

—— 构建城市元宇宙 ——

算存协同 数实共生

2022第十四届智慧城市论坛

2022年第14届智慧城市论坛主旨报告

脑信息智慧服务助力构建智能社会

2022.11.10

本主旨报告以脑信息智慧服务助力构建智能社会为主题，介绍脑信息学与网络智能的交叉融合研究，脑信息智慧服务的发展与应用，日本版社会5.0的特征与启示，通过脑信息智慧服务促进网络空间与物理空间的高度融合，构建以人为本的“数字孪生+智能孪生”城市，实现可持续发展的“超智慧型社会”-智能社会，并以针对脑与精神心理健康重大疾病（认知症、抑郁症等）的健康、医疗、福祉一体化技术支撑与服务体系构建为案例，展示智能社会建设将带来的前所未有的新价值。



钟宁
北京工业大学特聘教授
国际网络智能协会主席
日本工程院外籍院士



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WIC - An International Academic Organization

Web Intelligence meets Brain Informatics
Web Intelligence (WI) = AI in the Connected World



Web Intelligence Consortium (WIC)

Advancing world-wide scientific research and development in Web Intelligence (WI)

WIC introduction
WIC structure
WIC newsletter
WI journal
BI journal
Books
White papers
WIC conferences
WIC awards
New systems/standards
WIC research centres
WI related companies
Related resources
WIC Twitter
WIC Blog

Web Intelligence (WI) has been recognized as a new direction for scientific research and development to explore the fundamental roles as well as practical impacts of Artificial Intelligence (AI) (e.g., knowledge representation, planning, knowledge discovery and data mining, intelligent agents, and social network intelligence) and advanced Information Technology (IT) (e.g., wireless networks, ubiquitous devices, social networks, wisdom Web, and data/knowledge grids) on the next generation of Web-empowered products, systems, services, and activities. It is one of the most important as well as promising IT research fields in the era of Web and agent intelligence.

The Web Intelligence Consortium (WIC) (<http://wi-consortium.org/>) is an international, non-profit organization dedicated to advancing world-wide scientific research and industrial development in the field of Web Intelligence (WI). It promotes collaborations among world-wide WI research centers and organizational members, technology showcases at WI related conferences and workshops, WIC official book and journal publications, WIC newsletters, and WIC official releases of new industrial solutions and standards.

The major activities of WIC include:

<http://wi-consortium.org/>

From **Systematic Brain-Machine Intelligence Research**
to **New AI Industry Chain in the Connected World**

Connecting **Network** and **Brain** with **Big Data**

Brain Intelligence and
Brain-Machine
Intelligence

Brain and Mental
Health

Brain Internet and
the Connected
World

Unique in the World and Excellent in the World



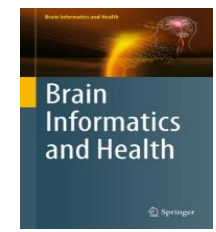
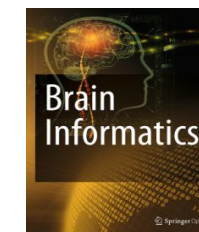
IEEE/WIC/ACM
International Conference on
Web Intelligence and
Intelligent Agent Technology
(WI-IAT)



International Conference
on Brain Informatics
(BI)



Web Intelligence, An International Journal
IOS Press



Brain Informatics, An International Journal
(<https://braininformatics.springeropen.com/>)
Brain Informatics & Health book series
Springer Nature



21 Years of WI-IAT Conference



Association for
Computing Machinery



2003 Halifax Canada

2010 Toronto Canada

2013 Atlanta USA

2016 Omaha USA

2007 Silicon Valley USA

2017 Leipzig Germany

2009 Milano Italy

2011 Lyon France

2005 Compiègne France

2014 Warsaw Poland

2019 Thessaloniki Greece

2004 Beijing China

2006 Hong Kong China

2012 Macau China

**2022
Niagara Falls
Canada**

www.wi-iat.com/wi-iat2022

2018 Santiago de Chile

2001 Maebashi Japan

2015 Singapore

2008 Sydney Australia

**2020 Online
2021 Melbourne
Australia
20th anniversary**





The 15th International Conference on Brain Informatics (BI 2022)

15 - 17 July 2022, Padova - Italy

Brain Science meets Artificial Intelligence



Hybrid event, co-hosted at:
Padova, Italy (in-person) and Queensland, Australia (online)

wi-consortium.org/conferences/bi2022

UNIVERSITÀ
DEGLI STUDI
DI PADOVA



Springer

SPRINGER NATURE



WI-IAT'04

Towards Human-Level AI



John McCarthy

1971 Turing Award Winner

WI-IAT'04 Keynote Speaker

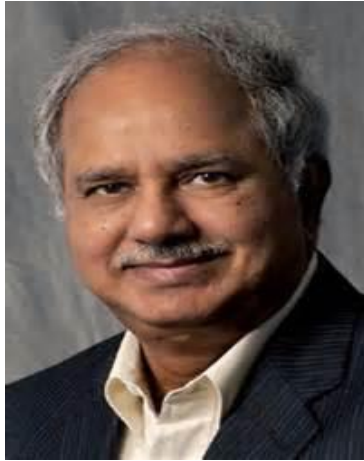
图灵奖获得者、美国斯坦福大学教授、“人工智能之父”约翰·麦卡锡（John McCarthy）教授在接受国际网络智能协会邀请出席在北京召开的第三届IEEE/WIC/ACM网络智能国际会议时指出，人工智能的终极目标是“**接近人脑级别智能**”。



Web Intelligence (WI) = AI in the Connected World



The Ultimate Web Intelligence : Computational Social Science



Raj Reddy

1994 Turing Award Winner
Carnegie Mellon University
WI'17 Keynote Speaker

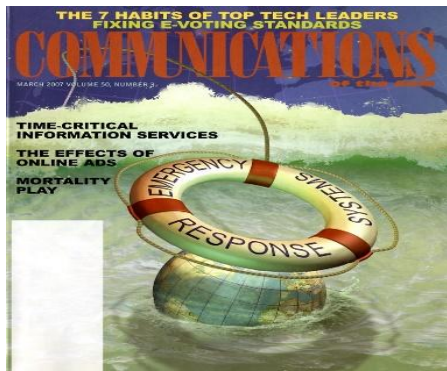
Abstract: Computational Social Science (CSS) is

图灵奖获得者、人工智能先驱、美国卡内基梅隆大学机器人研究院创建院长雷伊·雷蒂 (Raj Reddy) 教授在WI2017国际会议上对我们提出勉励和期许
“网络智能和国际WIC协会将在计算机科学与人工智能的前沿研究中发挥引领和开创作用”。

to be as productive as a PhD. Computer Science and Artificial Intelligence must embrace CSS as the next frontier in Web Intelligence and **Web Intelligence and WIC need to be at the forefront of inventing that future.**

-- 特邀講演 WI 2017 : IEEE/WIC/ACM International Conference on Web Intelligence , Aug 23-26, 2017, Leipzig, Germany

An interview with Professor Raj Reddy on Web Intelligence (WI) and Computational Social Science (CSS). *Web Intelligence*, 2018, 16(3): 143-146

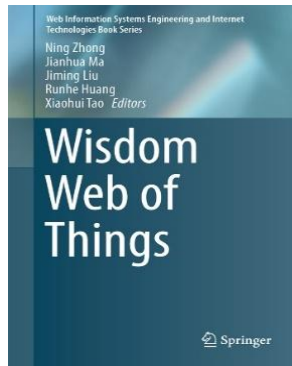


Envisioning Intelligent Information Technologies through the Prism of Web Intelligence
Users and businesses alike get to turn their raw data into new science, technology, and money.
BY NING ZHONG, JIMING LIU, AND YIYU YAO

Communications of the ACM,
2007, 50(3): 89-94



W2T (Wisdom Web of Things) $\Rightarrow$ WI = AI in the Connected World



The special issue on
**Web Intelligence = Artificial Intelligence in
the Connected World**
World Wide Web Journal, Springer, 2022

The special issue on
**Computational Social Science as the
Ultimate Web Intelligence**
World Wide Web Journal, Springer, 2020

**Web Intelligence Meets
Brain Informatics: Towards
the Future of Artificial
Intelligence in the
Connected World.**

Web Wide Web Journal 25(3) 2022

An interview with Professor Raj Reddy
on Web Intelligence (WI) and
Computational Social Science (CSS).
Web Intelligence Journal 16(3) 2018

The first **monograph** on W2T
published by Springer in 2016

Perspective of interplay & merging
between W2T and brain big data
IEEE Intelligent Systems in 2015

Elaboration on service-based
realization of W2T, i.e., WaaS
- a content-based cloud service
architecture for big data
IEEE Intelligent Systems in 2014

The first **special issue** on W2T
World Wide Web Journal in 2013

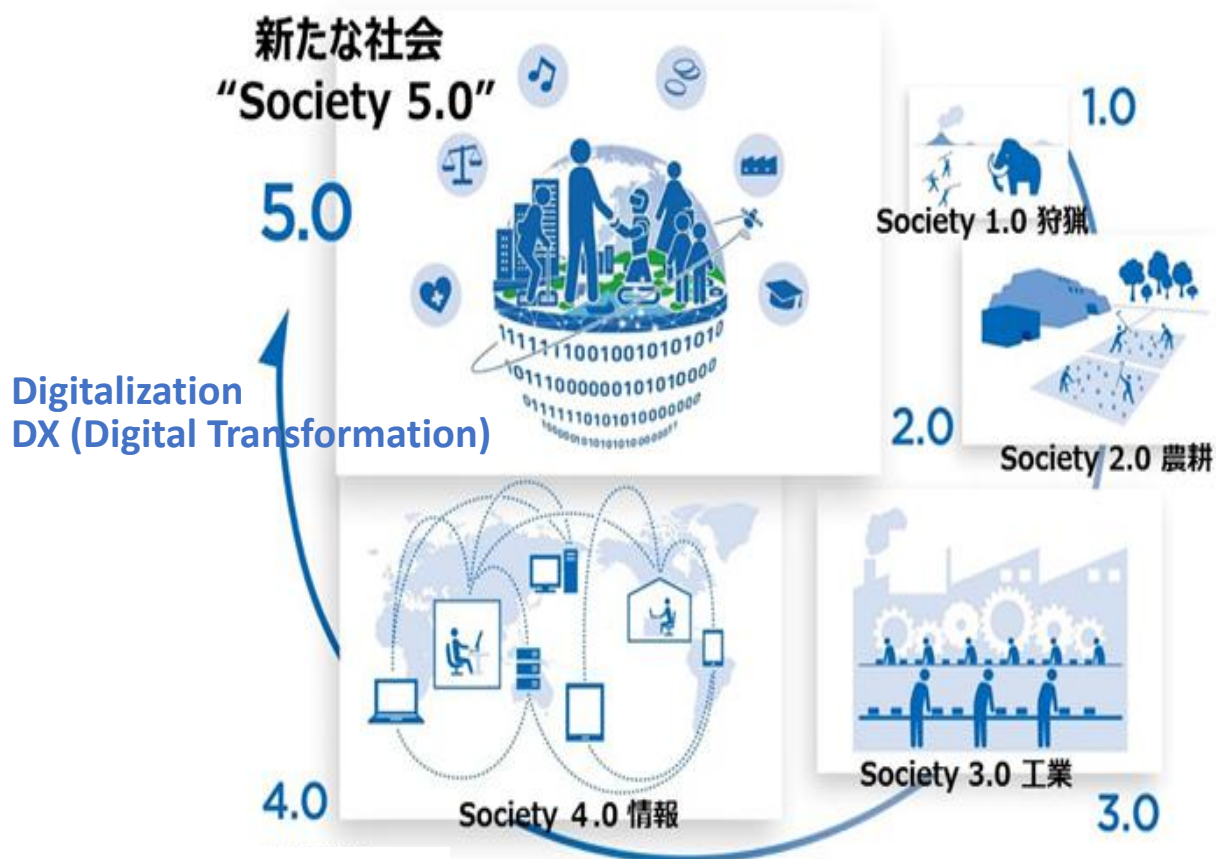
Wisdom Web of Things (W2T)
Proposed as a new research
direction of Web Intelligence
Journal of Supercomputing in 2011

网络智能 = 互联世界中的人工智能

创建未来**智能社会**、互联世界的人工智能技术。网络智能的研究包括如何实现智能在 Web of People, Web of Data, Web of Things, Web of Trust, Web of Agents, 以及浮现的 Web in industries, education, health and smart living in the 5G Era, 并以此为中心, 展开智能体计算、问题解决与推理、智慧云平台开发技术、智慧物联网、类脑计算、脑机智能等方面的研究。实现“物-人-数据-信息-知识-智慧服务-人-物”的数据循环和智慧生成链, 建立智慧物联网, 达到万物互联“人-机-物”合一互联共生。

社会5.0 (Society 5.0) - 日本版第4次产业革命

社会5.0 是日本政府提倡的未来社会概念。与德国等诸国为代表的“**工业4.0**”不同，**社会5.0** 的特征是立足整个经济社会，**不仅要提升产业的生产性，还要提升生活的便捷性**，解决少子高龄化、环境和能源等社会问题。这就需要**重新构建工业与整个社会的关系**，从更高层面构建全新的远景图，即如何在**信息社会**之后，实现**超智慧型社会**

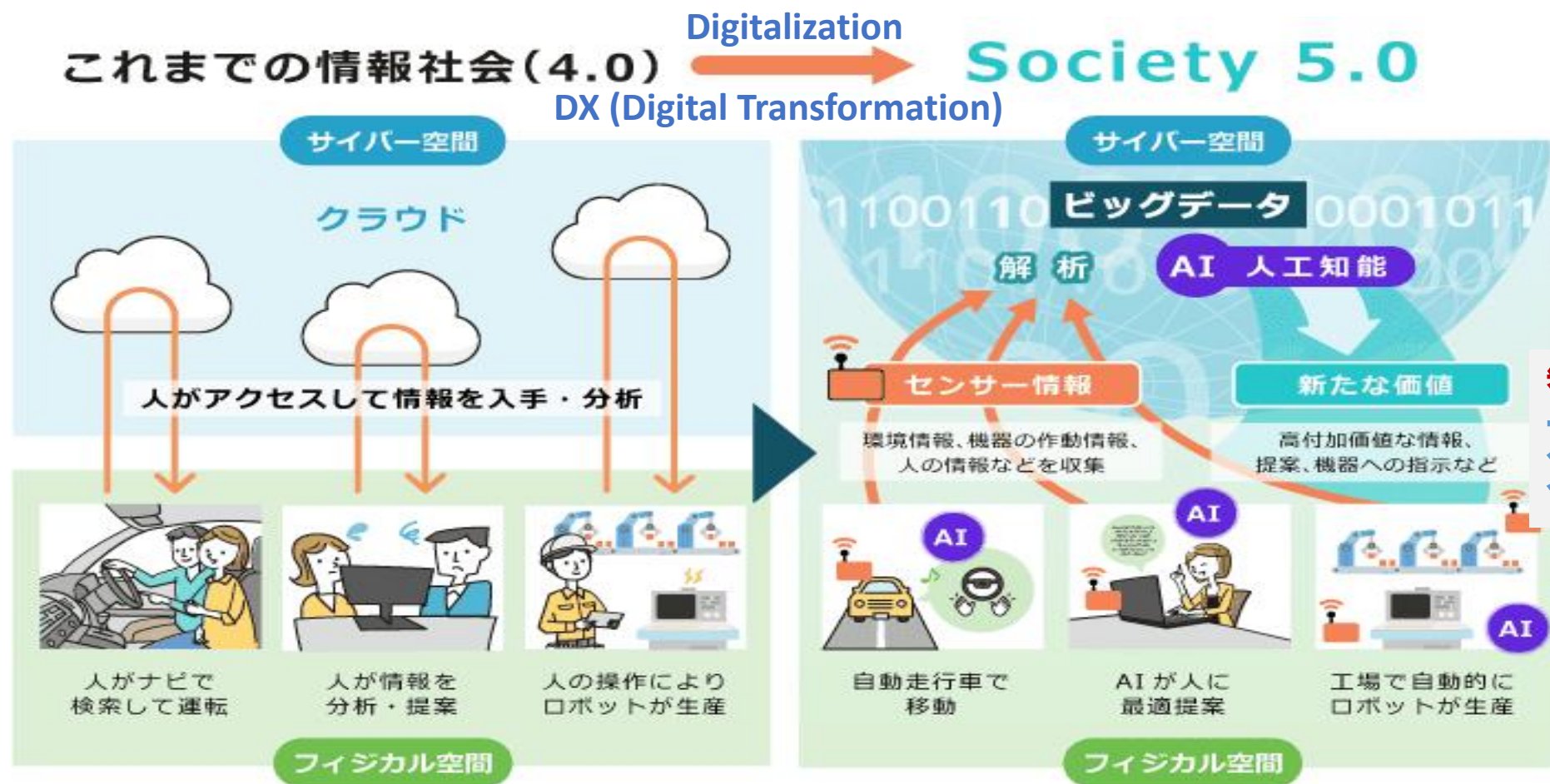


• 追求制造业的进化，世界各国采取的各种行动

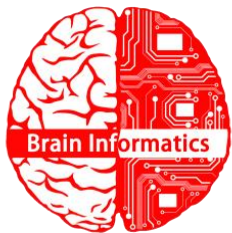


在日本《科学技术基本规划》第五期（2016年至2020年）中首次提出，2021年发布了以“迈向实现社会5.0”为题的科技创新白皮书
https://www8.cao.go.jp/cstp/society5_0/

社会5.0：通过**网络空间**与**物理空间**的高度融合，实现**以人为本**，可持续发展的“**超智慧型社会**” - **智能社会**；**网络空间**与**物理空间**的融合，正在以超过预期的规模与速度进化，而人与人的联系方式，以及社会，产业与经济的形式，也在发生着巨大的改变；由物质承担价值的资本集约型社会，向活用知识和信息的**服务承担价值的知识集约型社会**转换，为**工业和社会**带来前所未有的**新价值**



智能社会
万物互联 “人-机-物”
合一 互联共生的社会



脑大数据是**智能研究**和**智慧服务**的核心资源



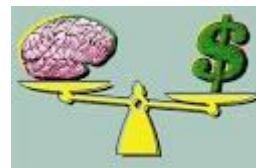
新型脑机接口



新型智能信息技术和服务



脑与精神疾病的智能化诊疗技术



神经营销学



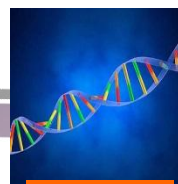
智慧城市
智慧健康

智慧医养

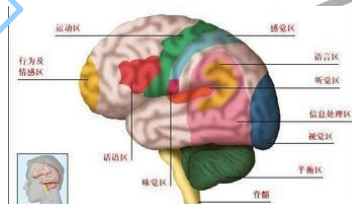
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神经元

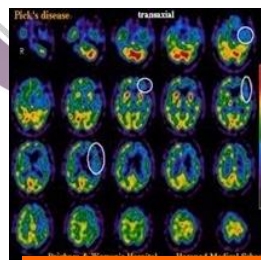


基因

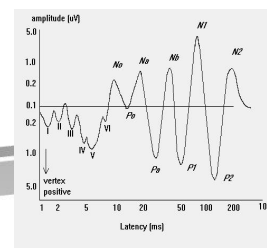


脑结构

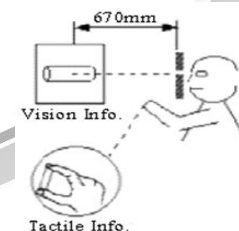
Brain Informatics



神经影像



脑电



认知心理

Brain Informatics = Brain Science in the AI and Big Data Era

脑信息学 = 人工智能大数据时代的脑科学

Brain Science meets Artificial Intelligence

脑科学与人工智能的交叉研究与产业创新

Cognitive and Computational
Foundations of Brain Science
脑科学的认知计算基础

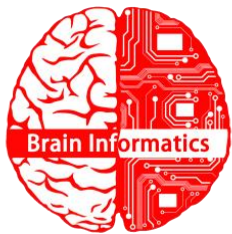
Human Information
Processing Systems
人脑信息加工系统

Informatics Paradigms for
Brain and Mental Health Research
脑与精神健康研究的信息学范式



Brain Big Data Analytics,
Curation and Management
脑大数据分析与管理

Brain-Machine Intelligence
and Brain-Inspired Computing
脑机智能与类脑计算



脑信息智慧服务

Brain Big Data Based Wisdom Services

融合**脑科学**与**信息技术**之优势，基于**脑信息学**关于脑认知机制的研究成果，以及系统化采集的、反映人脑思维与情感活动的脑认知数据资源，充分利用**网络智能**的优势，研发基于**脑认知大数据**的**智慧服务平台**及**脑与精神健康智慧服务**示范，推动形成以脑认知研究带动脑智能应用的创新生态链。

Brain Computing ➡ **脑智能，脑健康，脑联网**

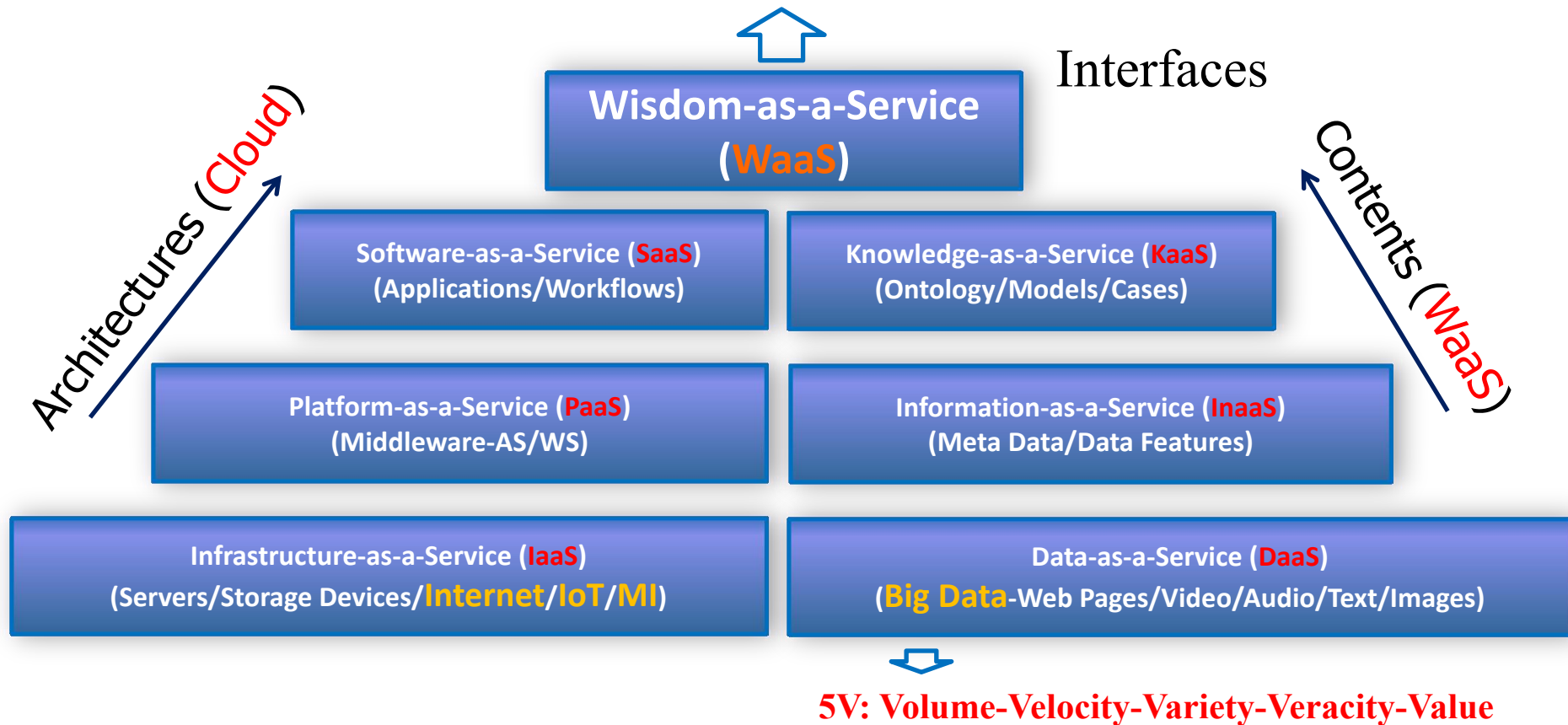
brain intelligence, brain health, brain internet

脑信息智慧服务助力创建智能社会，创新型国家

- ✓ 在以人为本的**智能社会**，需要最大程度地发挥**作为人的优势** - **创新驱动新价值的创出**。需要有不同于**工业化/信息化社会**的思想观念和创新力。**智能社会**，本质上是一种**新型的社会服务**，个性化应对个体多样化的潜在需求。以**Web服务(包括Web3.0)**的体系结构为基础, 以数据为基础的服务业兴起, 将数据收集、储存及利用作为新附加价值的基础, 形成**创新数据驱动的服务型社会**。
- ✓ 通过网络空间与物理空间的高度融合，**数字孪生与智能孪生**，“人-机-物”合一互联，社会问题与需求会浮现出来，催生**新型智慧服务**与其他领域/行业的高度融合，利用**大数据**和**智能机器人**的**新产业与新业态** (智慧社区、智慧教育、智能健康等)。
- ✓ **脑信息智慧服务**是**国际网络智能协会**推进的**互联世界智慧服务技术**，实现“物-人-数据-信息-知识-智慧服务-人-物”数据循环和智慧生成链，建立基于**数据脑网络**的新型服务体系，迈向**万物互联**“**人-机-物**”合一**互联共生的智能社会**。

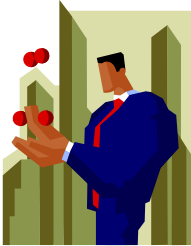
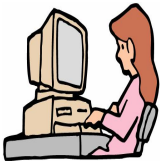
智慧即服务 WaaS – Wisdom as a Service

Providing the **right service**, including infrastructure, platform, software, as well as data, information, and knowledge, for the **right object** at a **right time** and **context**



智慧即服务 WaaS – Wisdom as a Service

Individuals



Agents



Companies/Societies
Sociocultural & organizational components



Smart City, Smart Health ...



Manufacturing

Architectures (Cloud)

Wisdom-as-a-Service
(WaaS)

MaaS (Manufacturing-as-a-Service)
EaaS (Education-as-a-Service)
RaaS (Robot-as-a-Service)

.....

TaaS (Thinking-as-a-Service)

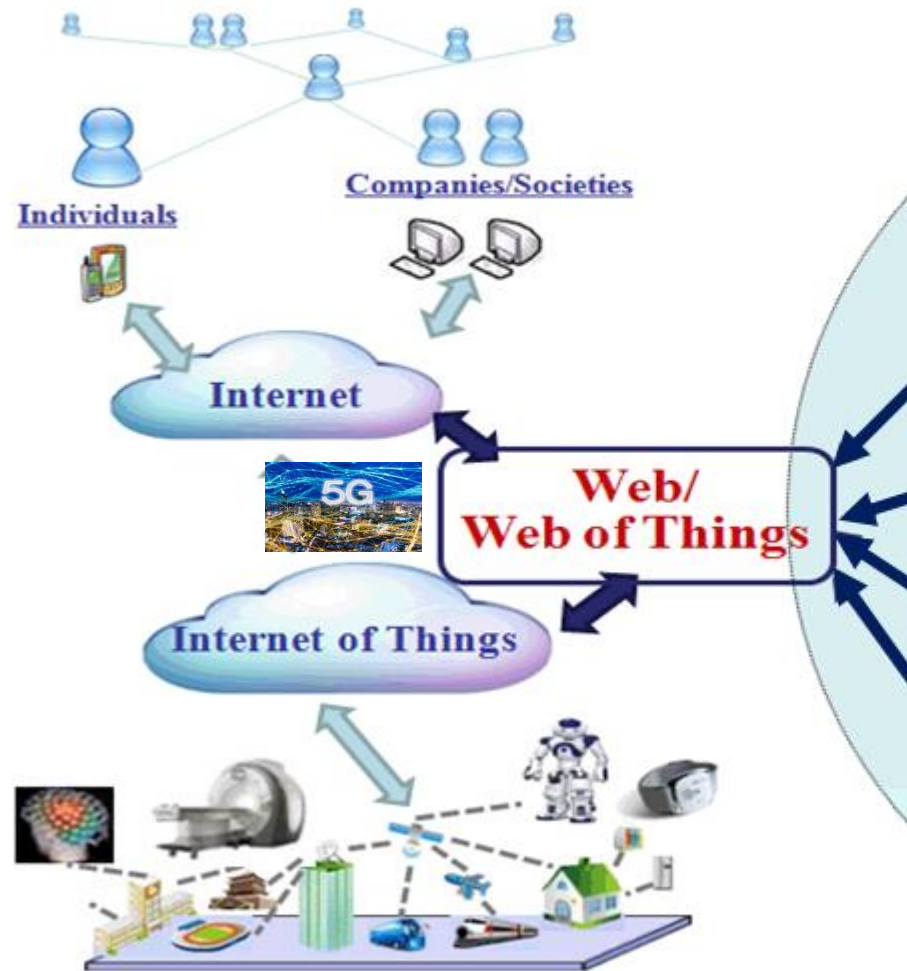
Contents (WaaS)

Infrastructure-as-a-Service (IaaS)
(Servers/Storage Devices/Internet/IoT/MI)

Data-as-a-Service (DaaS)
(Big Data-Web Pages/Video/Audio/Text/Images)

5V: Volume-Velocity-Variety-Veracity-Value

Social World



Physical World

Wisdom

Knowledge

Information

Data

网络智能 = 创建未来智能社会、互联世界的人工智能技术

智能社会

万物互联 “人-机-物”
合一互联共生的社会

Web of People
Web of Trust
Web of Things
Web of Data
Web of Agents
.....

Emerging Web in Industries, Education, Health, Smart Living

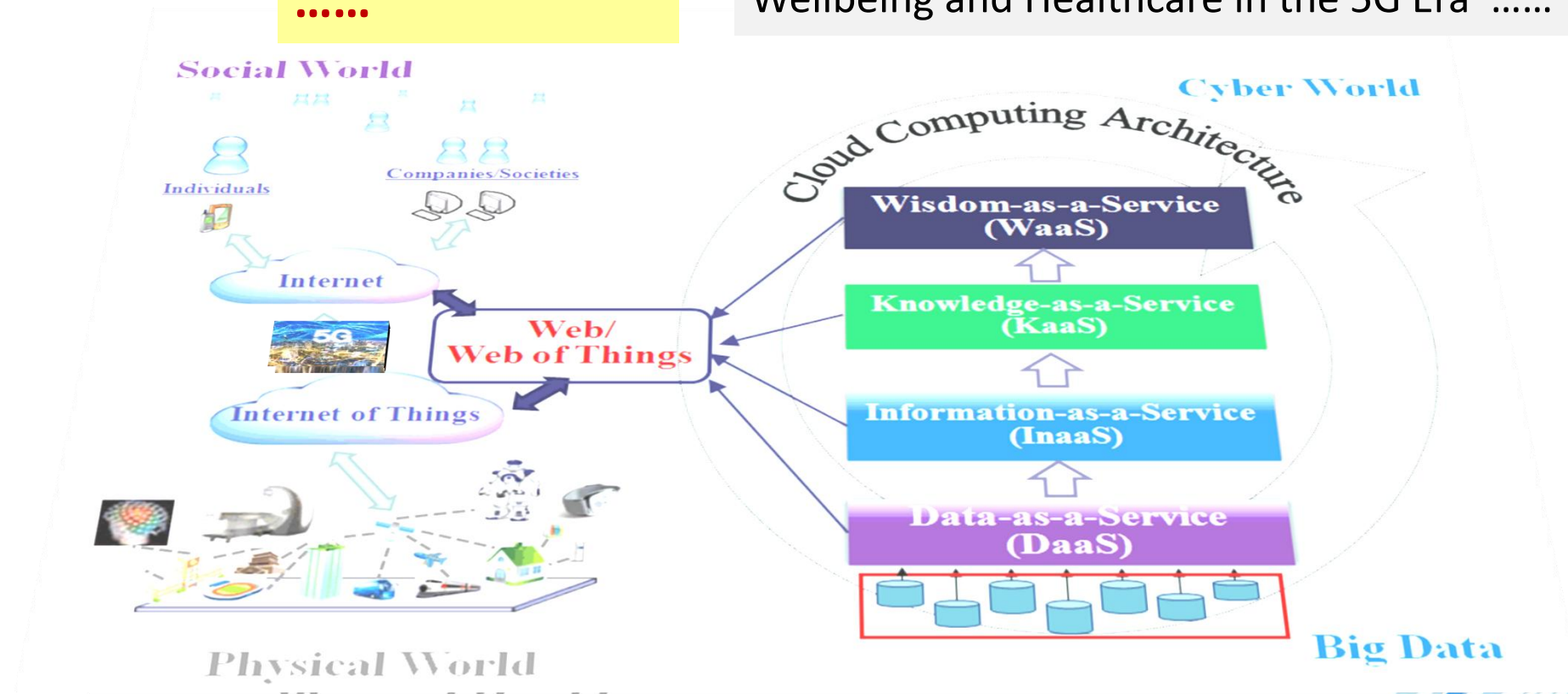
Big Data in Connected Industries, Education, Health, and
Smart Living

City Brain and Global Brain

Smart City Applications and Services

Time Awareness and Location Awareness Smart City

Wellbeing and Healthcare in the 5G Era





WIC智能健康技术

面向未来**智能社会**，针对**脑与精神心理健康**为核心的**重大疾病**（认知症、抑郁症等）构建**健康，医疗，福祉一体化的技术支撑与服务体系**

智能健康技术 = “WI meets BI” in Health and Wellbeing

- ✓ 以脑和精神心理健康为重点的重大疾病系统应对，主动健康方法论
- ✓ 脑与精神健康为核心的，身体、心理和社会功能的健康大数据
- ✓ 健康，医疗，福祉一体化的技术支撑与服务体系
- ✓ 脑智能，脑健康，脑联网，脑机智能，智慧服务机器人系统
- ✓

WHO宪章：健康不仅是没有**病**和不**虚弱**，而且使**身体，心理，社会**功能三方面的完美状态

多层次健康和医疗一体化模式

Level 0 健康的生活习惯

心情愉快, 心理健康 良好睡眠
健康饮食 适当运动 ...

Level 1 不健康的生活习惯

不健康的饮食习惯 睡眠不足 运动不足
吸烟 过度饮酒 压力过大 ...

健康な生活習慣



まだ間に合うよお～



バランスのとれた食事

運動不足

過度の飲酒

喫煙

不適切な食生活

不健康な生活習慣

まだ間に合うよお～

生活习惯 vs 疾病

治すなら
今だよお～

メタボリック
シンドローム

戻れなくなるよお～

越えちゃったよお～

危ないよお～

危ないよお～

本当に危ないんだぞお～

Level 3 亚临床

肥胖症 高血压症 高血糖症
高血脂症 睡眠障碍 糖尿病
抑郁心境 虚弱 ...

Level 2 亚健康

肥胖 高血压 高血糖
高血脂 失眠 疲劳 ...

Level 4 临床

认知症 抑郁症 糖尿病 脑卒中
癌症 心血管疾病 ...

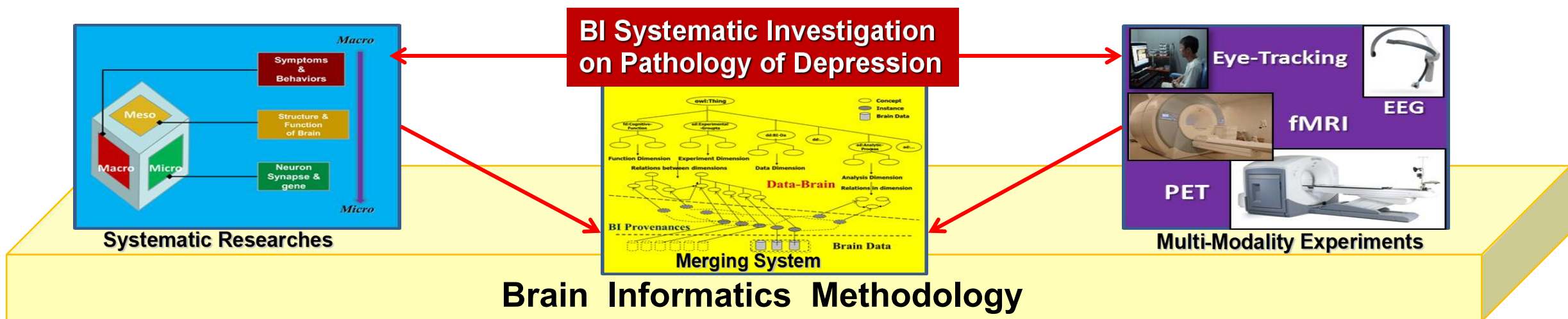
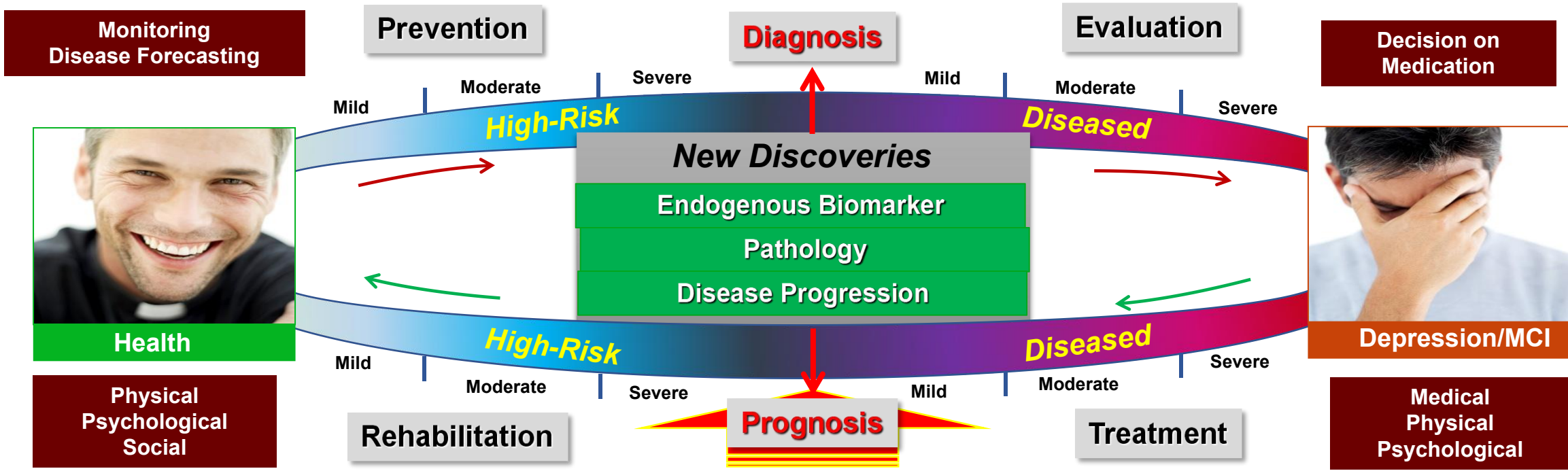
Level 5 后临床

认知症 半身瘫痪
日常生活障碍 ...

生活機能の低下
要介護状態

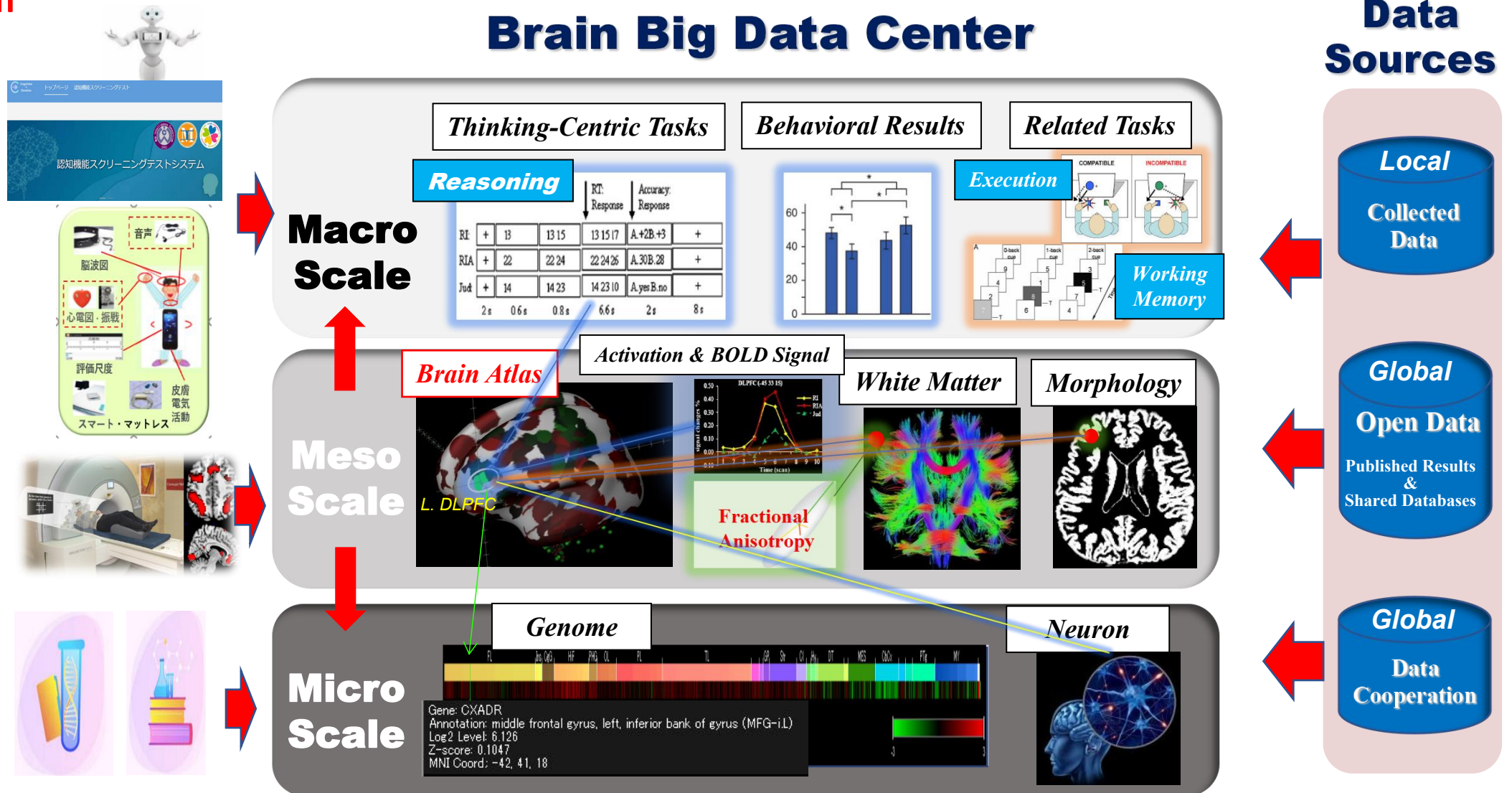


Systematic Investigation



Brain Computing by Integrating Multi-task, Multimodal and Multiscale Data, Information, and Knowledge

Top-Down
Principle



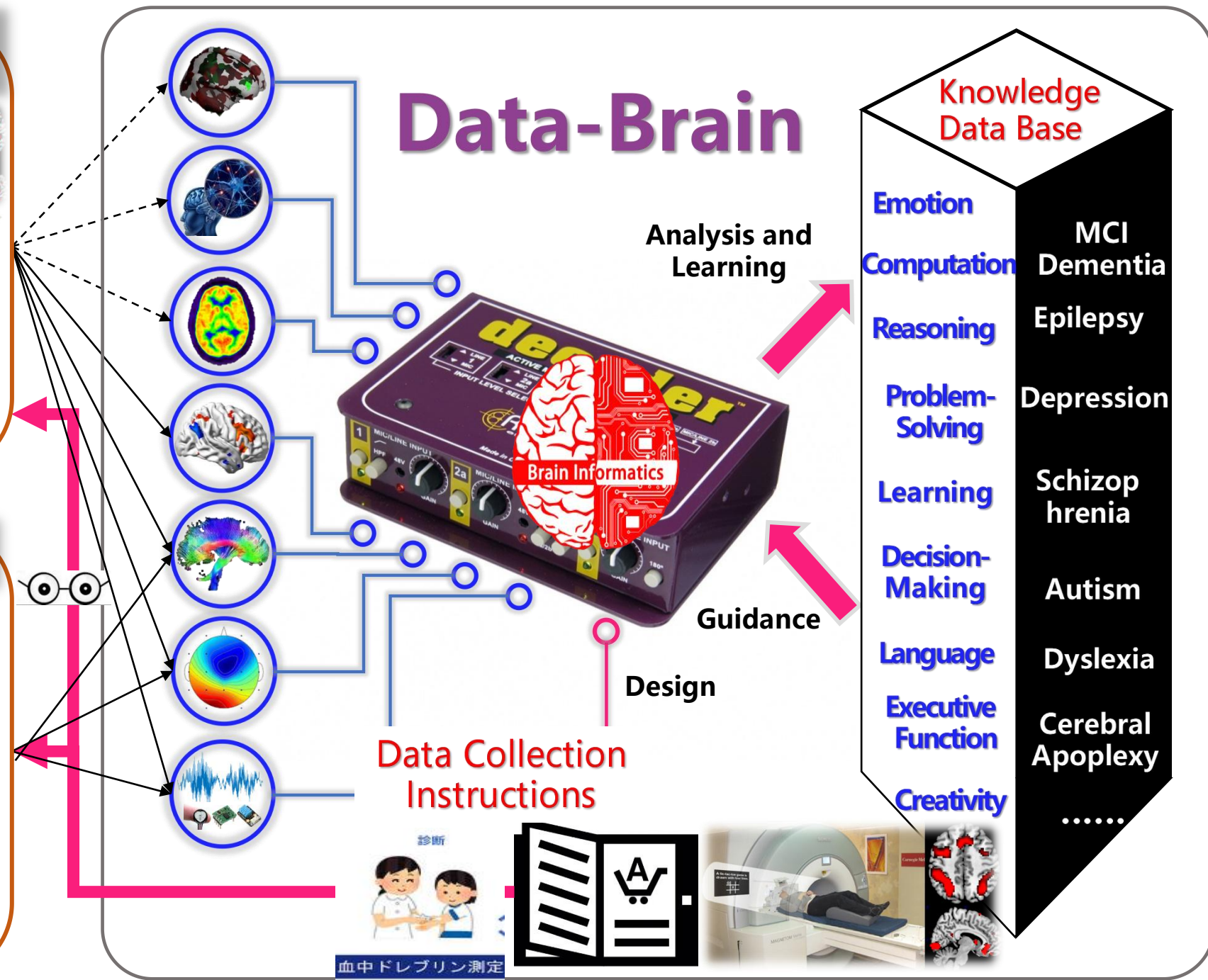
Brain/Mental Health Service Based on the Brain Cloud



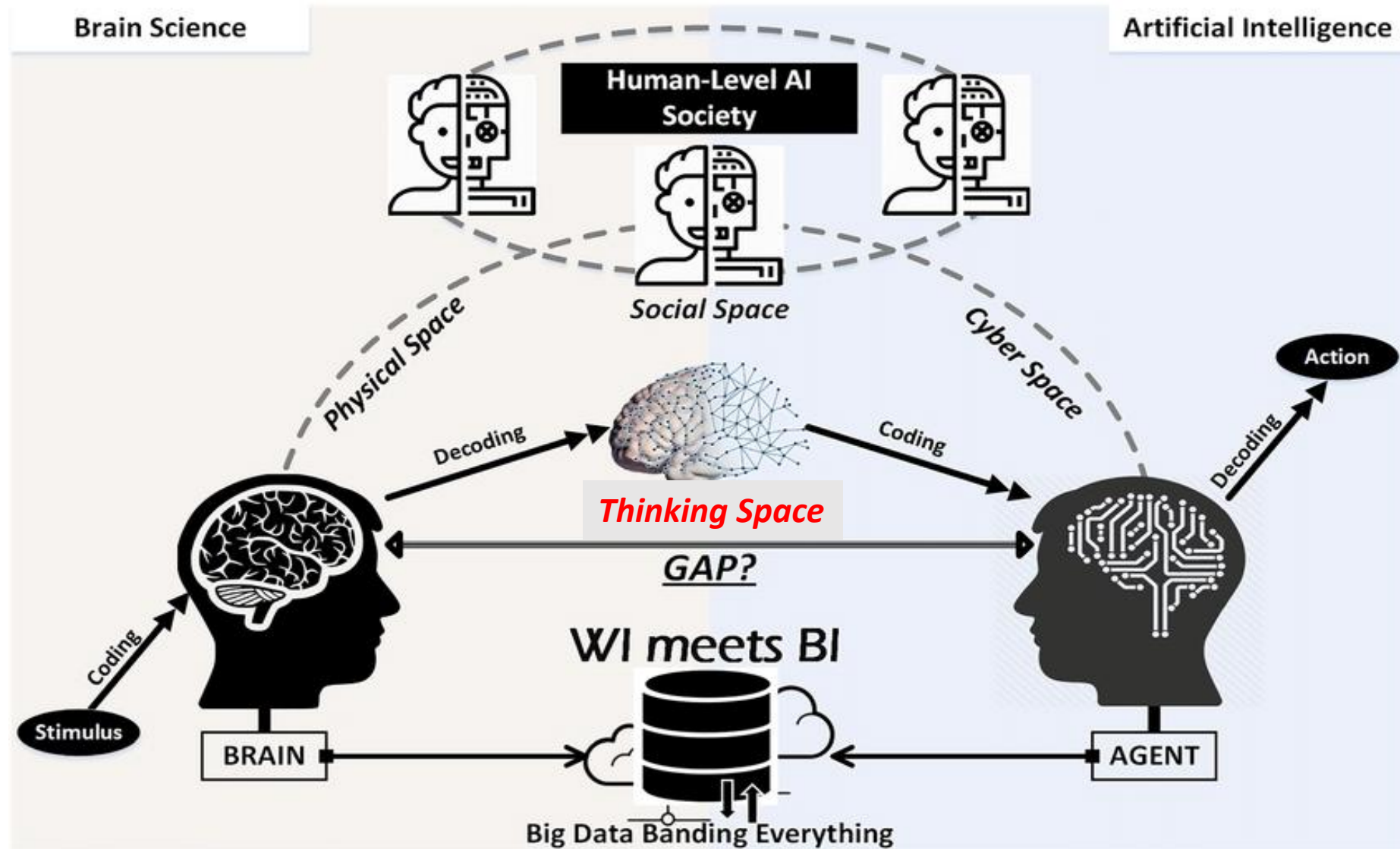
Medical Service Robot System Based on the Brain Cloud



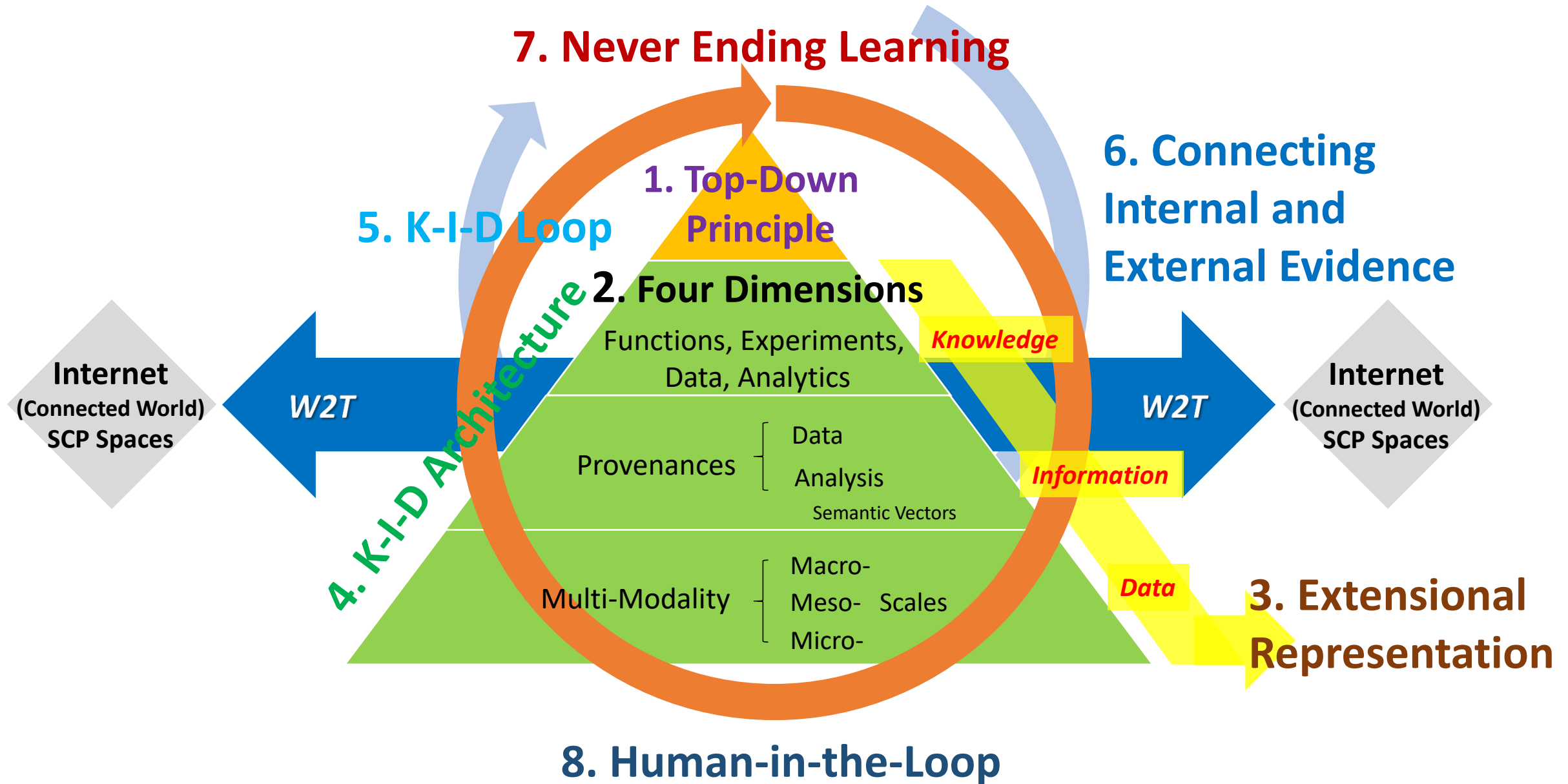
Data-Brain



数字孪生 + 智能孪生：脑机智能融合，脑智能的外延表达



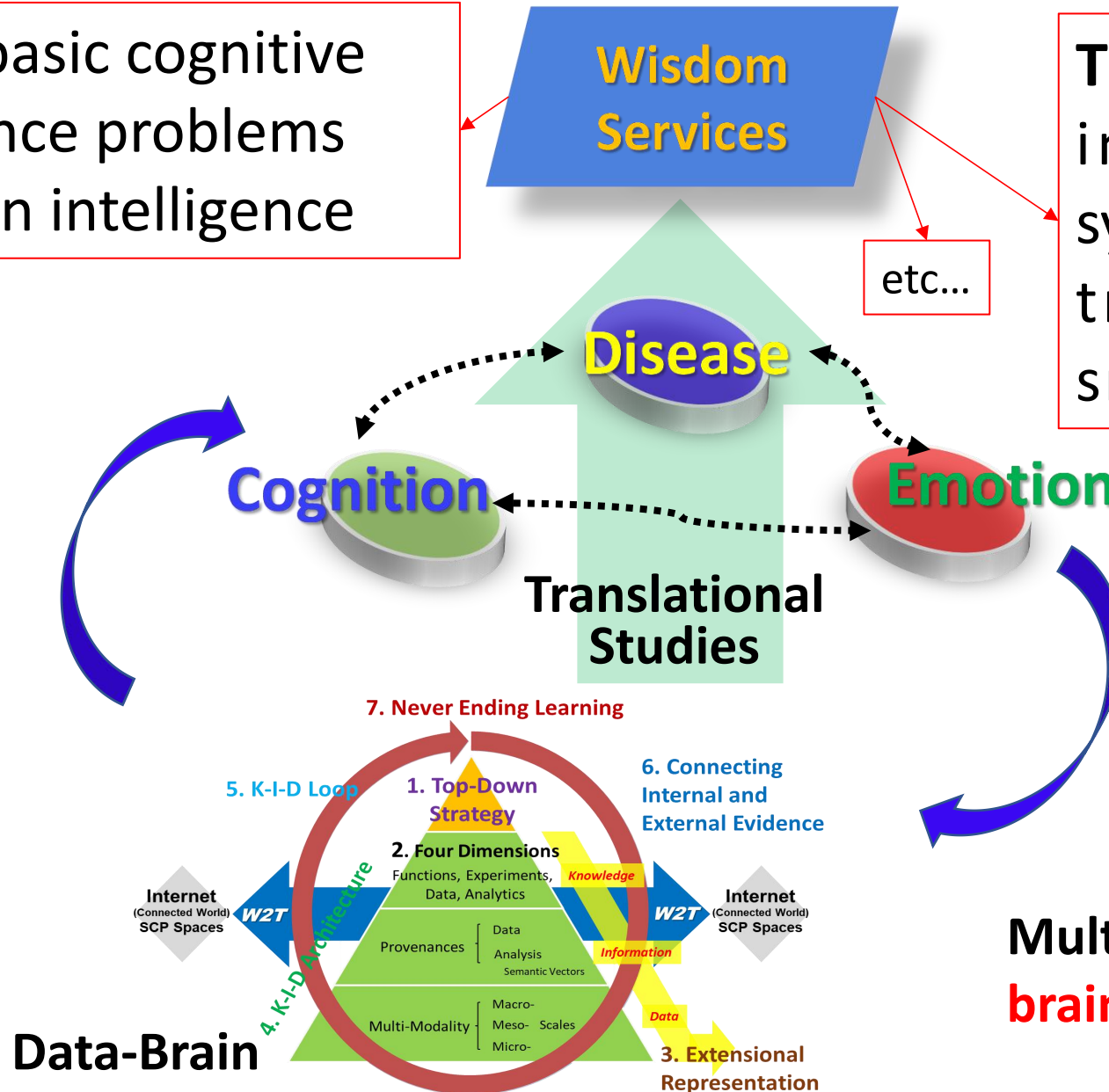
Data-Brain Driven General Intelligence Model (GIM)



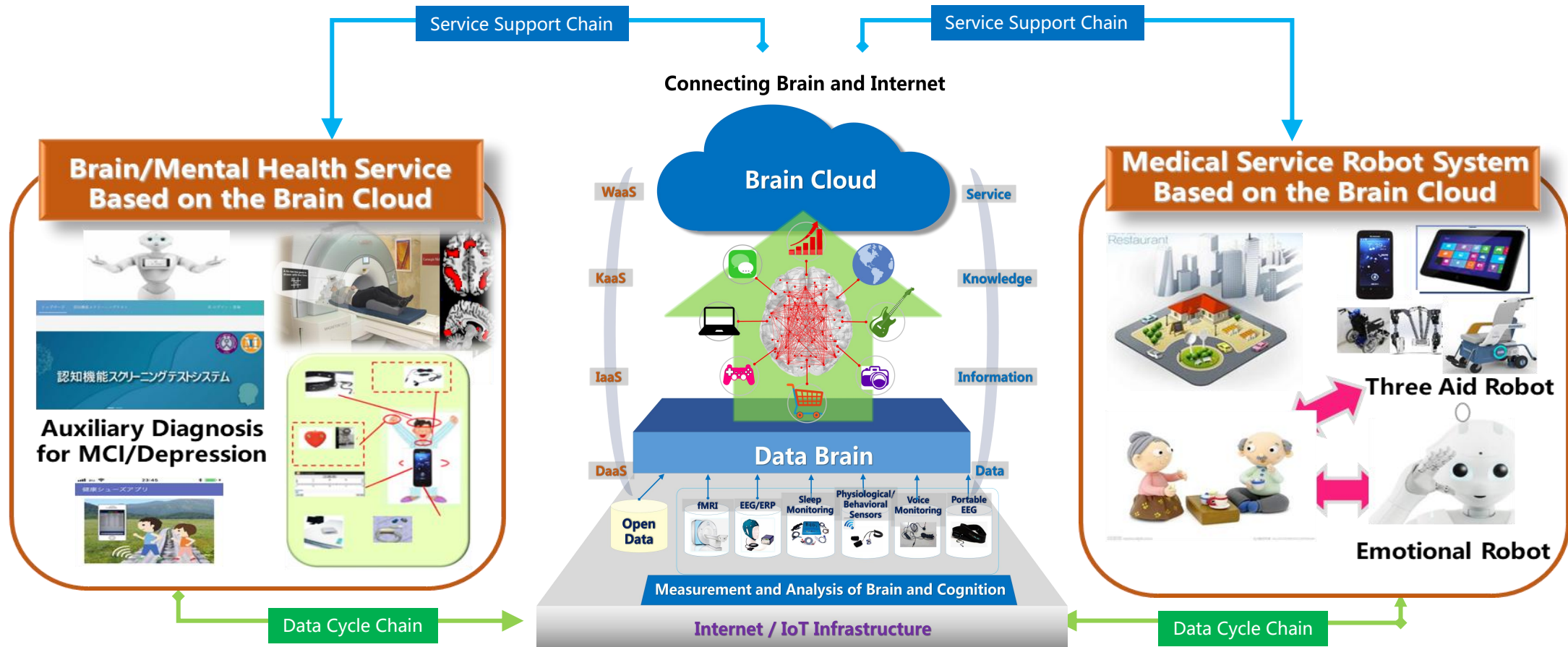
The GIM Based Wisdom Services

TO study basic cognitive neuroscience problems about brain intelligence

TO investigate brain intelligence and health systematically, and improve translational studies for smart health applications



Brain Cloud Based Wisdom Services



WIC Health Services



Wisdom Services

RaaS
(Robot
as a Service)



Dementia Prevention Service

Frail Prevention Service Sleeping Health Service
Smart Doctor Assistant Service
Lower Limb Function Rehabilitation Service

TaaS
(Thinking
as a Service)



Thinking Support Service

Never Ending Learning (NEL) Agent

KaaS
(Knowledge
as a Service)



Data-Brain Modeling Setting Service

IaaS
(Information
as a Service)



Open Literature Understanding Service

BRAI Reading/Learning Agent
External Evidence Learning Agent

DaaS
(Data
as a Service)



Brain Big Data Measurement Analysis Service

Data-Brain Driven
New Services and
New Business Model
Innovations

DX Based
Co-creation

Seeding the
Data-Brain



前橋市が目指す
「スーパーシティ」とは

SUPER CITY
スーパーシティ
X
スローシティ
SLOW CITY

Wisdom Services

RaaS
(Robot
as a Service)

TaaS
(Thinking
as a Service)

KaaS
(Knowledge
as a Service)

IaaS
(Information
as a Service)

DaaS
(Data
as a Service)

知能健康イノベーションぐんま

ホーム ・ 認知機能スクリーニングテスト ・ 「認知症」ってなんだろう

認知機能スクリーニングテストシステム

高齢者の健康を維持するための教室
～参加無料・参加者募集!!～

ココロとカラダとアタマのフレイル(虚弱)を予防しよう!

いったい
どうなっているんだい?



高齢者の健康データの測定
～参加無料・参加者募集!!～

カラダとアタマのフレイル(虚弱)状態を確認しよう!



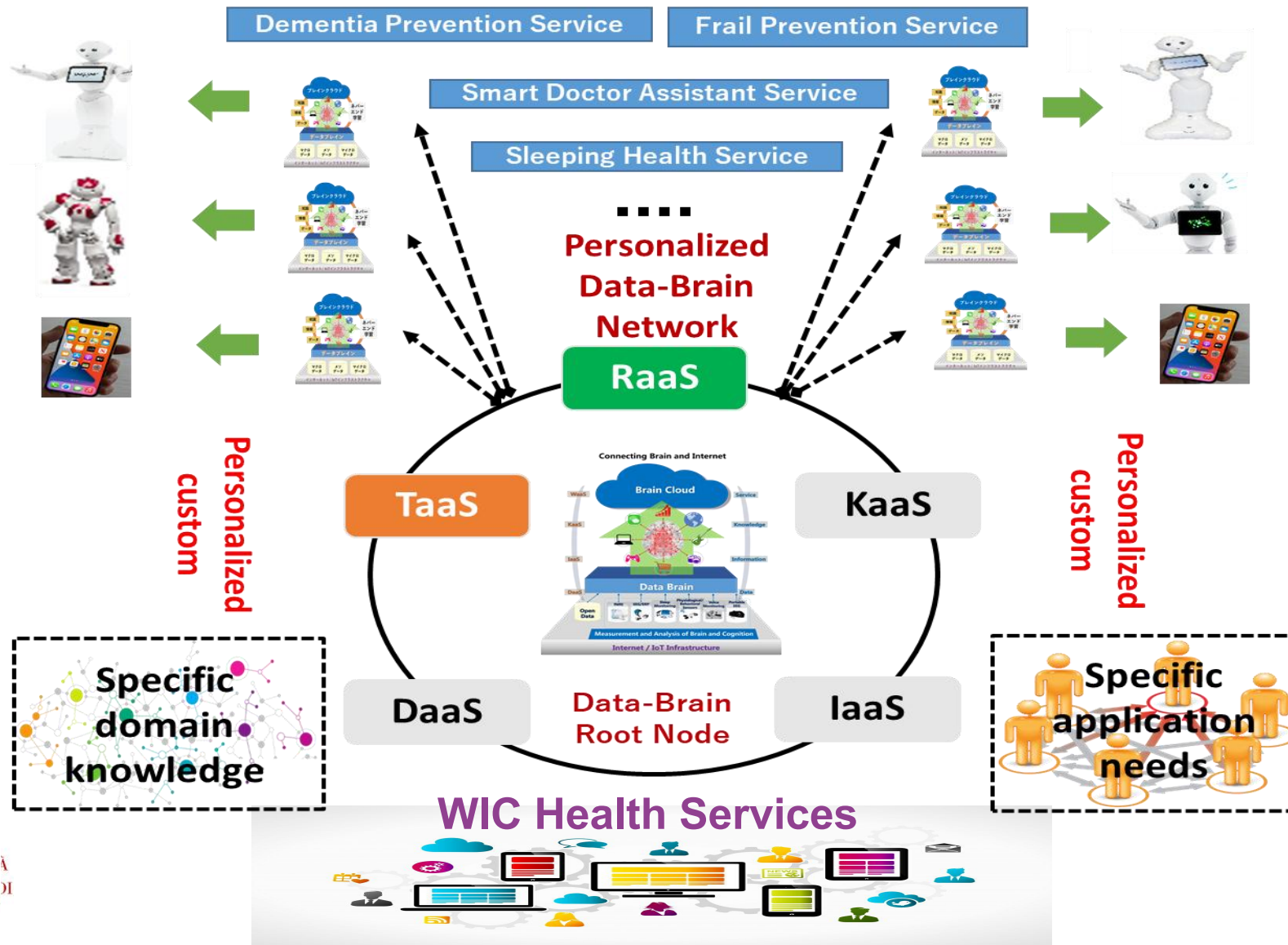
日本群馬创新创业大赛
GUNMA TECH PLANTER 2021
しのめ信金賞, SCSK賞



JP Node
UK Node
AUS Node
US Node
IT Node
.....



Data-Brain Network – Seeding the Data-Brain



CCRC Lifelong Town

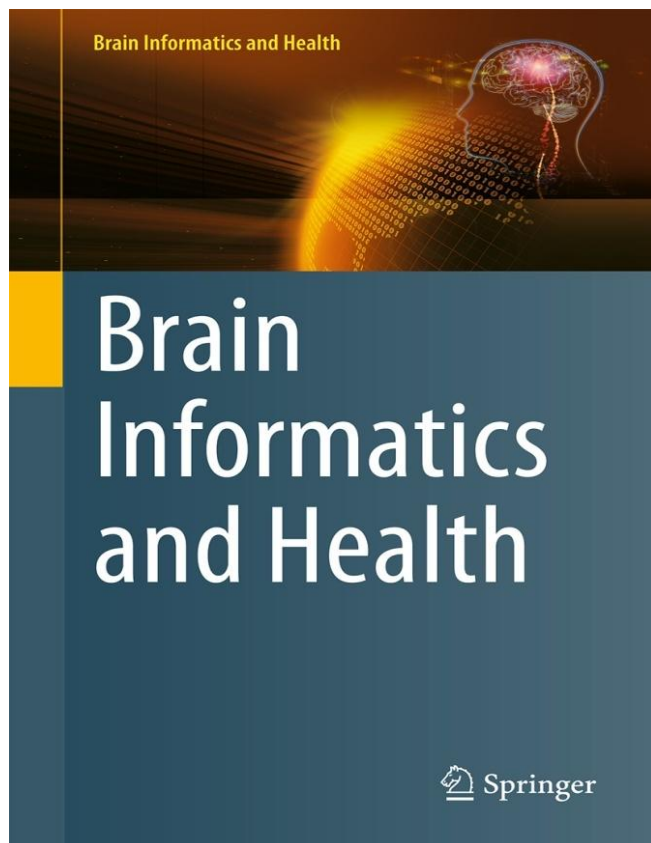
Hirose River BID Town Planning

Regional Inclusion Care System

.....

前橋市が目指す「スーパーシティ」とは
SUPER CITY
スーパーシティ
X
スローシティ
SLOW CITY





科学技术对人类很重要，
但自然和文化更重要

Thank You !

