\Orchestrating a brighter world NEC

Creating a human-centered society

by making maximum use of Data and Artificial Intelligence

January 21st, 2019

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Executive Vice President and CTO
NEC Corporation

Orchestrating a brighter world

NEC brings together and integrates technology and expertise to create the ICT-enabled society of tomorrow.
We collaborate closely with partners and customers around the world, orchestrating each project to ensure all its parts are fine-tuned to local needs.

Every day, our innovative solutions for society contribute to greater safety, security, efficiency and equality, and enable people to live brighter lives.

Social Issues

The Earth in 2050

Japan in 2050

NEC's Social Value Creation

NEC Safer Cities

Creating Societies that are Safe, Secure, Efficient, and Equal

NEC Value Chain Innovation

Smart Connectivity

NEC the WISE

Bio-IDiom

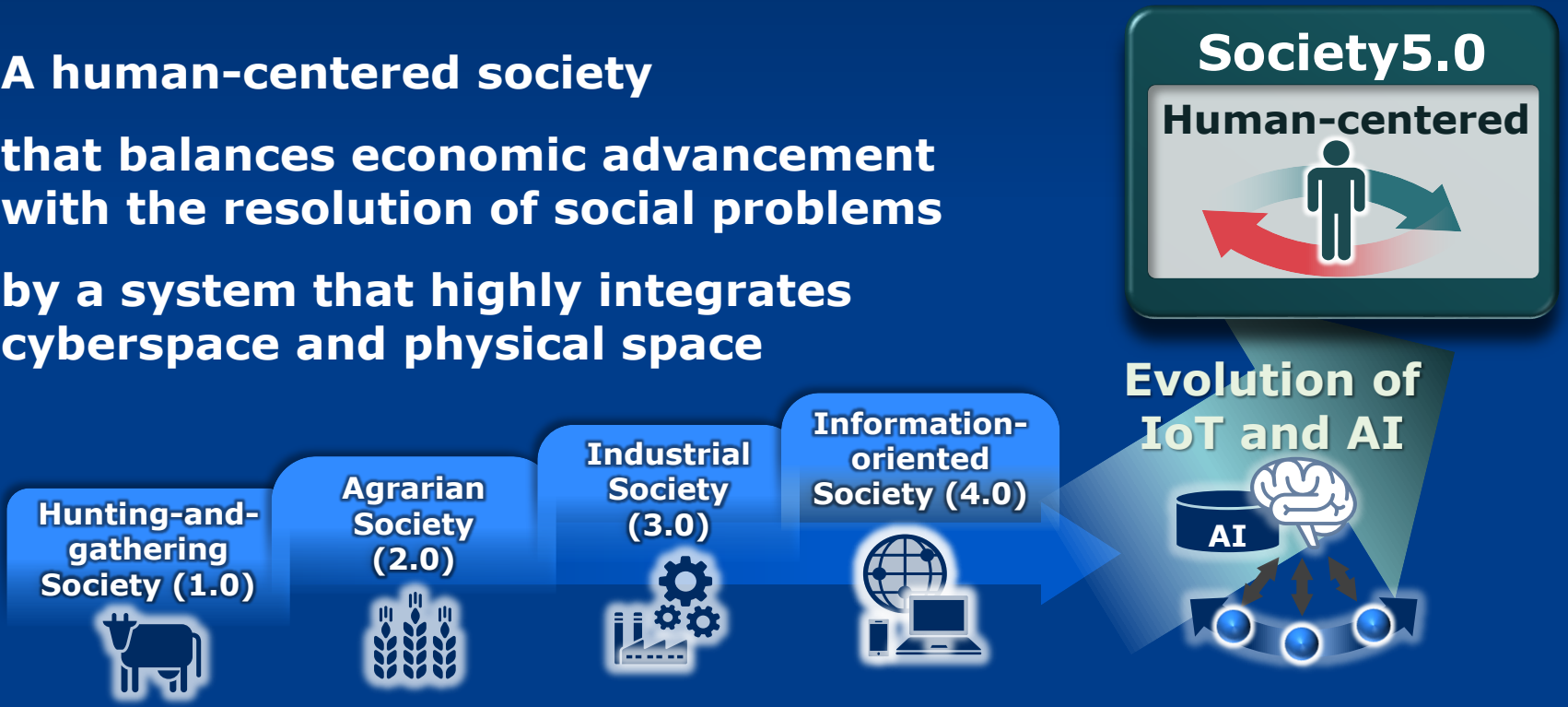
Cyber Security


1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

Society 5.0

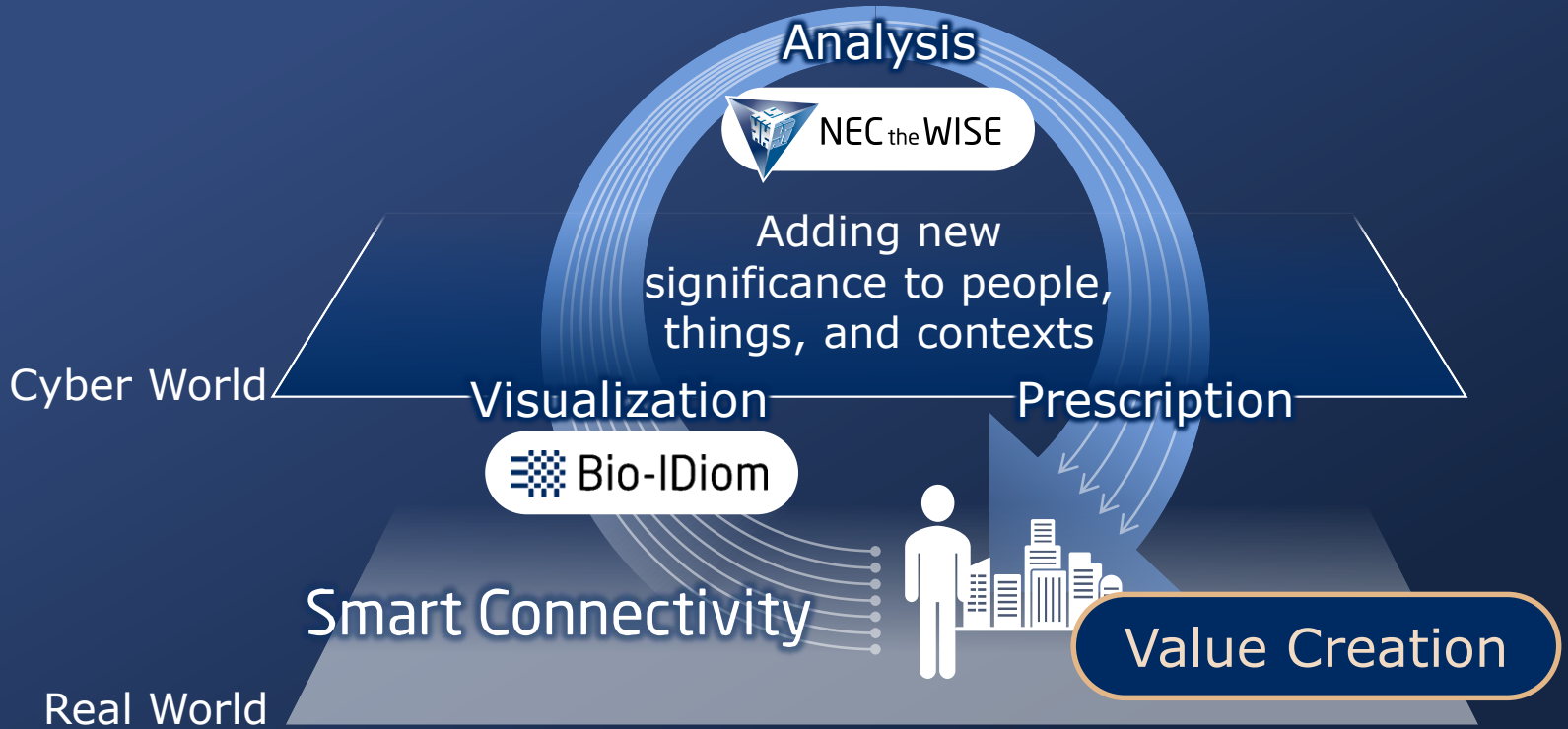
January 2017, Society 5.0 concept has been introduced in the 5th Science and Technology Basic Plan.

- **A human-centered society**
- **that balances economic advancement with the resolution of social problems**
- **by a system that highly integrates cyberspace and physical space**



Social Value Creation
enabled by evolving technologies

Value Creation in anticipation of Digital Inclusion



NEC Biometric Authentication

NEC's Cutting-edge AI Technology Suites "NEC the WISE"

NEC the WISE

AI technologies from NEC
for enriching human intellect and creativity

Visualization

Digitalization, Improvement of data quality

- Image clarification
- Only1 Learning based super-resolution
- Only1 Multi-modal image fusion
- Only1 Micro-size ID as a dot
- Only1 Discovery of rare critical events

Recognition & identification using the five senses

- No.1※1 Face recognition
- No.1※2 Fingerprint recognition
- No.1※3 Iris recognition
- Only1 Object fingerprint recognition
- Only1 Ear Acoustics Authentication
- Only1 Optical vibration sensing
- Speech, emotion recognition

Analysis

Understanding of meaning & intent

- No.1※4 Textual entailment recognition
- Only1 Crowd behavior analysis
- Only1 Profiling across spatio-temporal data
- Only1 Customer profile estimation
- No.1※5 Acoustic situation awareness

Analysis with interpretation

- Only1 Heterogeneous mixture learning
- Only1 Invariant analysis
- Only1 Log pattern analysis
- Only1 Automated Security Intelligence
- Only1 Predictive analytics automation technology
- Graph-based relation learning

High-precision analysis

- RAPID machine learning

Prescription

Planning & optimization

- Only1 Autonomous and adaptive control
- Only1 Predictive robust optimization framework

*1 : Ranked 1st four consecutive times in task assessment sponsored by NIST, *2 : Ranked 1st five times in task assessment sponsored by NIST, *3 : Ranked 1st in task assessment sponsored by NIST (2018)
*4 : Ranked 1st in task assessment sponsored by NIST (2012) , *5 : Ranked 1st in task assessment sponsored by IEEE AASP Challenge DCASE2016

NEC drives the evolution of AI technologies by solving social issues on two fronts.

NEC the WISE

Black Box
Discovered rules are unexplainable

White Box
Discovered rules are explainable

Unparalleled optimization
Problems with a fixed solution

- Safer cities
- Quality control
- ...

Advanced suggestions to humans
Problems with more than one solution

- Management decision
- New product development
- Interpersonal care
- ...

Case study

Plant × Digital
JRC Corporation

Black Box
AI
Invariant Analysis

NEC the WISE

Create normal behavior models by extracting invariant relationships among sensor data

Detect anomaly behavior in real-time

More stable, safe and efficient plant operation

Case study

Brewery × Digital
Asahi Breweries

Shipment

Weather

Product

Calendar

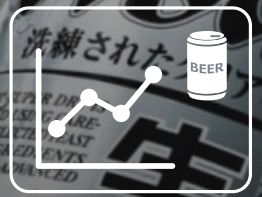
White Box AI

Heterogeneous mixture learning

NEC the WISE

Human wisdom

+



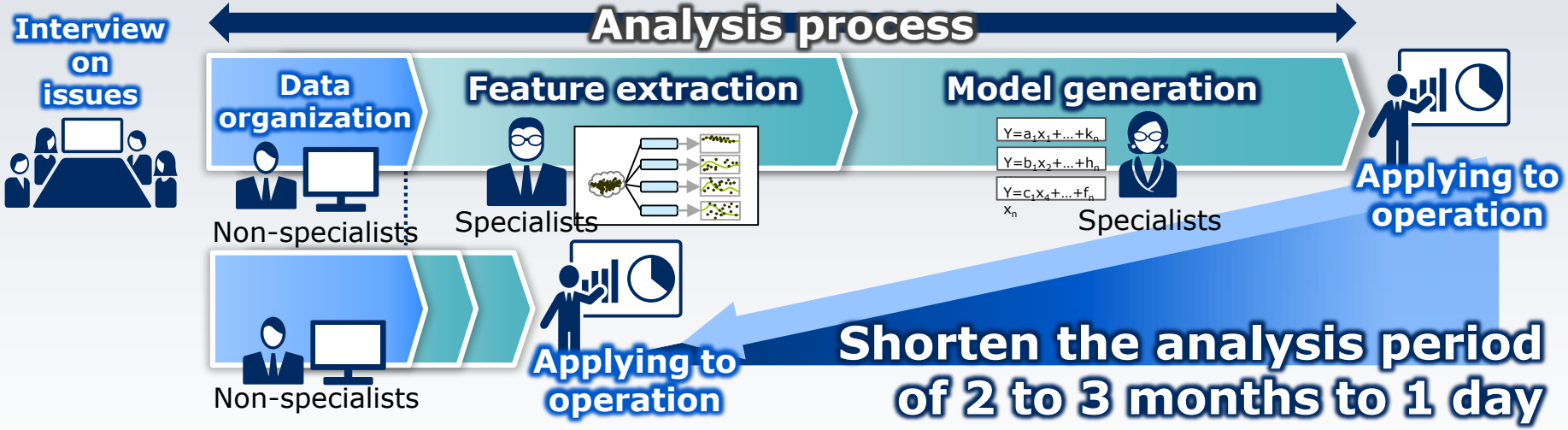
Demand forecasting

Optimization of production plan and inventory plan

Increase forecast accuracy by incorporating human wisdom into AI analysis

Data Analytics Process Automation

Case : Sumitomo Mitsui Banking Corporation



- Can quickly start AI application
- Can easily adapt environmental change

NEC Contributions for Social Value Creation

NEC Safer Cities

Santander, Spain
Efficient city operation

Singapore
Contribution to the innovative safer city concept (SSIPO)

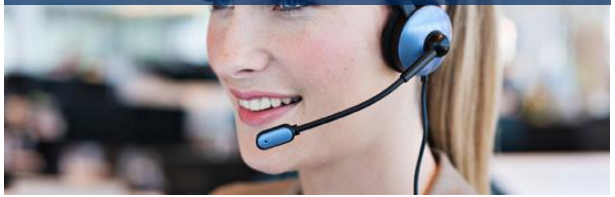
Tigre, Argentina
Real time city surveillance

NEC Value Chain Innovation

Kagome
10% increase in crop yields

Grocery Store
40% reduction in waste of grocery products

Call Center
30% reduction in operation time



Society 5.0

- Human centered
- Diversity and Inclusion
- Abundant and Wellbeing

Toward Future Society

For maximizing use of Data and AI

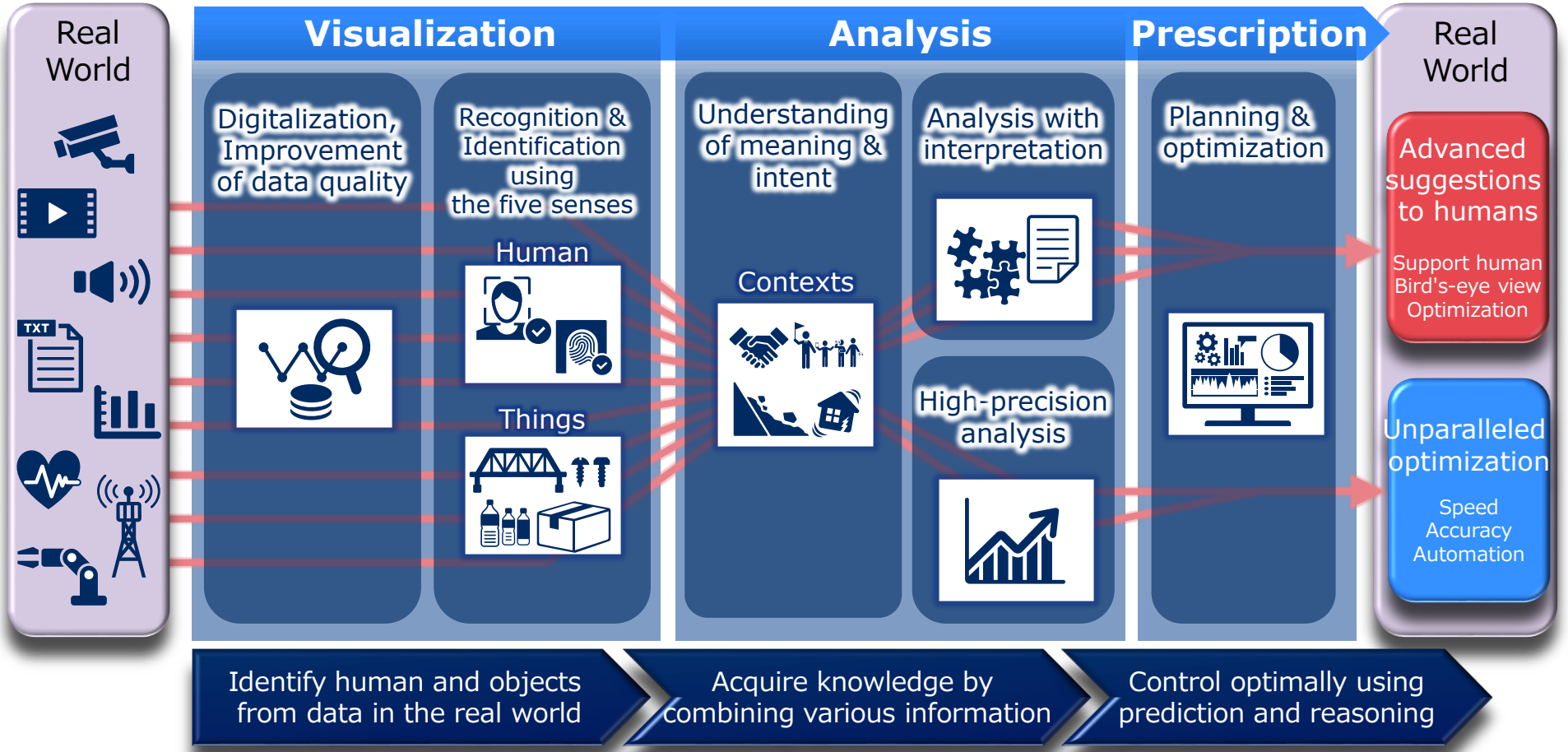
Safety

Security

Efficiency

Equality

Value Creation by Combining Various data and AI Technologies



Value Creation by Combining Various data and AI Technologies

Issues related to Data

- ◆ Data Utilization
- ◆ Data shortage
- ◆ Privacy and Data Security
- ◆ Data Quality

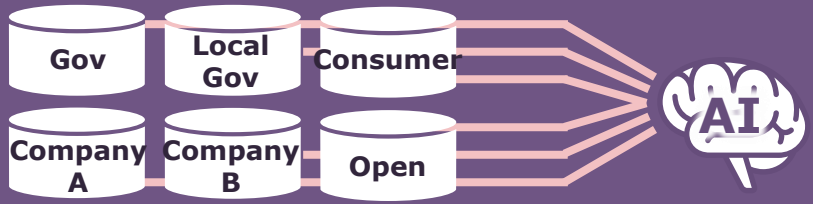
Issues related to AI and Human

- ◆ How human and AI should be in AI-era
- ◆ Collaboration and Co-evolution between Human and AIs

Safe and Secure Data Utilization

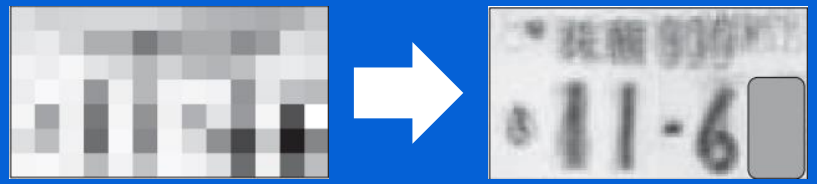
Data dictates the competitiveness of AI

Securing variety of data sources



- Inter-domain data acquisition and distribution
- Open data helps to secure certain amount of data

Improving data quality



- Reducing noise or bias from the data source
- Utilizing data which usually cannot be used
- Obtaining real time data

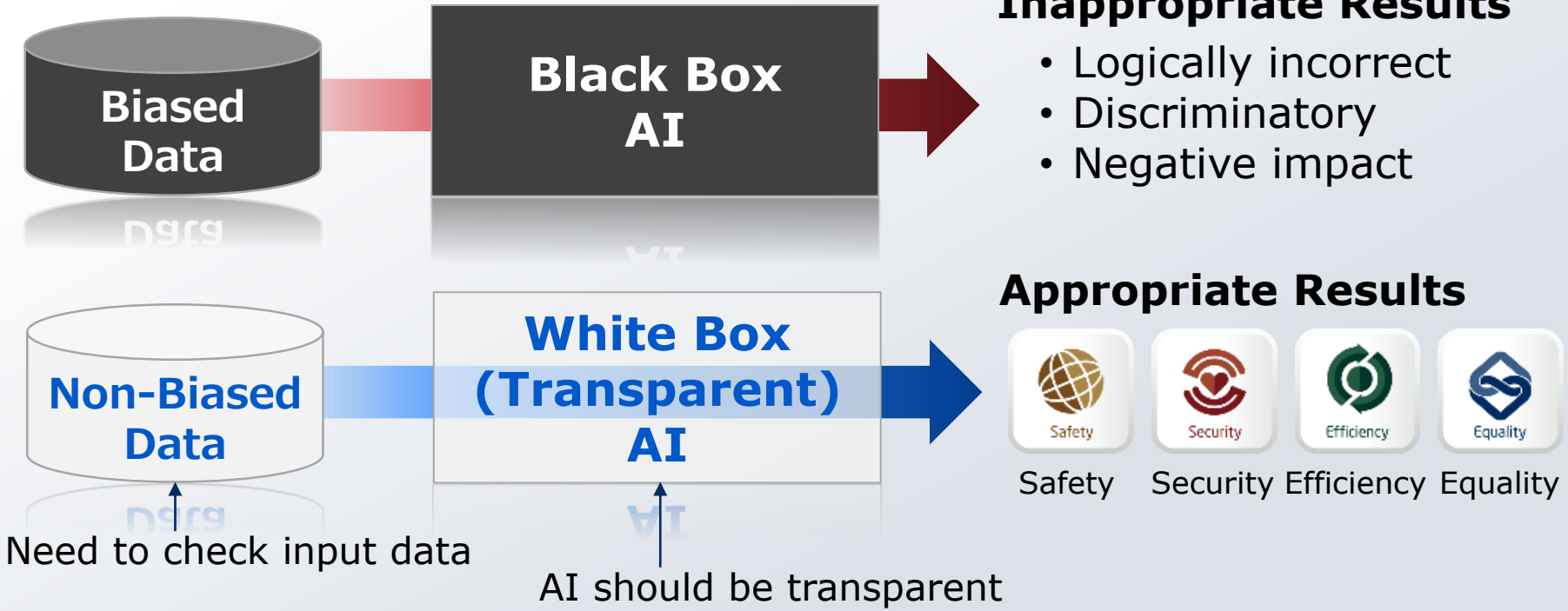
Secure Trust Data Utilization Platform

Encryption Tech	Anonymity tech	Blockchain	● ● ●
Data Protection	Privacy Protection	Automated Transaction/Contract	

Legislation | Rule Making | Standar-dization | Eco System | Authenti-cation | Contract | ● ● ●

To tackle “Data Bias” issues

For improving social acceptance of AI technologies



Industry-academia collaborations aimed at improving human consciousness

Vision-driven Collaboration

東京大学
THE UNIVERSITY OF TOKYO

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Value Creation by Combining Various data and AI Technologies

Real World

Visualization

Digitalization, Integration of data quality

Recognition & Identification using five senses

Human

Things

Issues related to Data

- Data Utilization
- Data shortage
- Privacy and Data Security
- Data Quality

Identify human and objects from data in the real world

Analysis

Understanding of meaning & intent

Contexts

Analysis with insight

High-precision analysis

Prescription

Planning & Decision

Issues related to AI and Human

- How human and AI should be in AI-era
- Collaboration and Co-evolusion between Human and AIs

Acquire knowledge by combining various information

Control optimally using prediction and reasoning

Real World

Advanced suggestions

Support Human

Bird's-eye view

Optimization

Unparalleled optimization

Speed

Accuracy

Automation

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Understand Properties of Human and AI

Designing an advanced system for our future society

Accelerated evolution of technology

Drastically changing society

How human should be

Routine Work

We can focus more on new challenges

Routine work can be minimized by technology

Toward Human centered society

NEC Future Creation Forum

An important indicator of AI is how much spare time can be created for human.

Kevin Kelly

Enhance the value of “Muda”

Sptuniko!

“systematization” vs “Creativity”

NEC Future Creation Forum

Creativity becomes noise for system
Keiichiro Matsumura

Unparalleled optimization

Advanced suggestions to humans

Systematization / Efficiency ⟷ **Humanity / Creativity**

Future design by appropriate allocation of roles Between human and AI

Real World AI

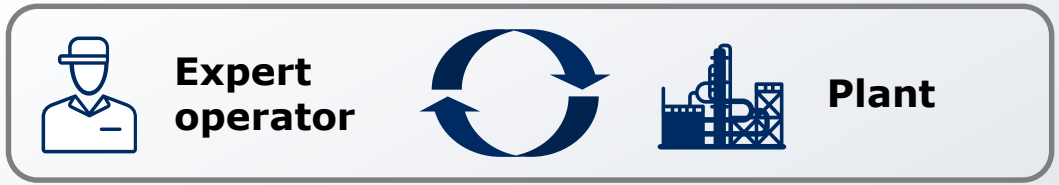
Case Studies

Case study

Issues on current plant operation

Operation

Experts design a recovery plan by monitoring the plant



Causes redundancy and oversights in operation

AI

AI may learn recovery plans by trials & errors on simulator

Requires learning for years

Case study

Logical Thinking AI assisting plant operations

NEC-AIST AI Cooperative Research Laboratory

From the research at NEC-AIST AI Cooperative Research Laboratory

Logical approach

Make a guess

Logical Thinking AI

Brief procedure

Valve A: Open
Valve B: Closed
Valve C …

Data approach

Search in detail

Procedure learning AI

Optimal procedure

Valve A: 80% Open
Valve B: 10% Closed
Valve C …

Use **logical reasoning**
to apply manuals, design, and other knowledge
in order to narrow down operating procedure candidates

Link knowledge and detailed procedure while learning

Procedure learning AI

Limited number of trial and error

Plant simulator

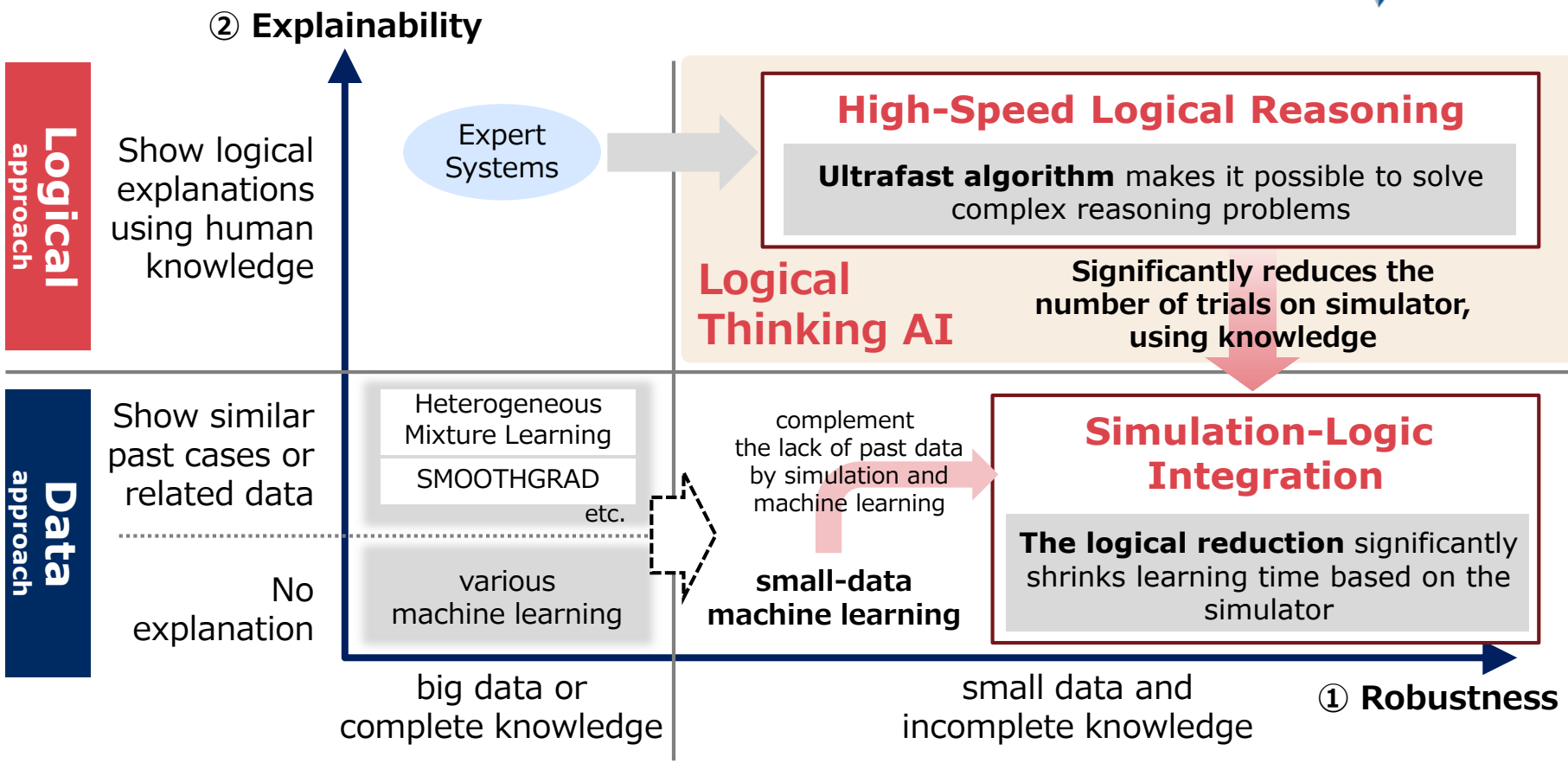
Shortened Years of learning to only a Few Days

Improved "efficiency"

Improved "feeling of satisfaction"

Direction of AI Technology Evolution

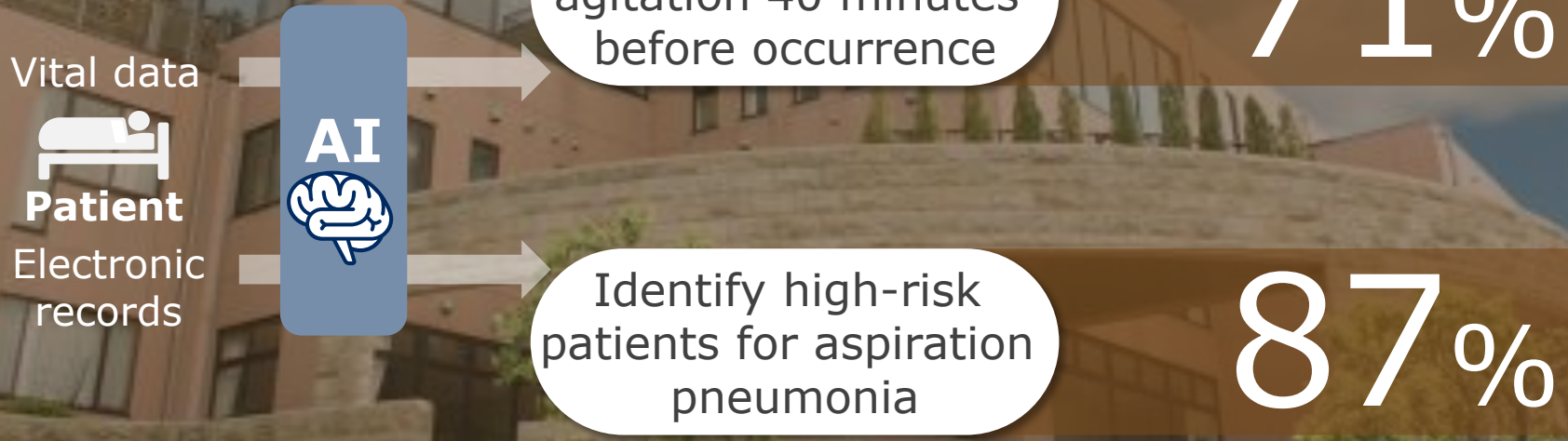
NEC-AIST
AI Cooperative
Research Laboratory



Kitahara Neurosurgical Institute

Technology demonstration

Source: Kitahara Neurosurgical Institute (KNI)

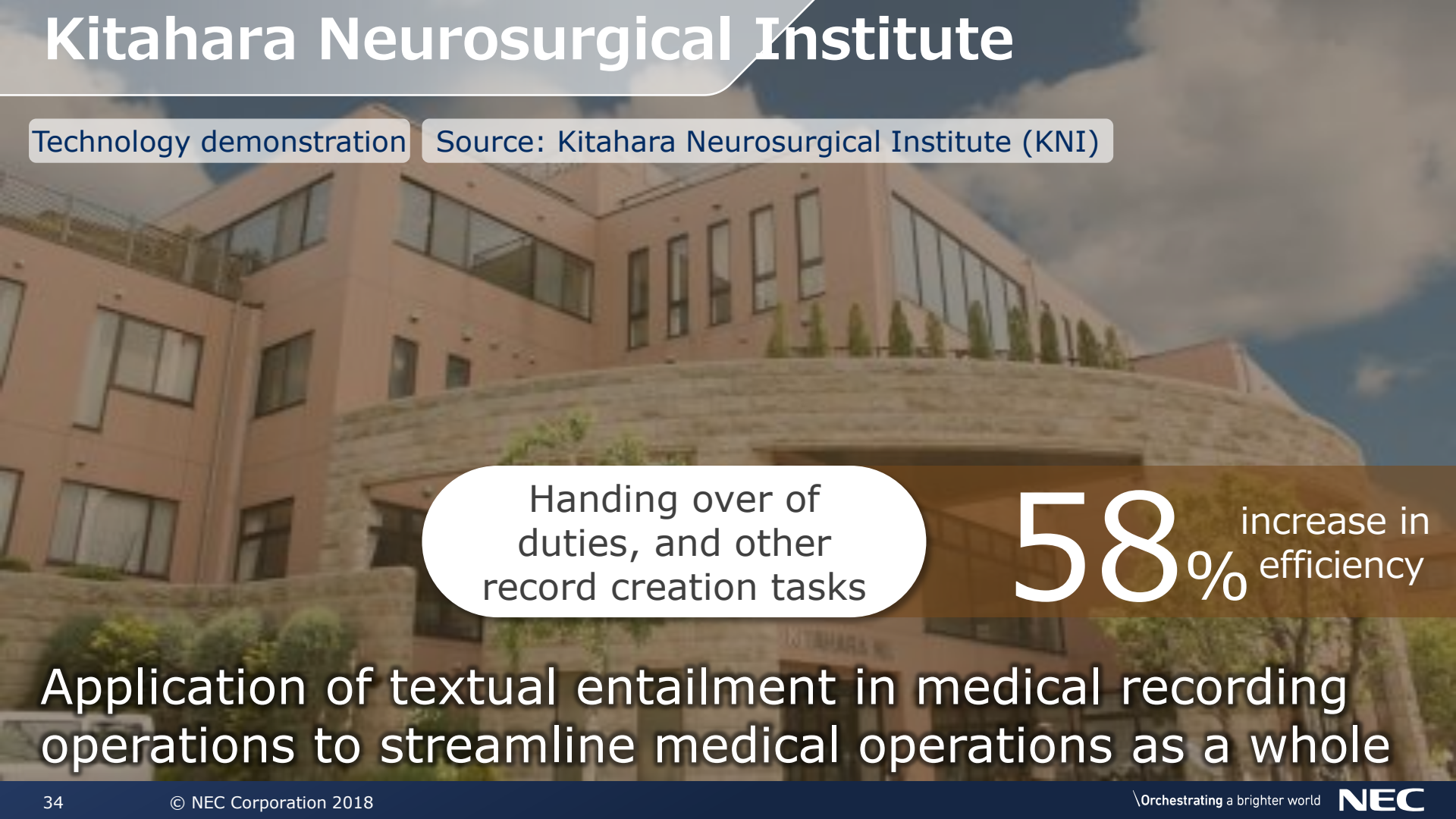


Support the medical setting through AI
Offer high-quality medical services to more people

Kitahara Neurosurgical Institute

Technology demonstration

Source: Kitahara Neurosurgical Institute (KNI)



Handing over of duties, and other record creation tasks

58% increase in efficiency

Application of textual entailment in medical recording operations to streamline medical operations as a whole

Further Evolution for Social Value Creation

Real time reproduction of 3D space
The 5 senses

Virtual Education

Omnipresent Healthcare

Cyber World

Mixed Reality

Real World

Global Connection and Collaboration

Free from time constraint
Free from ability constraint

Augmented Experiences

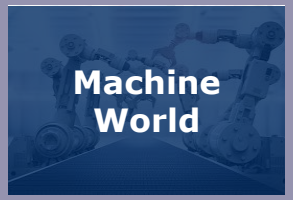
Assisted Homes

Cyber World

Digital Twin

Real World

Human-Centered Society

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