Modeling the evolving social dynamics of political figures with chronological historical records

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Introduction

Recent years have witnessed an increasing interest in using computational approaches to study social groups in the Chinese humanities, thanks to the proliferation of biographical databases (see for example (Rudolph and Chen, 2021; Bingenheimer, 2020; Li and Zuo, 2019; Tsui and Wang, 2020)). To further exploit the rich relational and temporal information in historical sources, we investigate two computational methods to model the evolving social dynamics among officials underlying the imperial historical records – the veritable records (Shi Lu). Similar to (Armand and Henriot, 2021), we construct a co-occurrence network based on mentions of official names in the records. Leveraging the longitudinal information in the records, we aim to render the social relations among officials in the past. As the social relations of officials are closely associated with the offices they held, we conduct a text analysis on mentions of offices in the records. This paper explores the results of a mainly explorative analysis using the two approaches on a corpus of veritable records in the Ming dynasty, *Ming Shi-Lu (MSL),* from 1368 to 1644.

Dataset and Methodology

The main hypothesis is that, if adopting computational methods, it is possible to reconstruct the underlying social structure from chronological historical records. Related to this are two questions:

1. To what extent the co-occurrence of official names in the records can reflect the social relations between officials?
2. Are the frequently mentioned offices in the records and the strongly associated officials revealed in the co-occurrence network studied in existing literature?

Building upon the results of two natural language processing tasks — named entity recognition (Lai, 2016) and named entity disambiguation (Wu, 2021) — on a digitized *MSL* corpus, we extract the co-occurrence ties based on the entities of official names in the records. We reason that if two individuals appear in a record, there is a possibility for some association. To construct the network, we treat the officials as nodes and the co-occurrence ties as edges. Specifically, we exclude records lacking temporal informa-tion such as "prefaces" (Xu 序) and "precious instructions" (Bao-Xun 寶訓). In each record, we count each pair of individuals only once, even if an individual is mentioned several times. The number of records used during each emperor's reign is shown in Table 1.

Book of Emperor	Reign Period (A.D.)	Number of Paragraphs	Number of Officials included
Hongwu	1368 - 1398	2,687	451
Yongle	1402 - 1424	2,032	547
Hongxi	1424 - 1425	227	199
Xuande	1425 - 1435	2,447	496
Yingzong	1435 - 1464	5,715	970
Chenghua	1464 - 1487	5,742	1,024
Hongzhi	1487 - 1505	4,142	1,000
Zhengde	1505 - 1521	5,042	1,258
Jiajing	1521-1567	11,197	2,042
Longqing	1567-1572	2,182	735
Wanli	1572-1620	15,689	1,721
Taichang	1586-1620	217	220
Tianqi	1620-1627	5,229	1,012
Chongzhen	1627-1644	4,494	1,230

Table 1. The number of records used during each emperor's reign.

The resulting output dataset is imported into the network analysis tool Gephi (Bastian et al., 2009). Each node is ranked with its degree, and each edge is associated with a weight specifying the total number of co-occurrence in a selected period of time. Further, we filter out edges with weights fewer than 7 to eliminate noise. Then modularity is calculated with resolution set at 1 for community detection, and the final layout is generated by the layout algorithm Yi-Fan Hu.

For the second experiment, we conduct a text analysis of the offices in the records. To reflect how important an office is to a record, we first collect all the office entities in a record per AD year in *MSL*. Secondly, inspired by a numerical statistic, term frequency-inverse document frequency (*tf-idf*), we compute the term frequency-document frequency (*tf-df*), in which a term represents one office,

$$tfdf(t, d, D) = tf(t, d) \times df(t, D)$$

where term frequency tf(t, d) is the frequency of term within a record, df(t, D) is a measure of how much influence an office provides within a year

$$tf(t, d) = f_{t,d}$$

$$df(t, D) = log(\frac{|d \in D : t \in d|}{N})$$

with

- t: term,
- d: record,
- D: records within a year
- N: number of D.

In practice, *df(t, D)* is computed as:

$$df(t, D) = log(\frac{|d \in D : t \in d| + 1}{N + 1}) + 1$$

Instead of incorporating the inverse document frequency to diminish the frequency of terms that not only frequently occur in a record but also frequently in all of the records within a year, we compute the document frequency to strengthen it. We reason that the more occurrence of an office in multiple records, the more important an office is in the year. To observe the change in importance of different offices over time, we rank each office in a record by *tf-df* and count the total number of times each office ranks first by year.

Results and Future Direction

Several instructive findings emerged in analyzing the results; however, we focus the report on the change in power of the Grand Secretariat, a top-level coordinating agency created in the early 1400s. Figure 1 is the result of the number of times the Grand Secretary (GS), the Ministers of the six Ministries (M), or Eunuch (E) ranks first in a record by tf-df from 1355 to 1644, presented in a percentage component bar chart. Up to around 1505, M is generally higher than GS. During this formative period of the Grand Secretariat, although the Grand Secretaries could offer suggestions to the emperors, their powers did not override the authority of the six Ministries (Yu, 2014; Shi, 2019). Beginning from the reign of Zheng-tong (1435-1449) to Zheng-de (1505- 1521), E has two significant peaks. This reflects that eunuchs wielded substantial political power due to the young age or fatuousness of the emperors, suppressing the growth in the authority of the Grand Secretariat (Yu, 2014; Lin, 2017). Starting from 1490, a significant rise in GS corresponded to the sudden increase in the number of

Grand Secretaries. Following a steady growth from 1521 to 1620, GS reached its apex during the reign of Wan-li, resulting from the growing importance of the Grand Secretaries, which "evolved into an effective coordinating organ superimposed on the six Ministries (Hucker, 1998)".
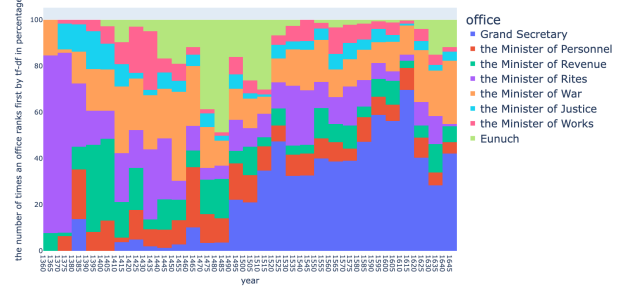

Figure 1. The percentage component bar chart of the number of times an office ranks first in a record by tf-df.

As shown in Figure 2, the strong connections between officials in the co-occurrence network during the reign of Wanli reveal the working relationships between the Senior Grand Secretaries and the Secondary Grand Secretaries – leading officials in the Grand Secretariat (See Table 2). The network also captures the cooperative relationship between Zhang Juzheng (A) and the eunuch Feng Bao (P) (Yu, 2014; Lin, 2017) and the close relationship between Sheng Shixing (F) and Wang Xijue (I). Additionally, communities in different colors delineate prominent political actors across office terms.
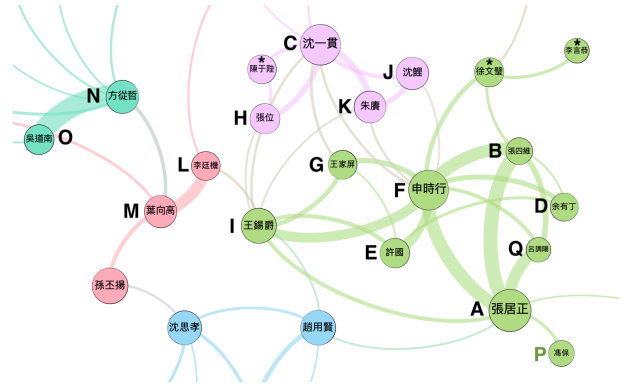

Figure 2. The co-occurrence network during the reign of Wan-li (1572-1620).

Officials marked with * only held the office Grand Secretaries.

Senior Grand Secretary (首輔)	Secondary Grand Secretary (次輔)	Time period
A: Zhang Juzheng (張居正)	Q: Lu Tiaoyang(呂調陽)	Long-qing 6 - Wan-li 6
	B: Zhang Siwei (張四維)	Wan-li 6-10
B: Zhang Siwei (張四維)	F: Shen Shixing (申時行)	Wan-li 10-11
F: Shen Shixing (申時行)	D: Yu Youding (余有丁)	Wan-li 11-12
	E: Xu Guo (許國)	Wan-li 12-19
G: Wang Jia Ping (王家屏)	Zhao Zhigao (趙志皋)	Wan-li 19-20
Zhao Zhi Gao (趙志皋)	H: Zhang Wei (張位)	Wan-li 20-21
I: Wang Xijue (王錫爵)	Zhao Zhigao (趙志皋)	Wan-li 21-22
Zhao Zhi Gao (趙志皋)	H: Zhang Wei (張位)	Wan-li 22-26
	C: Shen Yiguan (沈一貫)	Wan-li 26-29
C: Shen Yiguan (沈一貫)	J: Shen Li (沈鯉)	Wan-li 29-34
K: Zhu Geng (朱賡)	I: Wang Xijue (王錫爵)	Wan-li 34-45
	Yu Shen Xing (于慎行)	Wan-li 35-36
	L: Li Tingji (李廷機)	Wan-li 35-36
L: Li Ting Ji (李廷機)	M: Ye Xianggao(葉向高)	Wan-li 36-40
M: Ye Xiang Gao (葉向高)	N: Fang Congzhe (方從哲)	Wan-li 41-42
N: Fang Congzhe (方從哲)	O: Wu Daonan (吳道南)	Wan-li 43-45

Table 2. The statistics of the Senior Grand Secretary and the Secondary Grand Secretary during the reign of Wan-li (Lin, 2017).

In conclusion, the analyses of the two computational approaches, the co-occurrence network of officials and the number of times an office ranks first by *tf-df*, corroborate results from earlier studies on the development of the Grand Secretariat. The promising results validate the use of chronological historical records to piece together the evolution of social structure among historical people. Admittedly, both approaches have their limitations. For example, the co-occurrence network only preserves structural information at the expense of the semantic information. To this end, we are training a graph neural network to take full advantage of the *MSL* corpus and deepen our understanding of the political culture in Ming times.

Acknowledgements

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