
Preface

The present era of research and development is all about interdisciplinary studies attempting to better comprehend and model our understanding of this vast universe. The fields of biology and computer science are no exception. This book discusses some of the innumerable ways in which computational methods can be used to facilitate research in biology and medicine—from storing enormous amounts of biological data to solving complex biological problems and enhancing the treatment of various diseases.

In 1959, Arthur Samuel defined machine learning as the “field of study that gives computers the ability to learn without being explicitly programmed”. Since then, this field of study has undergone many advancements to make machine learning a combination of several disciplines such as statistics, information theory, theory of algorithms, probability, and functional analysis. Another aspect of machine learning is the extraction of common patterns from sets of data, known as data mining. Hence, a more inclusive definition of machine learning would be design and testing of algorithms facilitating pattern recognition, classification, and prediction based on existing data.

Internet of Things (IoT) is based on the concept of various hardware devices, including sensors, being embedded with software and apps able to transmit and process data. These new easy-to-use devices have innumerable applications, especially in the field of biotechnology and medicine. Any object, outfitted with the right sensors, can observe and interact with its environment, allowing hard-working individuals to control their personal and professional responsibilities from far away, using only a voice command in smartphone.

The relationship between biology and machine learning has existed for decades. The present status of research in the field of biotechnology calls for sophisticated methods to store the large amounts of data generated, and to ease the task of the researcher by going so far as to predict certain outcomes. In short, biological research has become much dependent on computational algorithms. Likewise, the management of the health care system also becomes easier with the intervention of machine learning and other computational tools.

In this book, we have started our discussion with how various machine learning algorithms can be used as a powerful tool for aiding biologists in their research work. In the first half of the book, we have talked about how different aspects of machine learning can complement bioprocess engineering, bioinformatics, and biofouling. We have also discussed how health care facilities and treatments can benefit from machine learning, covering a wide range of aspects such as autoimmune diseases, nosocomial infections, brain lesions, and even theranostics. The latter half of the book talks about how IoT can facilitate many aspects of biology, starting from health care systems to analytical labs, even revolutionizing traditional farming practices.

In conclusion, this book gives a comprehensive overview of some of the innumerable ways in which computational methods can aid research in biology and medicine to allow us to live a better life.

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