Artificial Intelligence and the Future of Urban Spatial Planning

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AI Analysis of City Changes
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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

- Safety
- Communication/IT
- Nutrition
- Mobility and traffic
- Urban Production
- Transport and Logistics
- Human and lifestyle
- Convergence of city systems
- Buildings and living
- City structure
- Energy and resource infrastructure
- Environment and climate
- Health
- Education
- Service and attendance
- Politics and administration
- Buildings and living
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

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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**“Traditional” Software Systems**

<table>
<thead>
<tr>
<th>Sense</th>
<th>Comprehend</th>
<th>Act</th>
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<tbody>
<tr>
<td>• Audio (Speech)</td>
<td>• Specific interpretations of input data</td>
<td>• Command Appliances</td>
</tr>
<tr>
<td>• Video (Photo, Movie)</td>
<td></td>
<td>• Trigger follow-up processes</td>
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<tr>
<td>• Digital (Log Data)</td>
<td></td>
<td>• Display meaningful texts</td>
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<tr>
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<td>• Play translated speech</td>
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<tr>
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<td>• Draw printings</td>
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<tr>
<td>• Smell (Gas Detection)</td>
<td></td>
<td>• Compose music</td>
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Knowledge-based Artificial Intelligence Systems

Explicit Application Domain
Knowledge acquired through
- Deep Learning
- Machine Learning
- Statistics/Analytics
- Rule Sets
- Ontology development

1 Sense
- Audio (Speech)
- Video (Photo, Movie)
- Digital (Log Data)
- IoT (Sensor Data)
- Touch (Fingerprint)
- Smell (Gas Detection)

2 Comprehend
- Deep Learning
- Machine Learning
- Statistics/Analytics
- Rule Sets
- Decision Making

3 Act
- Command Appliances
- Trigger follow-up processes
- Display meaningful texts
- Play translated speech
- Draw printings
- Compose music

Learning Artificial Intelligence Systems

1 Sense
- Audio (Speech)
- Video (Photo, Movie)
- Digital (Log Data)
- IoT (Sensor Data)
- Touch (Fingerprint)
- Smell (Gas Detection)

2 Comprehend
- Deep Learning
- Machine Learning
- Statistics/Analytics
- Rule Sets
- Decision Making

3 Act
- Command Appliances
- Trigger follow-up processes
- Display meaningful texts
- Play translated speech
- Draw printings
- Compose music

4 Feedback
- Cause/effect
- Right/wrong

5 Application Domain Knowledge: Learn /Train
- From coding to training

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

Quantitative Analysis of World Cities
4 Generations of City Big Data Base
Media-Scale Cities Simulation

- 12 Billion data records in 8 Categories
- 集聚了8类120亿条有效数据
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3. Examples
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: 30m x 30m
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
City Trees for 13810 world cities have been diagrammed by 2018 Jan 18.
Full coverage of 13810 independent built areas in the world
Illustrating the Development courses of 13810 world’s cities by City Trees

Findings: 7 Categories of Urban Development Modes and the related laws of growth.

- Sprouting (萌芽型)
- Rickets (佝偻型)
- Steady Growth (成长型)
- Rapid Growth (发育型)
- Matured Growth (成熟型)
- Regional Growth (区域型)
- Declining Growth (衰退型)
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<td>Regional</td>
<td>143</td>
</tr>
<tr>
<td>Declining</td>
<td>201</td>
</tr>
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7 Categories of cities by the measure of “City Tree”
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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3. Examples
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
东京湾
U.S. The Great Lakes region

东京湾
Tokyo Bay Area
Thank you very much for your attention!

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