

NEC Innovation Day 2023: NEC's Generative AI Initiatives

On December 15, 2023, NEC held an event called NEC Innovation Day 2023 to present the latest information about its research and development to investors and media. This was the third ever NEC Innovation Day with the first one held in 2021. At this event, the executive officers NISHIHARA Motoo, Corporate EVP & CTO, and YOSHIZAKI Toshifumi, Corporate EVP & CDO, took the stage to give a presentation about generative AI and other NEC technologies. An organizational structure which seamlessly links R&D and business was highlighted with the title "Research and Development of Advanced Technologies and Creation of New Business to Drive NEC's Next Growth." This article will report on the presentation and five demonstrations incorporating a large language model (LLM) exhibited at the venue.

1. Taking NEC Technologies to New Levels through Fusion with Generative AI

The main topic of the presentation was generative AI. CTO NISHIHARA (**Photo 1**), who was the first to take the stage, emphasized that the foundation model, such as large language models (LLMs) which attract attention as a new generation of AI, was the second biggest shock

in his life since the emergence of the internet. He stated the importance of this foundation model as it will further advance, automate, and expand the digital twin systems that connects all of society, which is NEC's technology vision.

NISHIHARA mentioned the following five points as updates to the NEC technology vision with the emergence of the foundation model.

1.1 Proprietary foundation model

NEC announced the development of its own LLM in July 2023. Although this LLM is small-scale with 13 billion parameters, it achieves high performance and is proficient at processing the Japanese language. While this LLM was created keeping in mind the optimal balance between performance and burden on customer server resources and power consumption, an idea for a scalable architecture from small to large that can be flexibly constructed by combining a variety of LLMs and other AI models was announced in this presentation. NISHIHARA stated NEC was developing a system that can flexibly build purpose-specific AI models by linking it



Photo 1 CTO NISHIHARA on stage.

with a diverse group of specialized AI technologies.

He also mentioned that the parallel development of a large-scale LLM with 100 billion parameters was also progressing.

1.2 Multimodal AI

NISHIHARA also mentioned that NEC's world-class image recognition, audio processing, and sensing technologies can create even more value by being combined with an LLM. He emphasized that the system will be able to understand various real-world events at the same level or higher level as humans and process them with high accuracy and autonomy, and provide innovative value by linking a variety of technologies within the NEC Digital Platform, a common platform that incorporates NEC's AI technologies.

Actual examples of multimodal AI could be seen in the demonstration exhibits described below.

1.3 Safety and security in the LLM era

When using LLM, there are concerns such as hallucination where the generative AI outputs incorrect information presented as plausible, ethical issues, and even leaks of personal information as well as cyber security issues. At this presentation, a policy was announced indicating that models would be provided after conducting accurate risk assessments in collaboration with Robust Intelligence, which is currently attracting worldwide attention for its AI risk management, to ensure that companies can use the LLM with a sense of safety and security.

1.4 Automation of system construction and operation

NISHIHARA also mentioned that system construction and operation management will be automated in addition to the streamlining software development and reducing power consumption.

1.5 Orchestration function

NISHIHARA also stated that the new AI orchestration would become important in preparation for the future where LLMs are installed in the cloud and on terminals and are also linked to each other. He stated that NEC aims to automate diverse real-world operations by implementing functions that automatically break down business processes into tasks, autonomously deploy and link AI models, and control networks and security.

2. Scenario and Organizational Structure Accelerating Generative AI Business

CDO YOSHIZAKI took the stage after CTO NISHIHARA and presented the current situation as well as the future direction of business using generative AI.

2.1 Generative AI "cotomi" developed by NEC and attracting worldwide attention

First, he announced that "cotomi" is the name of the generative AI developed by NEC and released in July 2023. He stated that the name "cotomi" is based on the idea that things will come to fruition (coto ga minoru) by words showing the future and that this name will continue to be used for LLMs and for services linking the LLMs and AI to be developed by NEC in the future (**Photo 2**).

Also, he mentioned that cotomi is attracting a lot of attention from many customers and global players because of its light weight, power savings, and high performance for the Japanese language.

2.2 Developing industry/business-specific models to gradually expand business

YOSHIZAKI also presented a scenario with three phases to introduce cotomi to a variety of industries and businesses for which NEC provides services. Phase I is an individual systems integrator (SI) where a generative AI environment specialized for each industry or business for individual customers is established. NEC has already been working hard with 15 companies and universities to create industry/business-specific LLMs.

He stated that NEC intentionally chose different industries such as manufacturing, finance, and healthcare for

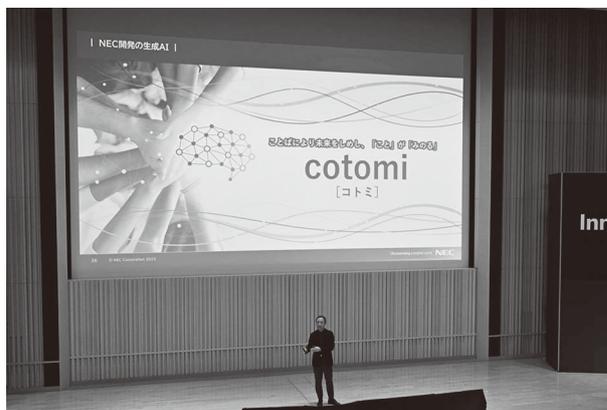


Photo 2 CDO YOSHIZAKI presenting cotomi, the generative AI developed by NEC.

this preliminary introduction. "If we can create a framework for each industry or business model, we can integrate these into industry-specific business packages and solutions. And then, we can expand our customer base to dozens, hundreds, or thousands of companies in each industry in Phase II," he said.

Furthermore, he stated that in Phase III NEC is thinking to collaborate with a variety of software companies as well as IaaS and SaaS vendors and to leverage cotomi's API to proceed with this. YOSHIZAKI also noted the high level of attention that cotomi has been receiving and said, "We have received requests to work with NEC's LLMs to enter the Japanese market and also received inquiries from many global companies."

2.3 Establishing a generative AI center and accelerating commercialization

Next, NISHIHARA and YOSHIZAKI announced new organizations to accelerate the LLM business (Photo 3). The establishment of a new generative AI center attracted particular attention. This center is an organization that aims to improve the efficiency of research and development by bringing together the know-how of approximately 100 outstanding researchers in the field of generative AI from Japan, Germany, and North America.

They also hinted that NEC has established a system to consistently conduct new technology research; develop prototype, alpha and beta versions of products; deliver them; and provide managed services for customers by seamlessly working with the NEC Generative AI Hub, which was launched in FY2023 to promote the commercialization of generative AI.

"In the world of generative AI, algorithms and software change rapidly. I believe that only businesses with a fast cycle of commercialization can survive in this en-



Photo 3 Explaining new organizations and acceleration of commercialization.

vironment that changes so quickly. This is exactly why we would like to accelerate the digital transformation, also known as DX, by having our R&D and business departments work together from a business perspective," YOSHIZAKI said to conclude the presentation (Photo 3).

3. AI x LLM Demonstrations with an Eye on Practical Applications

After the presentation, on-site demonstrations were conducted at a booth so visitors could experience NEC's cutting-edge technologies that are currently being researched and developed. Five demonstrations related to generative AI enabled visitors to personally experience NEC's research and development system, which works as a testament to speedy R&D with an eye toward commercialization (Photo 4 and Fig. 1).

3.1 Data driven solution by dotData

Emerging from the NEC research laboratories in 2018, the company dotData, which provides the dotData AI platform for automated feature engineering, announced on December 6, 2023, the launch of a new platform called dotData Insight that is driven by generative AI.

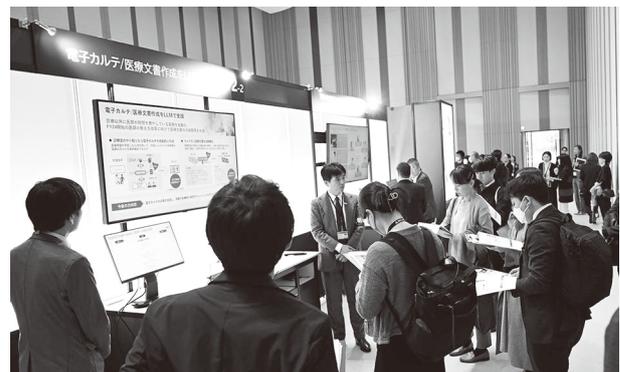


Photo 4 Demonstration.

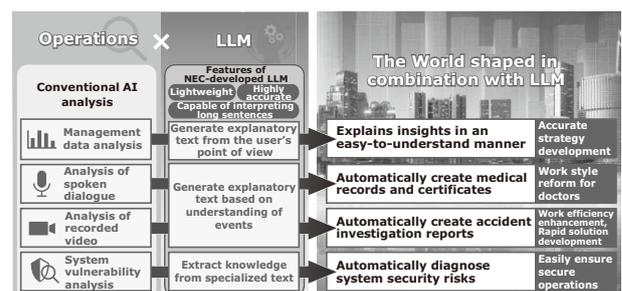


Fig. 1 Introduction of NEC'S LLM technology.

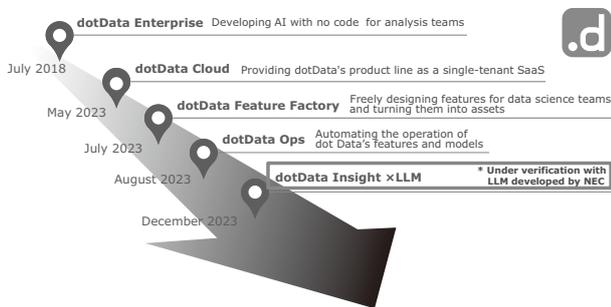


Fig. 2 Evolution of dotData products at the core of the data-driven DX business.

What was exhibited at this time was a solution that enables users to obtain business insights and hypotheses from data without the specialized knowledge and skills of a data scientist (Fig. 2).

The demonstration showed how dotData could be used to formulate a hypothesis by digging into factors from features in bank data that increase the risk of late payments on personal loans. Visitors saw how the hypotheses were refined through queries to the LLM and the input of domain knowledge on the user side.

3.2 Utilizing LLM to facilitate the creation of electronic medical record and documentation

This technology is expected to support the creation of electronic medical records and medical documents—which is a major burden on doctors—by using generative AI. The demonstration showed how electronic medical records are automatically generated through recognition of speech files of actual dialogue (Fig. 3) and how medical documents such as letters of introduction are automatically generated from a huge amount of text data in medical records accumulated from multiple medical treatments (Fig. 4).

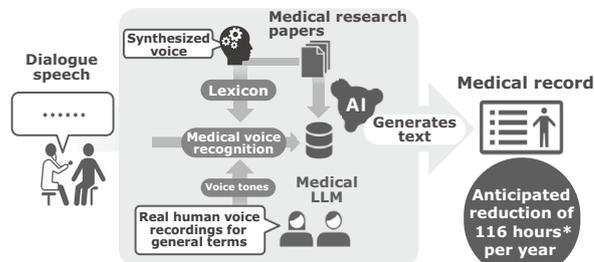
This support for the creation of medical records is expected to save 116 hours/year per doctor, and this type of support has been confirmed to reduce the amount of time required to create such documents by 47%.

This technology is attracting attention as doctors' work style reform begins in earnest due to the laws and regulations going into effect April 2024.

3.3 Further evolution of NEC's LLM

The LLM developed by NEC, which was announced in July 2023 and presented at NEC Innovation Day 2023, has further evolved over the past six months. By using nearly twice as much high-quality training data as be-

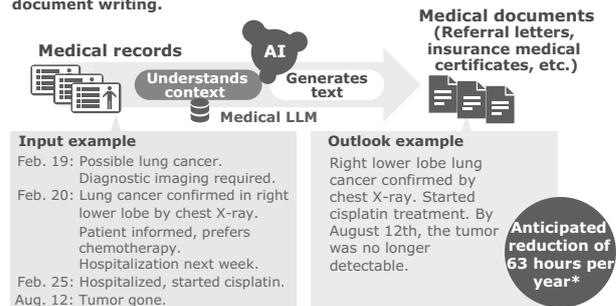
Medical records are automatically generated through dialogue speech recognition using an LLM trained in medical terminology. The doctor only needs to perform a final review of the medical record.



* Estimated value based on field observation.

Fig. 3 Auto-generate electronic medical records from patient-doctor dialogues.

Automatically creates diverse medical documents, understanding medical terms and treatment progress, and reduces medical record review during document writing.



* Analysis conducted by 10 Tohoku University Hospital physicians.

Fig. 4 Automatically generates medical documents from medical records.

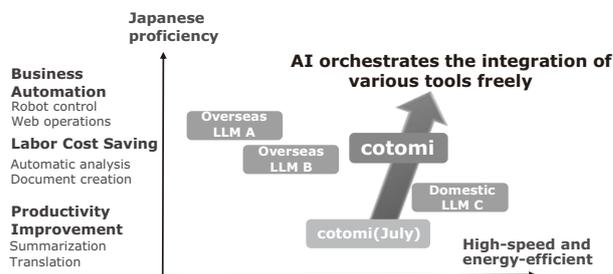


Fig. 5 Lightweight LLM with world-class Japanese proficiency.

fore, it has achieved an even higher ability to process the Japanese language (Fig. 5). Also, it has dramatically improved its ability to process long texts and can now handle up to 300,000 characters. This makes it possible to input business documents and internal manuals directly into the prompt. This LLM overcomes the drawback of

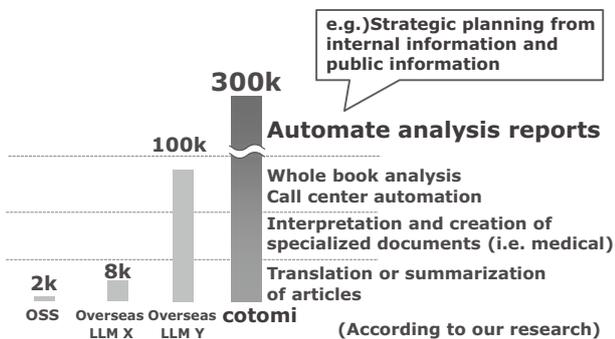


Fig. 6 Up to 150 times better text processing capability.

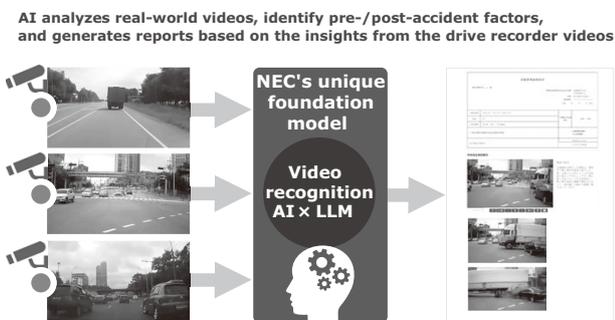


Fig. 7 Automatic generation of accident investigation reports.

conventional LLMs where knowledge is not updated from data at build time and this new LLM enables new data to be input from the prompt for learning (Fig. 6).

The demonstration showed how the text data of an entire novel is input, how a summary for each scene is generated, and how products are recommended in accordance with the user's preference after reading a large number of comments in product reviews.

3.4 Automatic report generation with video and LLM

Advanced technologies that combine LLM with image processing, video recognition, and video searches—areas in which NEC has traditionally excelled—were also on display. These new technologies automatically generate text after recognizing a huge amount of video data and can extract any requested video scene along with its explanatory text (Fig. 7). For example, for a long video recorded on a dashcam, if you type "Tell me the details of the traffic accident" or "Tell me the factors that caused the traffic accident" using the LLM prompts, the AI automatically displays relevant scenes along with explanatory texts. The demonstration showed how a report for an insurance investigation is created from a

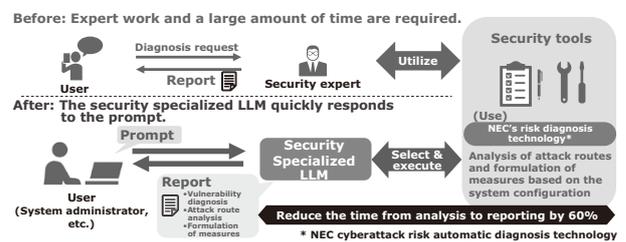


Fig. 8 Security specialized LLM performs tool-based analyses and reporting previously done by experts.

dashcam but it was emphasized that these technologies can be used in a wide range of other areas, including automatically creating nursing and medical care records in medical facilities or work records at factories and construction sites.

3.5 LLM-based automatic diagnosis of security risks

Previously, security risk diagnosis required significant costs and time as a high level of expertise was required. However, it is more effective to perform diagnostics as frequently as possible to respond to the threat and vulnerability information that is reported on a daily basis. This technology, which combines LLM and NEC's security risk diagnosis technology, enables users without specialized knowledge to easily and readily perform a diagnosis by interacting with an LLM (Fig. 8). The demonstration attracted the attention of LLM participants as it showed how the AI could respond by not only analyzing the existence of vulnerabilities and attack routes on the network but also recommending countermeasures.

The details about this paper can be seen at the following.

Related URL:

NEC Innovation Day 2023

<https://www.nec.com/en/global/ir/events/pr/others.html>

Robust Intelligence

<https://www.robustintelligence.com/>

dotData announces dotData Insight to ideate business hypotheses by combining AI-driven insight discovery and Generative AI

<https://dotdata.com/news/dotdata-insight-announcement/>

NEC, Tohoku University Hospital and Hashimoto Municipal Hospital demonstrate the effectiveness of using LLMs on the front lines of health care to make "Work Style Reforms" for doctors for doctors (Japanese)

https://jpn.nec.com/press/202312/20231213_01.html

Promoting the reformation of physicians' working style: Medical language processing technology

<https://www.nec.com/en/global/rd/technologies/202313/index.html>

NEC launches new AI business strategy with the enhancement and expansion of generative AI

https://www.nec.com/en/press/202312/global_20231215_02.html

NEC develops Large Language Model (LLM)

<https://www.nec.com/en/global/rd/technologies/202308/index.html>

NEC uses generative AI (LLM) and video recognition AI to automatically generate explanatory text from video

https://www.nec.com/en/press/202312/global_20231205_01.html

Summarizing long videos into shorter videos with text according to user instructions:

Video recognition AI × LLM

<https://www.nec.com/en/global/rd/technologies/202314/index.html>

NEC incorporates LLM into the cybersecurity field

https://www.nec.com/en/press/202312/global_20231215_01.html

Information about the NEC Technical Journal

Thank you for reading the paper.

If you are interested in the NEC Technical Journal, you can also read other papers on our website.

Link to NEC Technical Journal website

Japanese

English

Vol.17 No.2 Special Issue on Revolutionizing Business Practices with Generative AI

– Advancing the Societal Adoption of AI with the Support of Generative AI Technologies

Remarks for Special Issue on Revolutionizing Business Practices with Generative AI
Approaches to Generative AI Technology: From Foundational Technologies to Application Development and Guideline Creation

Papers for Special Issue

Market Application of Rapidly Spreading Generative AI

NEC Innovation Day 2023: NEC's Generative AI Initiatives
Streamlining Doctors' Work by Assisting with Medical Recording and Documentation Using Video Recognition AI x LLM to Automate the Creation of Reports
Understanding of Behaviors in Real World through Video Analysis and Generative AI
Automated Generation of Cyber Threat Intelligence
NEC Generative AI Service (NGS) Promoting Internal Use of Generative AI
Utilization of Generative AI for Software and System Development
LLMs and MI Bring Innovation to Material Development Platforms
Disaster Damage Assessment Using LLMs and Image Analysis

Fundamental Technologies that Enhance the Potential of Generative AI

NEC's LLM with Superior Japanese Language Proficiency
NEC's AI Supercomputer: One of the Largest in Japan to Support Generative AI
Towards Safer Large Language Models (LLMs)
Federated Learning Technology that Enables Collaboration While Keeping Data Confidential and its Applicability to LLMs
Large Language Models (LLMs) Enable Few-Shot Clustering
Knowledge-enhanced Prompt Learning for Open-domain Commonsense Reasoning
Foundational Vision-LLM for AI Linkage and Orchestration
Optimizing LLM API usage costs with novel query-aware reduction of relevant enterprise data

For AI Technology to Penetrate Society

Movements in AI Standardization and Rule Making and NEC Initiatives
NEC's Initiatives on AI Governance toward Respecting Human Rights
Case Study of Human Resources Development for AI Risk Management Using RCModel

NEC Information

2023 C&C Prize Ceremony



Vol.17 No.2

June 2024

Special Issue TOP