Development Process for AI Applications with Uncertainty and application examples

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In recent years, due to the evolution of IoT, Big Data, and hardware, technological research using neural networks such as artificial intelligence (AI), especially deep learning, has been actively carried out. Especially in the field of imaging, this technology has attracted attention as an alternative technology to what humans have done so far, and many innovations have already occurred.

In space systems, research that applies AI to the recognition functions of spacecraft that require autonomy (for example, identification of objects in image navigation and axis estimation), and AI for astronaut support robots operating in space stations. Research has begun to apply.

Systems that operate on human-defined rules, including rule-based AI systems, can be said to operate deterministically. Therefore, it is possible to build a safe system that is convincing for humans. Deep learning technology, on the other hand, allows networks to learn features from learning data and create judgment boundaries that are difficult for humans to understand. Therefore, the judgment result of deep learning is uncertain and unpredictable for humans. This problem can cause an accident. For example, in the United States, accidents involving self-driving cars (Google Car, Tesla, etc.) have occurred.

We developed a development process that focuses on "learning," which is unique to AI software (deductive software), and "false inference," which is an issue in AI SW that is different from conventional software (inductive software). Specifically, we analyzed the factors and causes of false inferences in each phase, including the learning phase, and based on the results, defined requirements for countermeasures to prevent false inferences in each phase.

In addition, we examined methods to prevent false inference from occurring and methods to extract false inference results, and tried this method on optical and SAR images, and were able to identify the false inference results.