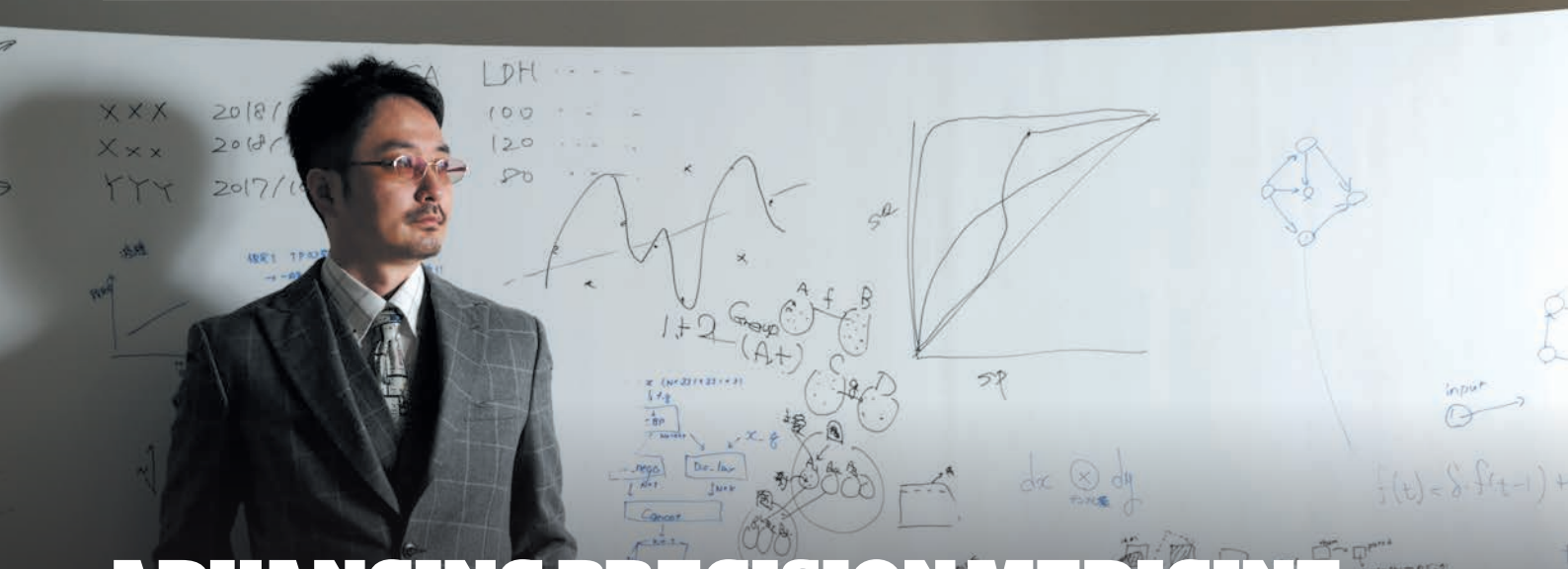

ADVANCING PRECISION MEDICINE USING AI AND BIG DATA

A DATA-DRIVEN APPROACH TO MEDICAL RESEARCH is helping to shed new light on cancer and other heterogeneous diseases

Artificial intelligence (AI) is transforming medical research by revealing data patterns that can be used to predict disease and treatment outcomes for individual patients. To realize the potential of AI and machine learning in precision medicine, Chiba University established the Center for Artificial Intelligence Research in Therapeutics (CAIRT) in 2018. The first AI centre as part of a medical school in Japan, it hosts more than 50 researchers who are developing data-driven approaches to stratify disease and develop novel treatment strategies.

"Our centre brings together multidisciplinary expertise to generate new insights into diseases," says Eiryo Kawakami, professor of artificial intelligence medicine at Chiba University and centre director.

Unlike conventional biomedical research where a hypothesis is evaluated with clinical trials on many patients, data-driven research relies on unbiased large-scale clinical data collection and analysis to find patterns and generate actionable predictions about disease progression.

"Hypothesis-driven research has limitations when it comes to the study of heterogeneous and multifactorial diseases," says Kawakami. Rather than investigate whether a given factor affects an outcome, a data-driven approach allows researchers to examine how variables affect each other and elucidate heterogeneous disease mechanisms.

The centre is characterizing patients' by collecting genomic and clinical data as well as other 'omics' data, which provides information about gene expression and metabolism. Information about the microbes in the body, environmental exposures, and lifestyle factors that can affect human health is also gathered.

"These data are high dimensional and nonlinear, making them difficult to analyse with conventional statistical methods," Kawakami explains. However, by developing and applying AI and mathematical approaches to these data, Kawakami and colleagues are able to differentiate disease states and predict the efficacy of particular drugs and future outcomes.

For example, when they applied machine learning techniques based on the 32 blood markers in ovarian cancer patients before treatment, they found a group of early-stage cancer patients with poor prognosis. This finding will help researchers develop new treatments for this group of patients. "Predictive algorithms can help identify disease groups that haven't been recognized by clinicians, as well as guide the selection of personalized treatment options for these patients," says Kawakami.

Cancer is just one of many diseases researchers at the centre are working on. In collaboration with world-leading research institutions such as RIKEN and Keio University in Japan, the University of Tübingen, Germany, and the University of Luxembourg, they are carrying out data-driven medical research on immune-allergic diseases, neurological diseases and metabolic syndrome.

"Thanks to AI and young talented researchers in our centre, we're developing methodologies for precision medicine and implementing them in clinical practice. To further address the heterogeneity of diseases, we need more young talents from a range of different disciplines," Kawakami concludes. ■

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