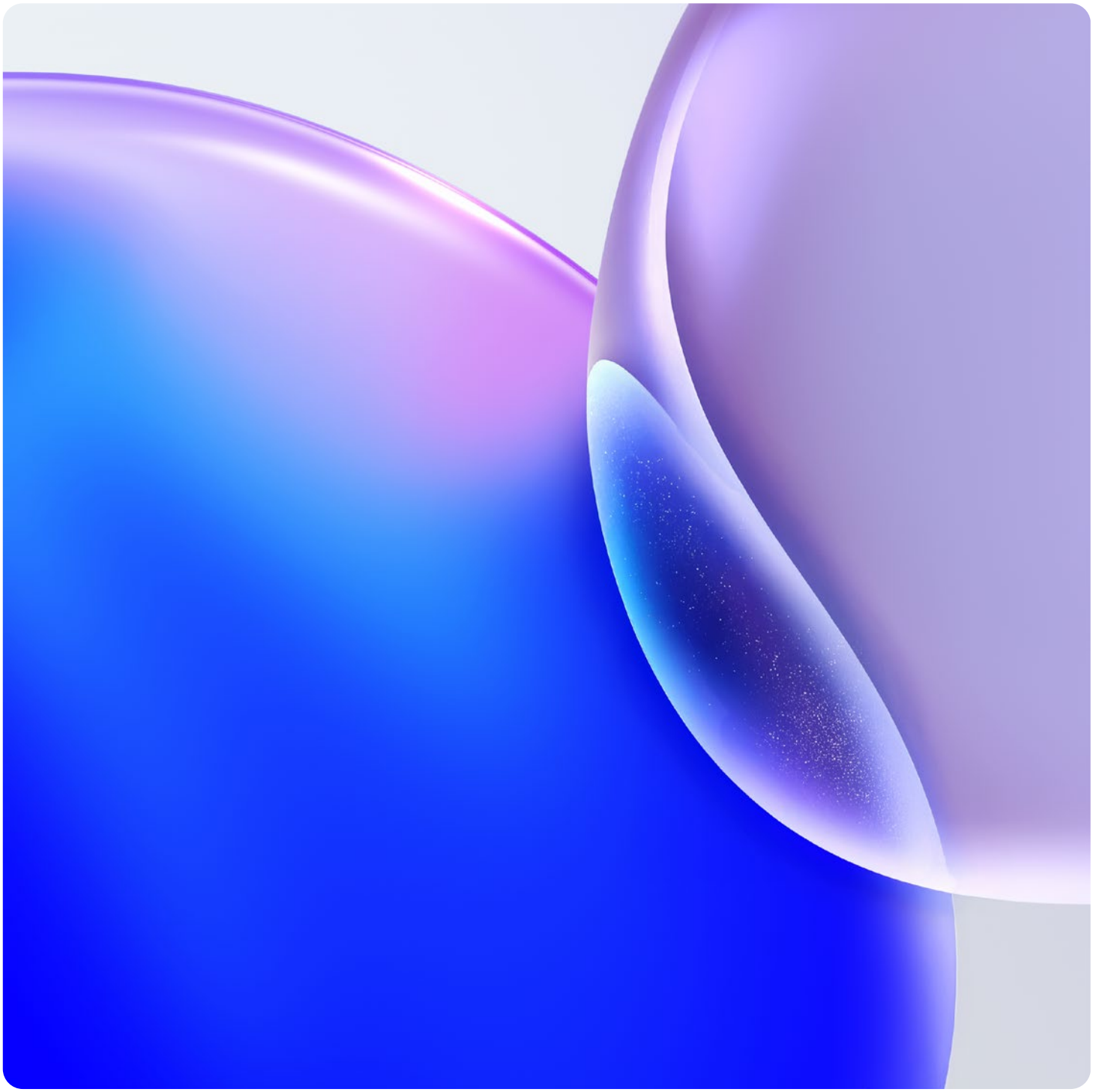
NEC \Orchestrating a brighter world

NEC's Cutting-edge AI Technologies Guide Book

- Accelerate Transformation with Responsible AI



Introduction

In today’s increasingly complex world, it has become extremely difficult to predict the uncertain future, and traditional business methods based on experience and intuition no longer suffice. Under such circumstances, AI has begun to garner significant attention. By leveraging AI, businesses can analyze vast datasets to predict optimal strategies and create new values. This is an essential theme when considering the future of business.

NEC focuses on the following initiatives in the AI field.

First of all, we’ve established AI ethics guidelines to ensure the safe, secure, and appropriate use of AI and earn trust across society. With years of AI research experience, we’ve accumulated extensive knowledge that enables us to optimize benefits for society as a whole through AI and data utilization. We also have a strong track record of applying AI across industries and sectors, allowing us to understand industry-specific challenges. Our ability to provide effective solutions for such challenges is one of our unique strengths. Furthermore, our team of leading researchers and data scientists continuously advances AI research and applications.

Through these initiatives, NEC is committed to contributing to society as a leading company in the AI field.

This guidebook details how AI can solve challenges faced by businesses and society, as well as the value NEC provides. It’s designed for executives seeking change, digital transformation leaders, and anyone interested in data utilization and application. We hope it helps you find effective solutions for your challenges.

INDEX

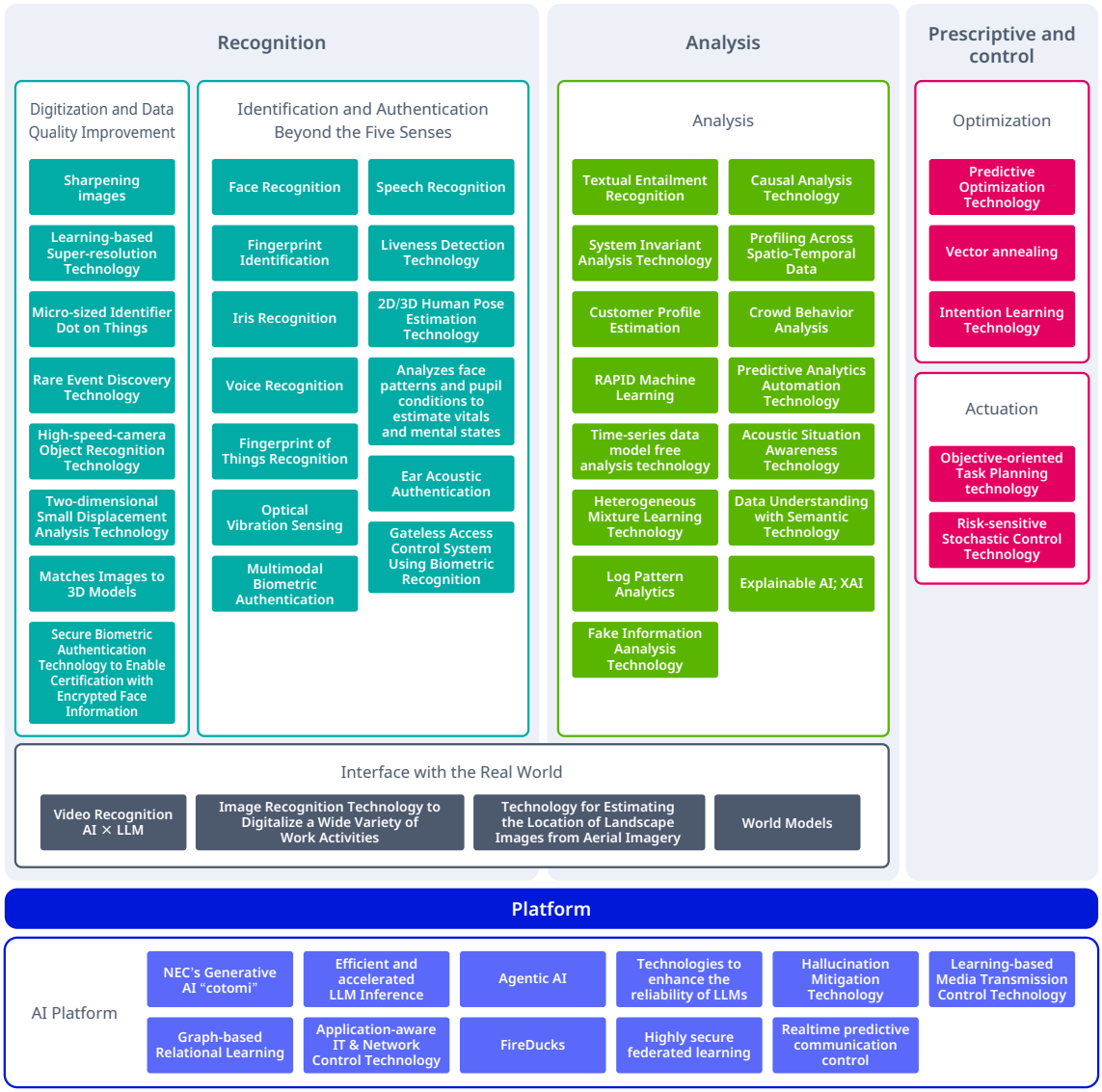
Proposing an AI Combination from NEC's Rich AI Technology Lineup to Suit the Purpose

Strength 1: Rich Lineup

NEC has long been focusing our efforts on AI (artificial intelligence)-related study. To meet various social and business needs, we have been developing and providing a wide variety of AI technologies. NEC deals with every situation flexibly and speedily by combining these various AI technologies.

For more information, https://www.nec.com/en/global/solutions/ai/analyze/index.html

NEC's Cutting-edge AI Technologies

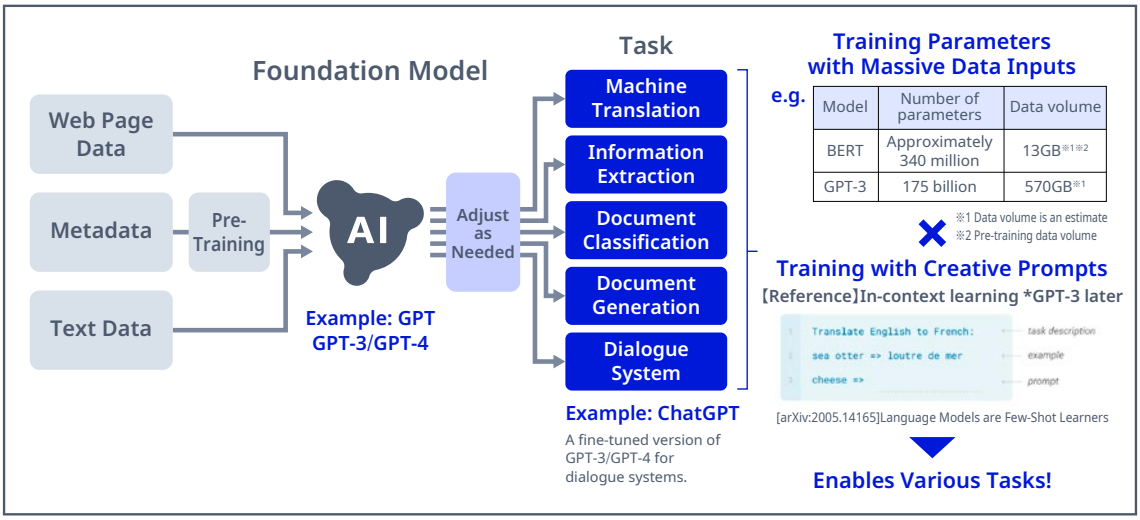


Strength 1: Rich Lineup

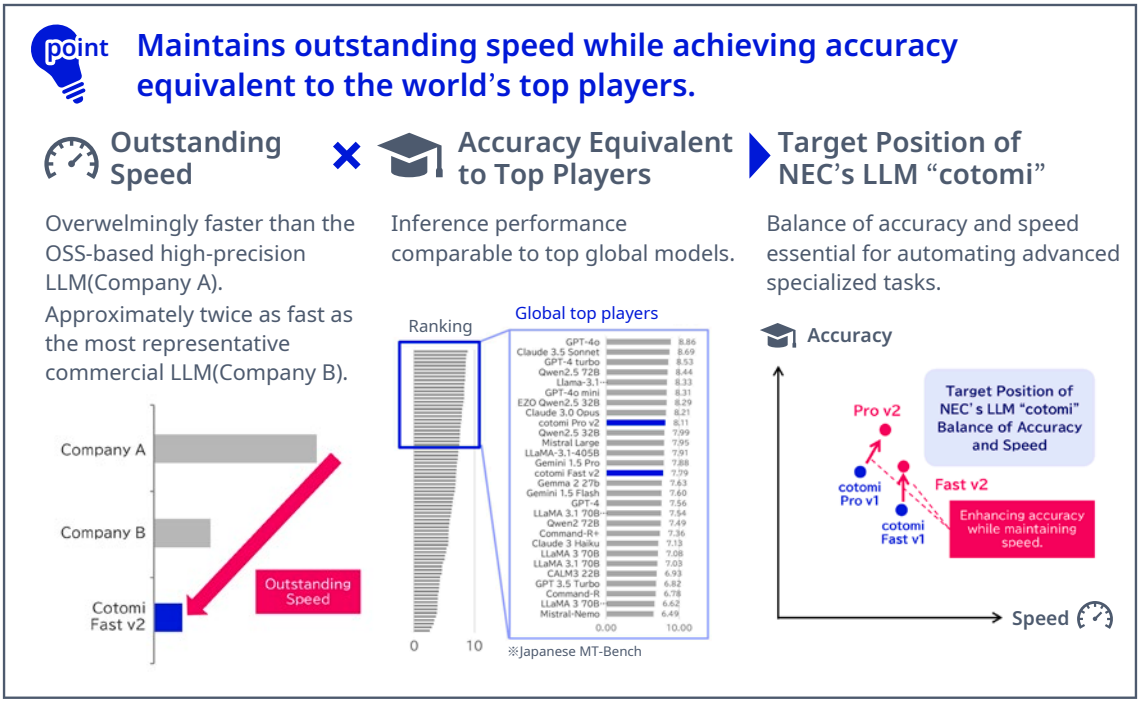
From our rich lineup of analysis technologies, here we introduce AI technologies that have been adopted by a large number of companies and organizations.

Large Language Models(LLM)

Large Language Models (LLM) are trained on extensive datasets and have a vast number of parameters. By inputting prompts, they can perform various tasks.



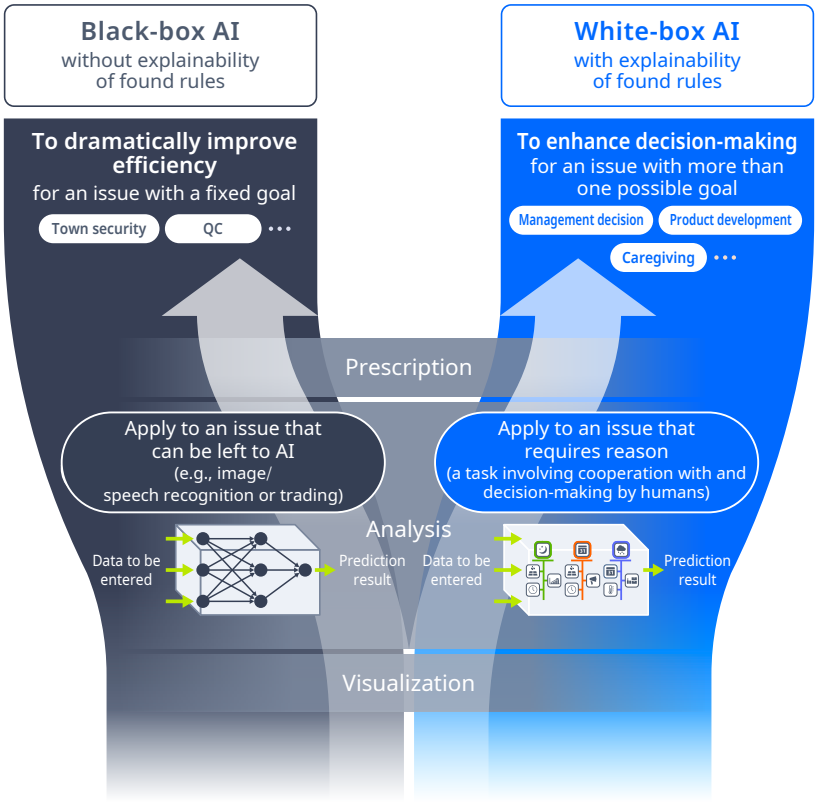
NEC's LLM "cotomi" boasts outstanding speed and high accuracy while ensuring security and industry-specific adaptability, helping clients achieve operational transformation.



Strength 2: Reliable AI

An AI product is suited for a particular purpose while another is not. What is white-box AI, which has exceptional interpretability, in the spotlight?

Depending on your purpose of AI introduction, NEC offers either or both of the following two types: black-box AI and white-box AI. Black-box AI is strong in areas where improving efficiency needs to be prioritized with clear AI tasks. For example, deep learning, which automatically finds out characteristics from enormous amount of data, contributes to image-based product inspection or other operations.
On the other hand, white-box AI (or explainable AI) can show reason for the result of an analysis performed by the AI. White-box AI is chosen for an issue--of management decision, for example--from which more than one answer can be brought. That is because reason for the prediction or judgment needs to be shown.



NEC works toward providing reliable AI, for which we take account of quality and respect for human rights such as privacy.

NEC Group AI and Human Rights Principles

These principles aim to prevent and resolve human rights issues which may be caused by adopting AI into society or utilizing data such as biometric information. Each of NEC's employees keep the principles in mind and act according to them, to always give the highest priority to respect for human rights in all the corporate activities.

For more information, https://www.nec.com/en/press/201904/global_20190402_01.html

Guidelines to Quality Assurance for Machine Learning-based Artificial Intelligence

NEC developed these guidelines to guarantee the quality of AI systems that cannot be sufficiently supported with traditional software QA. Unlike traditional system development, developing an AI-based system through trial and error involves difficulty in determining its specifications (prospective results) at the initial stage.

For more information, https://www.nec.com/en/global/sustainability/social/quality_management.html

NEC Nurtures Human Resources to Excel in AI, Capable of Implementing AI into Society

Strength 3: Development of Human Resources for AI

For AI implementation, professionals who can apply AI to business are indispensable.

As we now aim to realize a Super-Smart Society (i.e. “Society 5.0” *1), AI experts are expected to solve various social issues by leveraging AI, actively creating new values for society. NEC has opened the NEC BluStellar Academy for AI aiming to educate people on resolving social problems with AI, by using our abundant experience with AI education since 2013. This academy trains students to become professionals specialized in AI by giving them opportunities to learn and practically utilize AI.

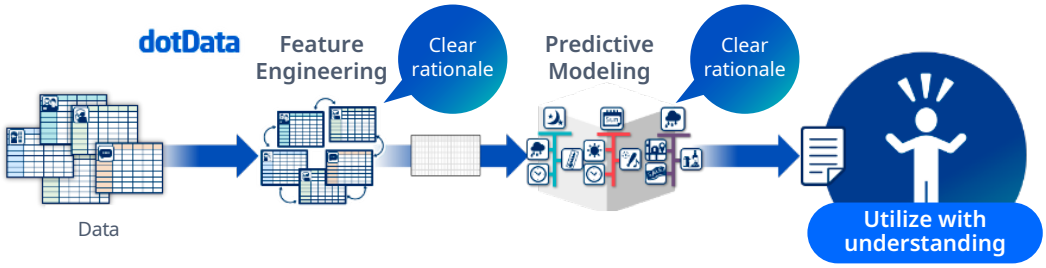
*1: A term coined by the Japanese government which represents the concepts of advanced future society

We Povide a Variety of Products and Services Leveraging NEC's Cutting-edge AI Technologies.

Products and services

dotData – automating predictive analytics

The automation of "Feature Engineering" and "Predictive Modeling" will solve the urgent problem of lack of data scientists worldwide. The predictions that dotData derives can reveal business insights that even human data scientists have never imagined. This enables data scientists to focus on examining business actions based on analysis results.

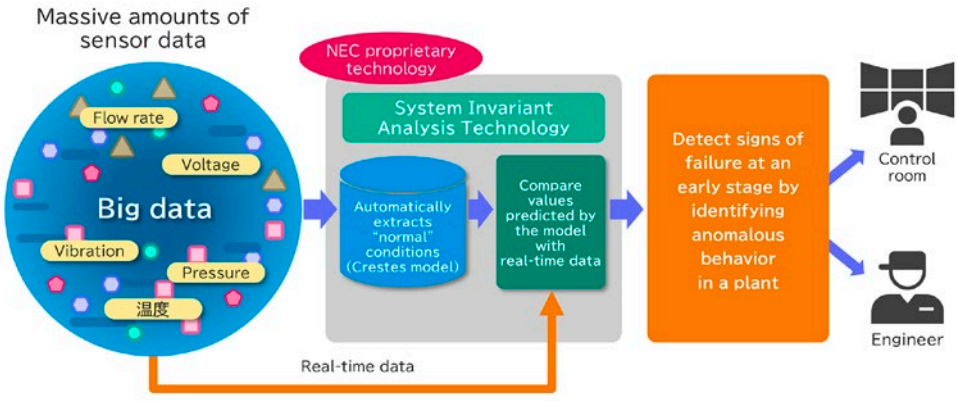


Features

- Automation: Automated feature engineering and predictive modeling enable advanced data analytics without depending on individual skills.
- Time: Analysis results equal to or better than those previously achieved in two to three months are available in less than a day.
- Reasons: The predictions, based on clear reasoning, can be used confidently for business management decisions.

NEC Advanced Analytics – Invariant Analyzer

The System Invariant Analysis Technology Package learns system behavior and detects failure signs. It visualizes a system's operational status on a dedicated screen to support safe and efficient system operation.



Features

- Automatic modeling of correlations based on past sensor data enables early detection of anomaly signs.
- Packaged as a software product to enable smooth introduction of AI to an existing system.
- Support service (starter package) is provided to aid in the introduction and initial operations of the software.

AI Maximizing Human Power in Every Business

Fields of Application of NEC's Cutting-edge AI Technologies

NEC's cutting-edge AI technologies help resolve issues in all industries, contributing to new value creation.

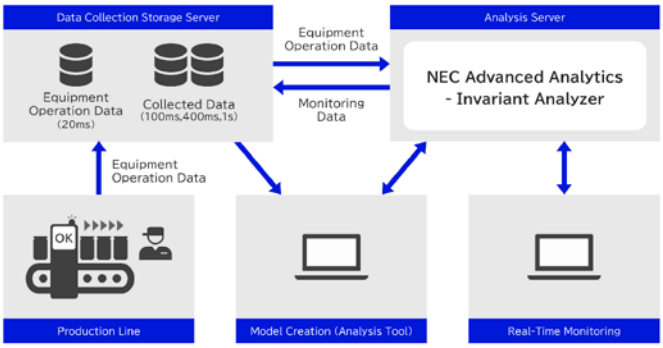
Anomaly Detection

Application Early detection of production line anomalies

Purpose | Detect production line anomalies early and resolve the resulting issues.

Used AI | Invariant Analysis Technology

Benefits | Supporting the stable operation of equipment by capturing subtle changes in individual data that require expert knowledge and detecting anomalies. Additionally, assist in passing down the expertise and experience of skilled workers.



Invariant Analysis Technology || https://www.nec.com/en/global/solutions/ai/analyze/invariant.html

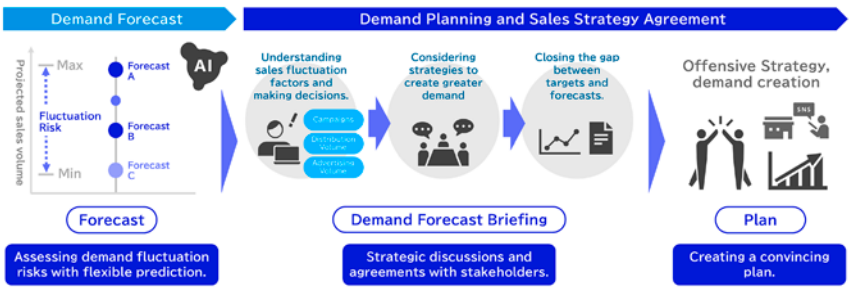
Demand Prediction

Application Demand prediction of new products

Purpose | Visualize demand fluctuation risks. Clarify the factors behind sales variations (white box), and consider actions to close the gap between targets and predictions.

Used AI | Similar Product Prediction, Difference Prediction

Benefits | - Using AI for similarity judgments and difference and causal analysis eliminates subjective biases and enhances transparency of the underlying data, fostering faster and more effective communication among stakeholders based on data-driven insights.
- A data foundation is built for demand prediction, enhancing prediction accuracy by visualizing tacit knowledge as data.
- Even with personnel changes, performance levels are maintained.

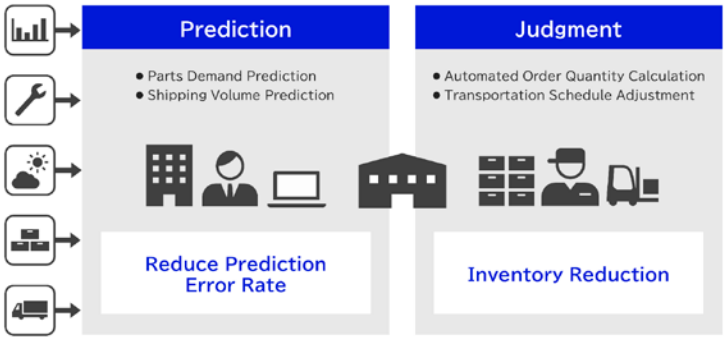


Inventory Optimization

Application

Optimization of maintenance parts inventory

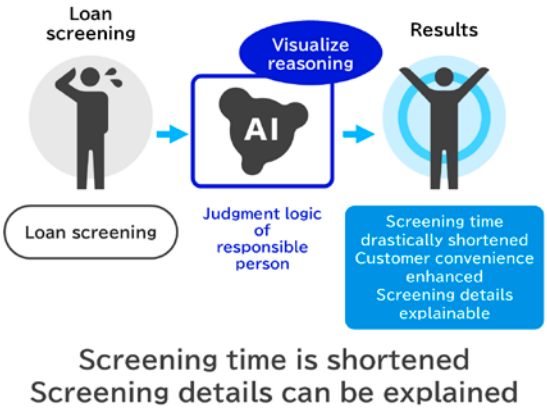
Purpose	Optimizing the purchase cost of maintenance parts, inventory storage costs, and disposal costs at the end of maintenance.
Used AI	Heterogeneous Ensemble Learning
Benefits	- Improve demand prediction accuracy, reduce stockout risks, and achieve inventory reduction. - Automatically calculate adjustment numbers and minimize planning effort.



Loan Screening

Application **Loan examination work**

Purpose	Improving efficiency of loan screening process and shortening screening time
Used AI	Heterogeneous Mixture Learning
Benefits	AI learns the judgment logic of responsible bank personnel for screening, which helps drastically shorten screening time, thus enhancing convenience for customers. AI can explain reasons for the examination result and ensure the same screening quality as that by humans, reducing the workload of responsible persons and allowing expertise and knowledge of financing examination operations to be taken over

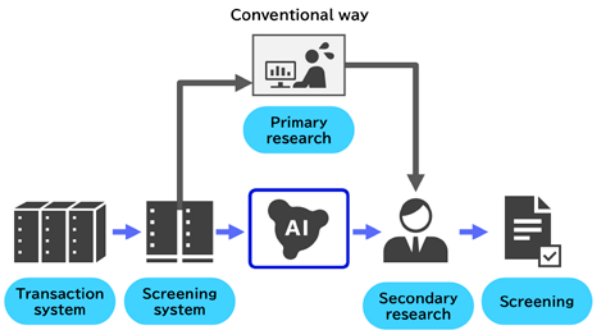


Heterogeneous Mixture Learning || https://www.nec.com/en/global/solutions/ai/analyze/pattern.html

Fraudulent Account Detection

Application **Detection of fraudulent transaction accounts**

Purpose	Sophisticating and streamlining monitoring work on suspicious transactions such as money laundering and bank transfer fraud.
Used AI	Heterogeneous Mixture Learning
Benefits	Instead of humans, AI detects and picks up bank accounts that need scrutiny, then scores the transaction risk level. The efficiency of examination operations is improved by utilizing AI for the primary research. Furthermore, AI recognizes any changes to an account that are not noticeable by humans, preventively identifying the account as a potentially high-risk one.



Heterogeneous Mixture Learning || https://www.nec.com/en/global/solutions/ai/analyze/pattern.html

Advancement of Insurance Operations

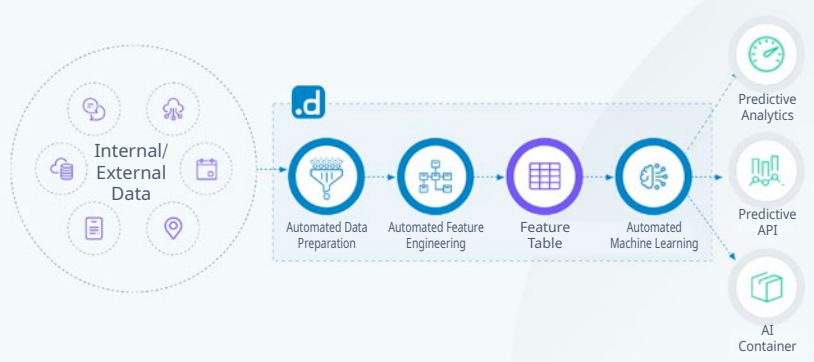
Application

Efficiency improvement and advancement of insurance operations using AI

Purpose | Offering personalized insurance products to each customer at the optimal time to improve the conversion rate.

Used AI | dotData

Benefits | A next-generation agency system utilizing AI supports over 30,000 agencies. The AI analyzes customer contract details, accident information, and personal data such as changes in family structure. By understanding the changes in customer needs and risks, it becomes possible to suggest adjustments or new related products at the optimal time.



Sales Assistance System

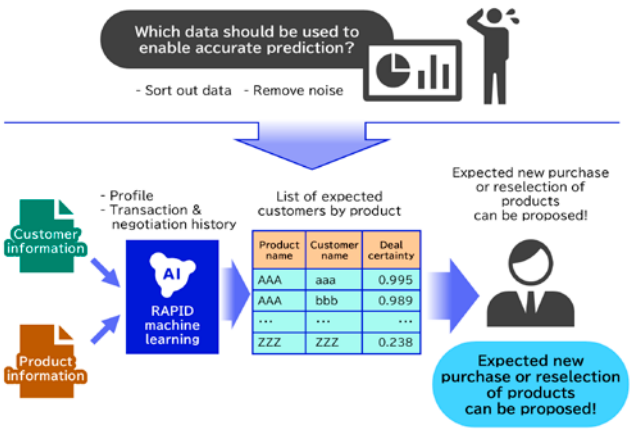
Application

Marketing for finding new customers

Purpose | Effectively proposing products and finding new customers, based on the change of customers' life styles

Used AI | RAPID machine learning

Benefits | This system is capable of finding potential customers who have been overlooked by manual checks, creating a list of larger number of customers than before. Customers who are considered to have high-potential needs can be found, and their needs can be detected in more advanced way.

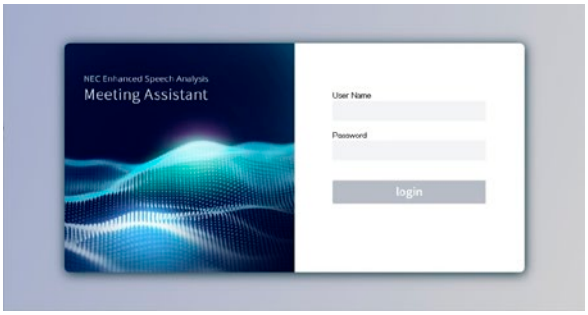


Traceability Management

Application

Automation and streamlining of document creation using speech recognition

Purpose	Automating the creation of various work records that require manual input to improve operational efficiency.
Used AI	speech recognition
Benefits	Achieving digitization across various operations, such as recording important disclosures during contract signings in sales and customer service, automatically generating call center response notes, and transcribing web conference audio into text in real-time.

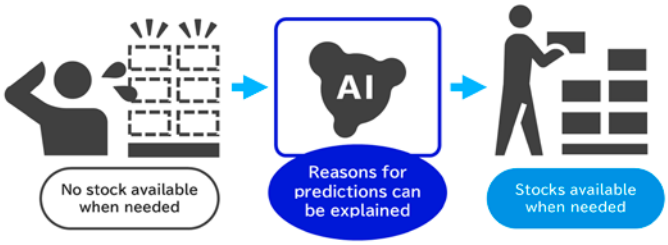


Demand Prediction

Application

Order placement operation at a retail store

Purpose	Optimizing order placement work which had depended on a veteran staff's instinct or experience
Used AI	Heterogeneous Mixture Learning
Benefits	Supply and demand forecasting by AI, by predicting the most appropriate number of sales, enables an optimum order placement, contributing to a reduction of food loss. This also leads to a departure from dependency on individual skills for order placement work, achieving improvement and standardization of operations.



Heterogeneous Mixture Learning || https://www.nec.com/en/global/solutions/ai/analyze/pattern.html

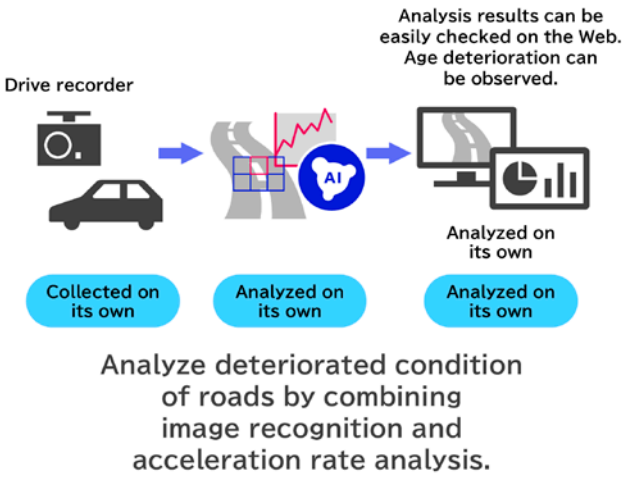
Use Cases

Social Infrastructure

Road Surface Inspection

Application **Routine inspection and maintenance management**

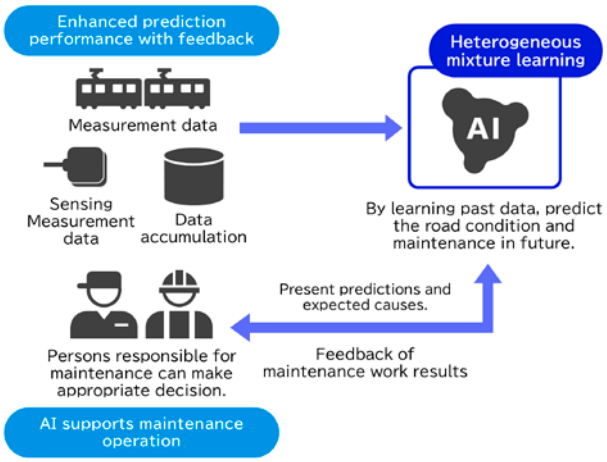
Purpose	Preventively maintaining road surfaces and runaways as well as reducing the workload of employees and officials.
Used AI	RAPID machine learning
Benefits	AI detects cracks in road surfaces or runways using image data from drive recorders at an early stage reducing the life cycle cost of maintenance. We enhance preventive maintenance in order to extend the life of roads by improving work efficiency with limited human resources and budgets.



Railroad Facility Maintenance

Application **Planning of maintenance work**

Purpose	Enhancing the quality of inspection and repair, as well as optimizing cost savings.
Used AI	Heterogeneous Mixture Learning
Benefits	Analyzing measured data by Heterogeneous Mixture Learning technology enables the prediction of future facility conditions and the identification of factors which cause facility deterioration. A prediction at the same level as a veteran engineer adequately supports planning and decision making for maintenance work.



Heterogeneous Mixture Learning || https://www.nec.com/en/global/solutions/ai/analyze/pattern.html

Passenger Ticket Sale Prediction

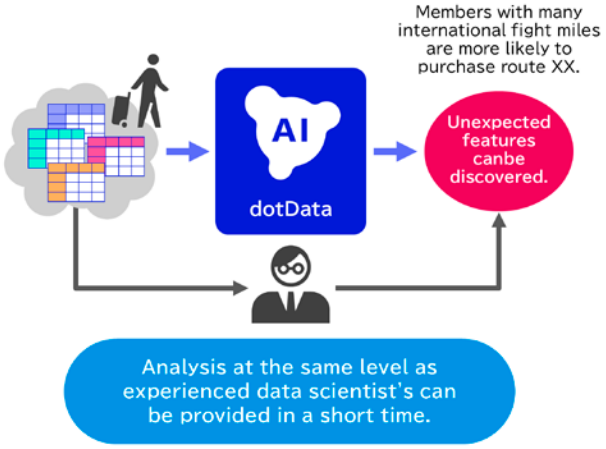
Application

Analysis of members' behaviors on the Web

Purpose | Helping eliminate the shortage of expert resources for data analysis, and improving methods for utilizing huge volumes of data

Used AI | dotData

Benefits | The analysis results of the same level as those drawn by an experienced data scientist can be obtained in a short time. Finding unexpected features can encourage the creation of a new method. Knowing tendencies difficult to grasp through human analysis can makes it possible to perform promotion activities such as a campaign notice at more appropriate timing than ever.



Solution: dotData || https://www.nec.com/en/global/solutions/dotdata/

Passing Down Skilled Expertise

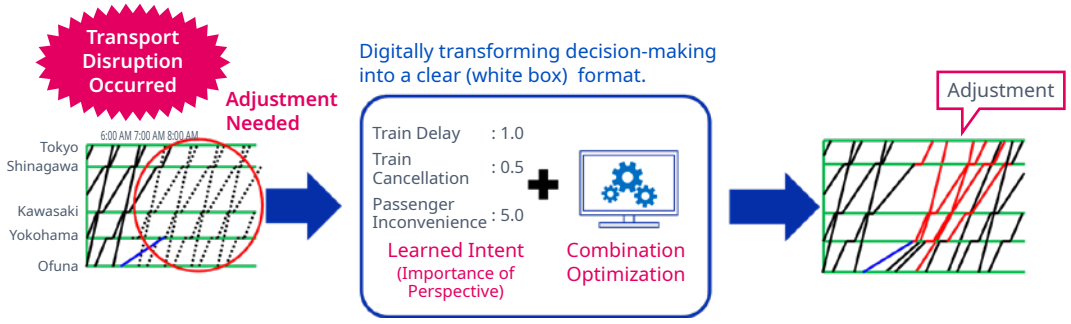
Application

Digital transformation of railway schedule adjustment operations

Purpose | Improve and optimize the efficiency of timetable correction operations for transportation systems, including railways, where quick responses are crucial.

Used AI | Intention Learning Technology

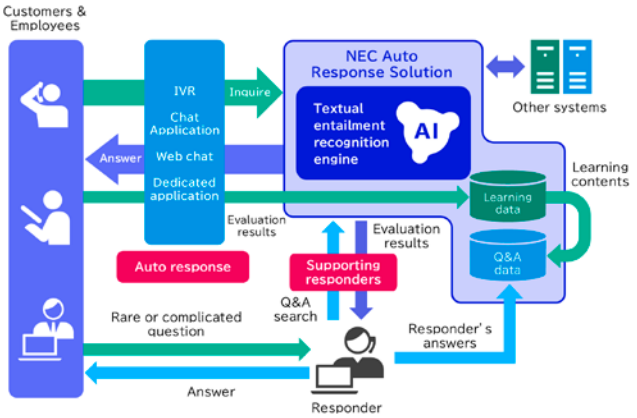
Benefits | The judgments of experienced professionals can be replicated by learning from exemplary decision-making case data and modeling the underlying intentions. Additionally, the tacit knowledge of experts can be inherited as explicit knowledge.



AI Chatbot

Application In-house help desk and call center work

Purpose	Improving efficiency of inquiry handing as well as strengthening the ability to support customers
Used AI	Textual entailment recognition
Benefits	Customers can inquire with AI Chatbots from the smartphones or computers regardless of when and where they do, which brings efficiency and labor-saving to inquiry handling, and increases customer satisfaction.

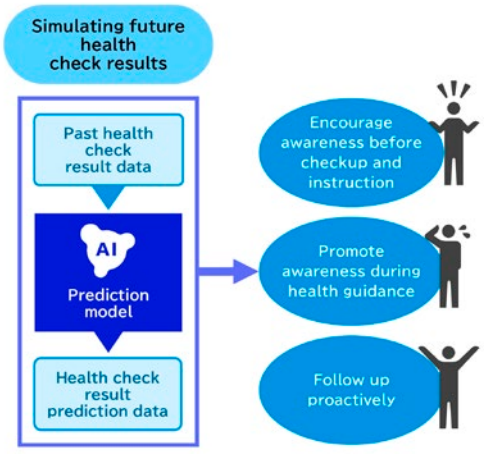


Textual entailment recognition	https://www.nec.com/en/global/solutions/ai/analyze/text.html
Solution: Auto response solution	https://www.nec.com/en/global/techrep/journal/g19/n01/190111.html

Self-care

Application Enhancement of health by analyzing health check data

Purpose	Increasing the accuracy level of prediction on future health check results by analyzing health check data with AI
Used AI	Heterogeneous Mixture Learning
Benefits	By analyzing health check data (e.g. weight, waist size, blood pressure, carbohydrate metabolism, lipid metabolism) and lifestyle data (e.g. exercise, diet, alcohol drinking), the health check values that will deeply affect the diagnosis of lifestyle diseases can be predicted for a few years ahead. Furthermore, future health check values after a subject revises the lifestyle are simulated, which encourages behavior modification of the subject.



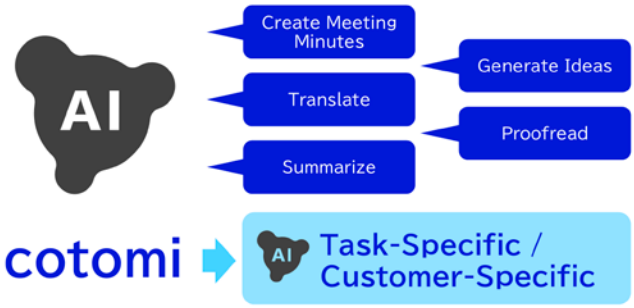
Heterogeneous Mixture Learning	https://www.nec.com/en/global/solutions/ai/analyze/pattern.html

All Industries

Daily Operations Assistant

Application **Smartening business operations with LLMs**

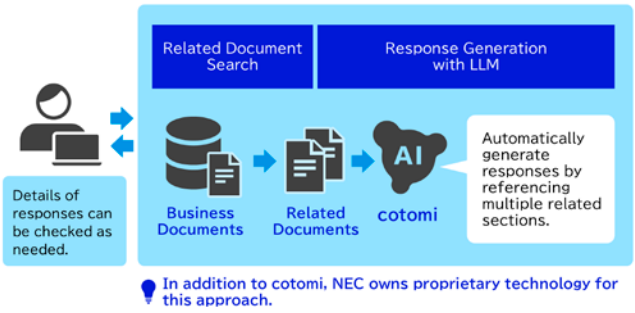
Purpose	Enable efficient creation of meeting minutes, translation, and summarization.
Used AI	NEC's LLM "cotomi"
Benefits	Using an LLM eliminates the need to create separate AI models for each task, allowing one model to handle various tasks. ☒Fine-tunin enables task specialization with fewer data than before.



Information Search

Application **Document search**

Purpose	Efficient searching of documents.
Used AI	NEC's LLM "cotomi"
Benefits	The LLM searches for relevant sections in internal manuals and explanatory documents and automatically generates responses based on the content.



Inquiry Response

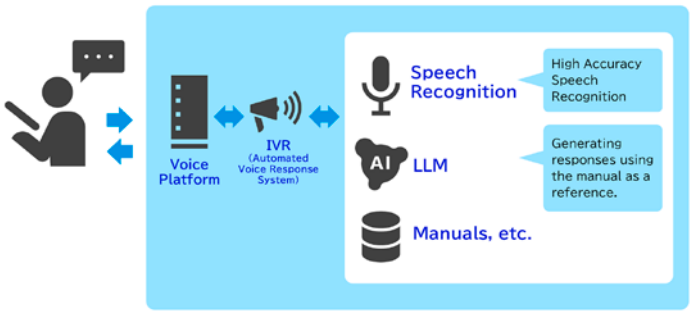
Application

Automated response for call centers

Purpose | Smartening business operations with LLM and speech recognition

Used AI | NEC's LLM "cotomi"

Benefits | Combining LLM and speech recognition technology allows for automatic and flexible responses based on a manual.



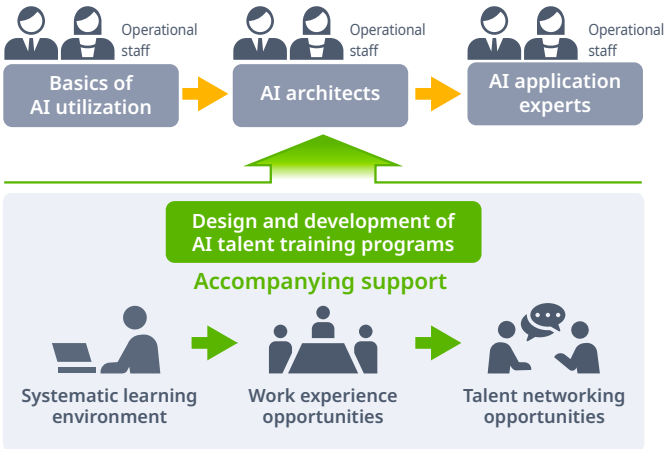
Development of AI Experts

Application

Design and development support for AI talent training programs

Purpose | AI talent development.

Benefits | Enable staff in each department to build and utilize AI on their own.



AI Talent development || https://www.nec.com/en/global/solutions/ai/academy/index.html

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