slides: http://bit.ly/netsci_LFN

Revealing the Hierarchical Structure of the Global Labor Flow Network

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Automation

"Total recall" (1990)

AND RESERVED







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http://atlas.media.mit.edu/en/

Millions of "Drivers"



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http://atlas.media.mit.edu/en/

Farm Jobs, % of Total U.S. Jobs 1790 to 2000





But the **speed** of change matters.

Skill gap



Number Of Former Workers On Disability



http://apps.npr.org/unfit-for-work/

Global competition



Even more challenging in developing countries

Challenges

- How do industrial sectors are interconnected?
- What kinds of jobs will be vanishing or appearing?
- What are the emerging skills?
- Given the past career, what can I do?

















Notable people tend to move to **nicer** place





Notable people tend to move to nicer place





Anchiano, Vinci



Schich, Maximilian, et al. "A network framework of cultural history." Science 345.6196 (2014): 558-562.

1452 Anchiano, Vinci

Does **Influx of talents** herald growth of an industrial sector?

Do we have a map?



http://www.timvandevall.com/printable-treasure-maps-for-kids/



Hidalgo, César A., et al. "The product space conditions the development of nations." Science 317.5837 (2007): 482-487.



Hidalgo, César A., et al. "The product space conditions the development of nations." Science 317.5837 (2007): 482-487.

Limitations:

Products & Countries

Non-product economy dominates

(United States)



Haksever, Cengiz, and Barry Render. Service Management: An Integrated Approach to Supply Chain Management and Operations. FT Press, 2013.
Country may not be a good resolution.

Location, location, location



Guardian: Hipster churches in Silicon Valley: evangelicalism's unlikely new home <u>http://www.theguardian.com/us-news/2015/jan/29/hipster-churches-sillicon-valley-evangelical-new-home</u>



http://www.npr.org/news/graphics/2009/may/bigthree/

Global companies



Sources: Apple, IHS (Suppli, IDC Worldwide

How can we capture

all types of **industries** that are both **localized** and span **many countries**?



How do we capture the relationships between them?



Talent Traffic 2.0

Based on original graphic and data from TopProspect. Figures show ratio of number of employees moving from one company to another (e.g. 15.5 employees left Google to work at Facebook for every employee who left Facebook for Google). The color of the cars match their source (brown cars left Microsoft).



Similar companies require:

Similar skills, experience, social contacts, culture, ...

Labor Flow Network (O. Guerrero & R. Axtell)



Guerrero, Omar A., and Robert L. Axtell. "Employment growth through labor flow networks. PloS one 8.5 (2013): e60808.

ECONOMIC GRAPH CHALLENGE



400 million users 200 countries

https://blog.linkedin.com/2015/10/29/400-million-members

Job history

Add Media: 📑 Document 💼 Photo 🖉 Link 🔘 Video 🛱 Presentation

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Linked in

400 million users 200 countries

https://blog.linkedin.com/2015/10/29/400-million-members

Company as vectors

(Banking, accounting, insurance, ...)



(MS Office, accounting, ...)

What's the large-scale pattern?

Industrial clustering



LinkedIn's Industry classification

Industrial clustering



LinkedIn's Industry classification

Geographical clustering



Core structure





US Banking Industry

SOUTH Bank O **Regions** Final

Wells Fargo Home Mortgage America

Huntington National Bank

Us Bank

Bmo Harris Bank

MEST

e Wes

Bank O

MIDWEST

TAST

Hierarchical community structure

Louvain method



Blondel, Vincent D., et al. "Fast unfolding of communities in large networks." Journal of statistical mechanics: theory and experiment 2008.10 (2008): P10008.





Pruning

Metadata-based pruning



Measuring concentration



Communities reduce metadata entropy much more than expected



Visualization





Tree visualization

Industries

Industries



Geography

Geography





Industry vs. Geography



Geography > industry



IT industry


IT industry





IT industry







"Microindustries": geo-industrial complexes



Flow of highly educated people (college and up)



Flow of highly educated people (college and up)



Skill distribution



Social Media

Public Relations

Labor flow vs. Growth

Does the net influx of talents matter?

Does the net influx of talents matter?



Talent ~ **College** degree





A tale of two companies

Flux ratio: log ratio of **in** and **out**



Influx trend: has the company been attracting gradually more people than losing?

Market cap trend: has the company's market cap been increasing?

Too noisy at the company-level

Aggregating into the microindustries



Aggregating into the microindustries



Aggregating into the microindustries



Is the influx trend associated with change in valuation?



Summary



GRAPH

Mike Conover

Linked in

ONOMIC

Jaehyuk Park

Yizhi Jing

Ian Wood

Azadeh Nematzadeh