


Chapter 1

Machine Learning in Cancer Care

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ABSTRACT

The new generation of medicine, known as precision medicine, refers to adjusting therapies for a subgroup of people who share a susceptibility to a certain illness or a comparable reaction to a medication. Instead of one size fits all, these medicines are customized to particular patient's needs and also taken into consideration are patient's omics, social, behavioural, and environmental factors particular to him or her and thus the name precision medicines. Precision medicines existed earlier, but recently the Precision Medicine Initiative was launched with greater interest, with the advent of machine learning and artificial intelligence methods becoming popular. Artificial intelligence, big data, machine learning, pharmaco-omics, social and environmental aspects, and then the integration of these with population and preventive medicines are the primary instruments of precision medicine.

INTRODUCTION

The evolution of oncology is one of the most profound discoveries of the current century with the progress of biology and ability to analyze data simultaneously. Attack on cancer has always been slow evolution for decades of surgery, radiation and chemotherapy. These centers of treatments are important but, the beginning of the

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21st century has been a shift towards data dominated medicine with revolutionizes the methods of analysis, diagnosis and most importantly, treatment of medicine as a set of intertwined complex diseases. To understand cancer is to commit a mistake of epic proportions, for it is made up of more than a thousand different diseases, each of which has its own molecular identity, its own sequence of evolution, and its own methods of treatment. This multitude of forms presents a formidable challenge which, until very recently, was beyond the comprehension and action oriented grasp of a human specialist.

The novel primary catalyst is the constant accumulation of biomedical data. The Human Genome Project and its sequel explosion in high throughput (>1 sequencer/ instrument) sequencing with its genomics, transcriptomics, proteomics, and metabolomics as shown in Figure 1. In this context, radiology and pathology slides have undergone a significant transformation from qualitative diagnostic tools to quantitative diagnostics due to advancements in medical imaging. Each patient becomes a multi-dimensional, high-volume data stream that is far more complicated than any conventional approach can analyze when these datasets (Swanson et al., 2023) are integrated with the rich clinical information included in Electronic Health Records (EHRs).

As Table 1 illustrates, this is where machine learning (ML) and artificial intelligence (AI) become crucial tools. Doctors can mix vast volumes of diverse patient data with the aid of machine learning. It is capable of making predictions and identifying patterns that people would not be able to perform on their own. This aids medical professionals in choosing more effective treatments. In essence, machine learning approaches cancer treatment like a mathematical problem. The most significant outcomes, such as the patient's potential lifespan, quality of life, and response to various therapies, are predicted using computer programs and all of the patient's health data.

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