

Commentary

Precision medicine with machine learning

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DESCRIPTION

Precision medicine is a new approach to clinical research and patient care that focuses on understanding and treating disease by integrating multimodal or multiomics data from an individual to make decisions tailored to the patient. Given the large and complex data sets generated by precision medicine diagnostic approaches, novel techniques for processing and understanding these complex data have been needed.

Precision medicine, often referred to as precision health, is a novel approach to understanding health and disease based on patient-specific data, including medical diagnoses, clinical phenotype (severity of disease, extent of functional impairment, etc.), biological investigations, including laboratory tests and imaging, and environmental, demographic, and lifestyle factors. Taken together, these data are considered multimodal because they contain information from multiple domains. The evolution of precision medicine has been greatly influenced by the exponential increase in the amount of biological data that can now be collected for each individual patient, due in large part to the advent of new technologies in medicine, genetics, metabolism, and imaging, to name a few. The amount and variety of diagnostic tests that can be performed generates an incredible amount of data that is difficult for a single patient to understand and analyze, and even more difficult in a data set that includes information from multiple patients.

These two developments go hand in hand as informatics methods take advantage of the vast amounts of data collected in healthcare, enabling the development of precision medicine diagnoses and therapies.

The origins of precision medicine are not entirely clear, due in part to the evolution of the term over time. One of the first areas in which a precision medicine approach was applied to the treatment of human disease was transfusion medicine, in which the discovery of blood types in the early 1900s

revolutionized blood transfusions by allowing matching of donor and recipient blood types and avoiding complications associated with mismatched donor and recipient blood. Since then, precision medicine has evolved considerably to include novel approaches to prevention, diagnosis, intervention, and treatment, all of which are changing the landscape of medicine. Based on its success and promising future prospects, precision medicine is now a field with significant support from research and clinical funding agencies, government agencies, and the general public, including private donors and policymakers.

Genetics, the study of genes and their role in heredity, and genomics, the study of a person's genome and the interactions between the genome and the environment, have both played important roles in the advent of precision medicine. In fact, most of the available data on precision medicine comes from genetics and genomics.

The rise of "intelligent" machines and technologies known as artificial intelligence is now part of daily life and a cornerstone of medicine and research. Machine learning is a branch of artificial intelligence in which computational models are created to recognize and learn patterns in high-dimensional data to create predictive and classification models based on the training data.

Precision medicine is a novel approach to research and clinical practice that uses data from multiple sources to understand and treat human disease. Machine learning methods, including new deep learning models, are an important part of analyzing and processing multiomics data to classify and predict outcomes for individuals and populations. Genetics and genomics have been critical to the development of precision medicine and lend themselves well to machine learning technology, and these data, in combination with other assessments, will be critical to the continued development of these fields. Our understanding of human health and illness has already advanced significantly thanks to precision medicine and machine learning, and these two fields have a bright future for all of mankind.

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