

# How explainable artificial intelligence can propel the growth of industry 4.0

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The survey highlights the existing AI and XAI methods and their applications being used in Industry 4.0. XAI-based methods are extremely important to speed up the developments in Industry 4.0 and to bridge the gap between human intelligence and machine function. Credit: Jetstar Airways

The very first industrial revolution historically kicked off with the

introduction of steam- and water-powered technology. We have come a long way since then, with the current fourth industrial revolution, or Industry 4.0, being focused on utilizing new technology to boost industrial efficiency.

Some of these technologies include the internet of things (IoT), cloud computing, cyber-physical systems, and artificial intelligence (AI). AI is the key driver of Industry 4.0, automating [intelligent machines](#) to self-monitor, interpret, diagnose, and analyze all by themselves. AI methods, such as machine learning (ML), [deep learning](#) (DL), [natural language processing](#) (NLP), and computer vision (CV), help industries forecast their maintenance needs and cut down on downtime.

However, to ensure the smooth, stable deployment and integration of AI-based systems, the actions and results of these systems must be made comprehensible, or, in other words, "explainable" to experts. In this regard, explainable AI (XAI) focuses on developing algorithms that produce human-understandable results made by AI-based systems. Thus, XAI deployment is useful in Industry 4.0.

Recently, a group of researchers, including Assistant Professor Gwanggil Jeon from Incheon National University, South Korea, surveyed existing AI and XAI technologies and their applications in Industry 4.0. Their review was published in *IEEE Transactions on Industrial Informatics*.

"Though AI technologies like DL can solve many social problems due to their excellent performance and resolution, it is difficult to explain how and why such good performance is obtained. Therefore, there is a necessity to develop XAI, so that DL, like the current black box, can be modeled more efficiently. It will also be easier to make applications," said Prof. Jeon explaining his motivation behind the study.

XAI-based methods are classified according to specific AI tasks, like the

feature explanations, decision-making, or visualization of the model. The authors note that the combination of cutting-edge AI and XAI-based methods with Industry 4.0 technologies results in various successful, accurate, and high-quality applications. One such application is an XAI model made using visualization and ML which explains a customer's decision to purchase or not purchase non-life insurance. With the help of XAI, humans can recognize, comprehend, interpret, and communicate how an AI model draws conclusions and takes action.

There are clearly many notable advantages of using AI in Industry 4.0; however, it also has many obstacles. Most significant is the power-hungry nature of AI-based systems, the exponentially increasing requirement for a large number of cores and GPUs, as well as the need for fine-tuning and hyperparameter optimization. At the heart of this is data collected and generated from millions of sources, devices, and users, thereby introducing bias that affects AI performance. This can be managed using XAI methods to explain the bias introduced.

"AI is the principal component of industrial transformation that empowers smart machines to execute tasks autonomously, while XAI develops a set of mechanisms that can produce human-understandable explanations," concludes Prof. Jeon.

**More information:** Imran Ahmed et al, From Artificial Intelligence to Explainable Artificial Intelligence in Industry 4.0: A Survey on What, How, and Where, *IEEE Transactions on Industrial Informatics* (2022). [DOI: 10.1109/TII.2022.3146552](https://doi.org/10.1109/TII.2022.3146552)

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