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Beijing City Lab

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北京航空航天大学
BEIHANG UNIVERSITY

SMART CITY



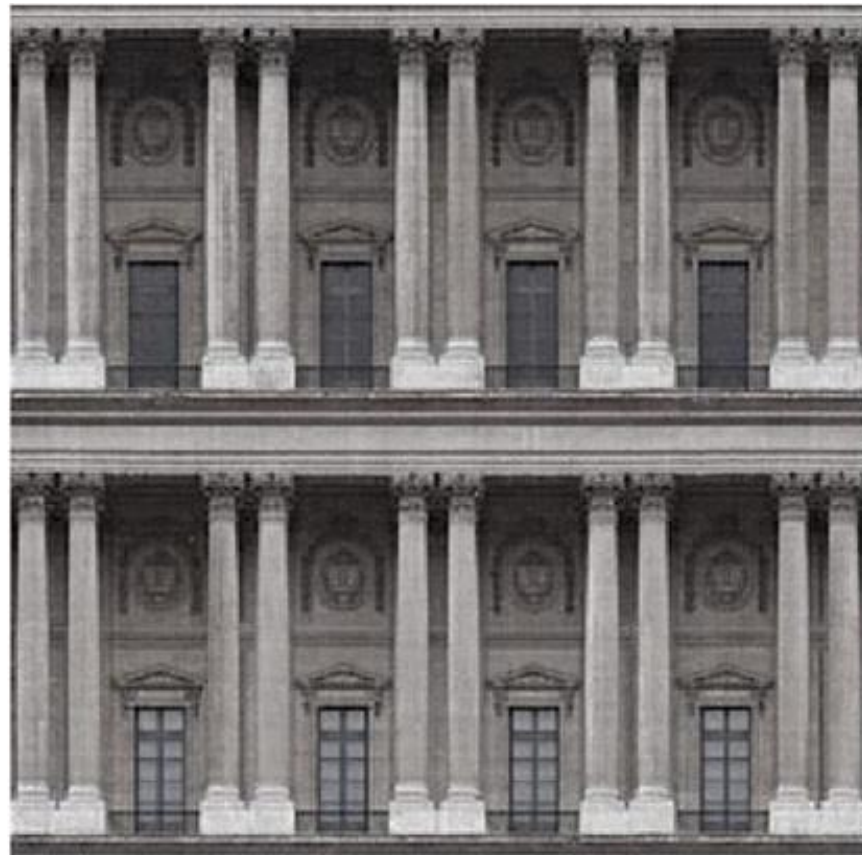
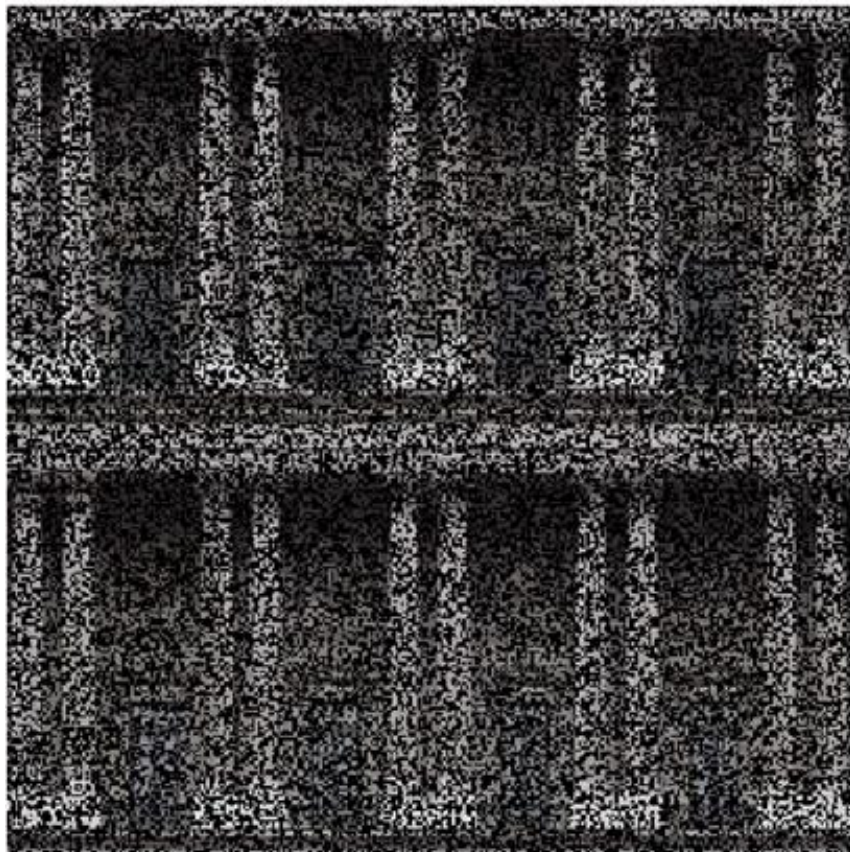
机器学习工具在城市数据分析中的应用

王静远

北京航空航天大学

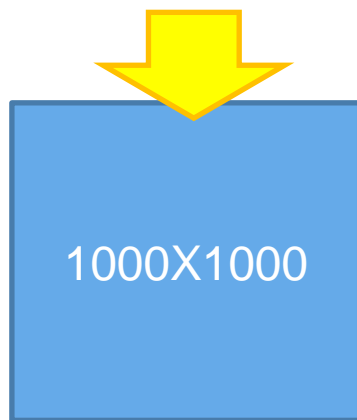
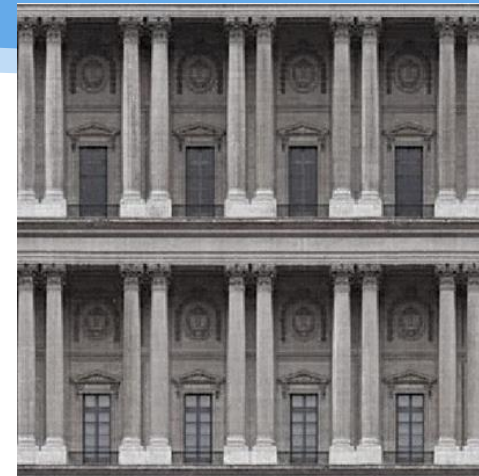
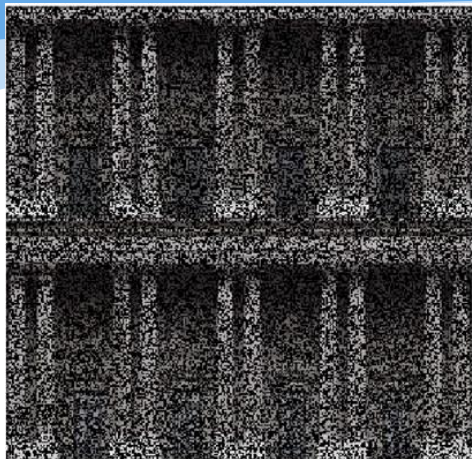


视频恢复

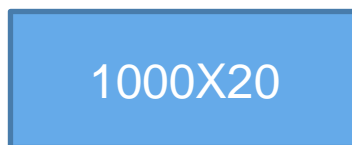




矩阵分解



Step1



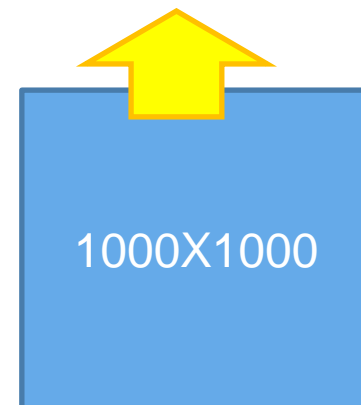
矩阵分解

X

Step2



=



Step3





电影推荐



The Matrix



Star Wars



Roman Holiday



Titanic



Shrek



Madagascar

Alice	5	4	5	?	?	2
Bob	?	4	?	5	1	2
Tracy	5	5	3	2	2	?
Steven	2	?	?	1	?	4
John	2	1	4	?	4	?

6X5的矩阵





矩阵分解

电影类型



The Matrix



Star Wars



Roman Holiday



Titanic



Shrek



Madagascar

科幻片

爱情片

动画片

0.63	0.64	0.32	0.25	0.11	0.03
0.28	0.06	0.54	0.73	0	0.28
0	0.13	0.01	0.01	0.77	0.61

6X3的矩阵

观众爱好

Alice	Bob	Tracy	Steven	John
5.6	5.2	7.6	3.2	0
5.2	4.4	0.3	0.08	6.93
0.5	0.7	1.3	6.9	5.1

X

5X3的矩阵





电影推荐



The Matrix



Star Wars



Roman Holiday



Titanic



Shrek



Madagascar

Alice	5	4	5	5	1	2
Bob	4.5	4	4	4	1	2
Tracy	5	4	4	4	2	1.8
Steven	2	2.8	4	1	5	4
John	2	1	4	5	4	5

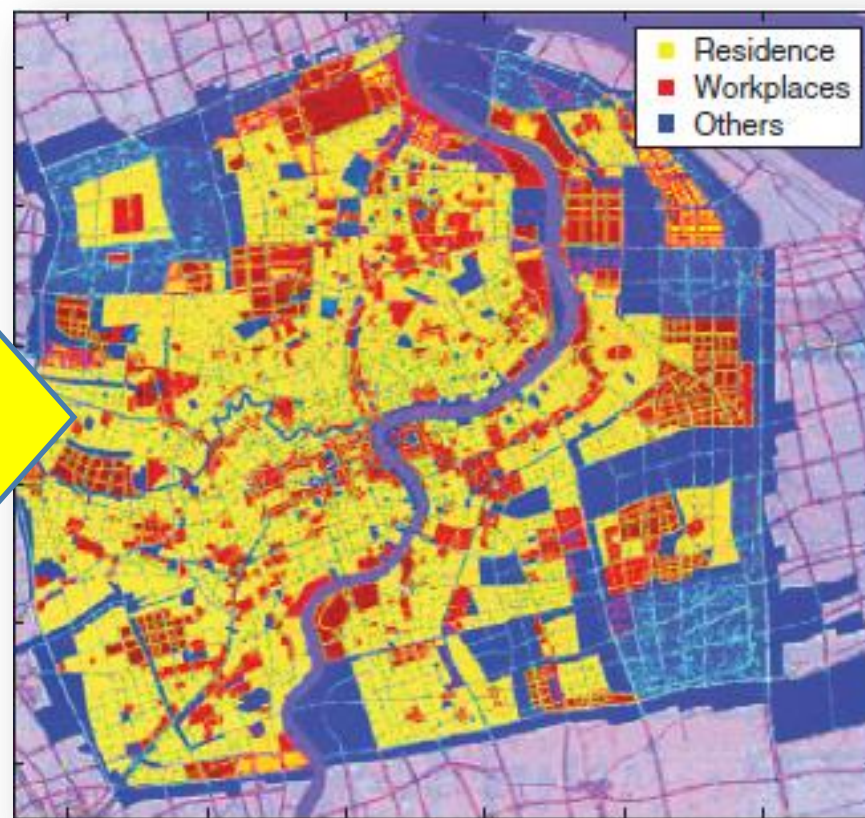
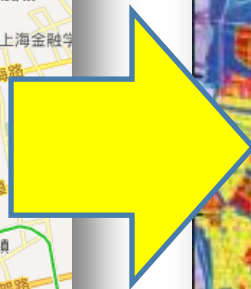
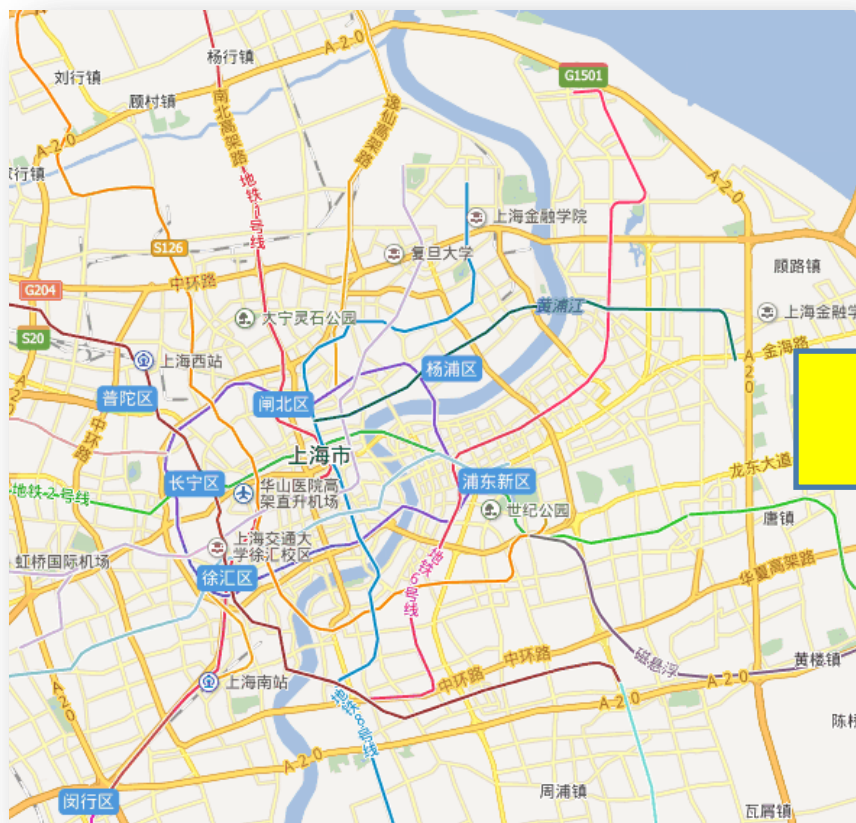
发现模式
推测未知





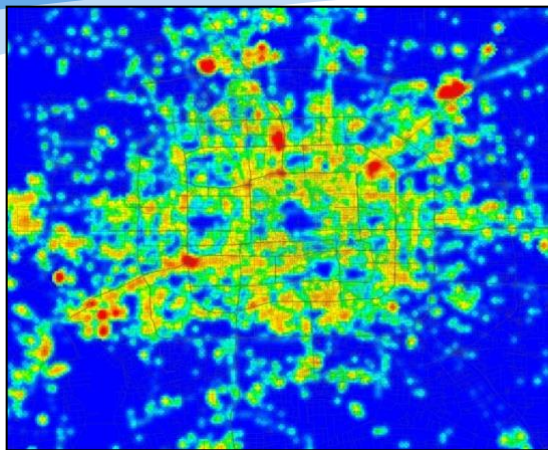
城市功能区划分

❖ PlosOne 2013





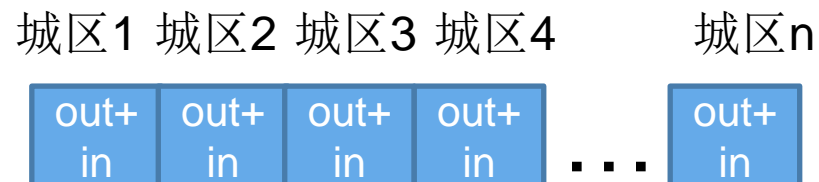
城市功能区划分



城市出租车交通量分布

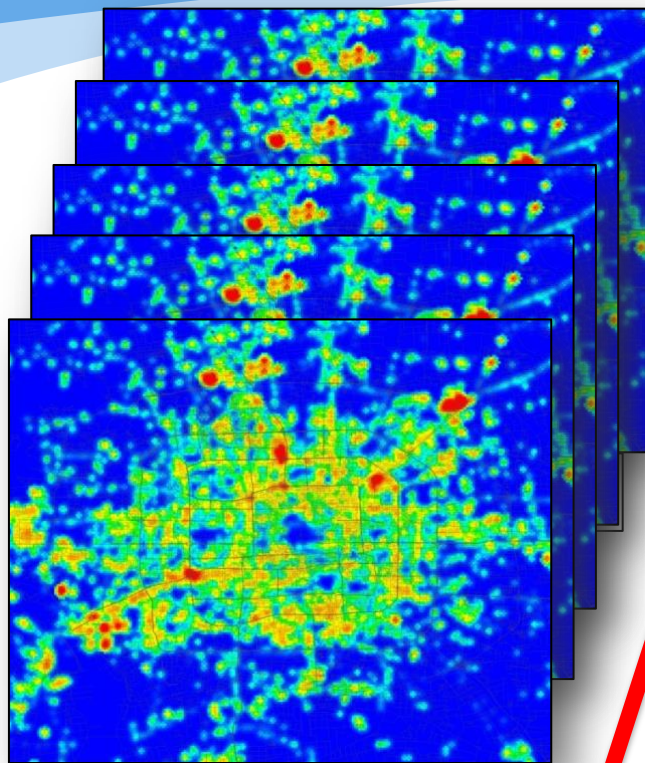


时间1





城市功能区划分



城市出租车交通量分布
随时间的变化

time



	城区1	城区2	城区3	城区4	...	城区n
时间1	out+ in	out+ in	out+ in	out+ in	...	out+ in
时间2	out+ in	out+ in	out+ in	out+ in	...	out+ in
时间3	out+ in	out+ in	out+ in	out+ in	...	out+ in
时间4	out+ in	out+ in	out+ in	out+ in	...	out+ in
					...	
时间n	out+ in	out+ in	out+ in	out+ in	...	out+ in

“时间-城区”交通量矩阵



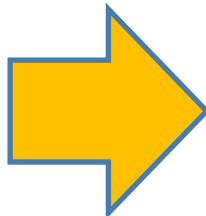


城市功能区划分

城区1 城区2 城区3 城区4 城区n

时间1	out+ in	out+ in	out+ in	out+ in	...	out+ in
时间2	out+ in	out+ in	out+ in	out+ in	...	out+ in
时间3	out+ in	out+ in	out+ in	out+ in	...	out+ in
时间4	out+ in	out+ in	out+ in	out+ in	...	out+ in
					...	
时间n	out+ in	out+ in	out+ in	out+ in	...	out+ in

“城区-模式”矩阵



“时间-模式”矩阵



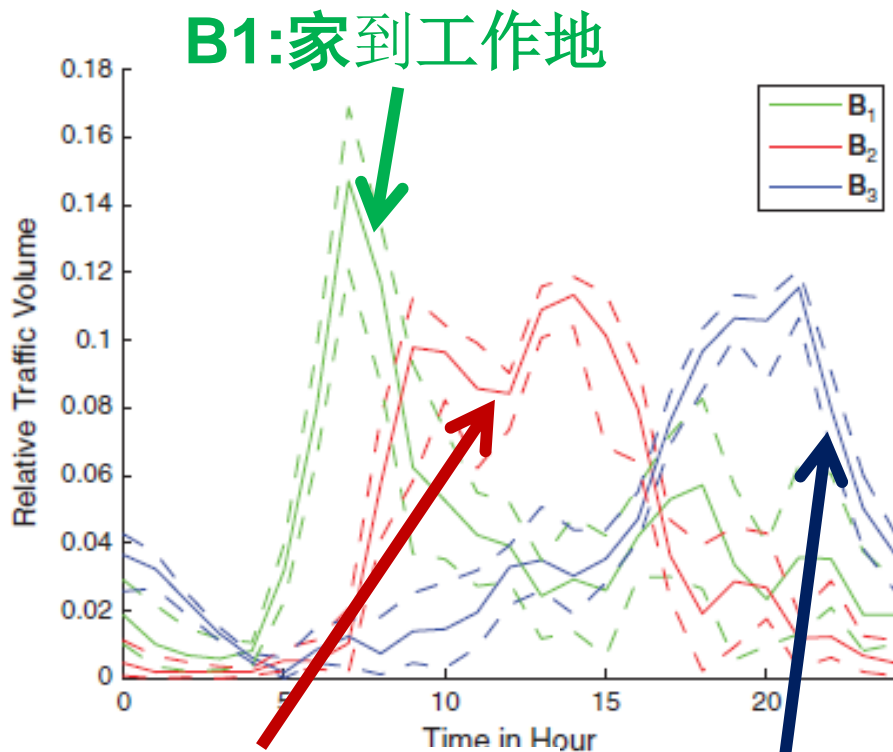
“时间-城区”交通量矩阵

矩阵分解





城市的功能区识别

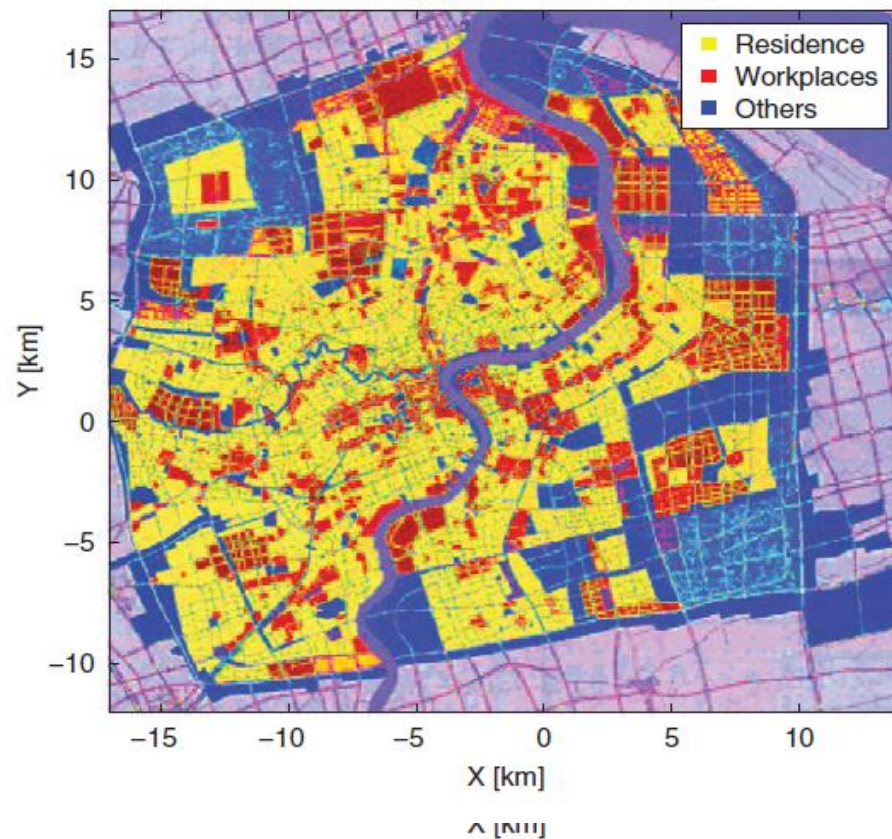


B1:家到工作地

B2:工作地到工作地

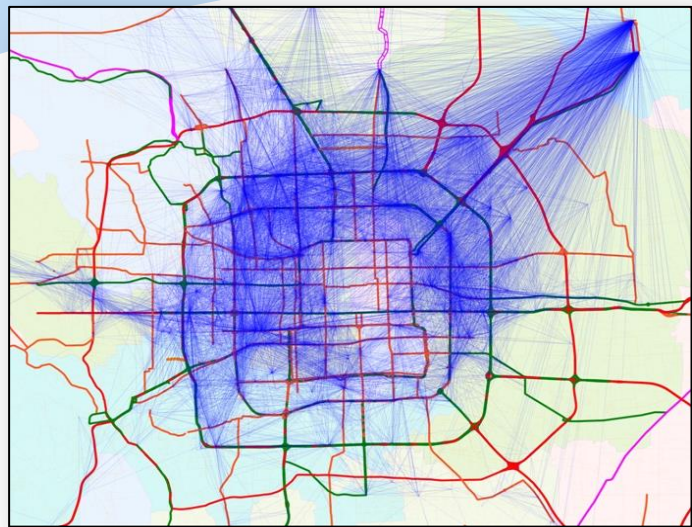
B3:工作地到其它

(b) Area Type by Urban Planning

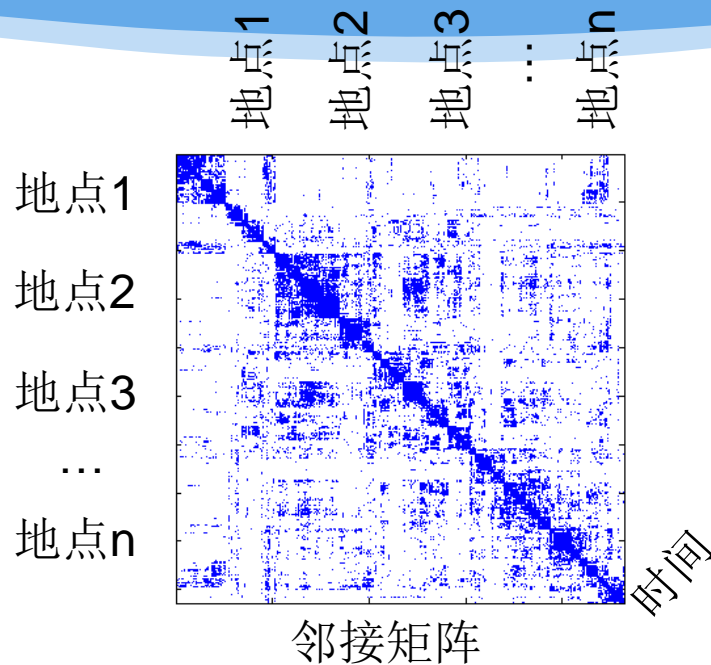
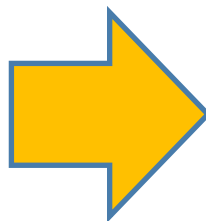




城市组团与职住分析

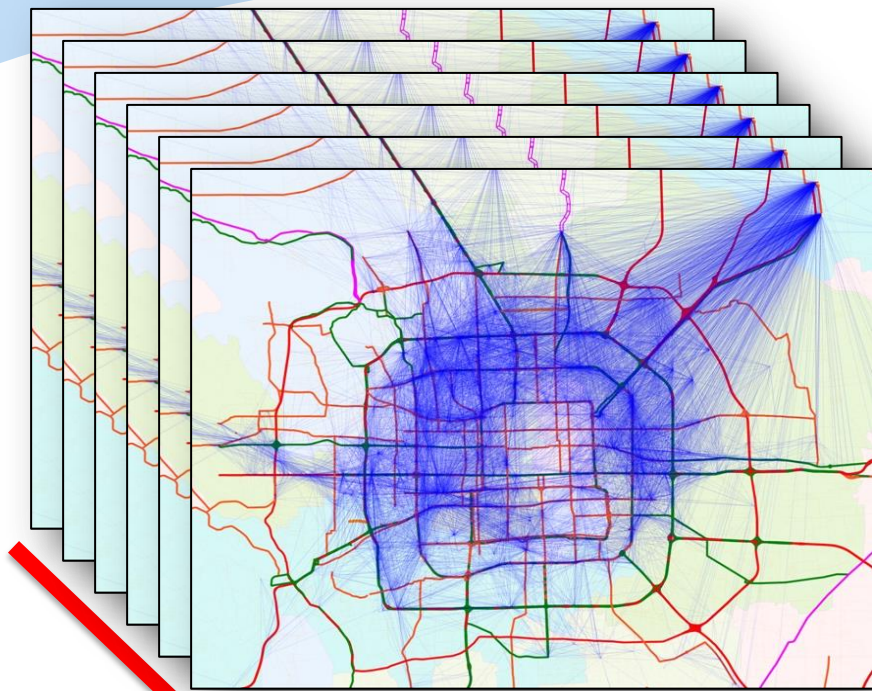


城市出租车OD网络



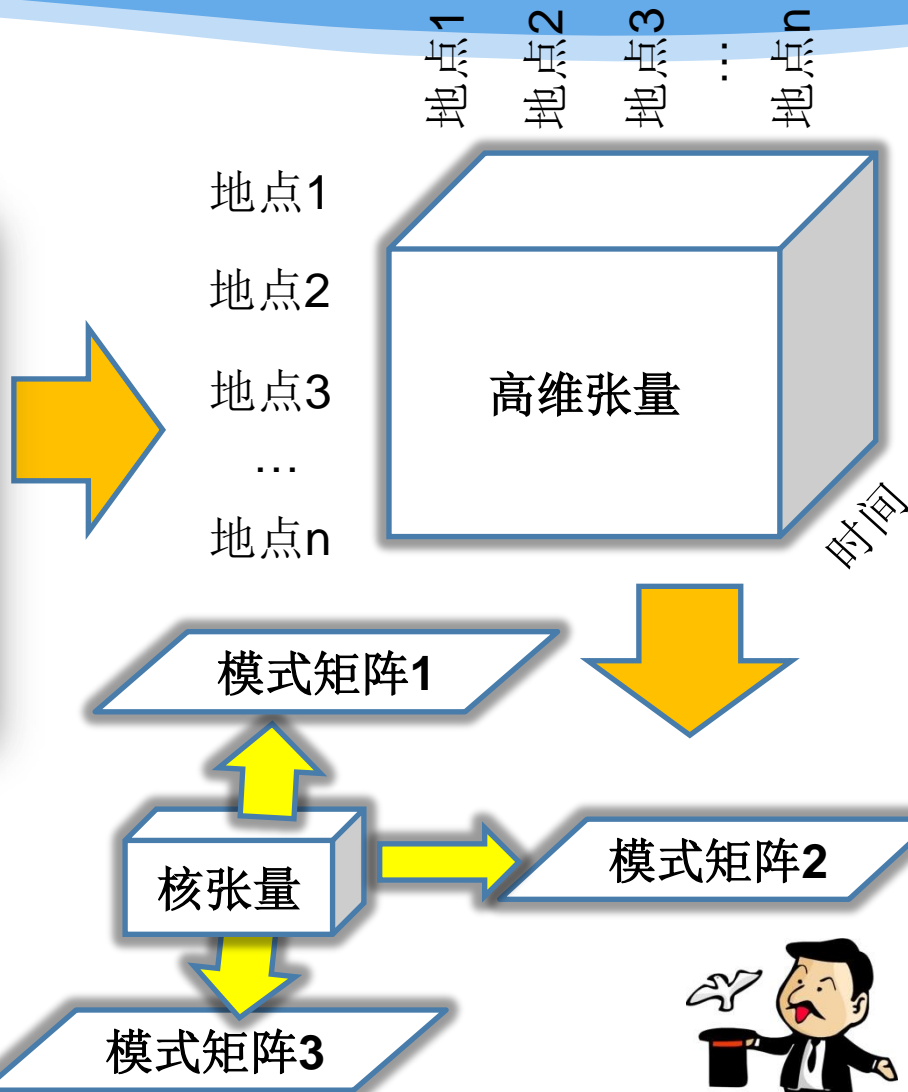


城市组团与职住分析



Time

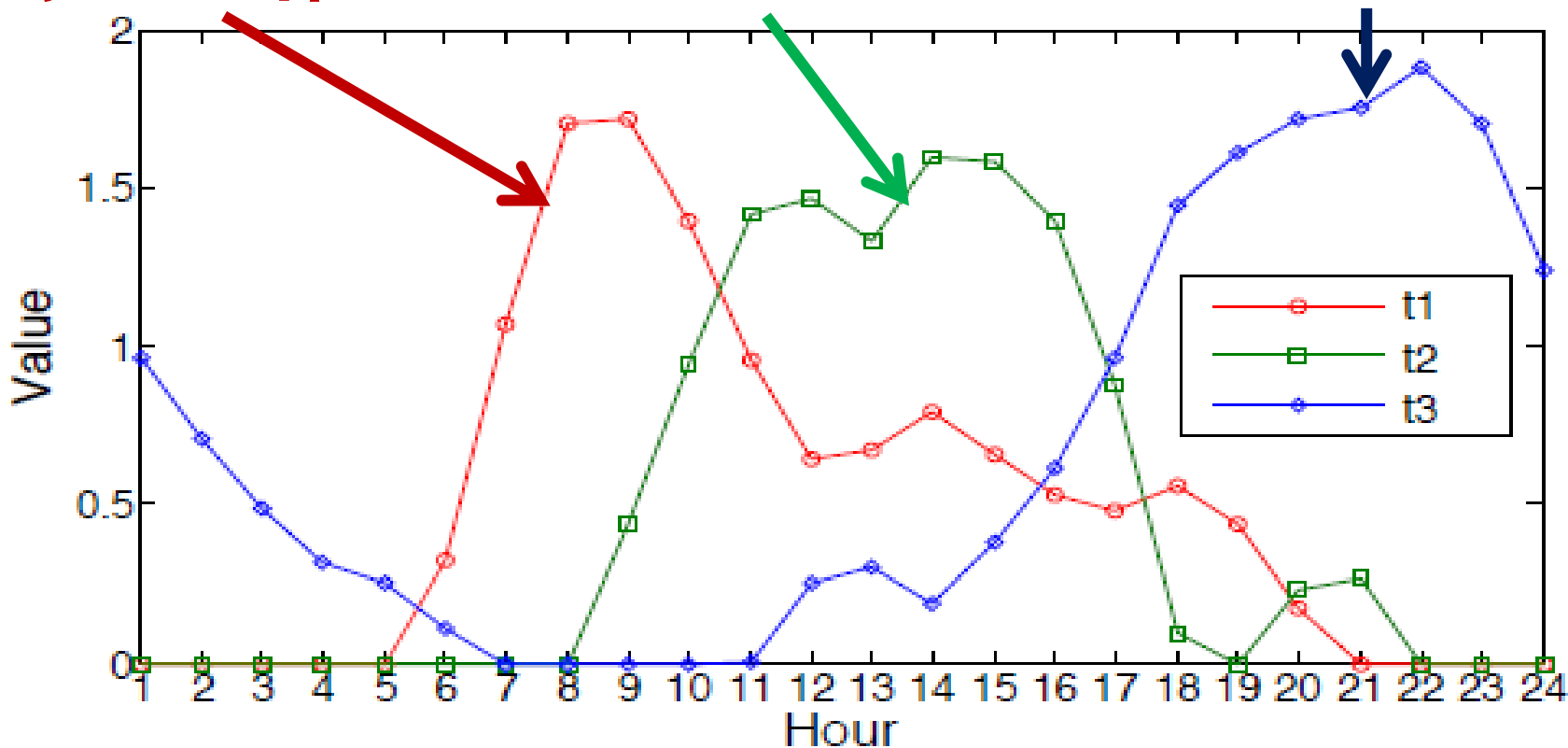
随时间变化的
城市出租车OD网络





时间-模式矩阵

家到工作地 工作地到工作地 工作地到其它

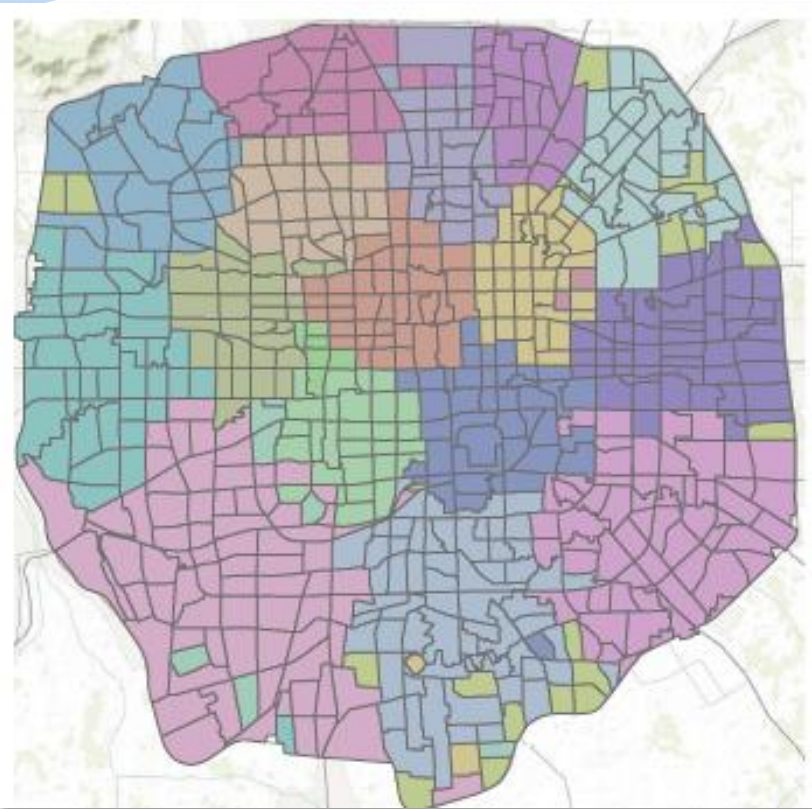


模式矩阵1

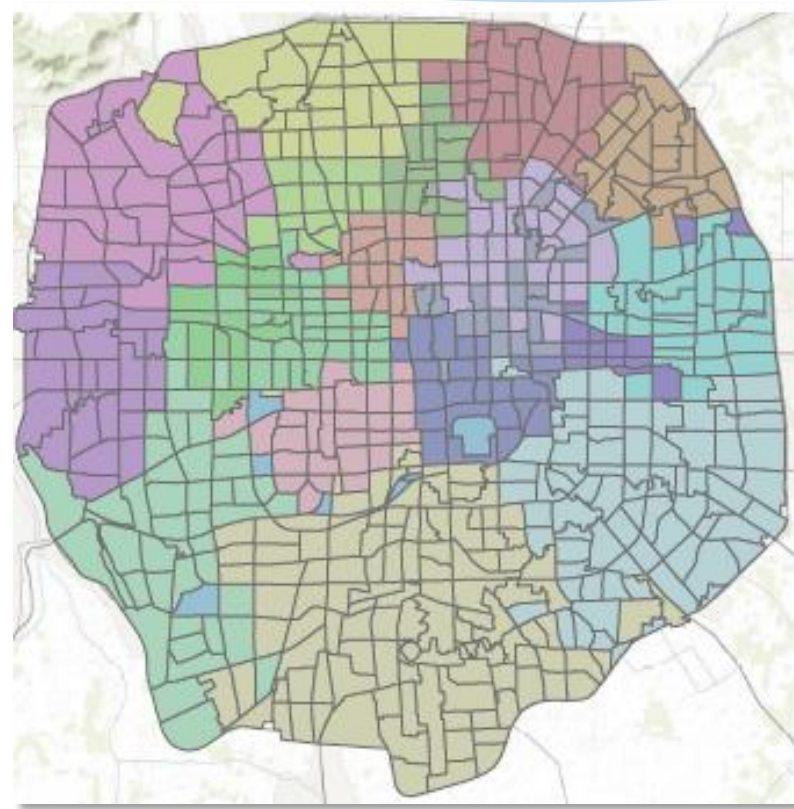




城市交通组团



**出发地的组团
(模式矩阵2)**



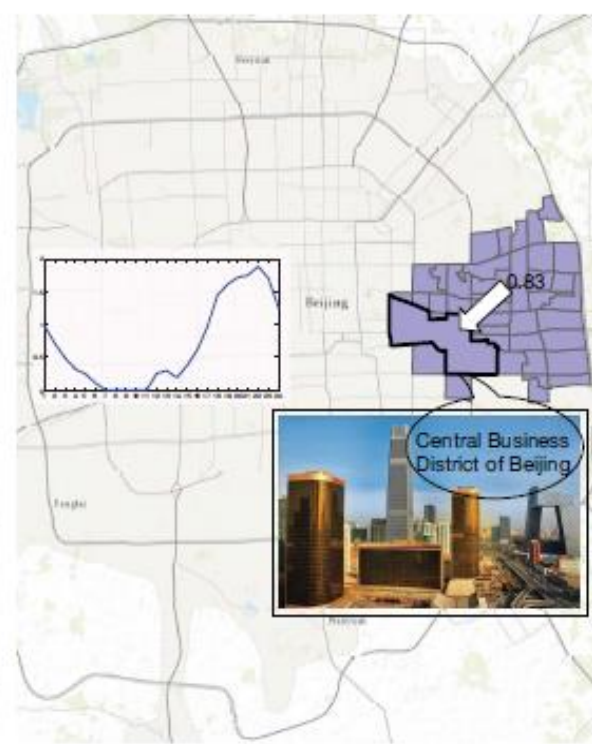
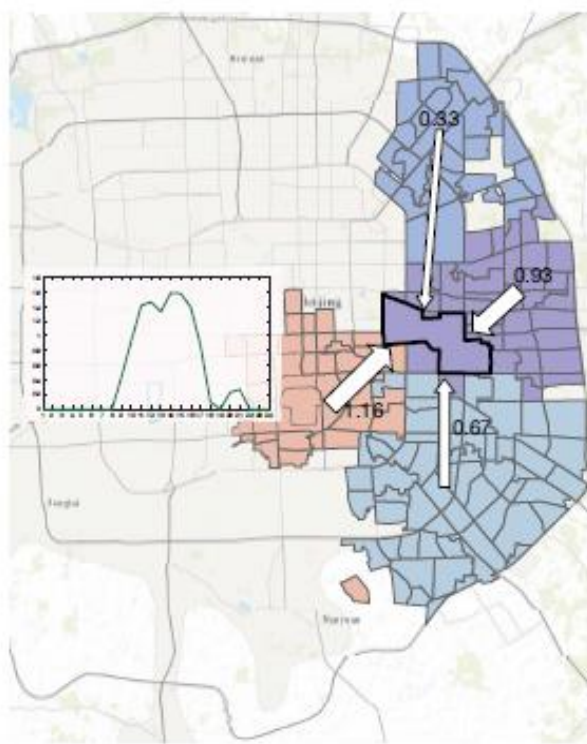
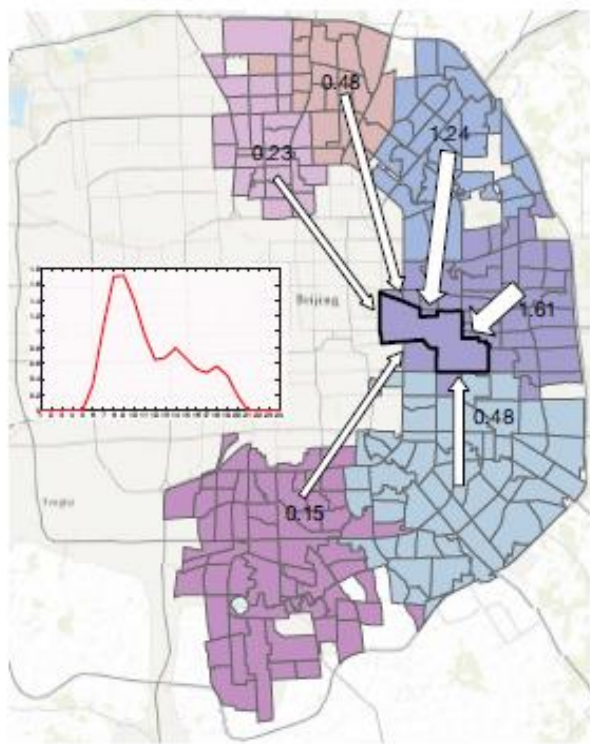
**到达地的组团
(模式矩阵3)**





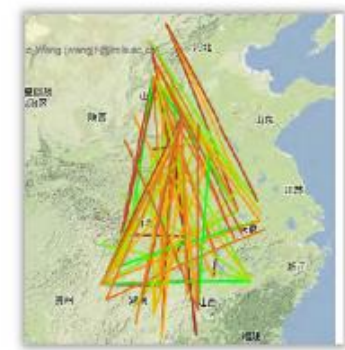
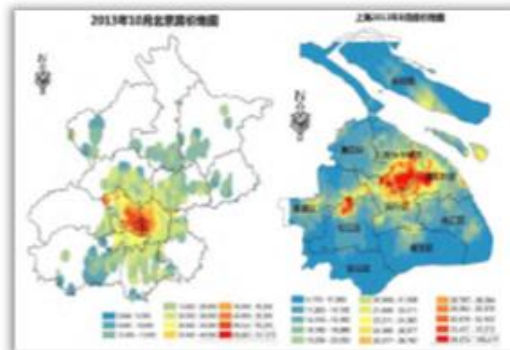
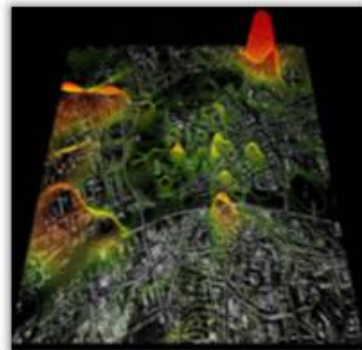
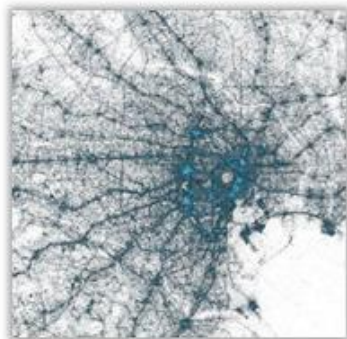
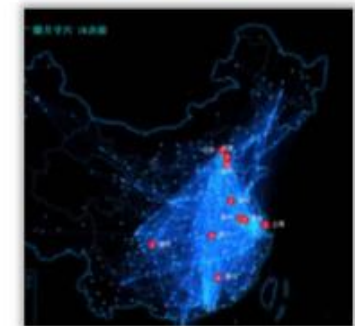
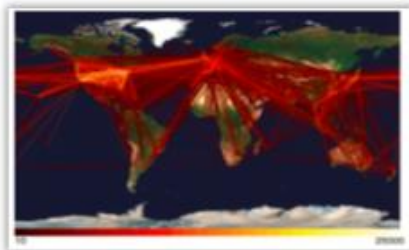
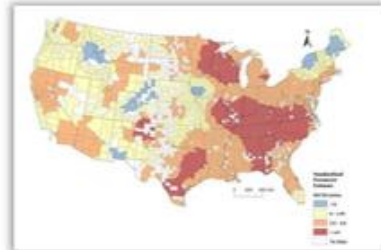
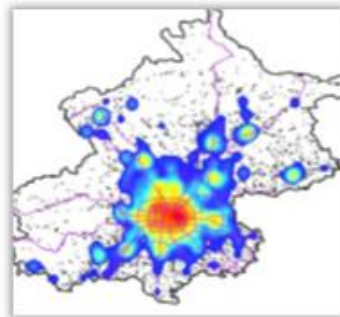
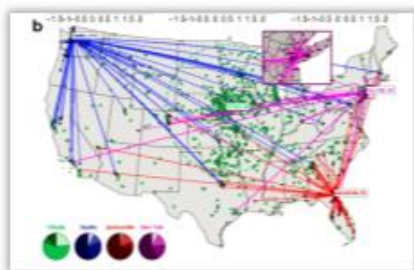
城市职住交通分析

❖ 以国贸为例



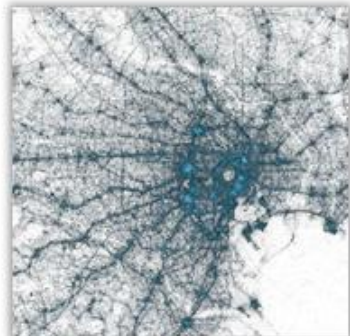
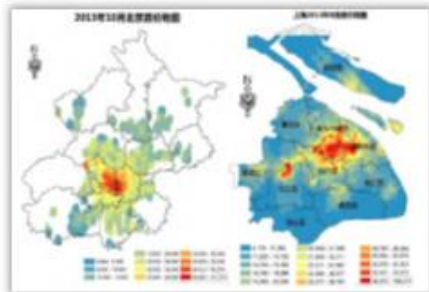


不同类型的城市数据

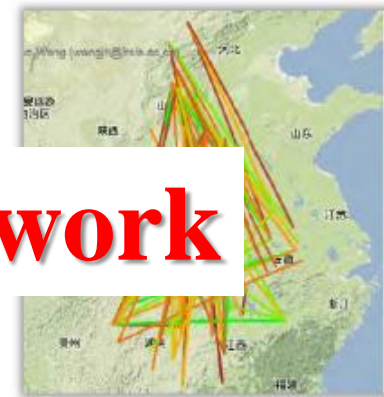
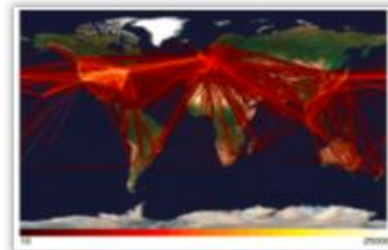
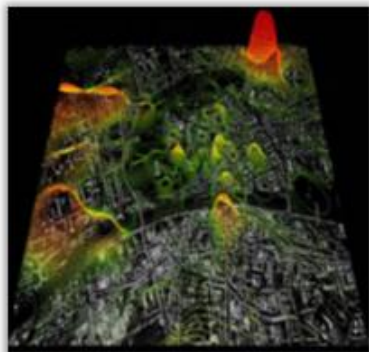
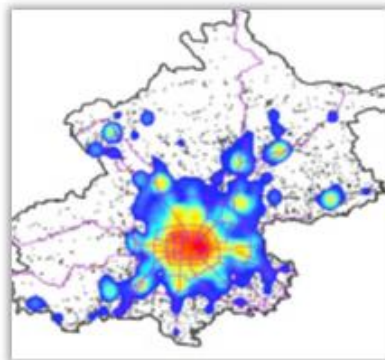




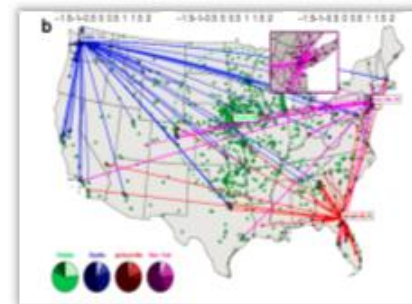
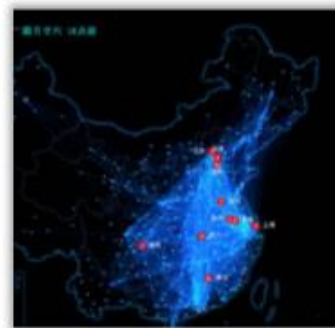
可以被分类为



Distribution

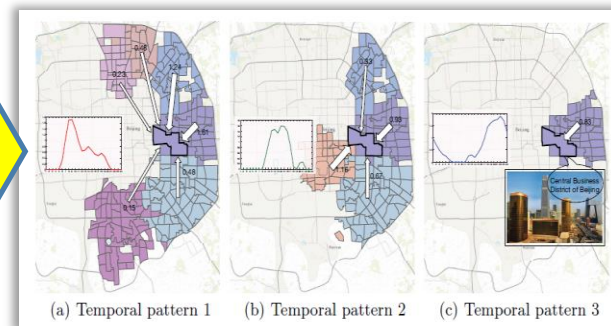
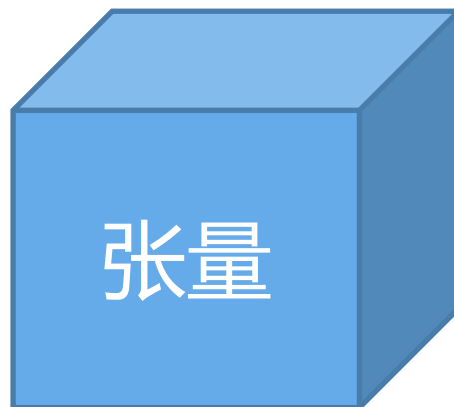
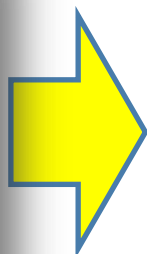
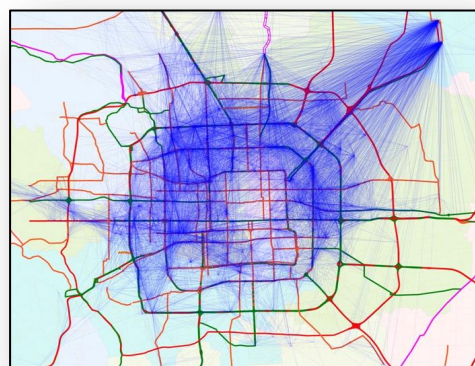
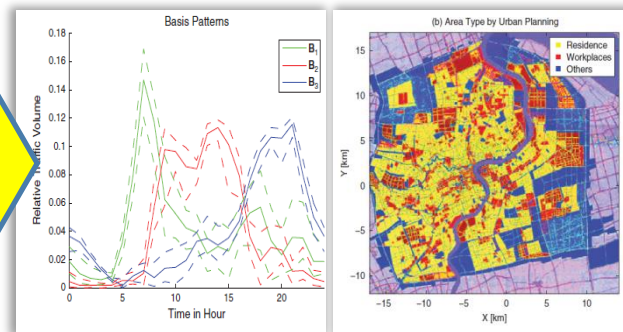
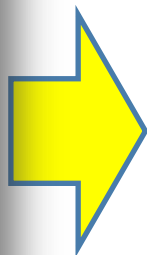
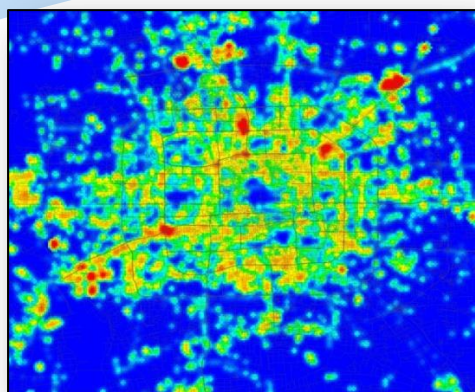


Network





基于矩阵的分析框架



1) 城市时空数据

2) 矩阵建模

3) 模式分析





定量的城市研究



城市规划
领域



Microsoft
Research
微软亚洲研究院

信息科
学领域

统计物
理领域



Barabási
美国东北大学





先进计算机应用技术教育部工程研究中心





科技部智慧城市863项目

九五
十五
十一五

十二五

2011

2012

2013

2014

2015

“智慧城市”试点示范

数字城市
数字中国

- 信息化理念
- 硬基础设施
- 软基础设施
- 人才积累

智慧城市
(一期)

- 顶层设计
- 产业联盟
- 高峰论坛
- 白皮书

智慧城市
(二期)和
技术示范

试点城市
和应用示
范推广

- 引领效果突出
- 促进产业链发展

打基础

做规划

求突破

谋发展





感谢大家!

❖ 联系我们

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- 微博账号: @王静远BUAA
- Homepage: <http://www.smartcity-buaa.org/jingyuan-wang/>

