AI Analysis of City Changes

同济大学智能规划协同创新中心

China Intelligent Urbanization Co-creation Center
iCity Group

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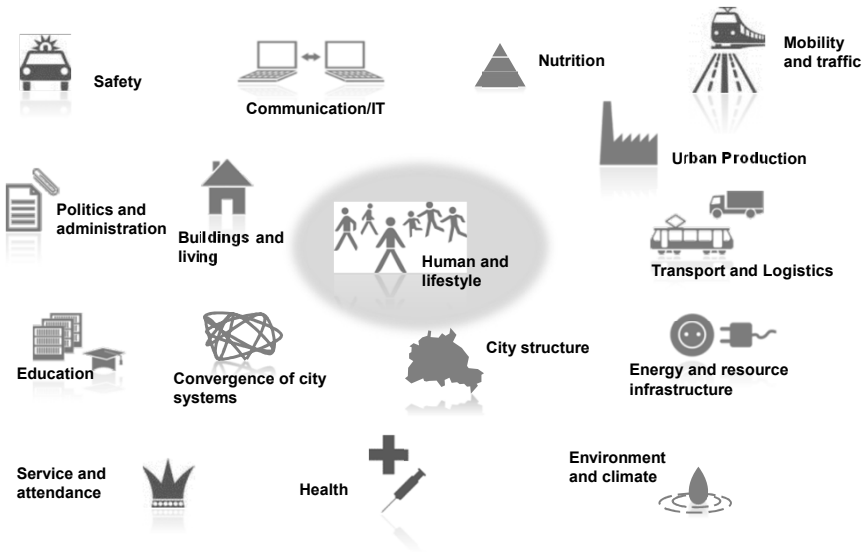
United Nations World Geospatial Information Congress
Deqing, November 19, 2018

Outline

1. City Development Challenges and Artificial Intelligence
2. Analyzing and Classifying City Images with Deep Learning Methods (Work done at CIUC by iCity Group)
3. Examples

Challenges for Intelligent Cities: Activity Spheres



Artificial Intelligence Areas

The overall research goal of Artificial Intelligence is to create technology that allows computers and machines to function in an intelligent way.

AI system capabilities are:

1. Reasoning, Problem Solving, Decision support
2. Knowledge Representation/Engineering
3. Learning/Big Data Analytics
4. Planning
5. Natural Language Processing
6. Perception – Pattern Recognition – Multimodal Interfaces
7. Motion and Manipulation/Robotics
8. Social Intelligence
9. Creativity

Source: Wikipedia, "Artificial Intelligence"

Artificial Intelligence Areas

The overall research goal of Artificial Intelligence is to create technology that allows computers and machines to function in an intelligent way.

AI system capabilities for Urban Planning are:

1. Reasoning, Problem Solving, Decision support
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4. Planning
5. Natural Language Processing
6. Perception – Pattern Recognition – Multimodal Interfaces
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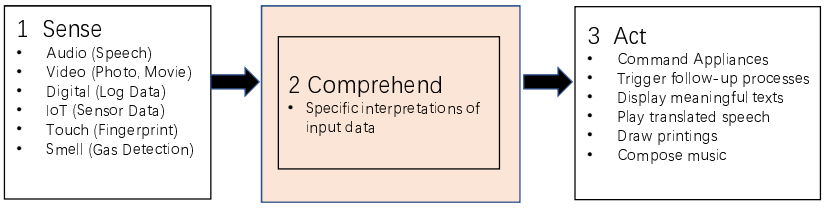
Source: Wikipedia, "Artificial Intelligence"

"Traditional" Software Systems



After Purdy, M., & Daugherty, P. (2016). Why Artificial Intelligence is the Future of Growth. Abgerufen am 8. Juni 2017 von https://www.accenture.com/lv-en/_acnmedia/PDF-33/Accenture-Why-AI-is-the-Future-of-Growth.pdf

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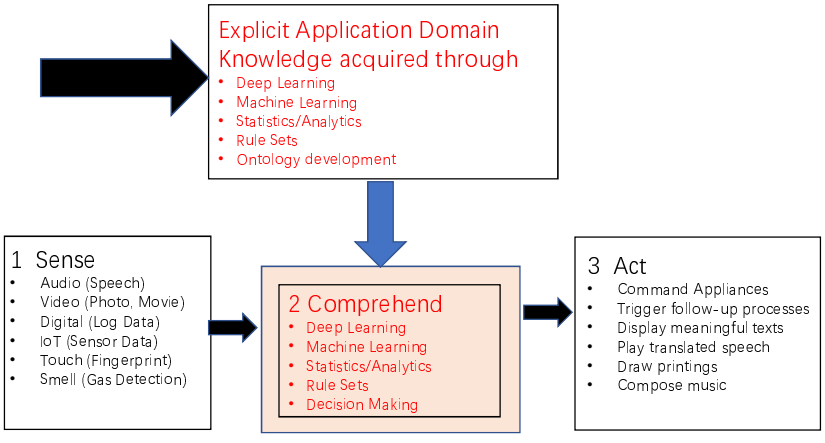
Knowledge-based Artificial Intelligence Systems



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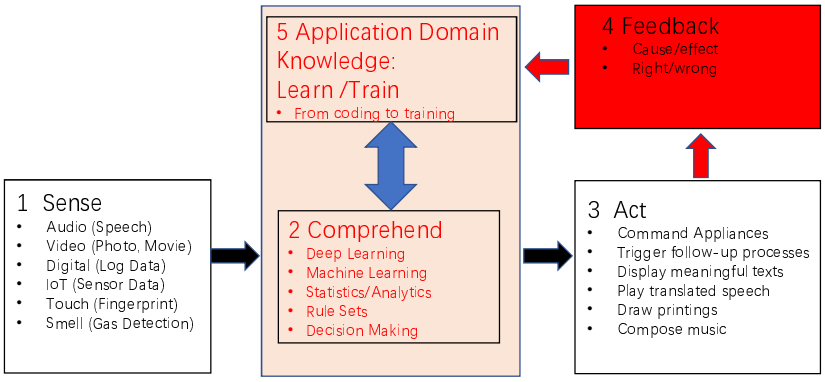
Learning Artificial Intelligence Systems



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Technological Innovation:
World Largest City Big Data Base constantly updated

技术创新：建立世界城市大数据，并持续升级 追踪超越原最大数据库

1988 Quantitative Analysis of World Cities

1997 4 Generations of City Big Data Base

2007 Media-Scale Cities Simulation

2016
- 12 Billion data records in 8 Categories
- 集聚了8类120亿条有效数据

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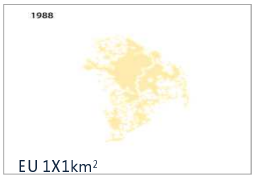
Spatial Law 空间规律

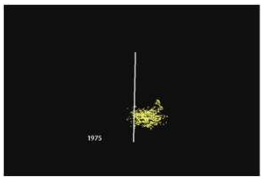
City Tree "城市树"

Satellite Images of Cities through 40 years
跨度40年城市卫片

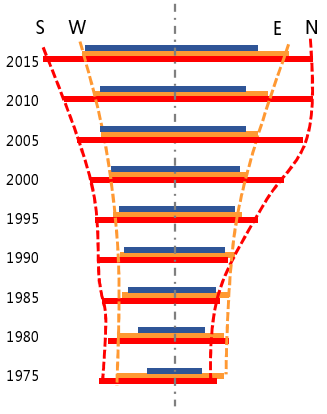
Super Precision:30mX30m
精度超越:30X30m



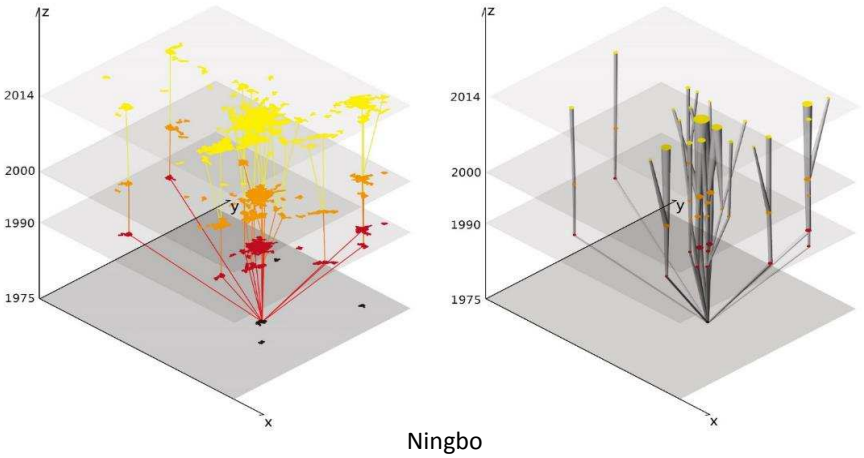
Super Speed: Intelligent Identification
速度超越:智能识别



New representation: City Tree
首创 "城市树"

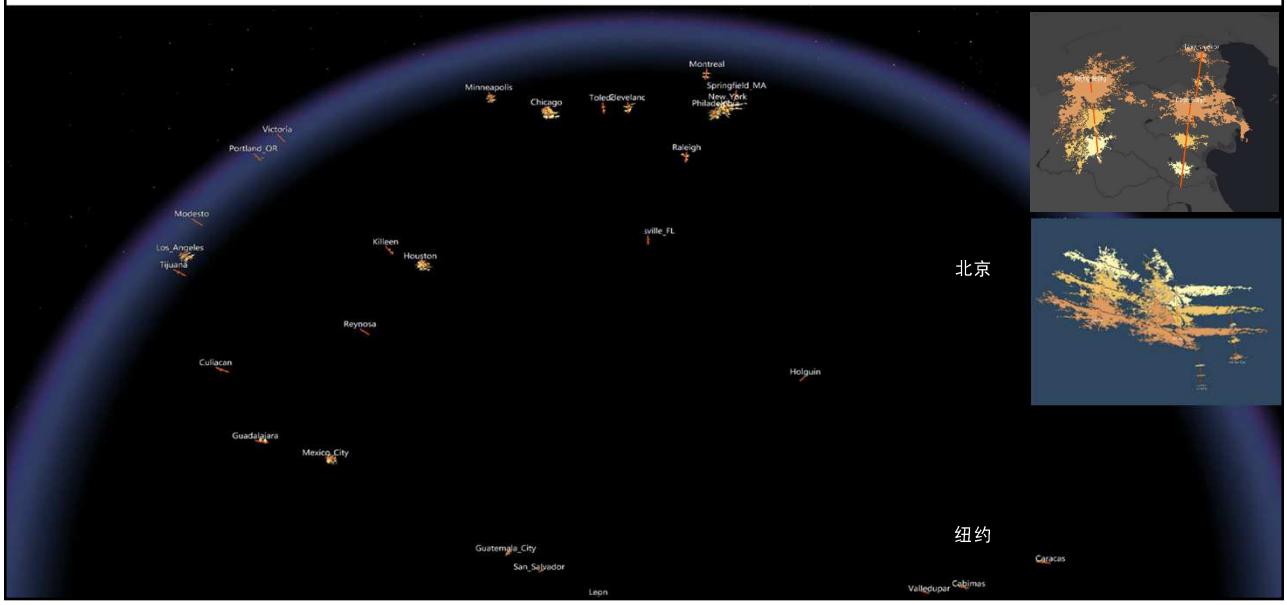


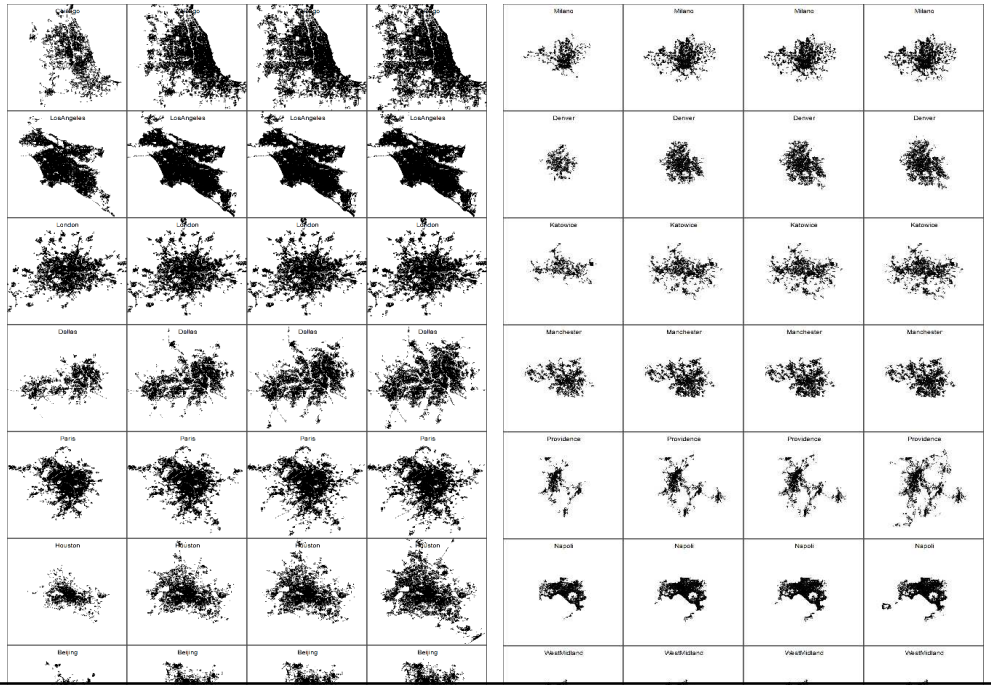
Spatial Law
空间规律



Ningbo

Spatial Law
空间规律

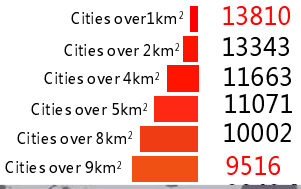


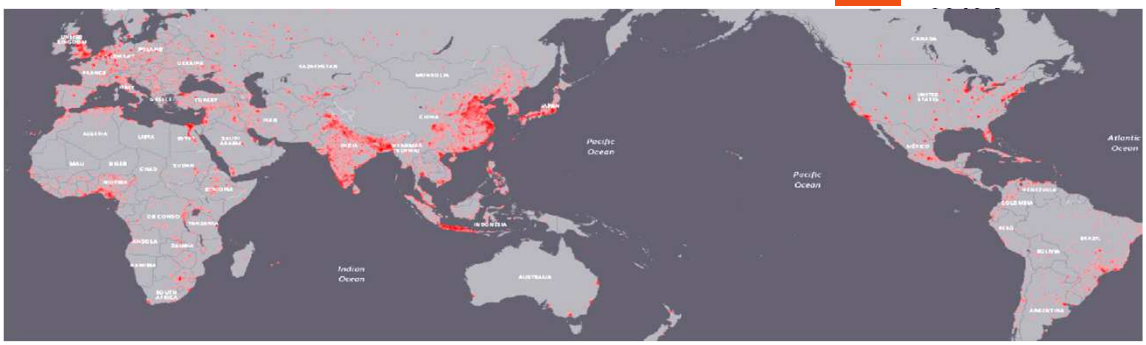


City Trees for 13810 world cities

have been diagrammed by 2018 Jan 18

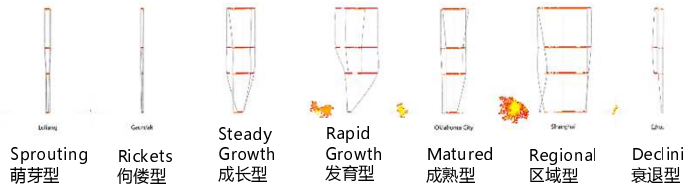
至2018年已绘制13810个城市的城市树





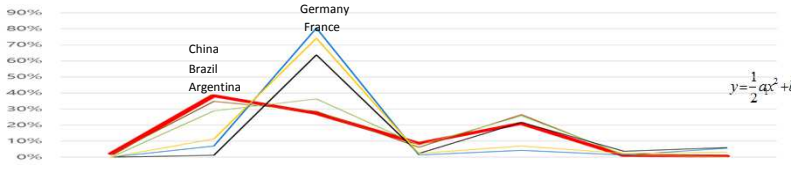
Illustrating the Development courses of 13810 world’s cities by City Trees

绘制“城市树” 完成了全球13810个城市发展历程的识别



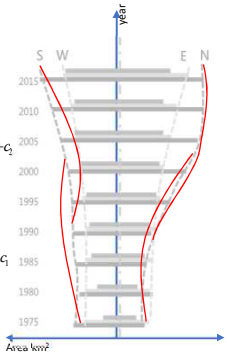
Sprouting 萌芽型 | Rickets 佝偻型 | Steady Growth 成长型 | Rapid Growth 发育型 | Matured 成熟型 | Regional 区域型 | Declining 衰退型

Findings: 7 Categories of Urban Development Modes and the related laws of growth. 发现并定义为7类城市发展类型及其特性，以及城市成长规律。



$$y=\frac{1}{2}a_2x^2+b_2x+c_2$$

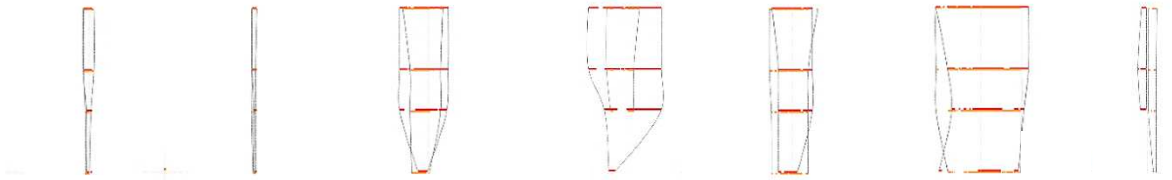
$$y=\frac{1}{2}a_1x^2+b_1x+c_1$$

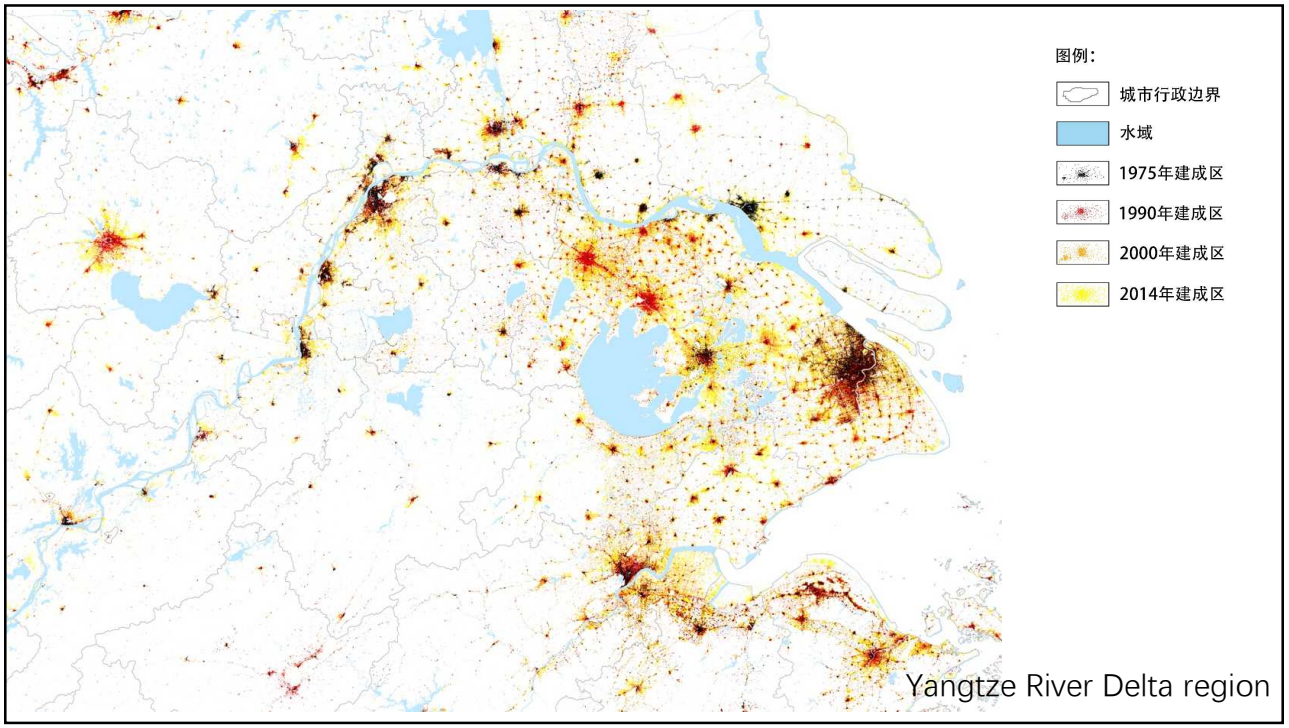


7种类型的城市分布

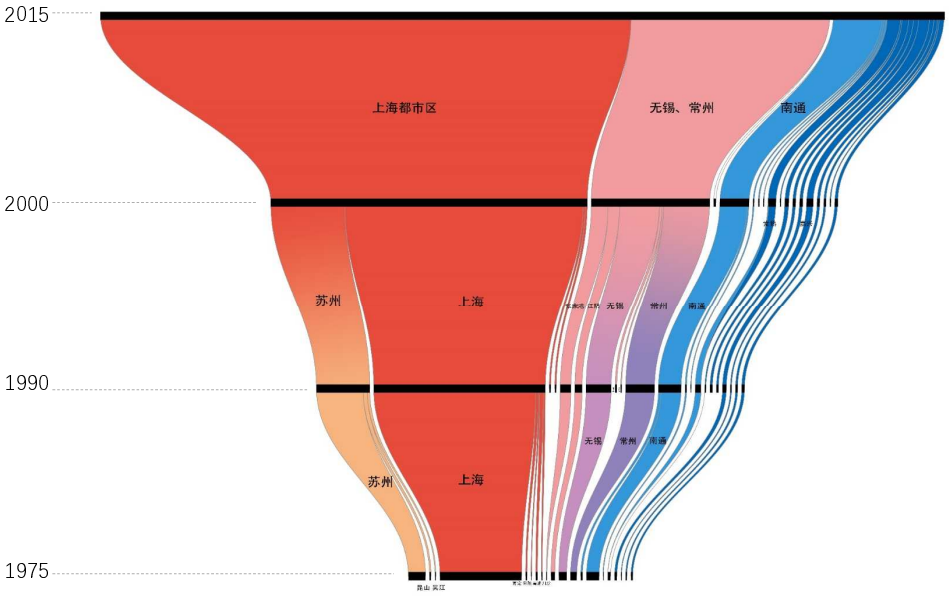
7 Categories of cities by the measure of "City Tree"

Spouting 萌芽型	Rickets 佝偻型	Steady 成长型	Rapid 发育型	Matured 成熟型	Regional 区域型	Declining 衰退型
435	3601	2365	831	1900	143	201





Yangtze River Delta region



■ 苏州、上海、无锡、常州、南通 城镇群集聚历程
Urban Agglomeration Process

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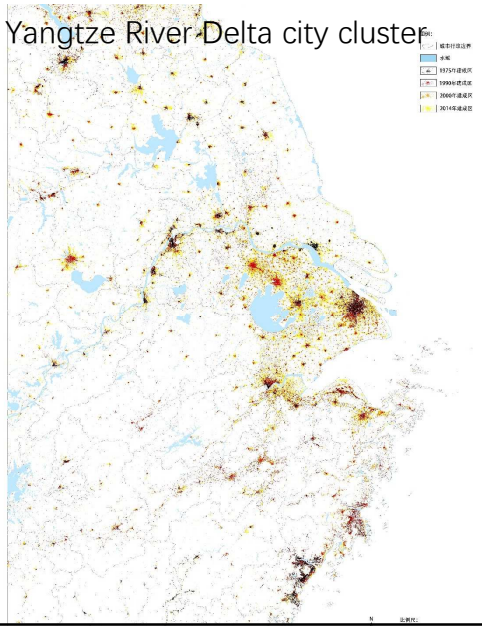
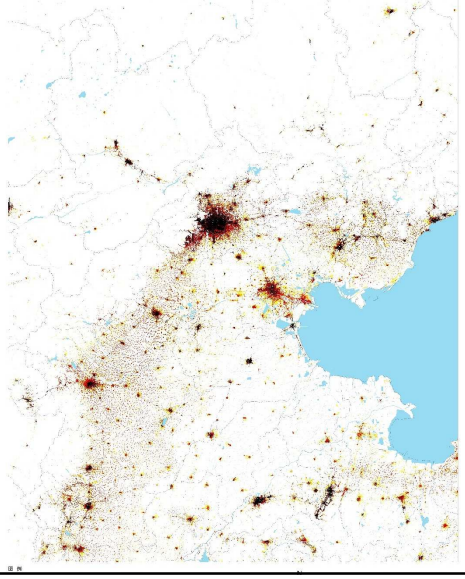
长三角城市群

Yangtze River Delta city cluster



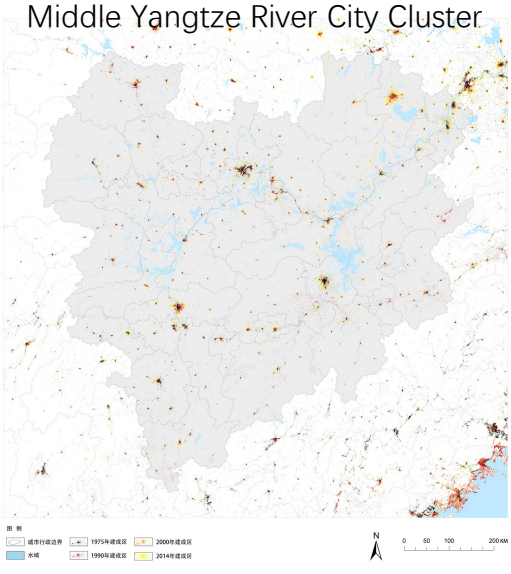
京津冀城市群

Beijing, Tianjin and Hebei city cluster



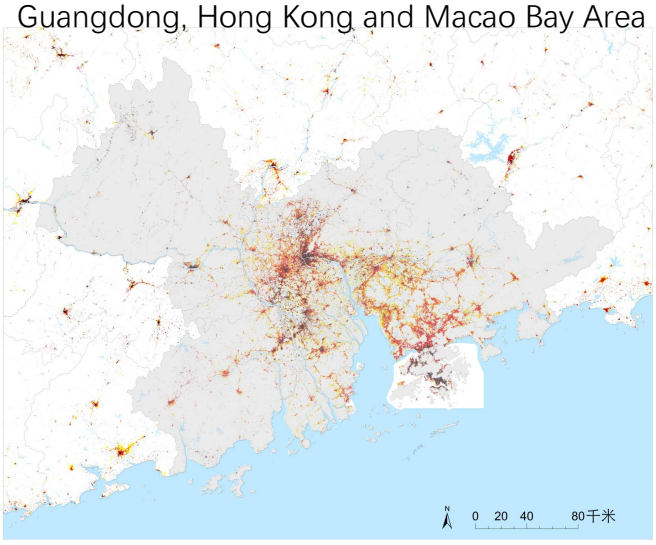
长江中游城市群

Middle Yangtze River City Cluster



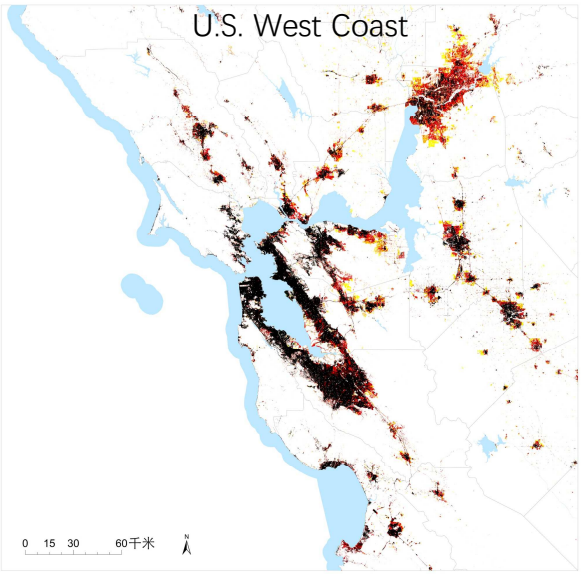
粤港澳湾区

Guangdong, Hong Kong and Macao Bay Area



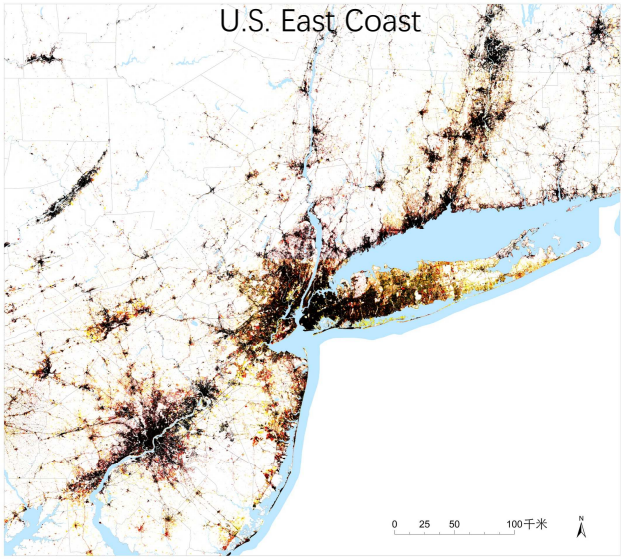
美国西海岸

U.S. West Coast



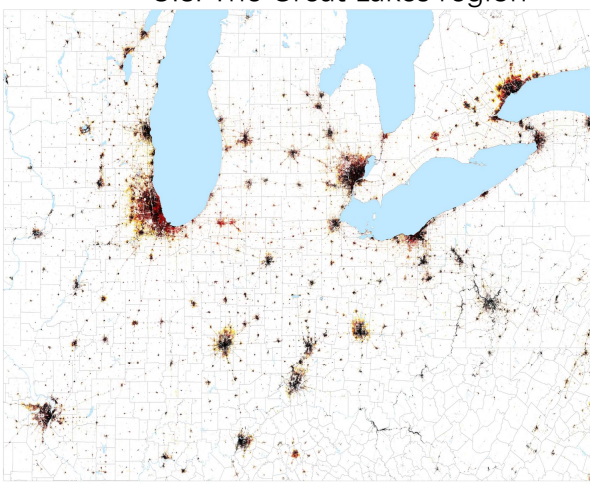
美国东海岸

U.S. East Coast



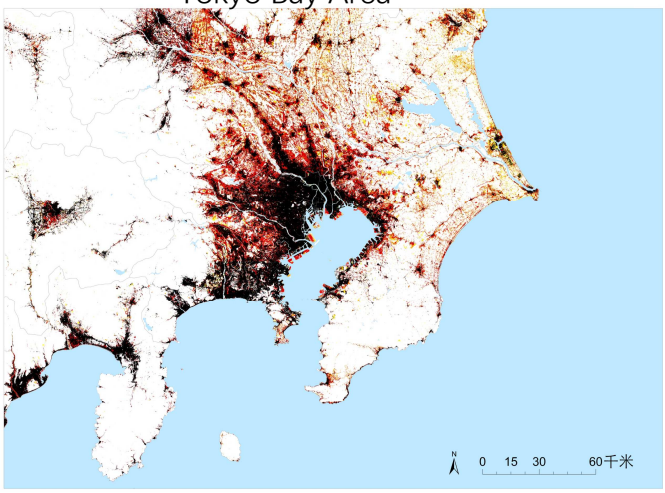
五大湖

U.S. The Great Lakes region



东京湾

Tokyo Bay Area



Thank you very much for your attention!

Otthein Herzog
herzog@tzi.de