AI Strategy and Related Activities In Japan (Overview)

October 25, 2017

Ministry of Internal Affairs and Communications (MIC), Japan
Based on instructions by Prime Minister Abe in “Public-Private Dialogue towards Investment for the Future” in April 2016, the Japanese government established “Artificial Intelligence Technology Strategy Council”.

In March 2017, the Council formulated “Artificial Intelligence Technology Strategy,” including “Industrialization Roadmap.”
Utilization and application of data-driven AI developed in various domains

Phase 1

Phase 2

Phase 3

Public use of AI and data developed across various domains

Ecosystem is built by connecting multiplying domains

Artificial intelligence as a service (AlaaS)

Phase 3

Complex application services

Multipurpose services

Services

Factory

Hospital

Call center

Agriculture

Truck, Drone

Phase 2

Phase 1

Approx. 2020

Approx. 2025~2030

Note: The concept of AlaaS is borderless and developed across fields.
As priority areas that should be taken up for the time being as part of the Industrialization Roadmap,

- Productivity
- Health, Medical care, and Welfare
- Mobility
A society where innovative services and products are continuously developed - Moving from manufacturing to value creation -

- **Prevalence of creative products and services**
  Products and services that go beyond established concepts are fused and continuously developed.

- **Realization of subconscious desires**
  People find things they really want and which cause them to realize new value.

- **High value-added items become familiar**
  Autonomous robots enable stable and high-quality production indoors and outdoors, realizing a zero-waste society.

- **Careful delivery**
  Necessary items are available at reasonable prices when needed.
A society that enjoys healthful life and longevity - From treatment medicine to advanced preventive medicine -

**Comfortable health control**
Easy and enjoyable to take preventive medicine every day for disease, dementia and anti-aging, leading to a long and healthy life.

**Designing your own body**
Disease can be immediately cured. Also, body functions can be easily replaced by artificial organs and sensors.

**Easy use of advanced medicine**
Medical treatment with advanced techniques and equipment can be easily implemented non-invasively at home under a doctor’s care.

**Personal robots**
General-purpose robots are utilized as family members in daily life, solving the problem of nursing care and allowing people to live in peace.

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**Phase 1**
- Construction of Japanese ICT integrated community care system by utilizing advanced electronic health record (EHR)
- Telemedicine and home medical care
- AI-assisted medical examination and suggestion of prescription candidates
- Collection of everyday health data

**Phase 2**
- Complete medical checkup at home
- Advanced individualized/grouped medical examinations
- Constant health monitoring service

**Phase 3**
- Worldwide deployment of Japanese ICT integrated community care system
- Personal healthcare concierge
- Al-assisted early detection, treatment and prevention of disease and illness
- Providing a variety of functional foods customized to the health condition of an individual

**prepare and organize data on health, medical care, and welfare**

**High-speed telecommunication, diagnostic medical equipment**

**Image recognition, anomaly detection**

**Vital sign sensor**

**Data collection, data preparation**

**Drug discovery**

**Regenerative medicine**

**Image recognition, tactile sensor**

**AI, medical, elderly care robots**

**Voice recognition, semantic interpretation**

**AI-assisted drug discovery**

**Organ transplants, regenerative medicine**

**Care facilities with installed sensors**

**Smart operating room with robots capable of supporting diagnosis using AI to assist surgical procedures**

**Robots that provide walking assistance, supervision, and support through conversation**

**Development of drug having a great effect on specific constitution and symptom with biomarker and DDS**

**Replacement of body functions with artificial organs**

**Nanorobots that work inside the human body**

**Surgical robot capable of simulating behavior of a skilled surgeon**

**Robots which understand a person’s intentions**
Industrialization Roadmap (Mobility)

Phase 1

- Expansion of car-sharing business
- Reservations/services for transportation devices
- Expansion of GPS-related industry
- Collection of travel information and prediction of surrounding environment using AI and sensors
- 3D maps/traffic control system
- Level 1, 2 autonomous car

Phase 2

- Expanded peripheral industries utilizing automobile data
- Autonomous transportation/delivery technology such as platooning
- Level 3 autonomous car
- Transportation devices powered by IoT-expanded application maintenance industries

Phase 3

- Maturity of sharing economy, changing the concept of ownership/use of travel equipment
- Realization of multipurpose use of owned car
- Providing services that realize seamless travel
- Autonomous transportation/delivery services
- Level 4 autonomous car
- Automatic version update of transportation devices while not in use
- Securing various means of travel
- Privatization of travel time and space
- Providing full-scale virtual travel

Society that enables safe and free travel
- From transportation (cost) to personalized space creation (value)
  - Reducing the number of people who have difficulty traveling and eliminating fatal accidents caused by human error
    (Accident fatalities: 1.25 million people worldwide; unlicensed people: about 6 billion overseas, 40 million domestic)
  - High value-added travel
    Maximizing additional value such as sightseeing, sports and personal contact during travel
  - Fusion of cyber and physical space
    Providing a near-realistic travel experience without traveling
  - Minimizing time and energy for transportation of people/goods
In realizing the Roadmap, it is necessary to take the following approaches:

- **R&D**
- **Fostering of Human Resources**
- **Improvement of Environment for Data and Tools**
- **Support for Start-ups**

AI Technology Strategy (in English) available at:
[http://www.nedo.go.jp/content/100865202.pdf](http://www.nedo.go.jp/content/100865202.pdf)
MIC’s AI research and development

MIC covers research from various perspectives on intelligence.

Approach to understand and create intelligence from Big data.
• Focus: Social aspects of intelligence
• Implementing agency: Universal Communication Research Institute, NICT (National Institute of Information and Communications Technology)
• Natural language processing (machine translation and question answering), image recognition, data mining, the IoT, and a methodology for dictionary and knowledge base construction

For real world applications
Opening a large number of systems to the general public, such as those related to the Tokyo Olympics, disaster prevention, and mitigation, the research and analysis of various social trends, education, and innovation support

Practical technologies
VoiceTra, WISDOM X, and DISAANA

Knowledge information with vitality creation of a vibrant knowledge information society

Present: E.g., the creation of comfortable space, medical applications, elderly measures, and control technology

Practical technologies
E.g., machine learning technique to learn on the brain and video evaluation techniques.

Approach to understand and create intelligence from the brain functions
• Focusing: Biological aspects of intelligence
• Implementing agencies: NICT CiNet and ATR
• Brain-machine interface (BMI), neurofeedback, rehabilitation assistive technology, brain function model, robot control, and biomarker

Two approaches are complementary to each other.
• Integrating them in the future in pursuit of AI and robots truly helpful to society.
NICT, a national R&D agency, took initiative and developed a multilingual speech translation system.

**Now**

**VoiceTra**
(Smartphone app)

- Supporting 31 languages.
- The translation of travel conversations between 10 languages, including Japanese, English, Chinese, and Korean, is possible on a practical level (a TOEIC 600-point level in terms of English).
- (Artificial intelligence (AI) is used for speech recognition and translation.)

**Download QR code**
VoiceTraSupport page: http://voicetra.nict.go.jp/

- **Efforts toward performance improvements.**
  - Making the translation of conversations other than travel conversations possible, such as those required for medical scenes.
  - Expanding the number of translatable languages on a practical level.
  - Supporting a variety of expressions, noise removal, and R&D of automatic learning and other functions.

**2020**

After R & D, followed by large-scale verification, VoiceTra will be put into practical use in society by 2020, when the Tokyo Olympic and Paralympic Games will be held.

- Nationwide expansion

**- Shopping**
**- Railroad**
**- Medical service**
**- Police**
**- Sightseeing**
**- Taxi**
**- Railroad**
**- Shopping**
**- Railroad**
**- Medical service**
**- Police**
**- Sightseeing**
**- Taxi**

**VoiceTra** Support in the street (e.g., by volunteers)

- Utilized by Keihin Electric Railway on a trial basis for transfer and lost property guidance.
- Utilized by the Okayama Prefectural Police for geographic information, lost property reporting, etc.
- Utilized by first-aid stations and volunteers for Tokyo Marathon 2015 and 2016.

**Utilized by**
- Narita Tra, a translation application dedicated to Narita Airport. (Technical transfer from NICT)
- Introduced by Tokyo Metro to all 170 stations under its management.
- Utilized by the Okayama Prefectural Police for geographic information, lost property reporting, etc.
The world's top-level natural language processing AI system with one of the world's largest knowledge base constructed from a huge amount of character data on the Internet (equivalent to more than four billion web pages or 22 billion sheets of manuscript paper).

- Not only responds to questions but infers hypotheses and proposes new questions.
- Open to the public at [http://wisdom-nict.jp](http://wisdom-nict.jp).

Example 1

“What should we worry about at the Tokyo Olympic Games?”

- Rising cost of materials
- An increase in construction costs
- Insufficient number of accommodations
- Comic Market opens
- Displays responses to athletes’ poor physical condition due to intense heat, disaster risk, terrorism, typhoons, radioactivity, etc.

Example 2

1) Question: What will happen if global warming progresses?

- Ocean temperatures will rise.
- Total damage amounting 100 trillion yen per year

2) A total of 450 responses

- Methane will be released.
- Coral bleaching will continue.
- Vibrio parahaemolyticus (E. coli) bacteria will increase.

Based on the answer 3), the system proposed the question, “What will happen when the sea temperature goes up?”
The user clicked on this proposal.

Later, a journal reported an increase in food poisoning from vibrio parahaemolyticus bacteria as a result of a climate change.

April 13, 2016, the National Institute of Information and Communications Technology; NICT
Displays the point in real time where the rescue request is made. A normal search engine enables a user to acquire similar information only after the user sees at least 10,000 pieces of information.

Discoveries by DISAANA

Twitter information on the rescue request

Area designation: Joso, Ibaraki Prefecture

Easily find such tweets in just two clicks.

(A part of the D-SUMM has been researched and developed under the Cabinet Office Cross-ministerial Strategic Innovation Promotion Program (SIP))

April 13, 2016, the National Institute of Information and Communications Technology, NICT

[DISAANA]  
http://disaana.jp

- An application of WISDOM X technology to analyze and organize disaster-related information on Twitter in real time and provide time-sensitive assistance in situational awareness and judgment.
- Incorporating versatile real-time functions (e.g. (1) find disaster reports in designated areas automatically, (2) determine groundless rumors, (3) answer disaster-related questions)

[D-SUMM]  
https://disaana.jp/d-summ/

- Summarizing huge disaster damage reports compactly on an area-by-area and/or type-by-type basis to overview entire disaster damage situations.
Experience

Modeling human brain activity via motion-energy representation

Decoding perceptual experiences using a Bayesian inference

Application: Decoding of imagined vision

Imagination-based Google image search  (Naselaris et al., 2015 NeuroImage)
Brain/Mind Reading

‘Brain/mind reading’: inferring mental states from looking purely at brain activity

Reconstructing viewed images from brain activity of a person watching a movie – by Shinji Nishimoto, CiNet.
Application: high bandwidth BMI for thought controlled machines/communications
The Conference toward AI Network Society

- An advisory expert group for Institute for Information and Communications Policy (IICP), MIC
  - Chaired by Dr. Osamu SUDO H (Prof., University of Tokyo)
  - Experts from industry, academia, the private sector
    (with observers from gov’t agencies, national research institutes, industry group)

- Established to study social, economic, ethical, and legal issues toward promoting AI networking, including:
  - preparing a draft used for international discussions for formulating AI R&D Guidelines
  - assessing impact and risks of AI networking in each of sectors in society
Draft AI R&D GUIDELINES

- Released by the Conference in July 2017
- Draft guidelines for AI R&D (i.e. for AI developers)
- Aiming at increasing benefits and mitigating risks of AI systems
- Prepared for international discussions (e.g. G7, OECD)
- Compiling “AI R&D Principles” with comments

Basic Philosophies

- Achieve a human-centered society.
- Share the Guidelines as non-binding soft law and their best practices among stakeholders internationally.
- Ensure a balance between benefits & risks of AI networks.
- Ensure technological neutrality, avoid excessive burden on developers.
- Review constantly and revise as necessary.
AI R&D Principles

To promote the benefits of AI systems

- Collaboration

To mitigate the risks of AI systems

- Controllability
- Transparency
- Safety
- Security
- Privacy
- Ethics

To improve acceptance by users and other stakeholders

- User Assistance
- Accountability
G7 ICT Ministers’ Meeting

2016 (Takamatsu, Japan)
- Japan proposed that G7 countries take the lead in international discussions toward the formulation of “AI R&D Guidelines” as a non-regulatory and non-binding international framework.
- The participating countries agreed to its proposal.

*A tentative proposal on AI R&D Guidelines including 8 principles was also distributed.

2017 (Turin, Italy)  Annex 2 to the Ministerial Declaration
“G7 Multistakeholder Exchange on Human Centric AI for Our Societies”

“...Building on the debate initiated by the 2016 G7 ICT Ministerial in Takamatsu, national and international events have been held to foster exchange of views (for example “A.I. R&D Guidelines” organized by the Conference of Advisory Experts of Japan’s Ministry of Internal Affairs and Communications). We recognise the need for further information sharing and discussion, to deepen our understanding of the multifaceted opportunities and challenges brought by A.I. ...”
Ministry of Internal Affairs and Communications

Merci/Thank you.