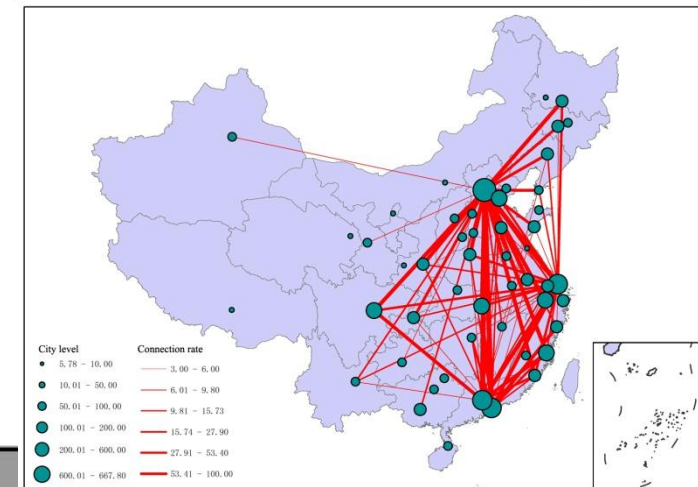
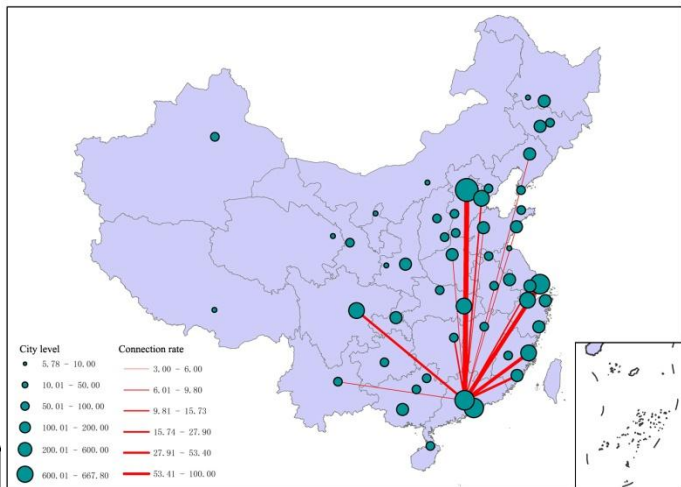
Spatial Analysis of Urban Network System

- **High level city-dominated urban network system**

Cities with high hierarchy dominate the urban network system, such as Beijing, shanghai, Guangzhou.



The network connection between Beijing, shanghai and Guangzhou to other cities



Conclusions and Discussions

- From the perspective of social space, with the help of the social relation network reflected in micro-blog friends, this paper studies the patterns and characteristics of urban network system in the social network space. This is a new attempt of the urban network research under the influence of globalization and informatization.
- Based on an empirical analysis of Sina Micro-blog, from the perspective of micro-blog social space, the paper finds that significant hierarchical relationship and level distinction exist in China's urban network. A city's network connectivity is positively correlated with its comprehensive strength and hierarchy.

Conclusions and Discussions

- Based on the city's network level and network contact intensity, the research results show significant spatial differences between the three major regions of Eastern China, Central China and Western China, but the difference between Eastern China and Midwest China is more significant.
- Hierarchical agglomeration exists in China's urban network system, the specific performance of which is the spatial pattern of "Three Majors and Four Smalls". It can be said that the emergence of micro-blog network space promotes the further agglomeration of the original geospatial urban network system.
- Of course, as a newly emerging network community, micro-blog is still in its infancy. Its influence on the geographic entity space remains to be verified. But undoubtedly, the spatial "flow" and "viscosity" brought by this powerful social dynamics will have a positive impact on the reconstruction and networking of national and regional urban systems.

Thanks for your attention!