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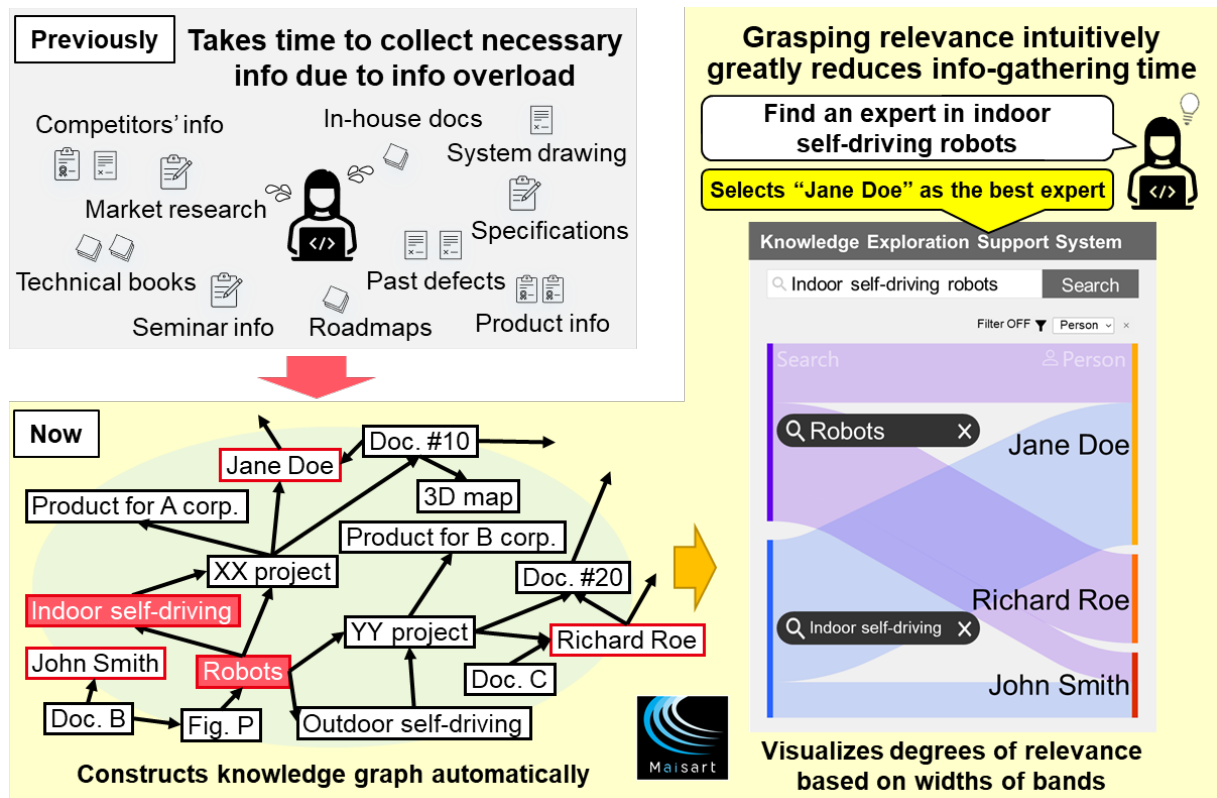
Public Relations Division
Mitsubishi Electric Corporation

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Mitsubishi Electric’s AI Creates Knowledge Graphs from Text and Graphics to Visualize Information Relevance

Users can grasp necessary information quickly and intuitively



New AI technology compared with conventional method

TOKYO, May 31, 2022 – [Mitsubishi Electric Corporation](http://www.MitsubishiElectric.com) (TOKYO: 6503) announced today that it has developed a technology based on its Maisart^{®1} AI technology that automatically constructs knowledge graphs by acquiring key phrases, authors, citation relationships and whole-part relationships of elements in various materials, including figures and tables, and then visualizes the relevance of the information so that users can identify and understand the most necessary information quickly and intuitively. The new technology is expected to greatly reduce the amount of time users spend gathering information.

¹ Mitsubishi Electric’s AI creates the State-of-the-ART in Technology

Conventionally, it can take much time to collect necessary information from the overload of information people are exposed to these days. Moreover, to quickly find necessary or interesting information, the information must not only be digitalized but also managed based on information relationships within or among the materials. Mitsubishi Electric's new AI technology structurally digitalizes materials and data by extracting important information and estimating the interrelationships in advance. Thereafter, when users explore the information, they can grasp the strengths of relationships based on the varying widths of bands in diagrams (see figure above) to quickly and intuitively find necessary, interesting and even previously unnoticed information.

Features of Development

1) Automatically constructs knowledge graphs from materials

- The new AI acquires key phrases, authors, citation relationships and whole-part relationships of elements in documents and graphic data, and then constructs knowledge graphs.
- Automatic construction of knowledge graphs from shapes as well as texts is an industry first.²
- Automated constructing of knowledge graphs enables systems for supporting knowledge exploration to introduce faster and for less cost than conventionally.

2) Visualizes relevance of information and reduces amount of time for gathering information

- The industry's first² visualization of information relevance using the widths of bands in Sankey diagrams³ allows users to grasp desired information intuitively.
- Compared to conventional full-text searches for specific strings of characters in multiple documents, the time of information gathering has been reduced by 41.7%.⁴

Future Developments

Mitsubishi Electric and its subsidiary Mitsubishi Electric Information Systems Corporation will verify the technology in actual business operations, aiming at formally introducing the technology in various departments⁵ by 2027.

Feature Details

1) Automatically constructs knowledge graphs from materials

Given the overexposure to information these days, finding necessary information requires the information not only to be digitalized but also managed based on interrelationships within or between the source materials. In particular, to acquire knowledge from charts, humans conventionally must determine the connections among the shapes and cells. Mitsubishi Electric, leveraging its Maisart knowhow, has now developed an AI technology that automatically constructs knowledge graphs from materials and data including documents, charts, presentation slides, images and audio. It is the industry's first such technology to include figures, tables and text in documents, for which it estimates whole-part relationships based on object types and positional information.

² According to Mitsubishi Electric research as of May 31, 2022.

³ Type of flow diagram in which the widths of the bands are proportional to the flow rates.

⁴ Test involved constructing a knowledge graph from in-house technical documents to find a key person.

⁵ All necessary procedures will be followed to ensure data privacy when verifying the technology for use in actual business.

For example, in Fig. 1, conventional AI knows that “Document A” contains the key phrases “Robots” and “XX Project,” but cannot estimate the relationship between the two. The new technology, however, learns the object types and their positions in advance and then automatically estimates the relationships of these key phrases depending on the combinations of objects and other elements. In this example, this enables us to know that “Indoor self-driving” and “XX project” are in the same set (“Indoor self-driving” belongs to “XX project”) and that “Robots” and “XX project” are in the same row (“XX project” is a project about “Robots”). As a result, the knowledge graph includes the whole-part relationships of objects, which could not be obtained through conventional text-only analysis. By integrating knowledge graphs obtained from multiple materials, the new AI thus constructs more detailed knowledge graphs.

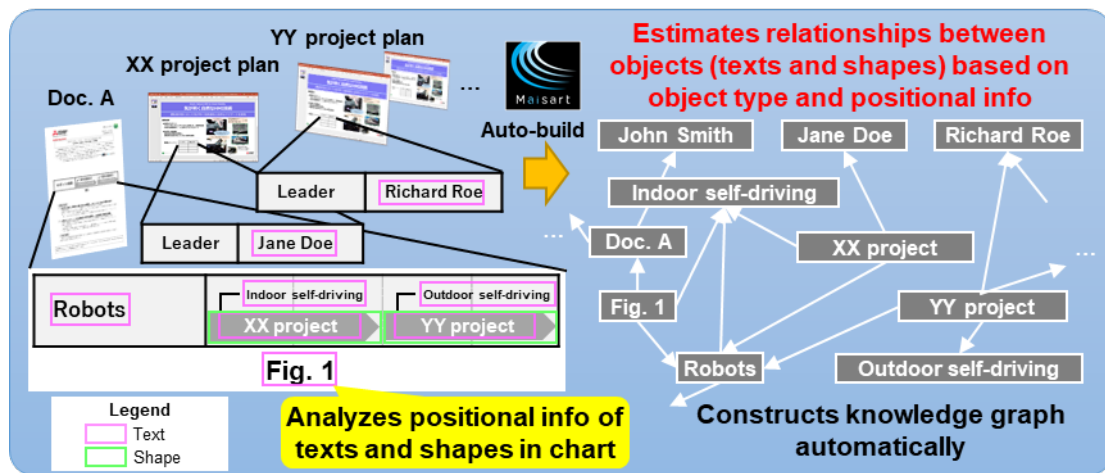


Fig. 1 Construction of a knowledge graph from materials

2) *Visualizes relevance of information and reduces amount of time for gathering information*

A knowledge graph constructed from a large number of sources contains an enormous number of nodes and relationships, making it hard to grasp desired information by simply displaying the knowledge graph. As such, structured knowledge cannot be fully utilized. Mitsubishi Electric again leveraged its Maisart AI to develop a technology that infers the degree of relevance from knowledge graphs and then visualizes information relevance via the widths of bands in Sankey diagrams (Fig. 2).

For example, in Fig. 2, the user wants to find an expert in “Indoor self-driving robots.” In this case, three people related to the key phrases “Indoor self-driving” and “Robots” can be found from a knowledge graph constructed in advance, but it is hard to understand who is the most knowledgeable. The new technology, however, infers relevance between these three people and the respective key phrases “Indoor self-driving” and “Robots,” and then visualizes the relevance in the widths of bands in a diagram, allowing the user to intuitively understand that “Jane Doe” has the most expertise in “Indoor self-driving robots.”

Internal tests showed that compared to conventional full-text searches, the new technology reduced the amount of time to find the best expert by 41.7% using a knowledge graph constructed from technical documents.

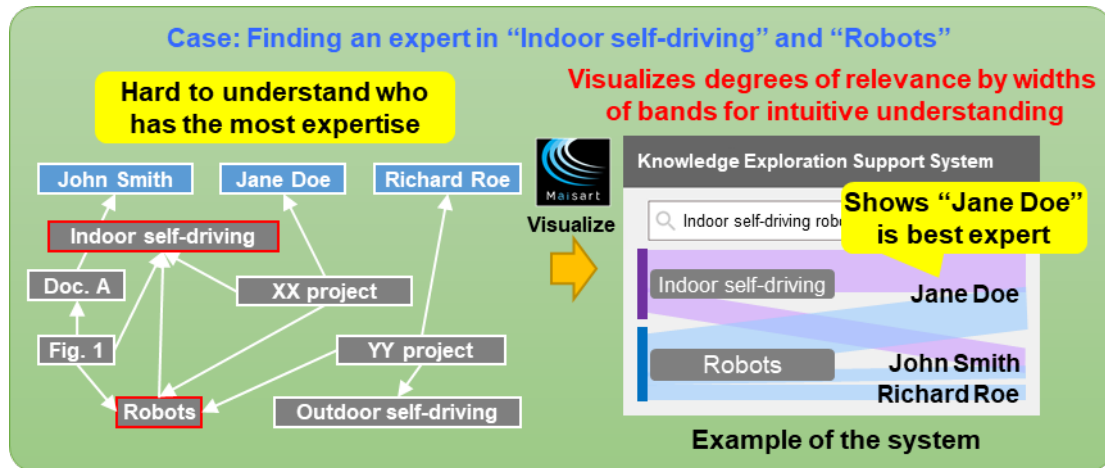


Fig. 2 Visualization of information relevance by inferring degree of relevance from a knowledge graph

About Maisart

Maisart encompasses Mitsubishi Electric’s proprietary artificial intelligence (AI) technology, including its compact AI, automated-design deep-learning algorithm and extra-efficient smart-learning AI. Maisart is an abbreviation for “Mitsubishi Electric’s AI creates the State-of-the-ART in Technology.” Under the corporate axiom “Original AI technology makes everything smart,” the company is leveraging original AI technology and edge computing to make devices smarter and life more secure, intuitive and convenient.

Maisart is a registered trademark of Mitsubishi Electric Corporation.

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About Mitsubishi Electric Corporation

With more than 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Mitsubishi Electric enriches society with technology in the spirit of its “Changes for the Better.” The company recorded a revenue of 4,476.7 billion yen (U.S.\$ 36.7 billion*) in the fiscal year ended March 31, 2022. For more information, please visit www.MitsubishiElectric.com

*U.S. dollar amounts are translated from yen at the rate of ¥122=U.S.\$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2022