State Snapshot Process Discovery on Career Paths of Qing Dynasty Civil Servants

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Pan Shi’en 潘世恩 (2)

- Born in 1770 in Jiangsu province
- Graduated in 1793, top of jinshi degree class
  - Provincial Commissioner of Education
  - President or Vice-President of Boards of Ceremonies, War, Civil Offices, Works
  - Grand Secretary to the Cabinet
  - ...

Some Questions

Pan Shi’en sounds like an exceptional fellow.

• How exceptional?
• Could we place his career in context with other officials?
• Visualise it?
Qing Dynasty For The Impatient

- Qing 1644-1911
- Early modern Eurasian land empire
- Founded by Manchu rulers from what is now NE China and eastern Siberia
- Continued and adapted Chinese bureaucratic institutions
Qing Graduate Paths

- Elite civil service with examination main entrance path
  - 2 million candidates for every prefectural exam
  - prefecture → province → national → palace
  - 26000 successful national candidates over entire dynasty
- Specific rules for graduate appointment to jobs
- This study: jinshi, the degree for those who sat the palace examination
Executive Tracks: Normative Career Path Flowchart

Adapted from:
Data Preparation

- Government gazettes published quarterly throughout dynasty
- China Government Employee Database-Qing (CGED-Q) database (Lee-Campbell Group)
- 1830-1905 data selection
- Han officials have clearest case linkage by name (person_id)
- Join with examination records for exam tier
- Split concurrent roles in single label using role dictionary
Concurrent Role Example

Example roles, Liu Futiao’s career

- Senior Compiler (1892-1894)
- Chief Examiner (1893)

years

1892 1893 1894
<table>
<thead>
<tr>
<th>person id</th>
<th>name</th>
<th>date (y-m)</th>
<th>roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>188330054900</td>
<td>陳冕</td>
<td>Chen Mian</td>
<td>1883-06 {修撰 Senior Compiler }</td>
</tr>
<tr>
<td>189230033500</td>
<td>劉福姚</td>
<td>Liu Futiao</td>
<td>1892-09 {修撰 Senior Compiler }</td>
</tr>
<tr>
<td>189230033500</td>
<td>劉福姚</td>
<td>Liu Futiao</td>
<td>1893-03 {修撰 Senior Compiler, 正主考 Chief Examiner }</td>
</tr>
<tr>
<td>189230033500</td>
<td>劉福姚</td>
<td>Liu Futiao</td>
<td>1894-03 {修撰 Senior Compiler }</td>
</tr>
<tr>
<td>189230033500</td>
<td>劉福姚</td>
<td>Liu Futiao</td>
<td>1897-03 {修撰 Senior Compiler, 副考官 Vice Examiner }</td>
</tr>
</tbody>
</table>
Place Labelled Petri Nets

- Use Petri net places to represent roles (cf activities)
- State reflected by marking of potentially multiple places
- Transition weights reflect probabilities
- Place capacities of one
State Snapshot Miner Algorithm

One way to discover such models automatically
### Discovery Example

1. Each role becomes a place
2. Add initial and final places
3. Inspect direct follow pairs of role sets
4. Direct follow role sets become transitions

\[
(\{p_I\}, \{ \text{Senior Compiler} \}), \ldots
(\{ \text{Senior Compiler} \}, \{ \text{Senior Compiler, Chief Examiner} \}), \ldots
\]
State Snapshot Miner Design and Implementation

- Complexity $O(||L|| \cdot |R|)$
- Noise handling
  - Using direct-follows frequency
- Python implementation and sample public data
  https://github.com/adamburkegh/statesnap-miner
1. Household Administrator of the Heir Apparent
2. Assistant Provincial Examiner
3. Provincial Education Commissioner
4. Day official
5. Secretary
6. Hanlin Bachelor
7. Principal Chief Examiner
8. Archivist
9. Junior official
10. Southern Internship
11. Minor capital official
12. Capital official
13. Casual scholar
14. Senior Compiler
2. Assistant Provincial Examiner
3. Provincial Education Commissioner
6. Hanlin Bachelor
10. Southern Internship
14. Senior Compiler
Maybe

Definitely
Tier 1&2 Candidates (3897) - first three years - State Snapshot Miner

3 Provincial Education Commissioner
5 Secretary
6 Hanlin Bachelor
15 County Magistrate
16 Censor
17 Prefect
18 Board Director
19 Petitioner
20 Junior Compiler
21 Bureau Vice-Director
Pan Zengying in context with Tier 1&2 Candidates (3897)

6 Hanlin Bachelor
15 County Magistrate
20 Junior Compiler

4.5 years

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Evidence promotion rules actually followed
  - Not to be assumed in this period
Identification of canonical career paths
“Zoomed out” view of Tier 1&2 candidates new
  - not possible with close reading methods
Does this happen anywhere else?

Yes.

At least one other example in historical career data:


Plus,

- holding multiple jobs is hardly unusual today
Gig economy

The gig economy uses mobile apps or websites to connect individuals providing services with consumers.

You may also know the gig economy as the:
- platform or app economy
- sharing economy
- on-demand workforce.

On this page:
- About the Australian gig economy
- Working in the gig economy
- Misclassifying employees as independent contractors
- More information for gig economy workers

About the Australian gig economy
Related and Future Work

• Career path Direct Follow Graphs of Portugese government corporation over 35 years (Silva et al 2017)
• Declarative models of Italian graduate career paths over five years (Bellodi et al 2010)
• Region-based and stochastic miners
• CGED-Q cohorts by year or location
• Other miners with state snapshot input
• Other historical and sociological data sets
• Connections to social sequence analysis
Thanks for your time. Questions welcome.