

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

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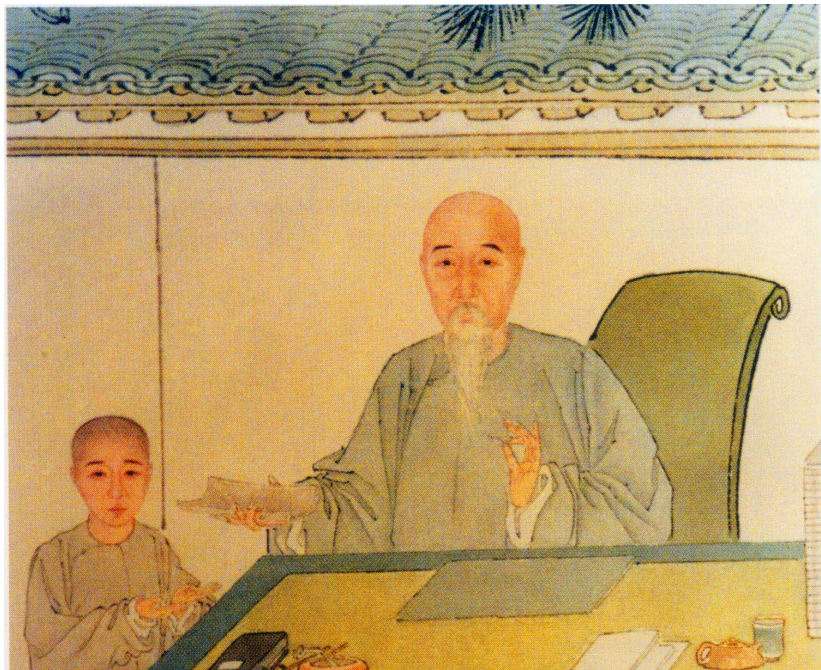
Moe Wynn

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Pan Shi'en 潘世恩



- 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
 - ...

From Arthur W. Hummel Sr, ed. *Eminent Chinese of the Ch'ing period (1644-1912)*. eng. Global Oriental classic reprints ; no. 7. Folkestone, Kent, UK: Global Oriental, 2010

Pan Shi'en sounds like an exceptional fellow.

- How exceptional?
- Could we place his career *in context* with other officials?
- Visualise it?

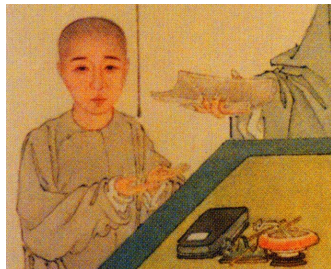
Qing Dynasty For The Impatient

- 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

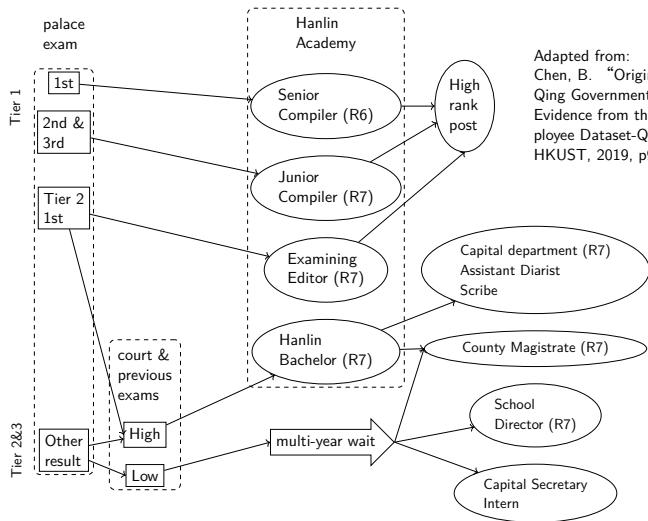


Qing Graduate Paths

- 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



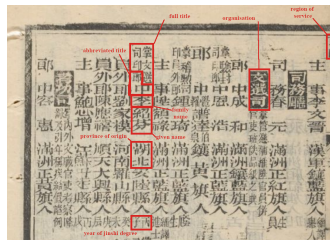
Executive Tracks: Normative Career Path Flowchart



Adapted from:
Chen, B. "Origins and Career Patterns of the Qing Government Officials (1850-1912): Evidence from the China Government Employee Dataset-Qing (CGED-Q)". PhD Thesis. HKUST, 2019, p96.

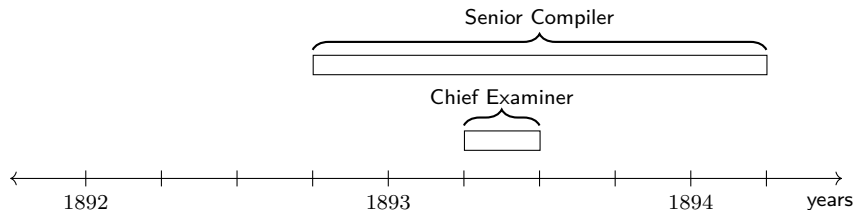
Data Preparation

- 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

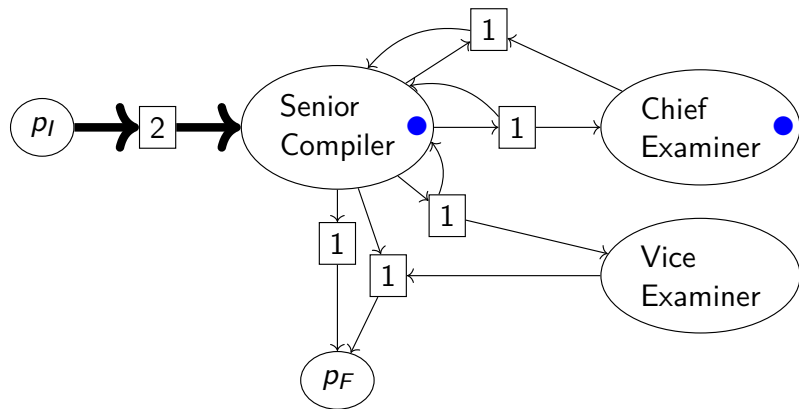


State Snapshot Logs

person id	name	date (y-m)	roles
188330054900	陳冕 Chen Mian	1883-06	{ 修撰 Senior Compiler }
189230033500	劉福姚 Liu Futiao	1892-09	{ 修撰 Senior Compiler }
189230033500	劉福姚 Liu Futiao	1893-03	{ 修撰 Senior Compiler, 正主考 Chief Examiner }
189230033500	劉福姚 Liu Futiao	1894-03	{ 修撰 Senior Compiler }
189230033500	劉福姚 Liu Futiao	1897-03	{ 修撰 Senior Compiler, 副考官 Vice Examiner }

- 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

Place Labelled Petri Net With Career Data



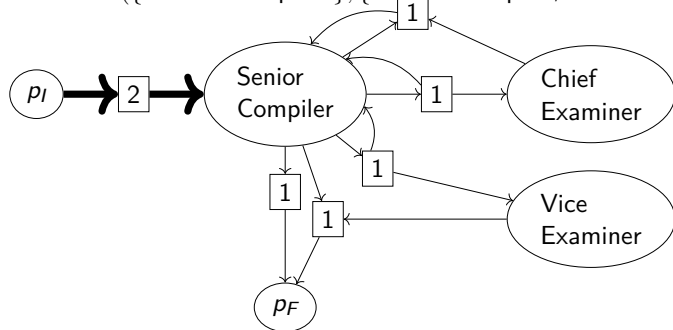
One way to discover such models automatically

Discovery Example

2. Explicitly list followership chains of role sets

($\{p_I\}$, { Senior Compiler }), ...

({ Senior Compiler }, { Senior Compiler, Chief Examiner }), ...

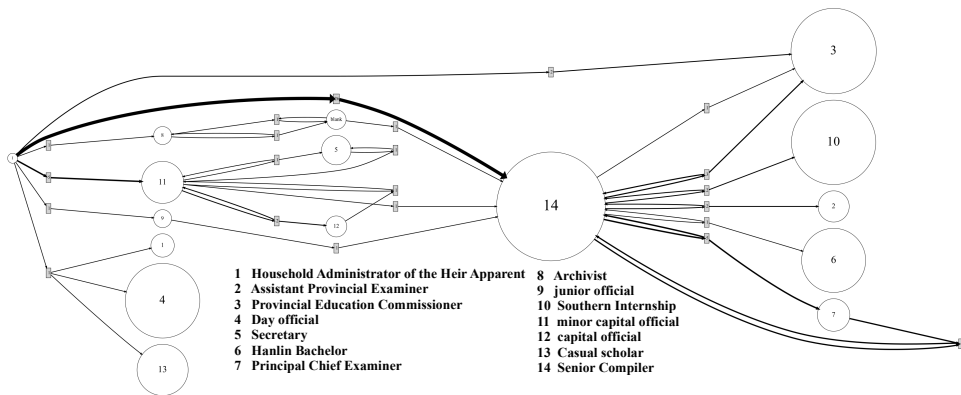


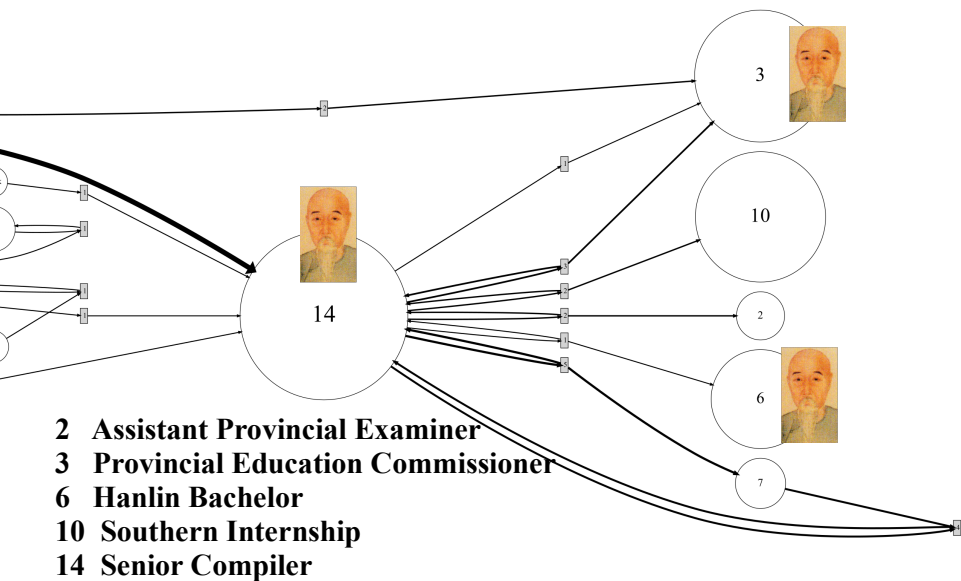
State Snapshot Miner Design and Implementation

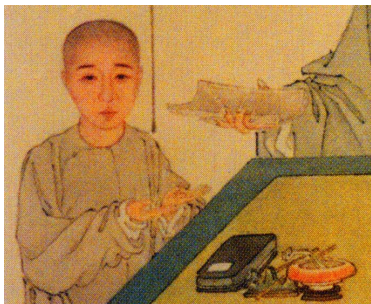
- Complexity $O(|L| \cdot |R|)$
- Noise handling
 - Using direct-follows frequency
- Python implementation and sample public data
<https://github.com/adamburkegh/statesnap-miner>



Top Placed Candidates (36) - first three years - State Snapshot Miner





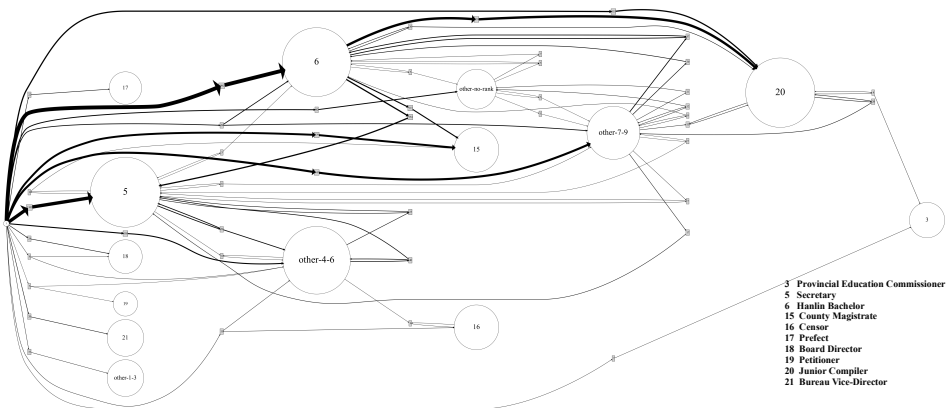


Maybe

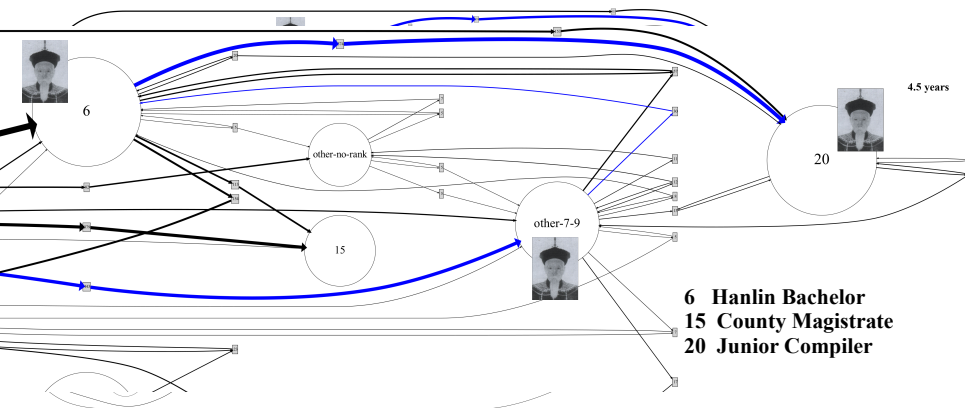


Definitely

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



Pan Zengying in context with Tier 1&2 Candidates (3897)



- 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:

- German musicians 1660-1810 [Andrew Abbott](#) and [Alexandra Hrycak](#). “Measuring resemblance in sequence data: An optimal matching analysis of musicians’ careers”. In: *American journal of sociology* 96.1 (1990), pp. 144–185

Plus,

- holding multiple jobs is hardly unusual today



Aboriginal and Torres Strait Islander peoples

Apprentices and trainees >

Building and construction industry

Contracting labour & supply chains >

Contract cleaning >

COVID-19 and workplace laws >

Employees with disability

Fast food, restaurants and cafes >

Franchises >

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](#)



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

Thanks for your time. Questions welcome.

