

# THE GALLERY OF CALLIGRAPHY

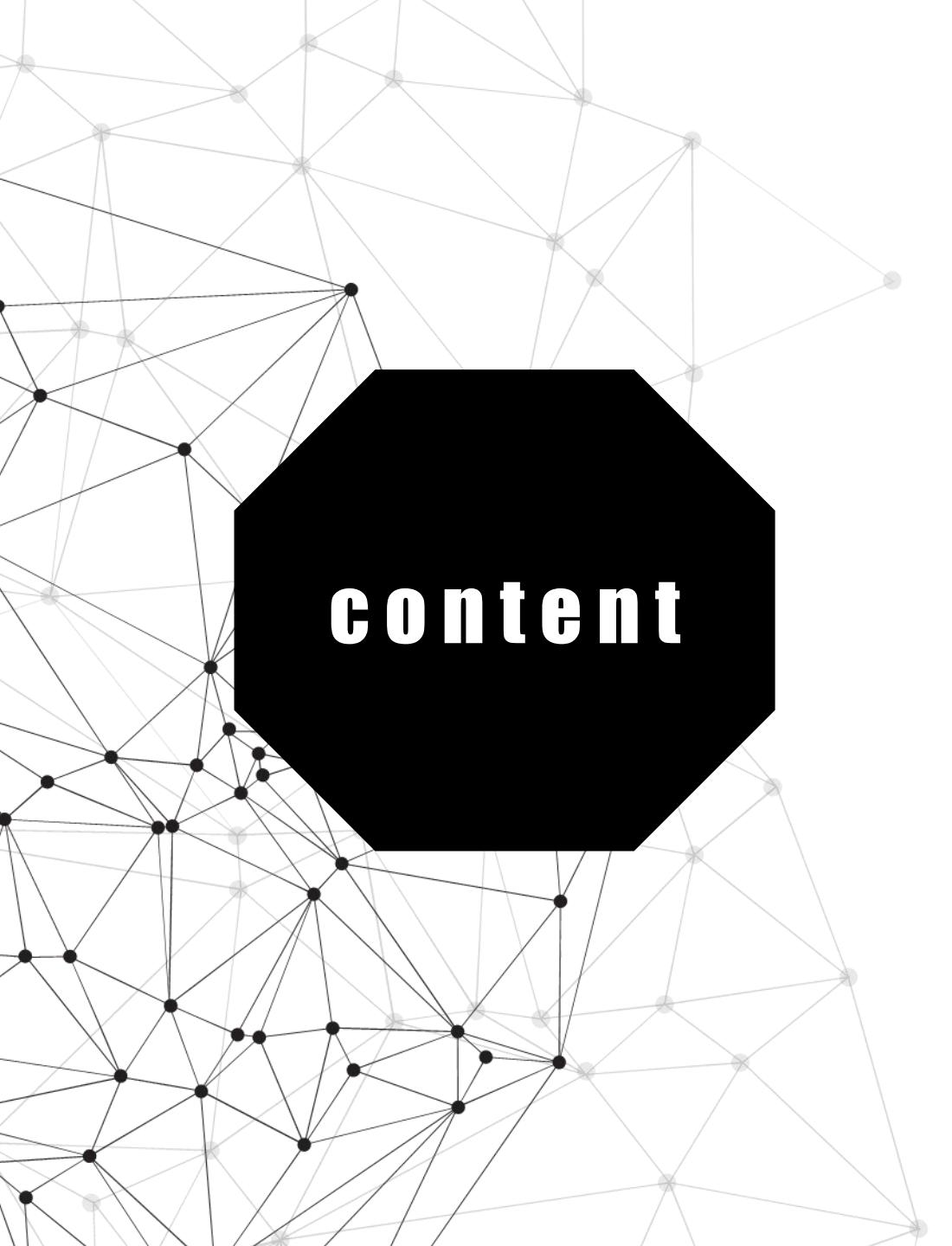
TEAM 6

GUO MINGHAO

NIU YIBO

YU LIN

WU YI



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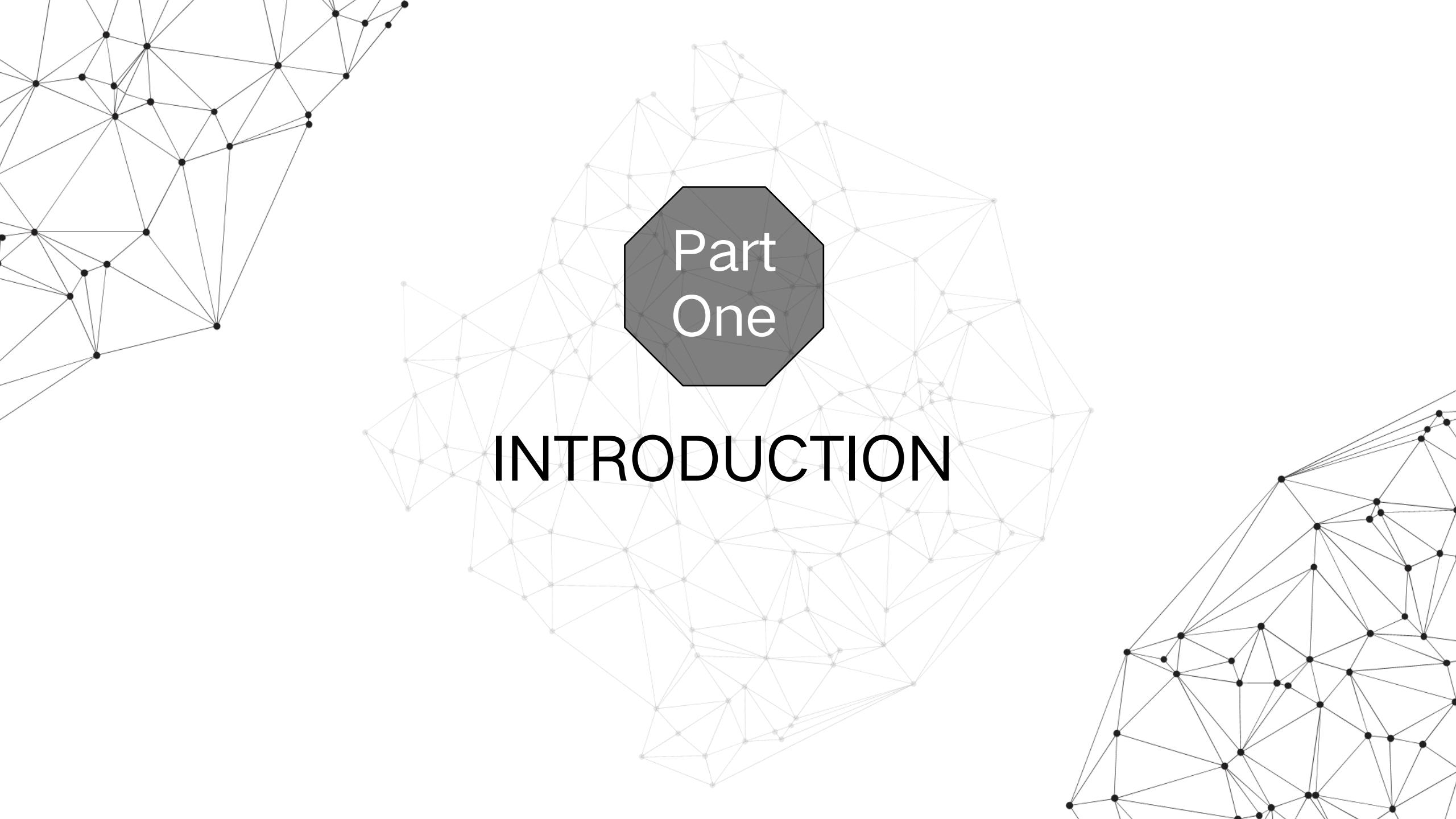
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The background of the slide features a complex, abstract network graph composed of numerous small, light gray dots connected by thin white lines, creating a sense of interconnectedness and data flow.

**Part  
One**

# **INTRODUCTION**

# Five Styles of Chinese Calligraphy



Seal Script (篆书)

- Rectangular
- Curved brush.
- Beauty of balance



Clerical Script (隶书)

- Flat and square
- A silkworm head and a wild goose



Regular Script (楷书)

- Square and regular

202 BCE - 220 CE

Han

Qin

221-207 BCE



Cursive Script (草书)

- Joined together in a flowing manner
- Writing faster



Semi-cursive Script (行书)

- Between regular script and cursive script.

266 CE-420 CE

Jin

# Objectives

- Explore the connections between different styles of calligraphy.
- Analyze and validate the evolution of calligraphy.
- Analyze the relationships between calligraphers

## Five Styles

Clerical 隶书      Cursive 草书  
Regular 楷书      Seal 篆书  
Semi-Cursive 行书

## Different Calligraphers

Xizhi Wang      Song Dynasty  
Fu Mi      Song Dynasty  
Zhengqing Yan      Tang Dynasty

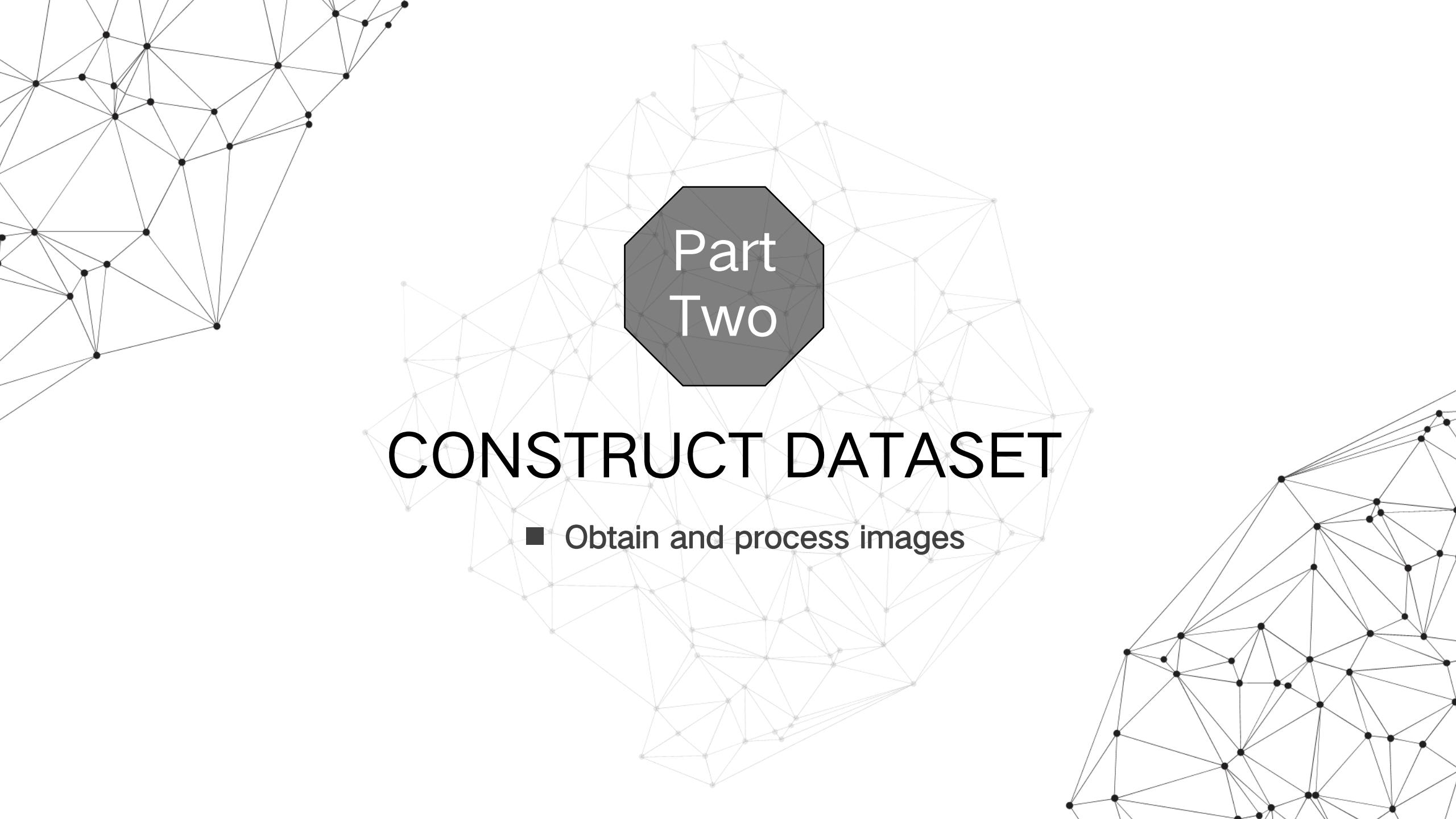
# Procedure

Collect data and form two datasets.

Use Siamese neural network to generate dissimilarity matrix.

Apply different community detection algorithms.

Do the visualization, analyze and compare the results of the two datasets.



A large, abstract network graph is visible in the background, composed of numerous small, light gray dots connected by thin white lines, creating a complex web-like structure.

## Part Two

# CONSTRUCT DATASET

- Obtain and process images

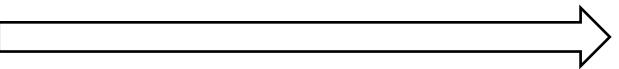
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## Obtain and Process Data

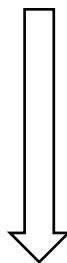
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Using Java to get hundreds  
of images from the Internet



[www.shufami.com](http://www.shufami.com) 书法迷



After image binarization

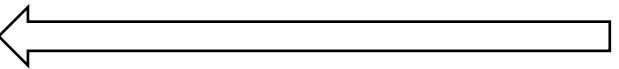
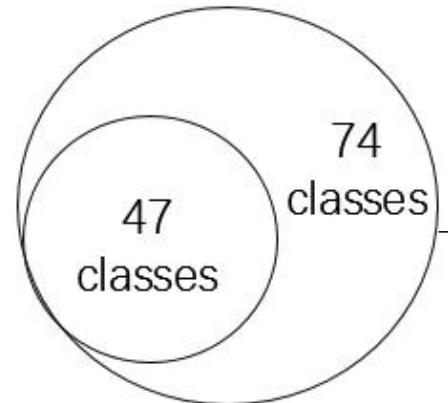


Image cropped

# Structure Of Dataset



Two datasets  
(for comparison)

Each class  
contains 10 images

Style

Cursive

Regular

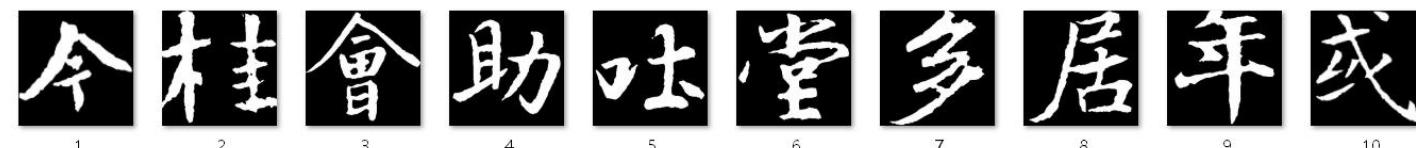
Clerical

Semi-Cursive

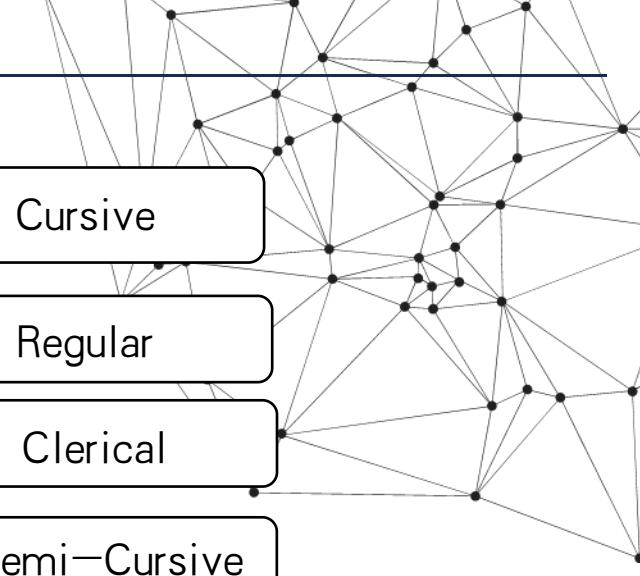
Seal

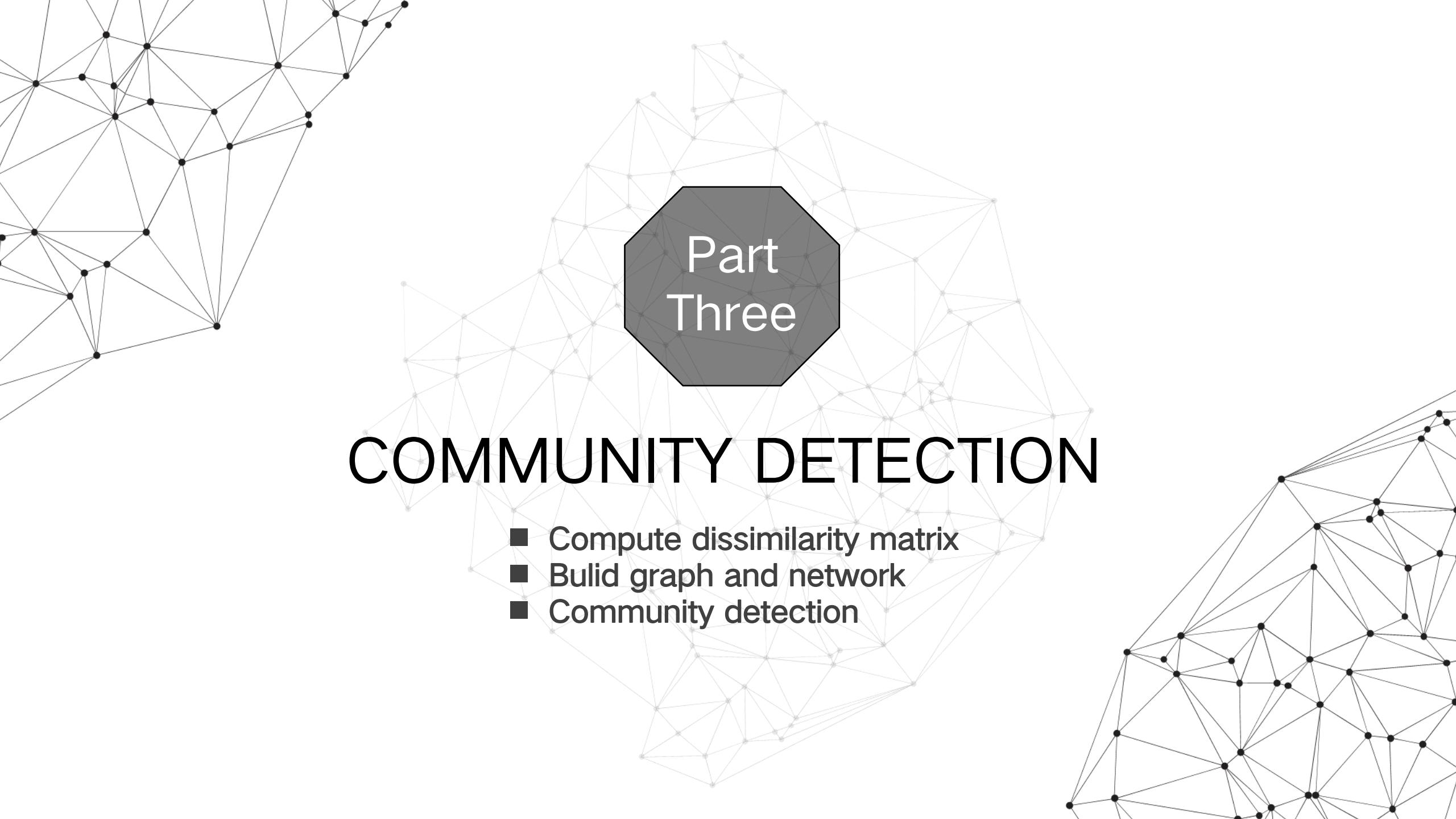
Calligrapher

e.g.



Xizhi Wang's Regular Characters



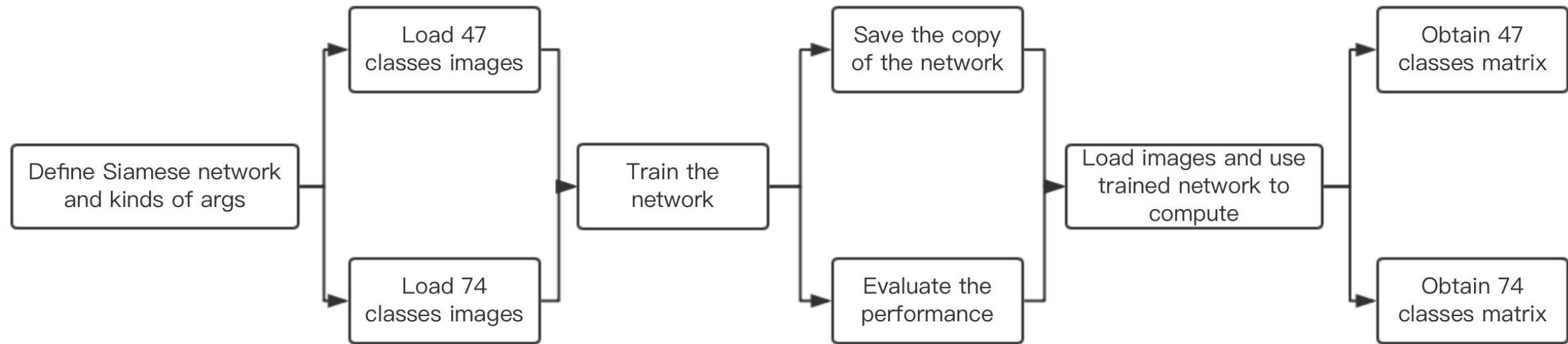
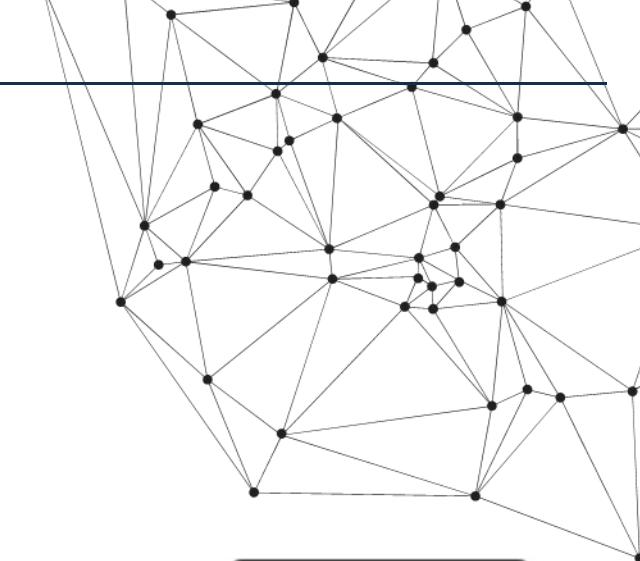
A large, faint, abstract network graph serves as the background for the slide. It consists of numerous small, light-gray nodes connected by thin gray lines, forming a complex web-like structure.

## Part Three

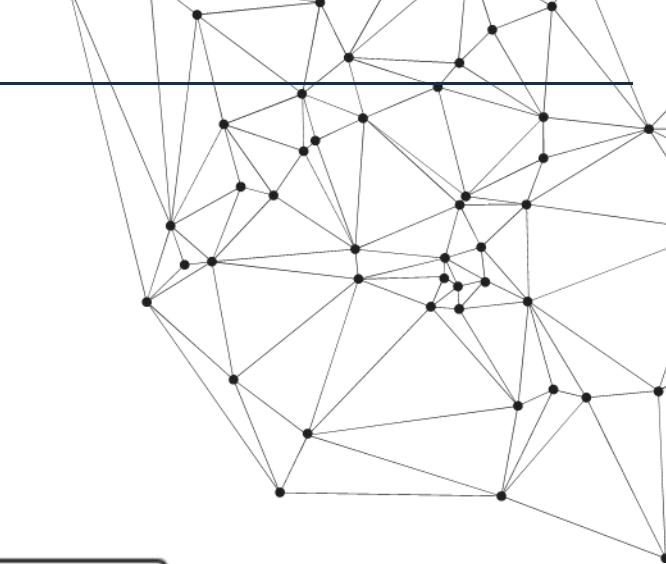
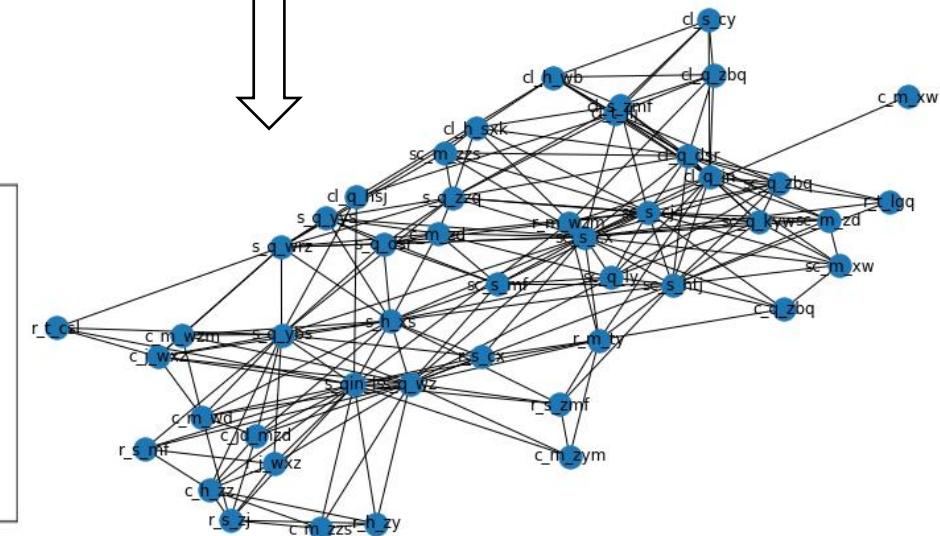
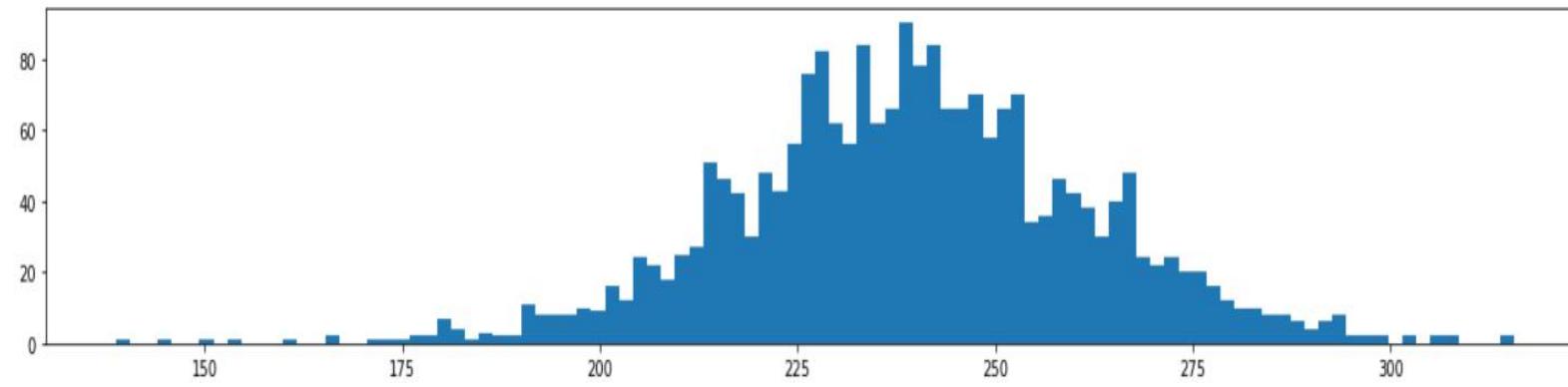
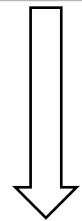
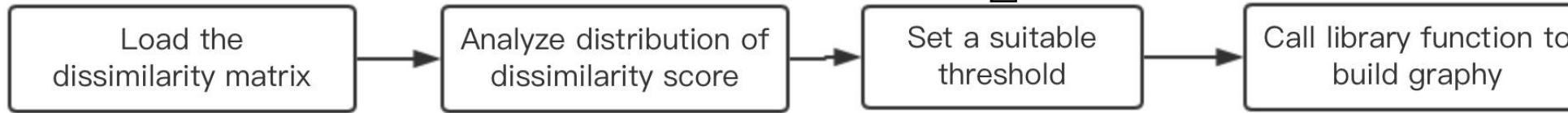
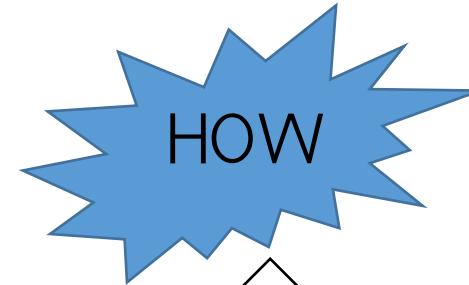
# COMMUNITY DETECTION

- Compute dissimilarity matrix
- Build graph and network
- Community detection

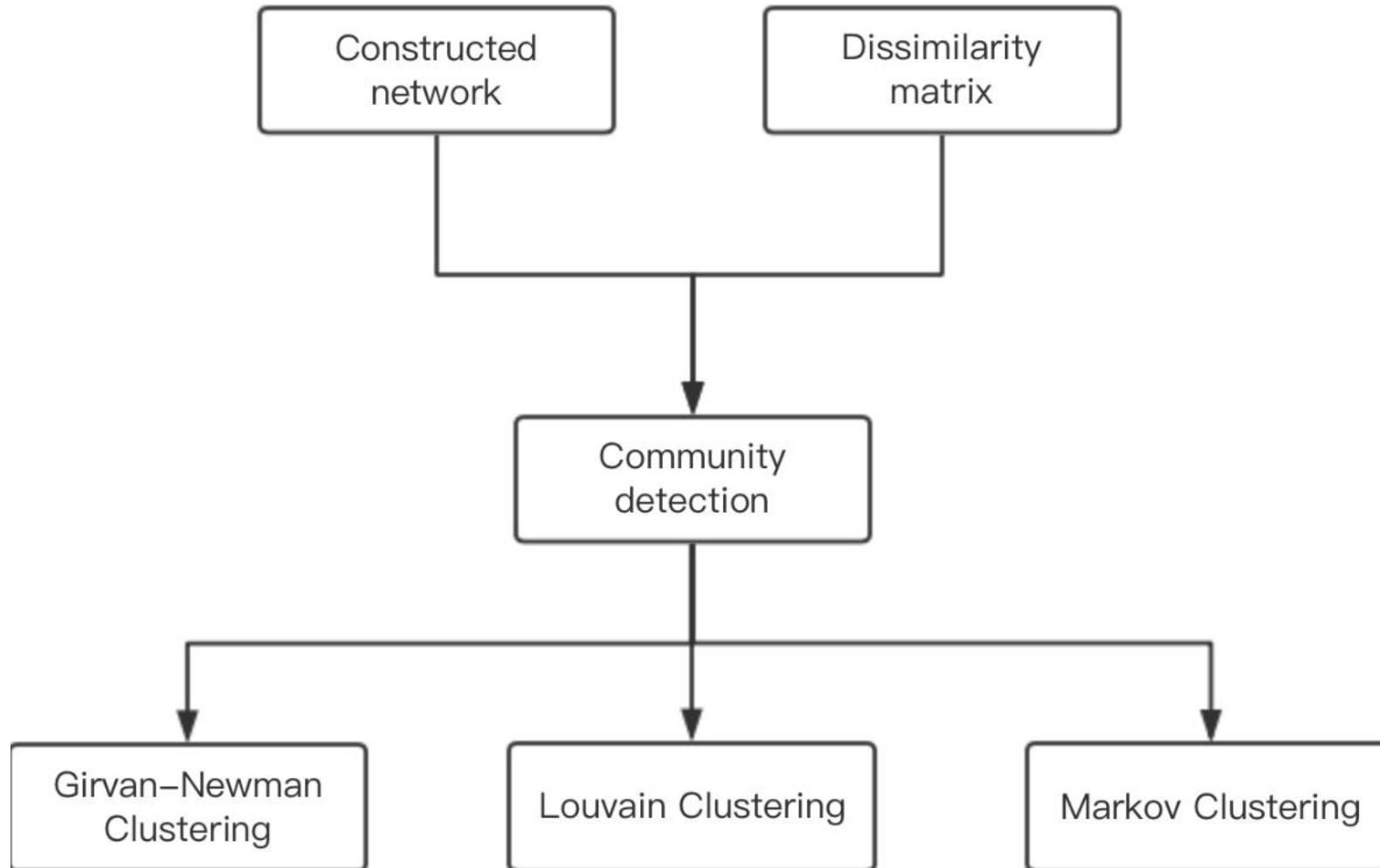
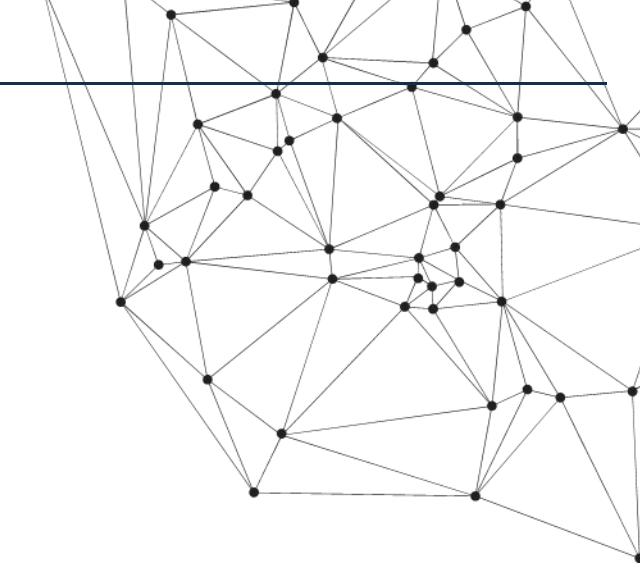
# Compute Dissimilarity Matrix



# Build Graph and Network

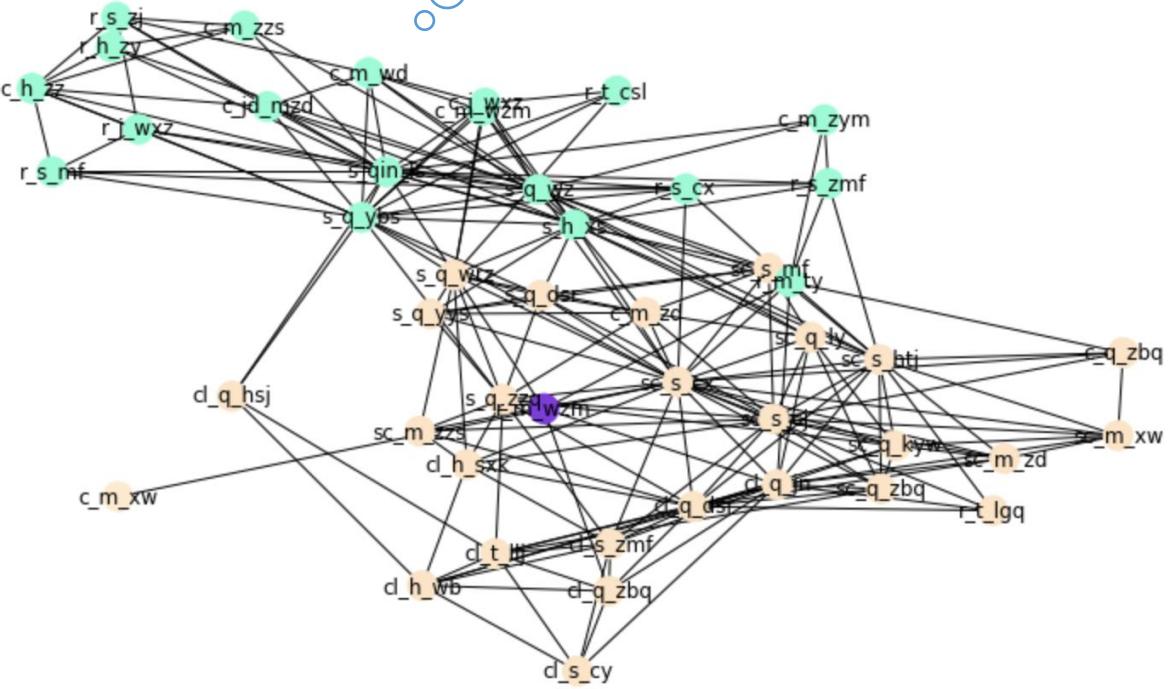


# Community Detection



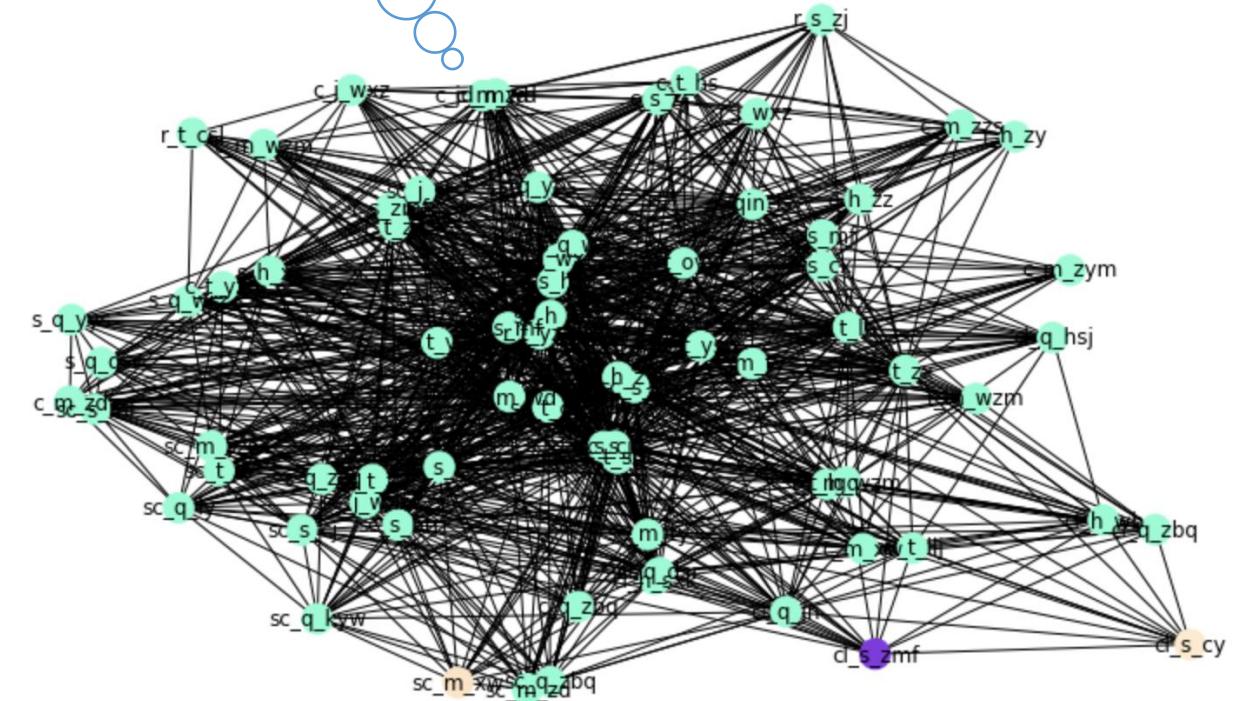
## Girvan Newman

The number  
of community  
is very few



47 Classes images

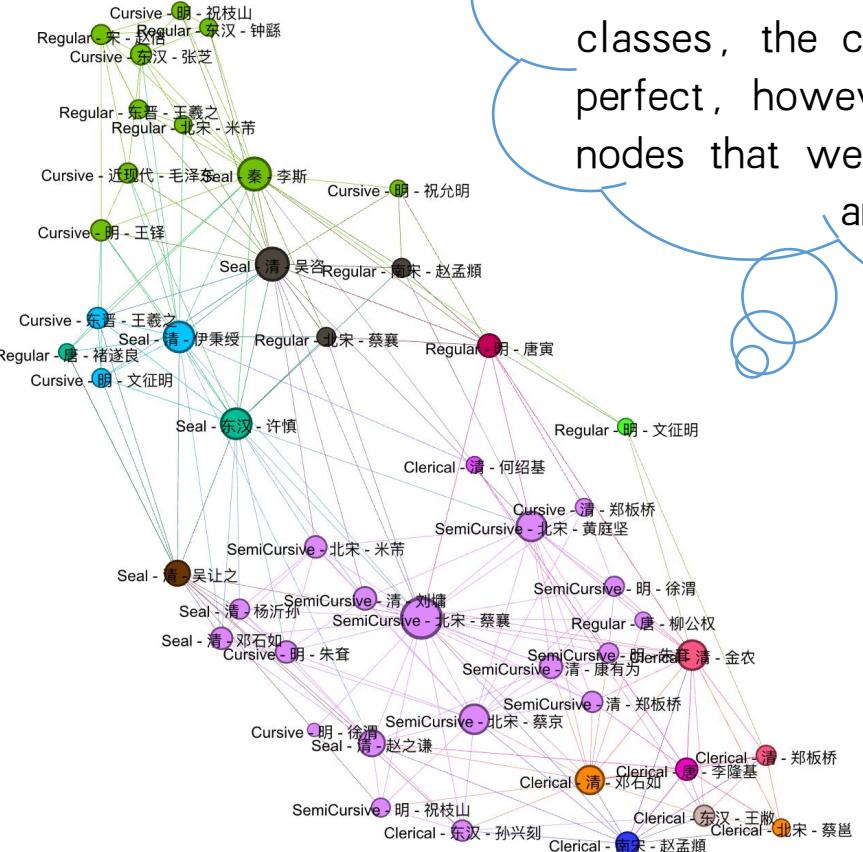
The core of the  
community is  
too dense



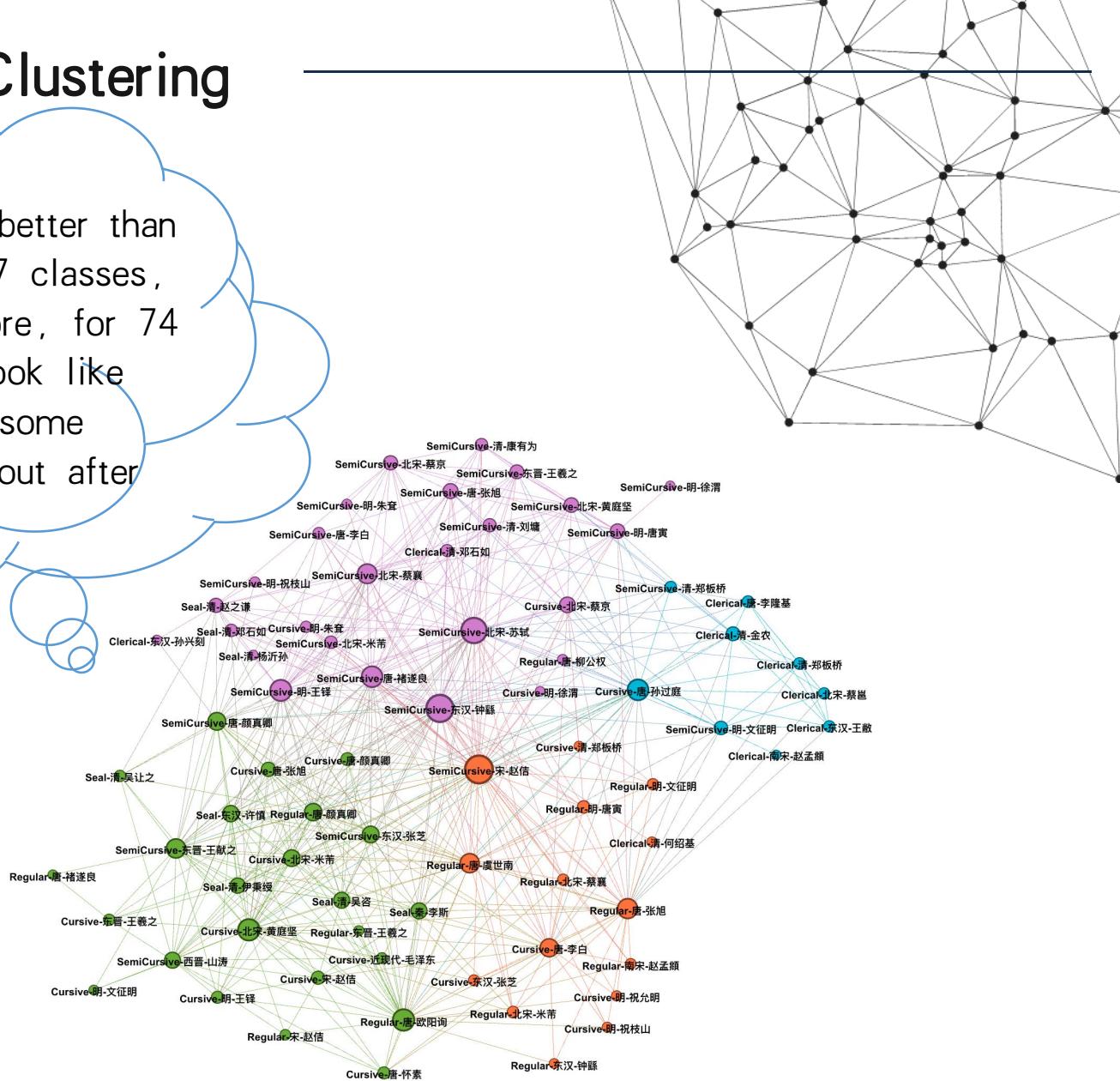
74 Classes images

# Markov Clustering

Markov Clustering is much better than Girvan—Newman. but for 47 classes, communities are a little more, for 74 classes, the communities look like perfect, however there are some nodes that we can't figure out after analyzing



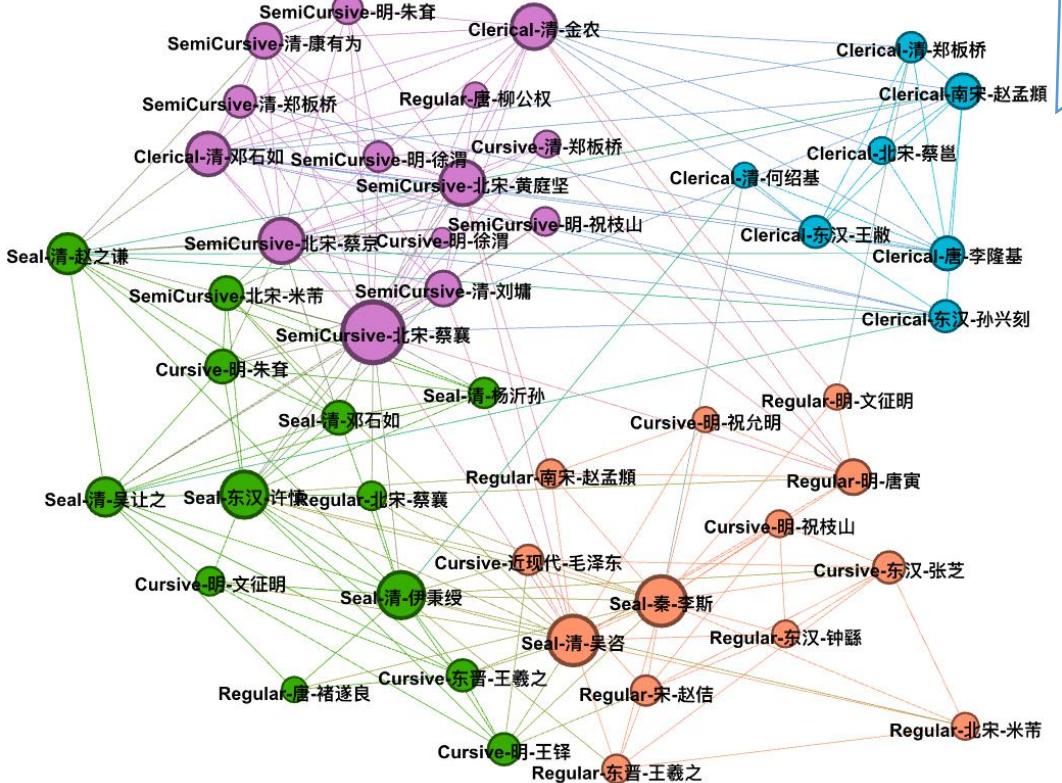
47 Classes images



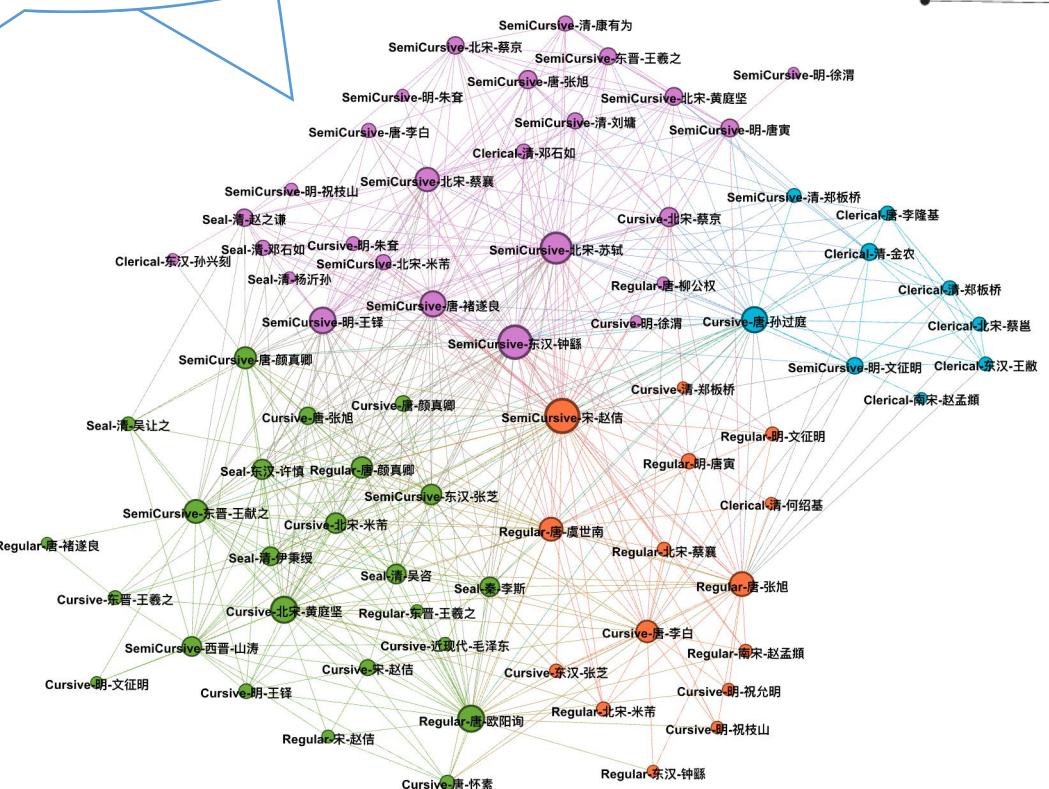
74 Classes images

# Louvain Clustering

About clustering, Louvain clustering works as good as Markov Clustering, on the other hand, there are better relationships between nodes in below two graphs



47 Classes images



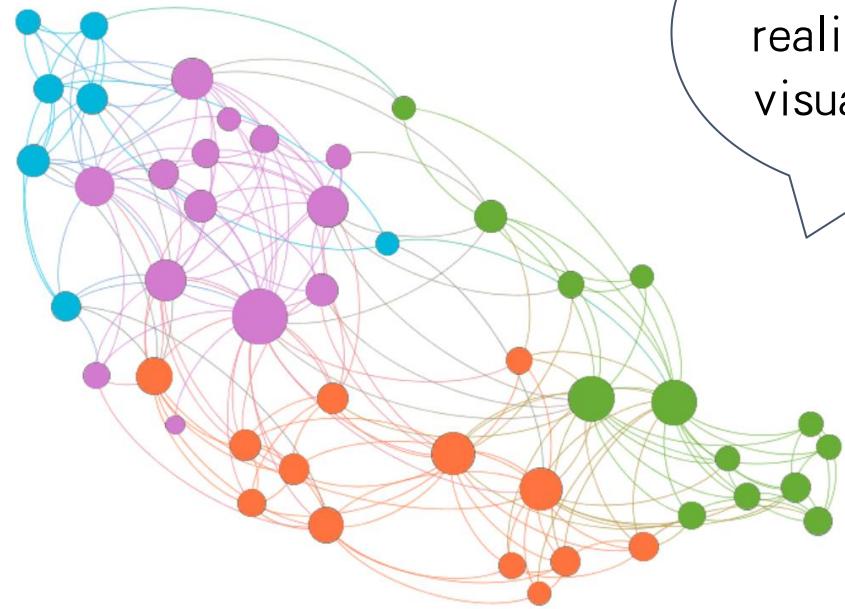
74 Classes images



## Part Four

# ANALYSIS OF THE RESULT

# The visualization of the clustering results



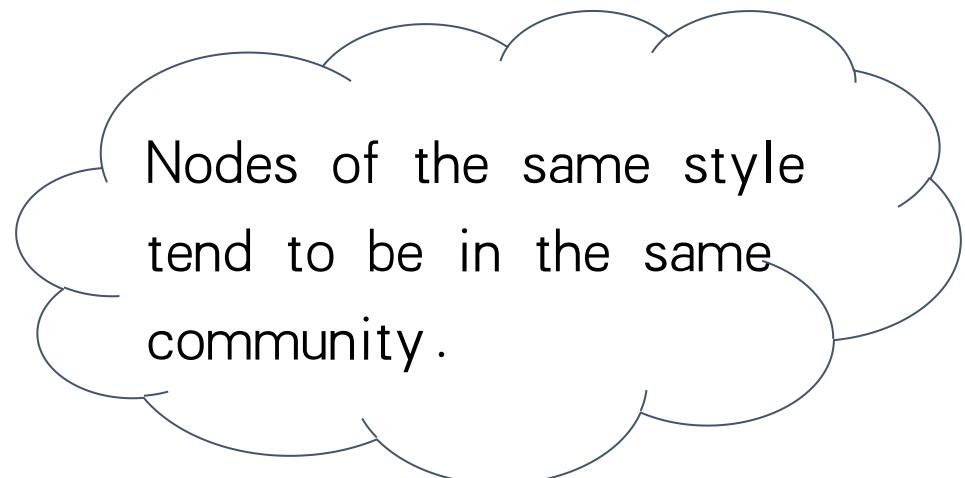
the result of 47 categories

Use gephi to  
realize the  
visualization.



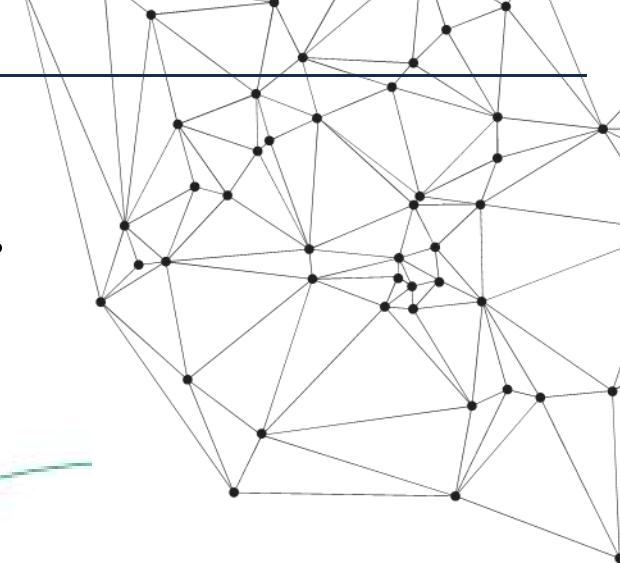
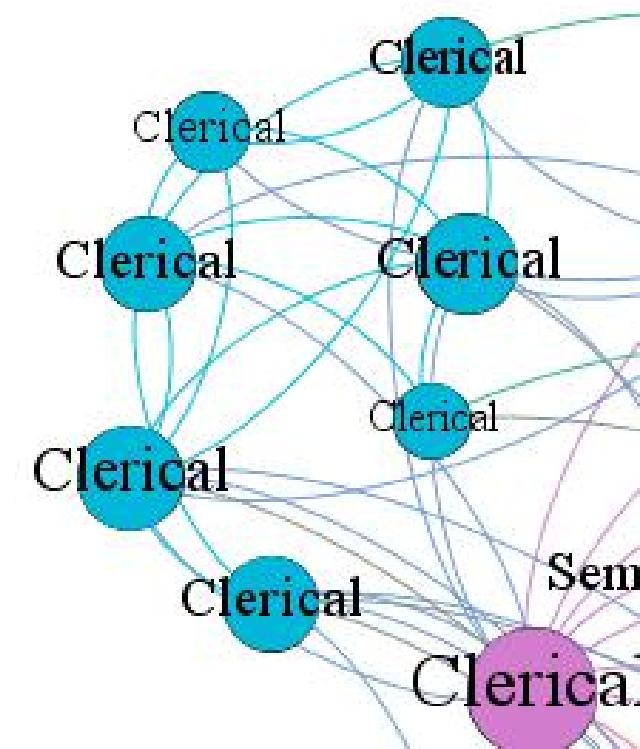
the result of 74 categories

# What we expected from the old data set

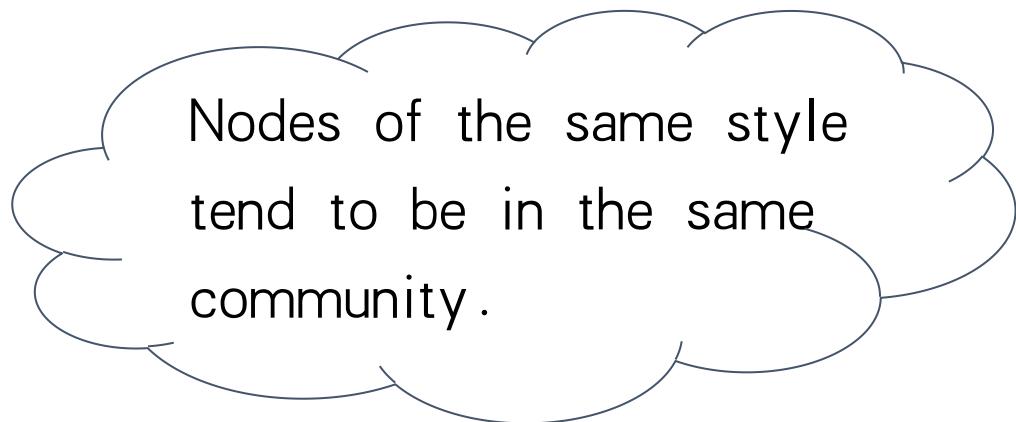


In this community :

- Only has clerical script
- Most clerical scripts are in it

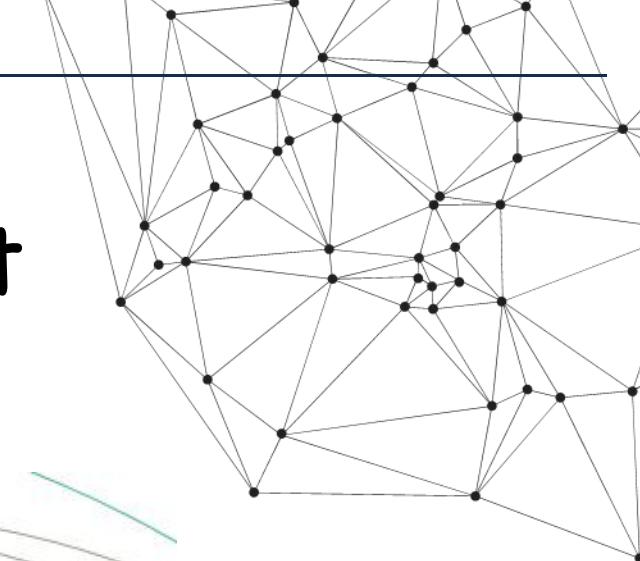
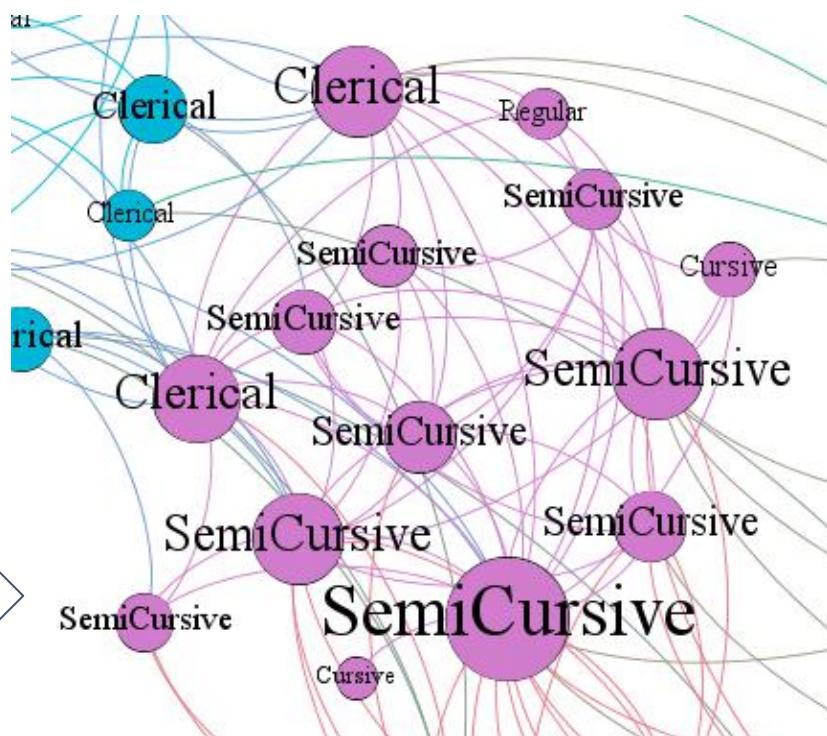
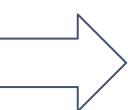


# What we expected from the old data set



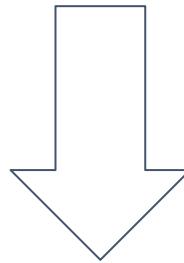
In this community:

- Mainly consist of semi-cursive script
- Most semi-cursive scripts are in it

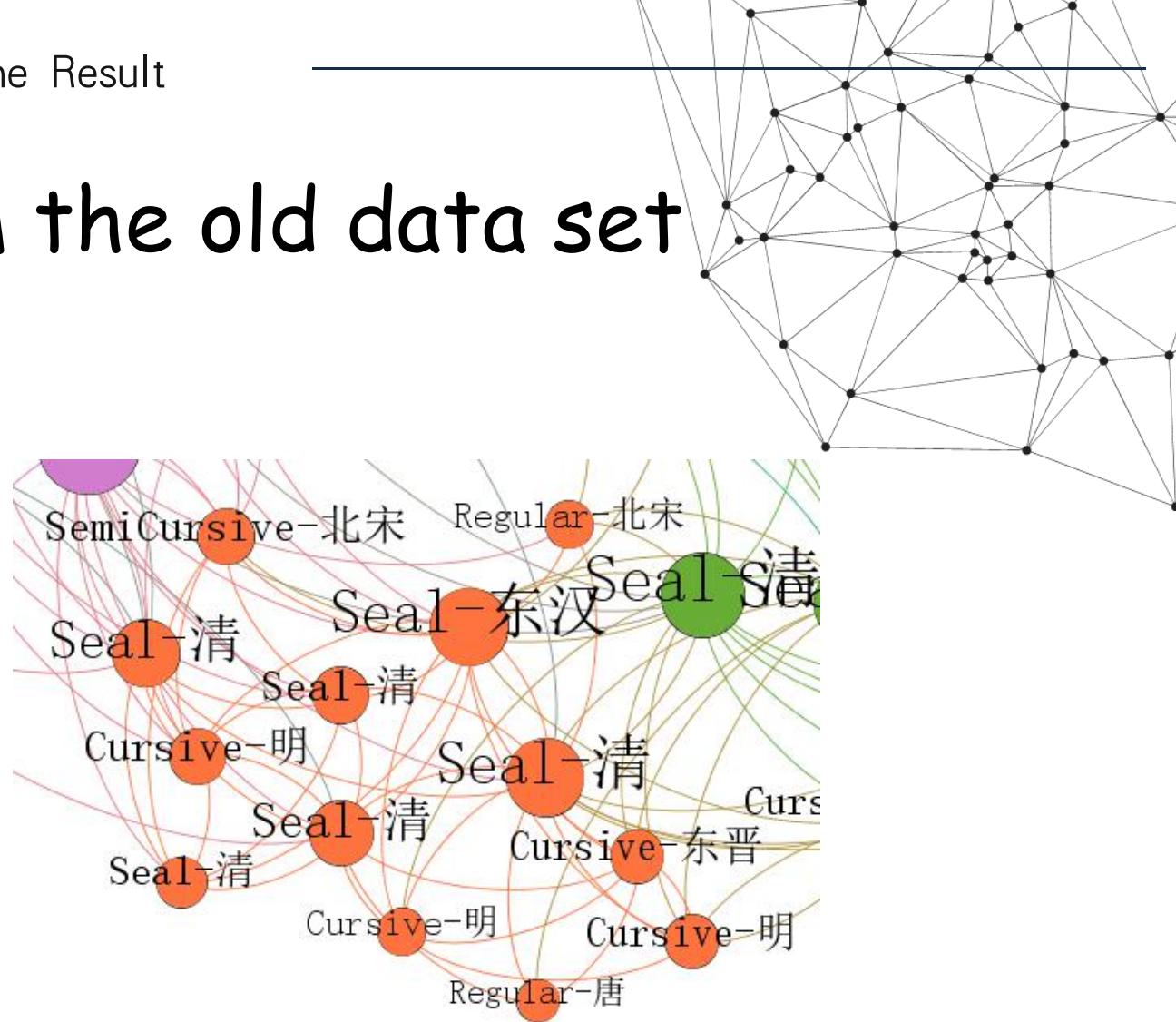


# New insights we get from the old data set

Many seal script fonts in Qing dynasty are clustered with cursive script fonts



The evolution of seal script in Qing dynasty made it more similar to the characteristics of cursive script

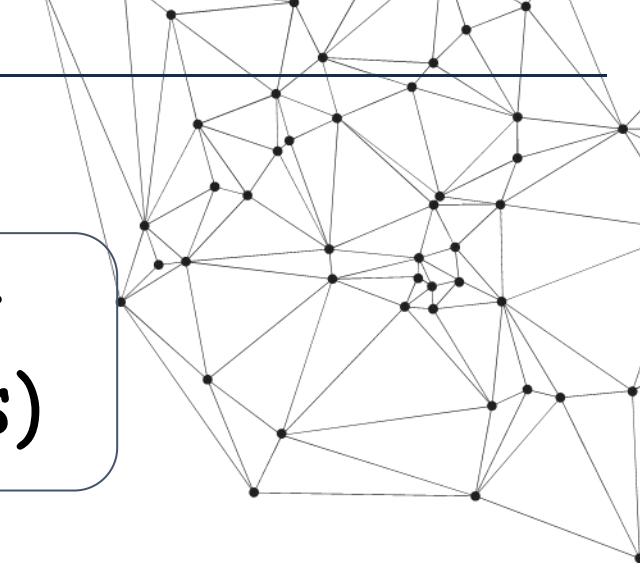


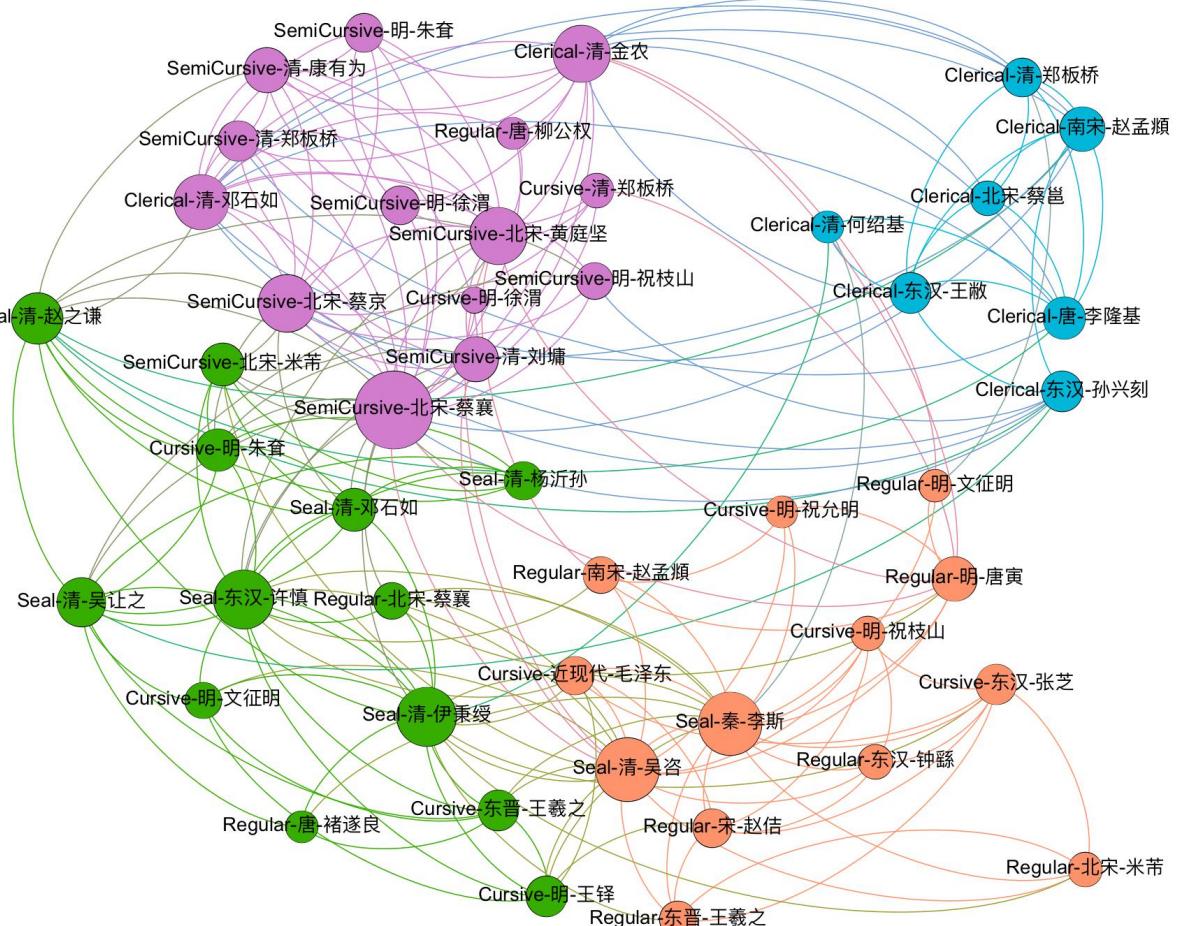
Old data set  
(47 categories)

New data set  
(74 categories)

Expand

Connection and  
Difference





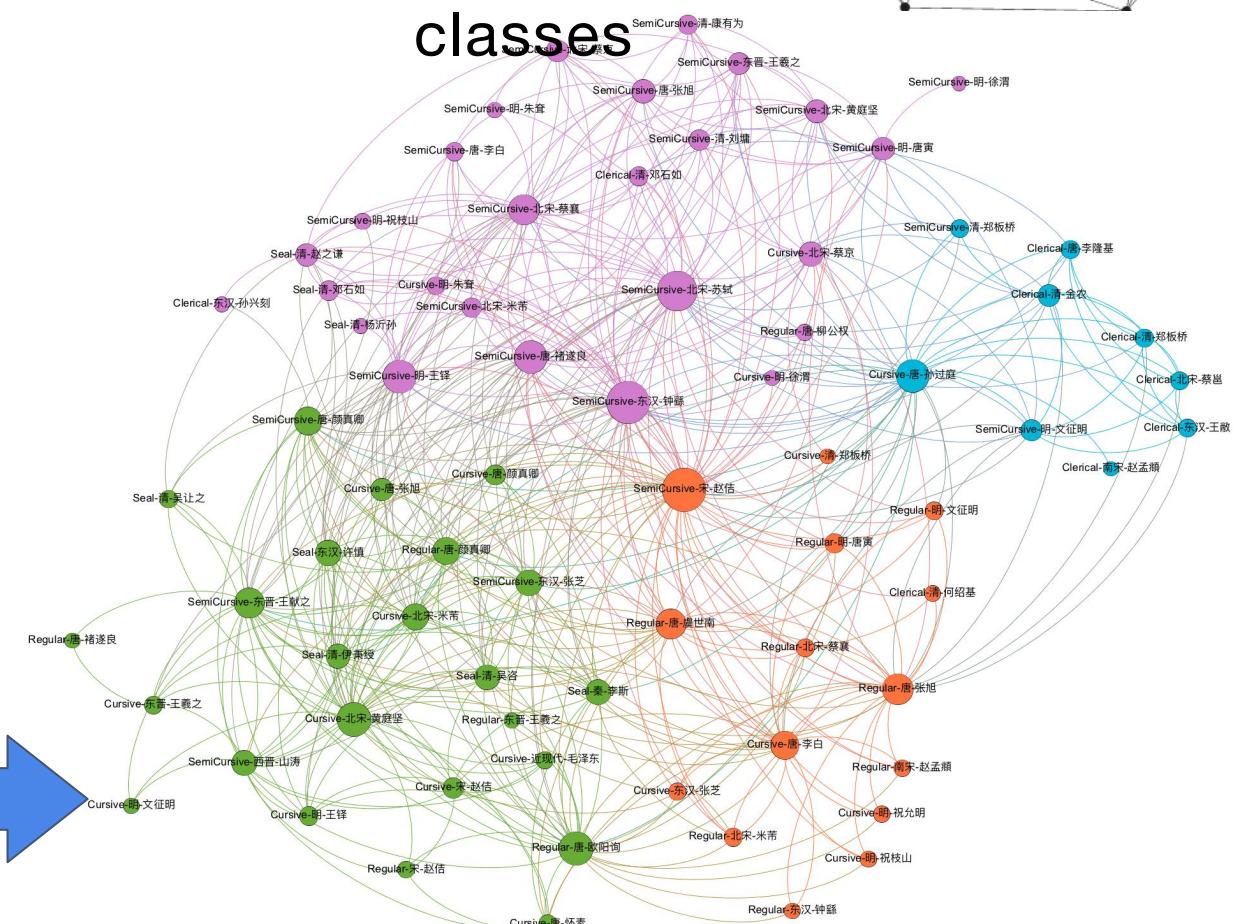
Graph of 47  
classes

enlarge the data set



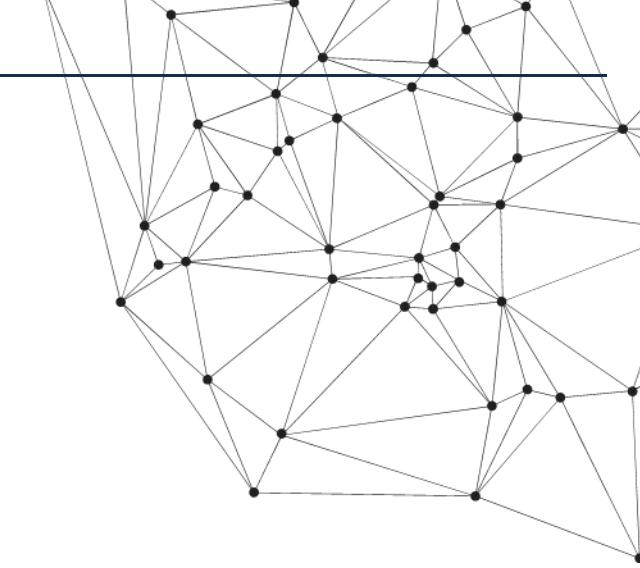
Communities of the same colour nearly have the same core.

Graph of 74  
classes

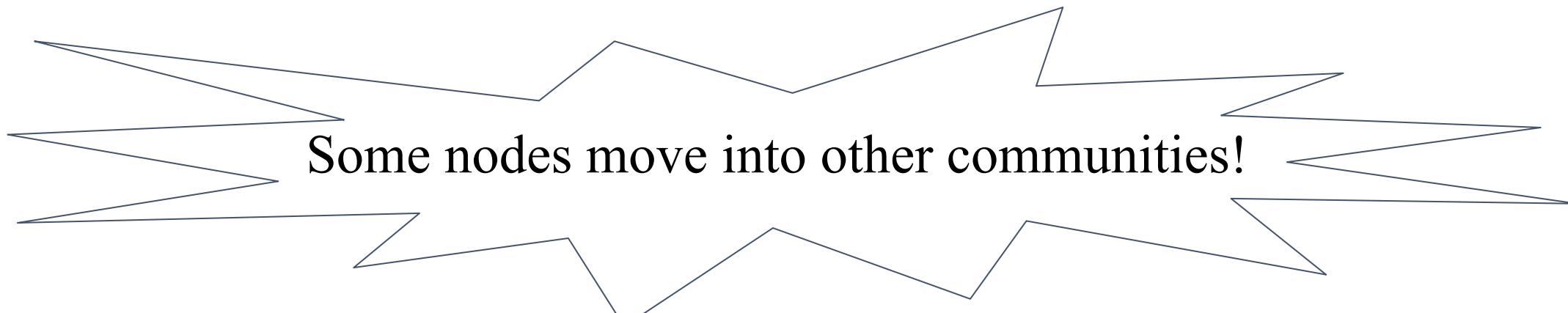


# Connection

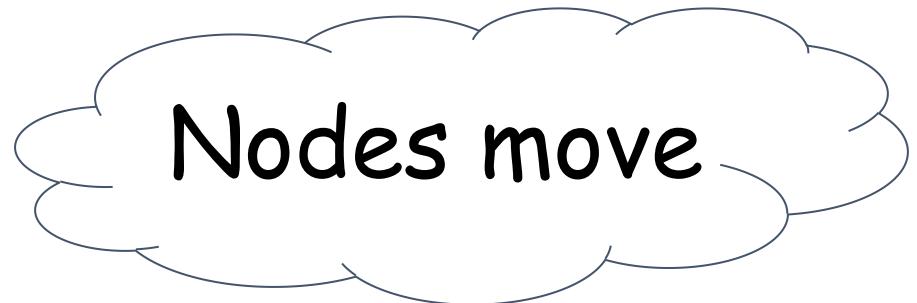
- ❖ Both data sets are clustered into four communities.
- ❖ The core of each community changes little.



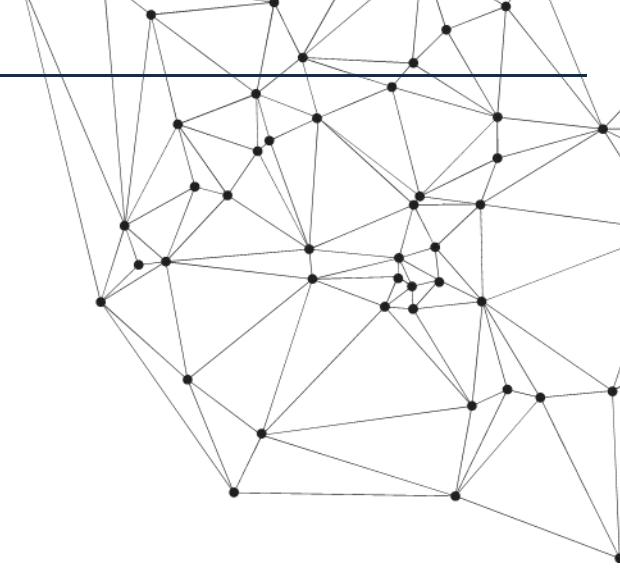
# Difference



Some nodes move into other communities!

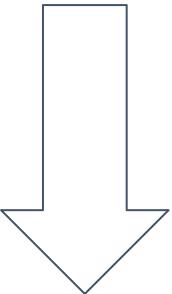


- ❖ Why they move
- ❖ Why some of them move together

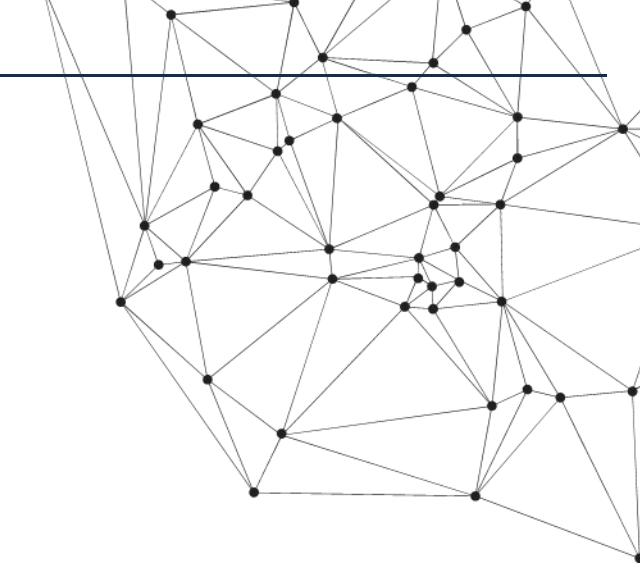


# Why they move

Some new nodes which have more connections with some old nodes are added



Such old nodes tend to move into a more corresponding community together with those new nodes



# Examples

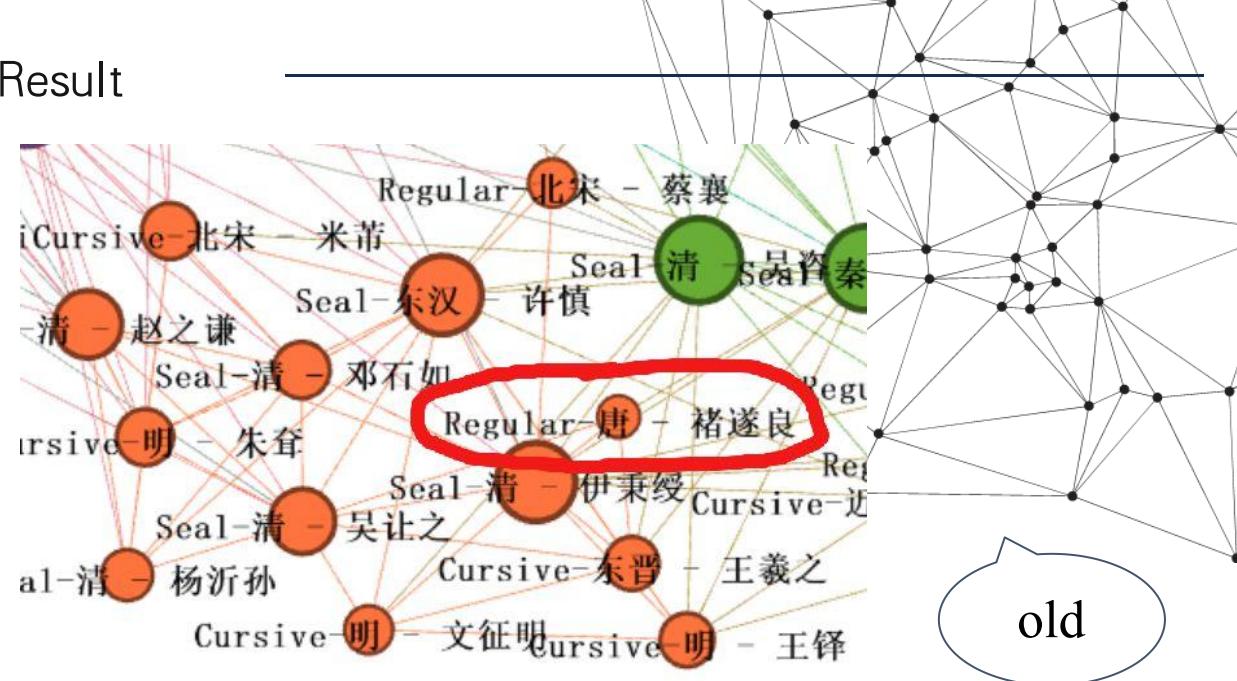
## Analysis of the Result

*Each color means one community*

Chu Suiliang studied the calligraphy of Ouyang Xun and Wang Xizhi

the regular script of Ou Yangxun was added

The same script of Chu Suiliang moved to the same community with those two



old



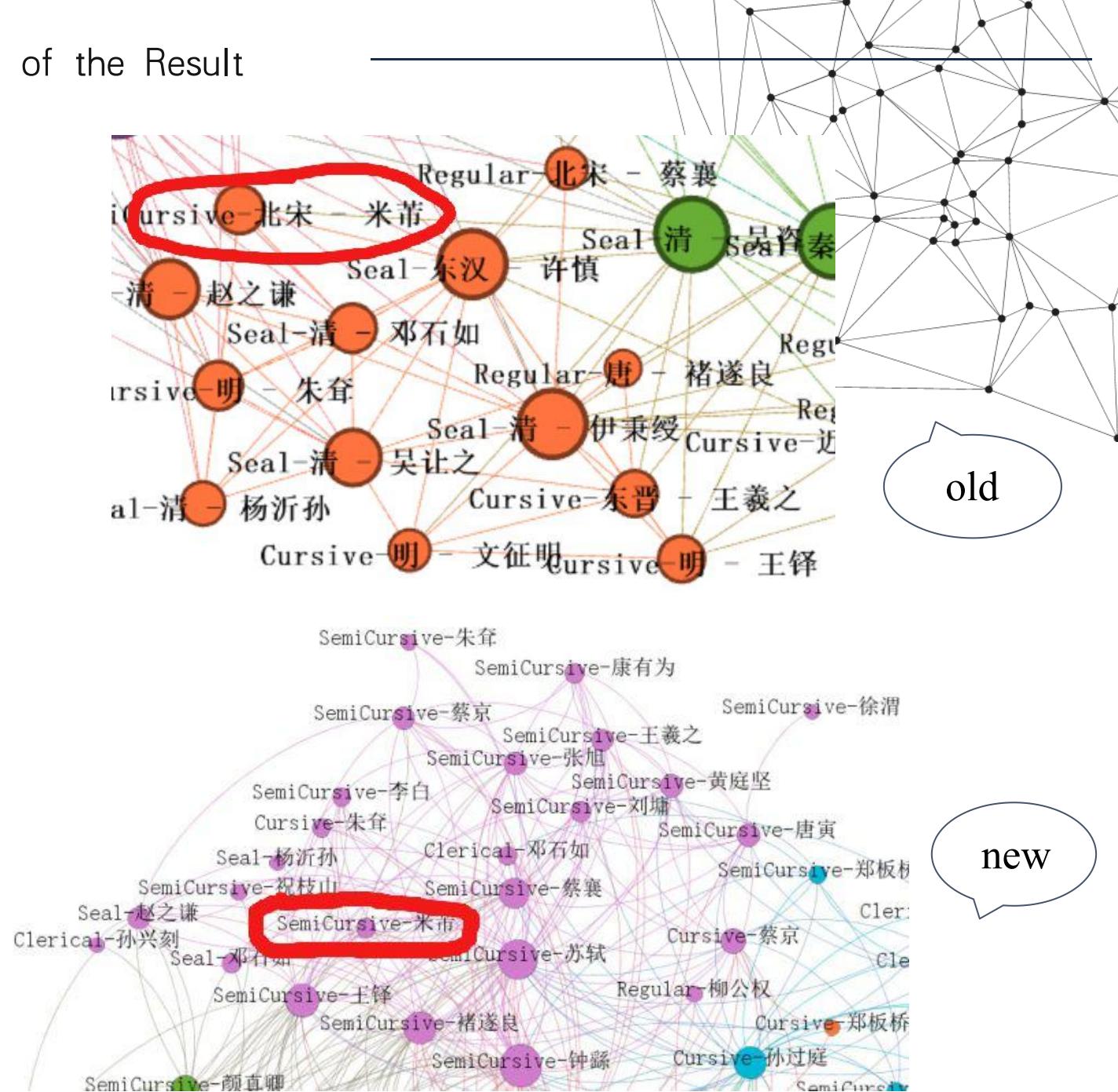
new

# Examples

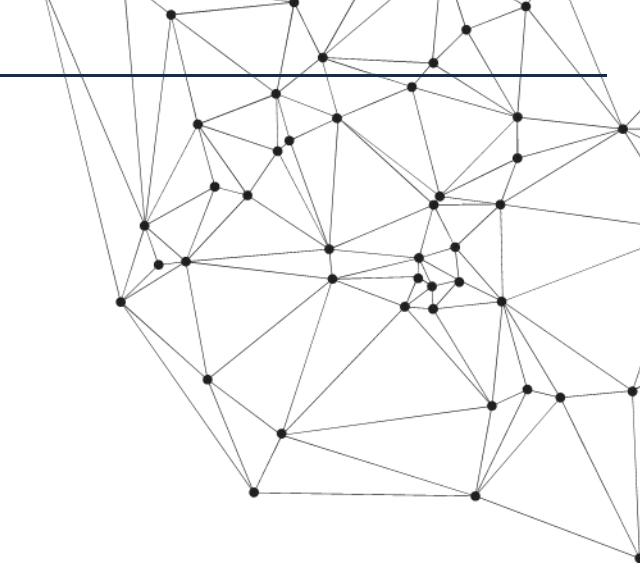
It's difficult to explain why Mi Fu's semi-cursive script were clustered into the orange community before

more semi-cursive scripts are added

It moved into the purple community which contains most semi-cursive scripts

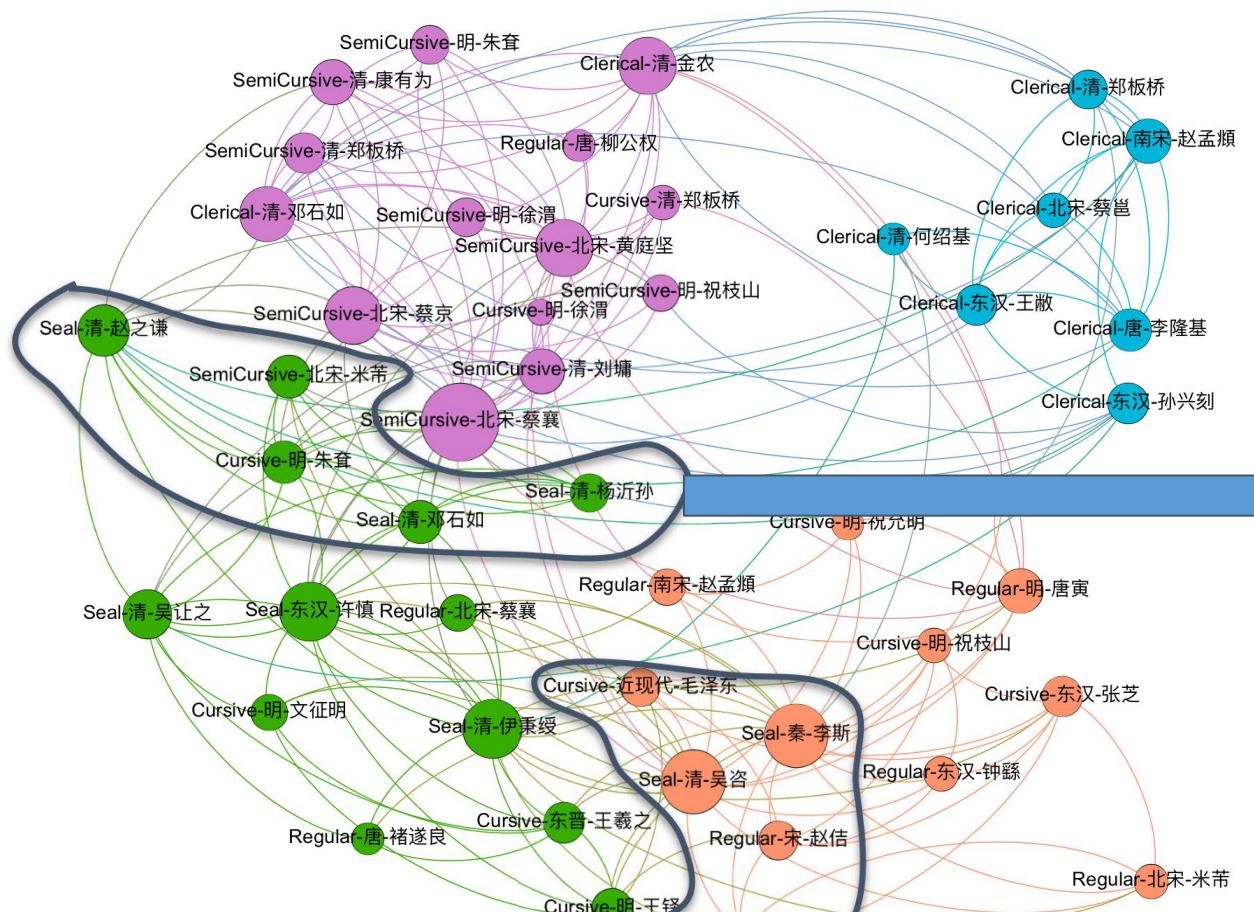


# Why they move together



Most moving nodes in the same  
community move to the same other  
community

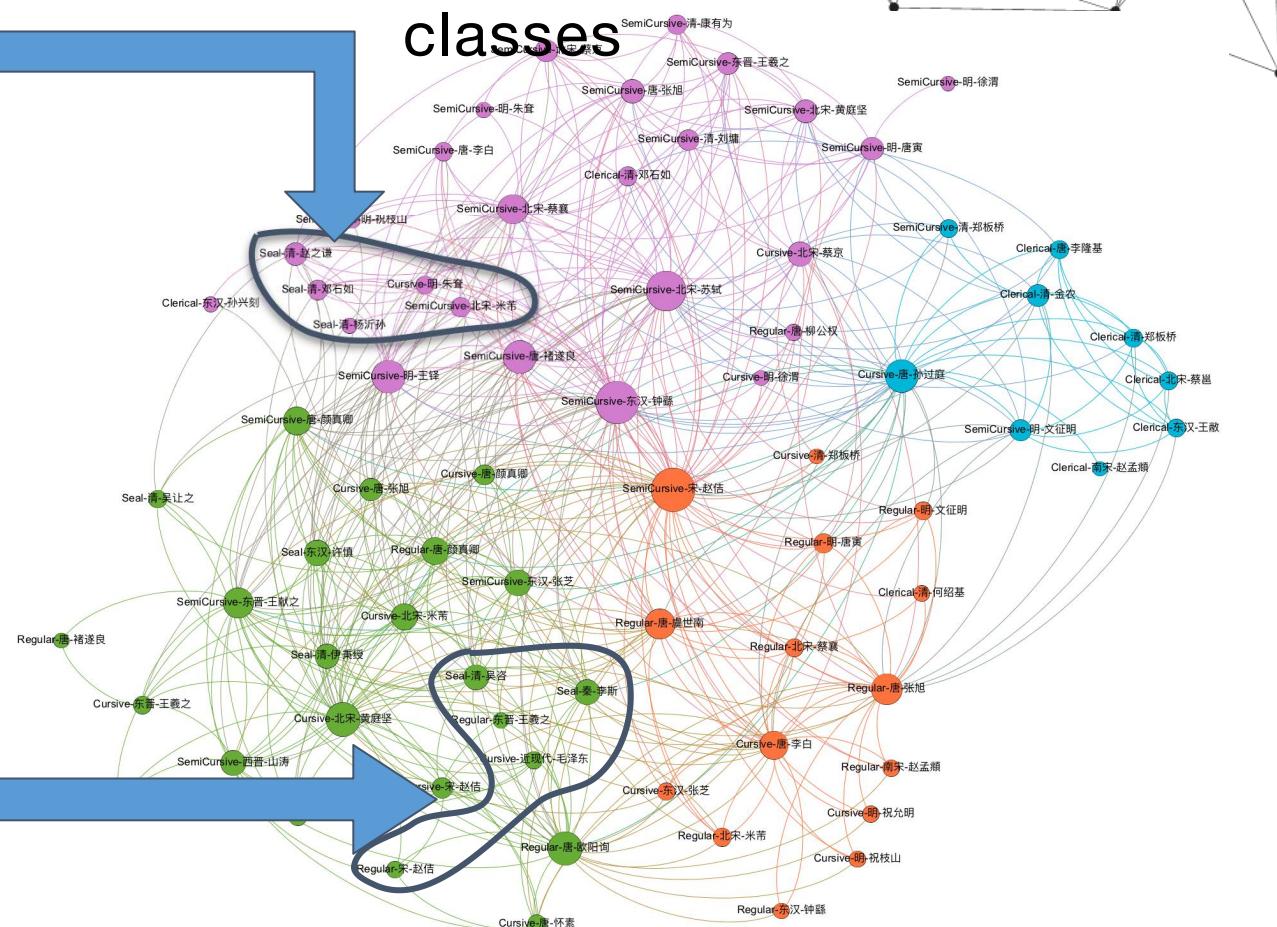
Graph of 47 classes



1. cursive—朱耷 seal—邓石如 seal—杨沂孙  
seal—赵之谦 semicursive—米芾

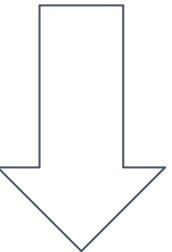
2. seal—吴咨 seal—李斯 regular—赵佶  
cursive—毛泽东 regular—王羲之

Graph of 74 classes

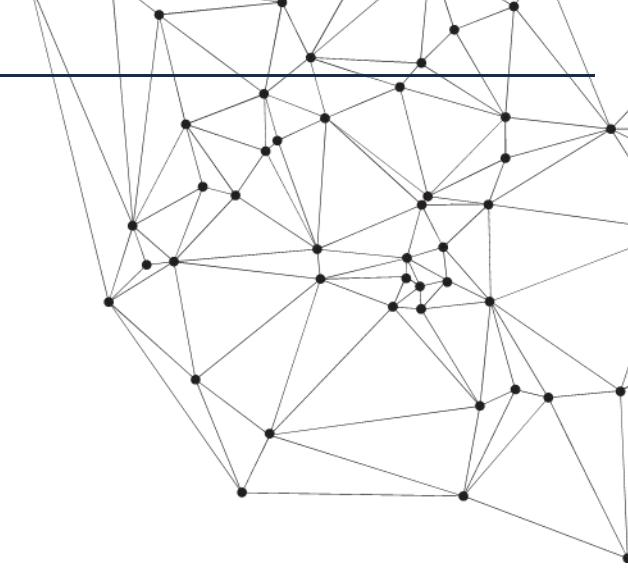


# Why they move together

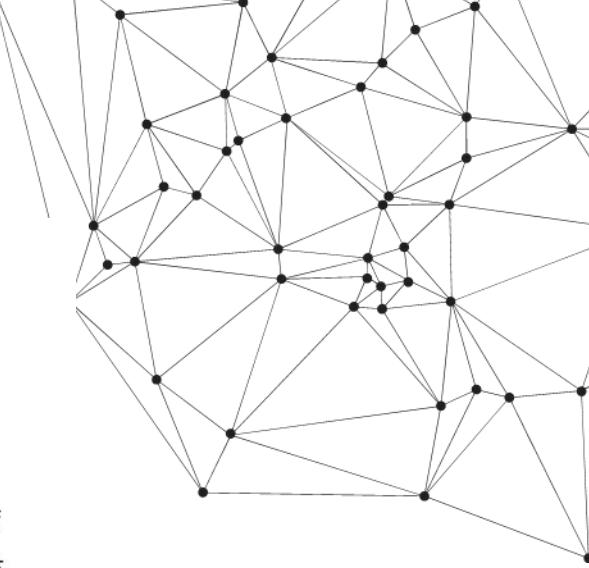
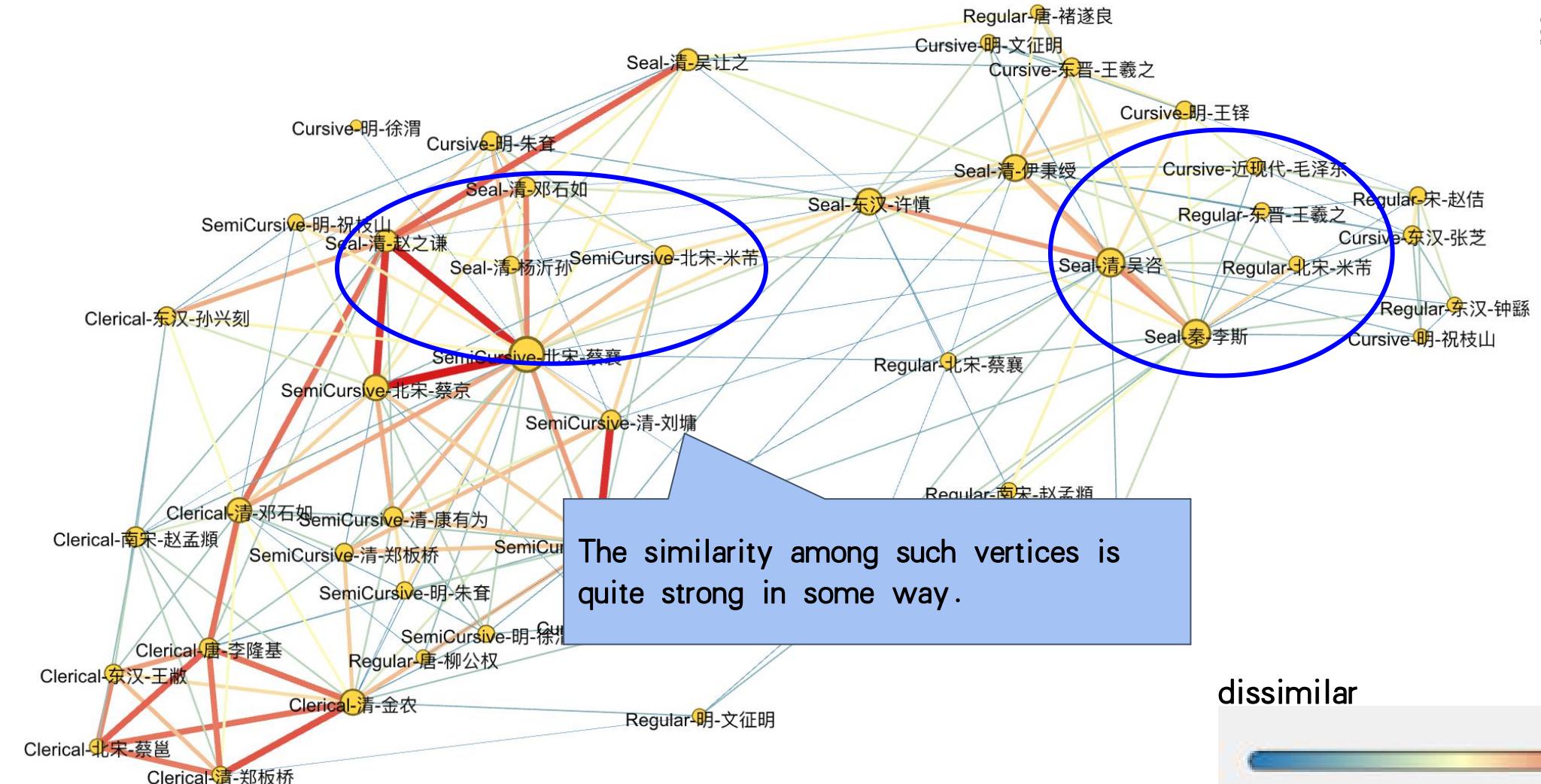
Most moving nodes in the same community move to the same other community



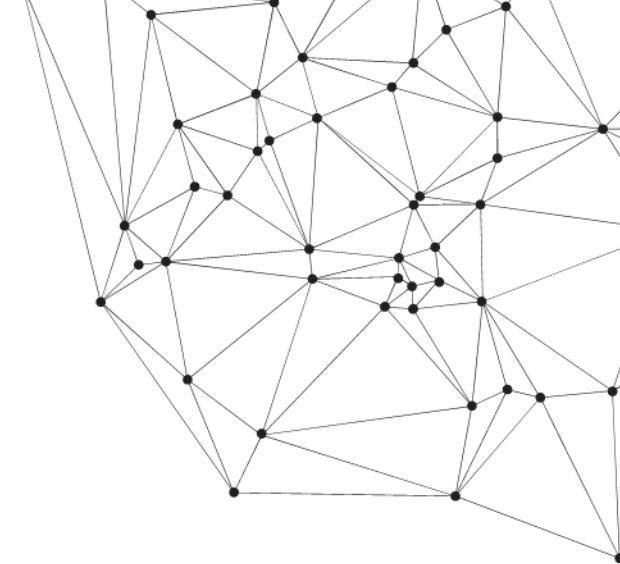
They connect with each other strongly



# Weighted Graph



# Possible reasons



- Similar characteristics

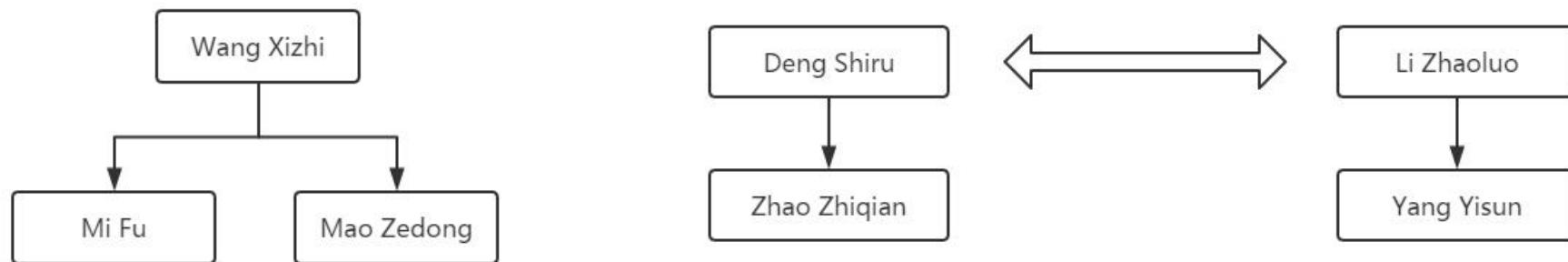
飼 桂 雜 處 庭 祖 開 祠 穀 小

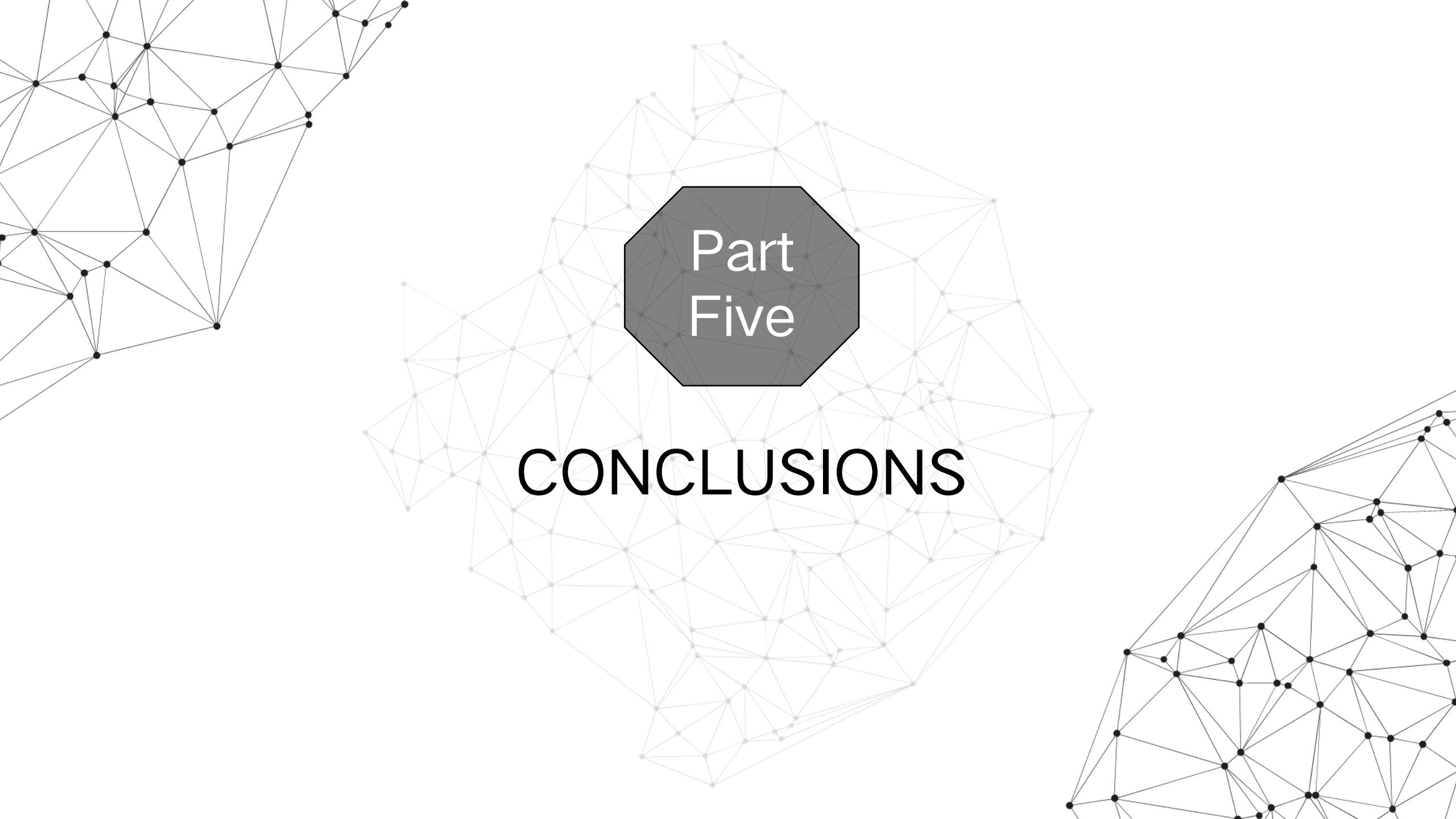
Seal of Li Si

懷 香 抱 宮 隨 戶 月 稹 繢 開

Seal of Wu Zi

- The learning relationship between calligraphers



The background of the slide features a complex, abstract network structure composed of numerous small, light gray dots connected by thin white lines, creating a mesh-like pattern that covers the entire frame.

Part  
Five

# CONCLUSIONS

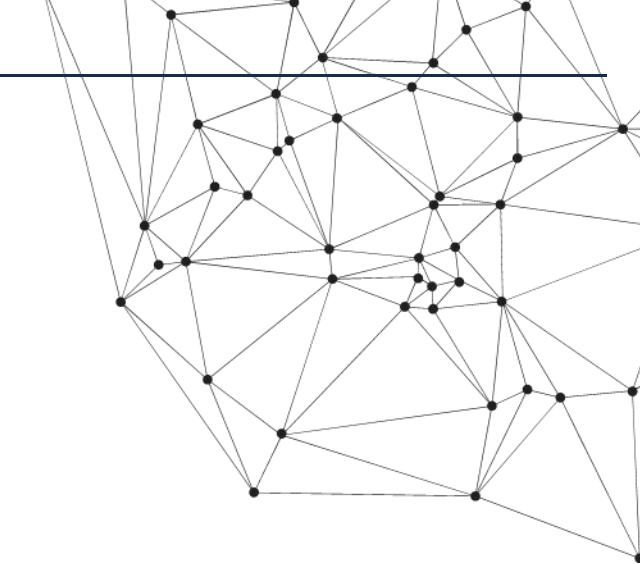
# Conclusions

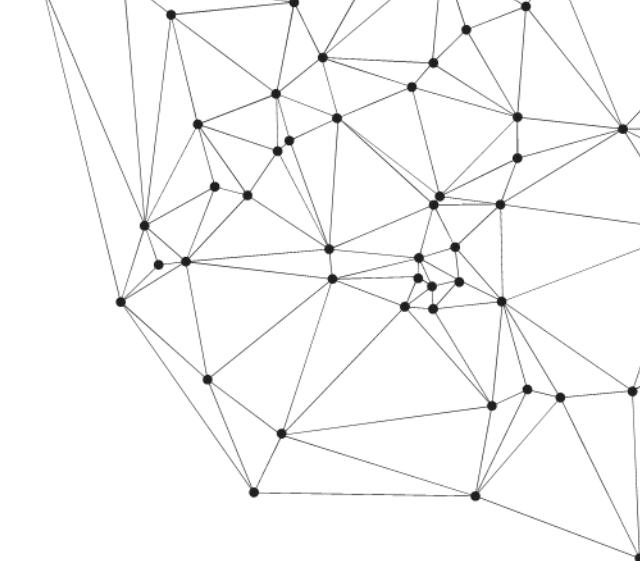
## ❖ What we expected

- Nodes of the same style tend to be in the same community.

## ❖ Interesting findings

- Even the same style of calligraphy works may be clustered into different communities because of historical factors, such as evolution or revolution of calligraphy, and so on.
- On the contrary, different styles may be clustered into the same community.
- As the expanding of data set, even the core of each community changes little, some vertices are clustered to other communities. Moving nodes in one community always move together.





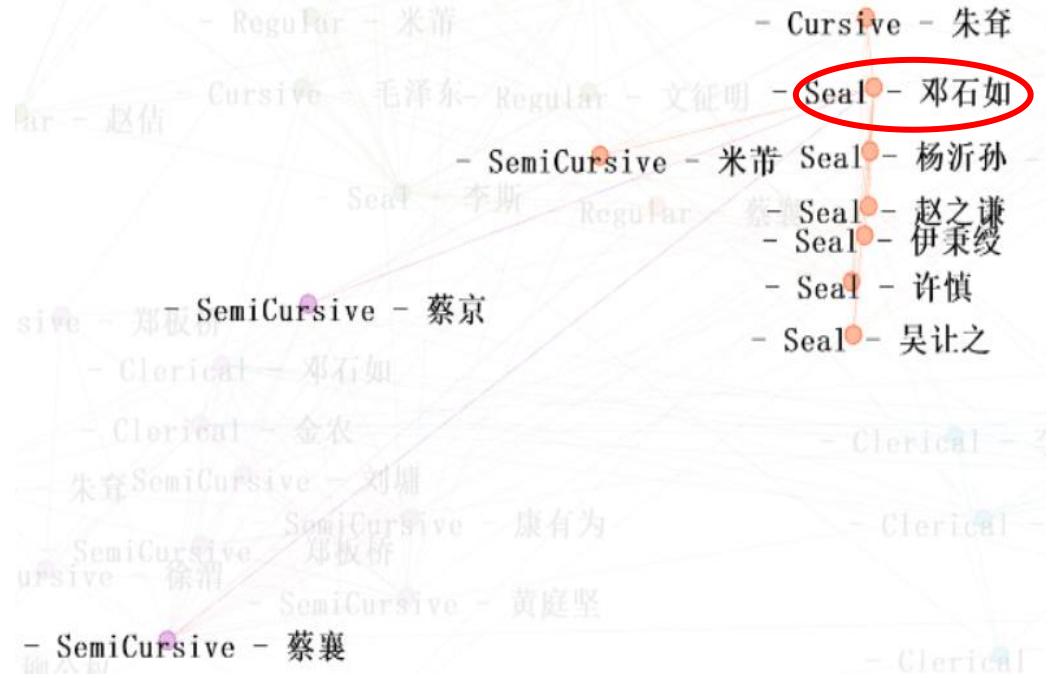
# How can the findings be used?

- Study calligraphy history or validate calligraphy knowledge.
- Find relationships among calligraphy or calligraphers which are rarely paid attention to.
- Gain new perspectives to classify calligraphy instead of traditional classification (types of style).

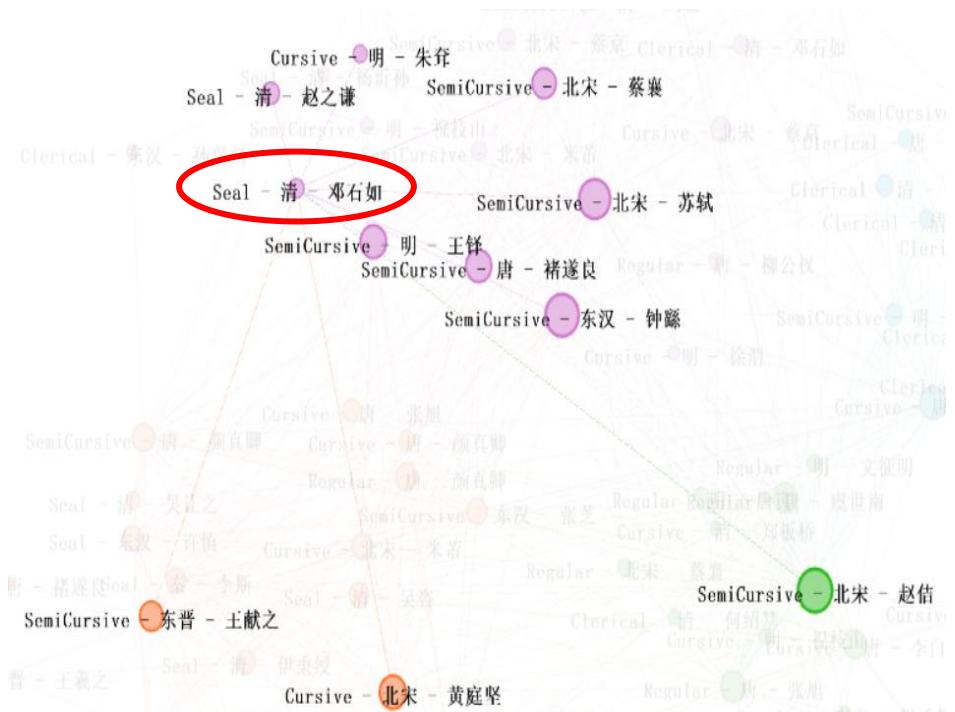


Thanks

# Seal-邓石如

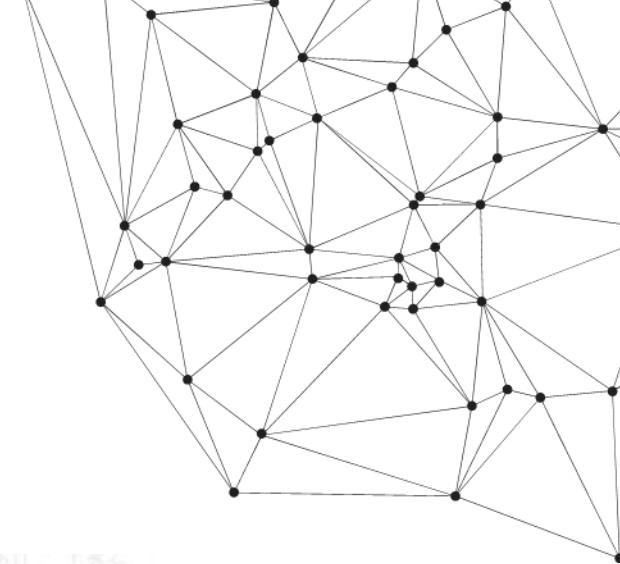


Communities of the same colour nearly have the same core.

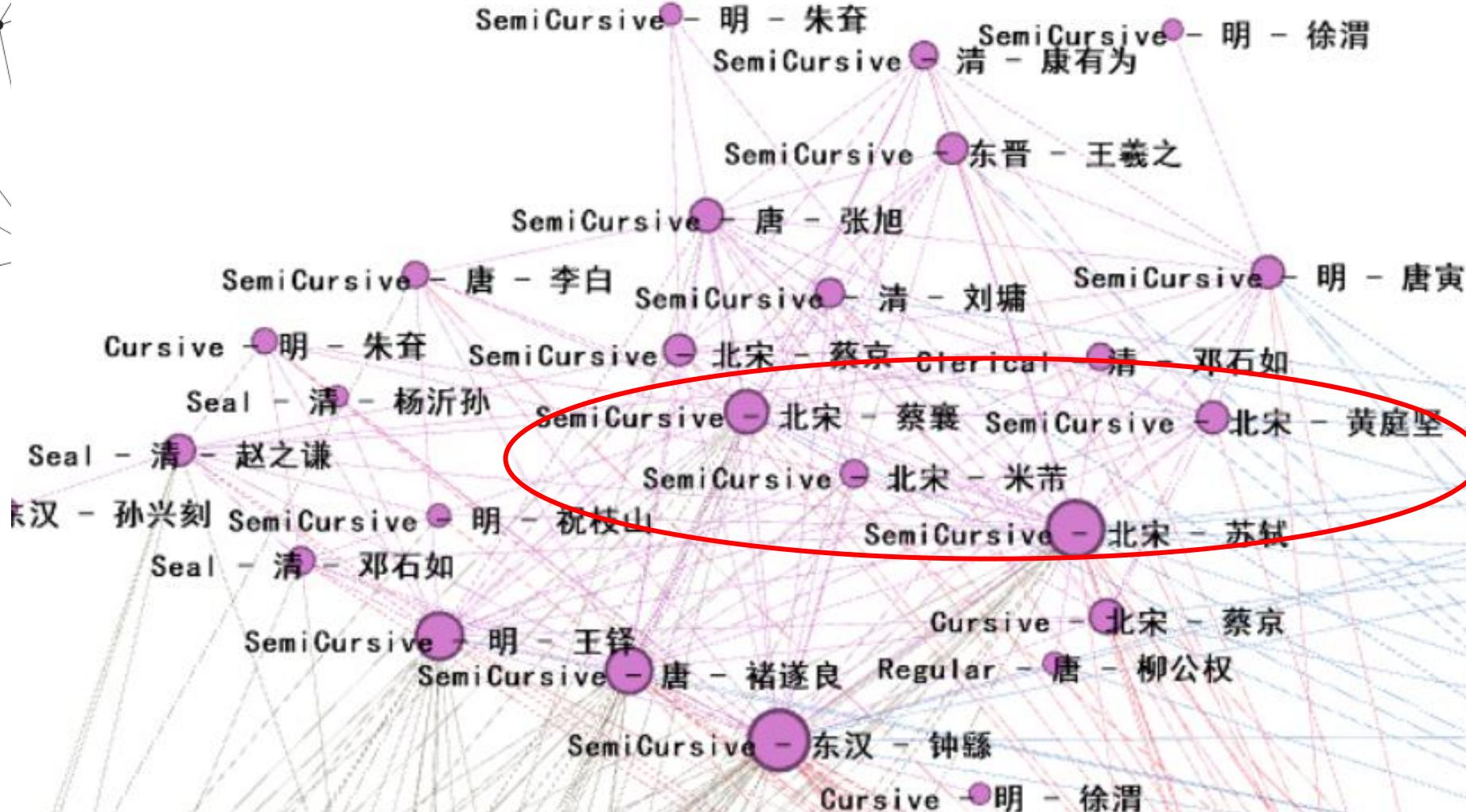


# semicursive-米芾

Communities of the same colour nearly have the same core.



# the Four Masters of the Song Dynasty (Chinese: 宋四家)



# Four Talents of Wu (Suzhou) (Chinese: 吴中四才子)

