International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN: 2347-5552, Volume-6, Issue-4, July 2018
10.21276/ijircst.2018.6.4.7

Recent Advances and Future Directions of Bioinformatics in Biomedical Engineering Perspective

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***Abstract*—Bioinformatics is an interdisciplinary field of biomedical engineering and biotechnology that incorporates computational, mathematical, statistical analysis and information technology to provide a better solution to biological and biomedical engineering problems. Bioinformatics aims at the advancement of biomedical engineering by furnishing an open platform for biomedical engineers, researchers, educators, and scientists.Biomedical engineering and bioinformatics is experiencing remarkable expansion and recognition at present. Applied bioinformatics is thus right now is a hot, alluring and captivating field that incorporates life sciences, biomedical sciences, computationl biology and software engineering for better future of mankind.**

I. INTRODUCTION

Bioinformatics is the term which is interdisciplinary in nature[1].According to the dictionary of Merriam-Webster dictionary"bioinformatics is the collection, grouping, storage and analysis of biochemical and biological information via computers mainly as concerned with molecular genetics and genomics" [2].

Manuscript received June 29, 2018

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It makes strategies and programming tools for the perception ofnatural and biological knowledge [3].The primary objective of bioinformatics is to build the comprehension of biological knowledge with the help of information technology procedures.

II. BIOINFORMATICS IN BIOMEDICAL ENGINEERING PERSPECTIVE

Bioinformatics is linked up with biomedical engineering in many perspectives.As an important part of science, bioinformatics adds software engineering, computer science, mathematics, statistics and designing to examine and decode natural information (Figure 1). It is thus combined both terminology for the group of biological investigations that utilization of computer programming as an element of their technique, and in addition a reference to certain inquiry "pipelines" that are more than once used, particularly in the section of genomics [4-5].

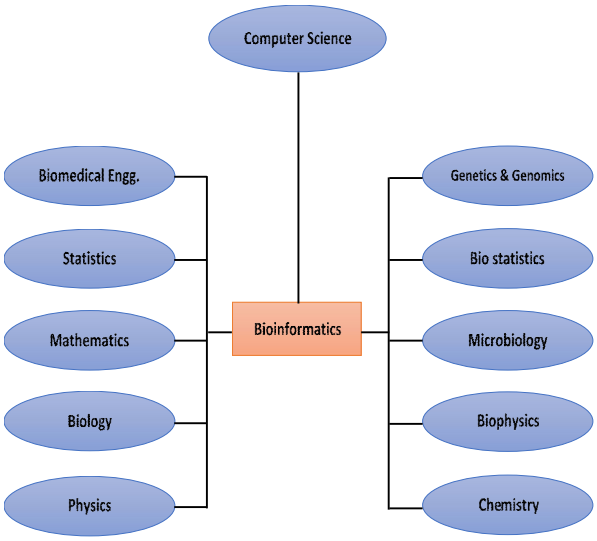

Fig 1: The interdisciplinary nature of bioinformatics

The initial human genome project (HGP)costs more than $3 billion and took approximately twelve years. At present time with the help of bioinformatics technological improvement, we can findour genome

sequenced at under $1,000 and within two days [6]. It is practical to visualize that next ten years or somewhere in the vicinity, everybody's genome could be sequenced, on the off chance that they required it, at the cost of $100 per genome and in a substantially shortenedtime-frame.

Bioinformatics and computational biology incorporate the investigations of biological data, especially DNA, RNA, and protein engineeringthat generates and applies computational procedures to break down substantial procurement of biological data, for example, hereditary groupings, cell populaces or protein tests, to create new forecasts or search new science [4, 7-8].Bioinformatics is thus advancing the knowledge of biomedical engineering to a great extent. Bioinformatics is also providing opportunities to biomedical engineers for improving their innovative engineering modeling, technological skills and engineering experiences [9].

Bioinformatics is promising to bring about revolutionary changes in the biomedical sector. CRISPR (clustered regularly interspaced short palindromic repeats) is paving us the way to the bright future of bioinformatics in solving biological problems [9]. In recent times, many important discoveries and many solutions to biotechnology and biological problems have been provided by bioinformatics that has accelerated the development of biomedical engineering. It is now being considered as a key to recent cancer discoveries. In two current cancer studies researcerchers used bioinformatics to arrange public domain genomic data to support recognize gene's role in human cancer [10]. Bioinformatics has successfully transformed growth factor-β gene expression signature in mouse hepatocytes that have predicted the clinical outcome in human cancer [2]. To improve the quality of medicine and to develop more efficient antibiotics is one of the future challenges of bioinformatics in biomedical engineering. The analytical and computational bioinformatics program in biomedical engineering is reassuring to train up the future leader to this bioinformatics based biomedical engineering revolution [10].

Bioinformatics has developed tools that has provided next generation sequencing appratusto determine mutation very quickly from the resulting whole genome sequences [11]. Integrative transcriptome inquiry has revealed common molecular subclasses of human hepatocellular carcinoma.As an emerging field inbioinformatics,information technologies are used forthe improvement to gather, oversee and utilize biological information to develop the personal satisfaction of people [12].

Computional biology and bioinformatics is valuable for the fields of bio-enterprenurship, wellbeing of human andsurrounding environment, biotechnology and biological engineering [4]. It advances biomedical research and improvements and preventive pharmaceuticals, recognizes sustainable information substance in DNA, RNA, protein arrangements, structure, architecture, and substance of genomes. It also incorporates metabolic engineering data processing, data capacity and recovery, database structures, explanation and also data mining concerning machine learning instruments, neural nets, computerized reasoning. Bioinformatics is being applied in many interdisciplinary fields [7, 8].It is the use of computer novelty to the administration of biological data. For example, microbial genome, molecular and personalized medicine, gene therapy, drug development and preventative medicine, and in forensic analysis. Information technologies are used to accumulate, depot, examine and incorporate organic, and hereditary data which would then be able to be connected to quality-based medication issue and progress [13]. Major research areas ofbioinformatics includingsequence analysis, genome annotations, computational drug configuration, analysis of gene expression, and computational evolutionary biology. It also analyses of changes in cancer, prediction of protein configuration and expression. Now a days RNA structures, TSS prediction, comparative genomics, demonstrating of biological frameworks, high throughput image examination, protein-protein docking, and data mining are hot topics of research in developed countries[14].

Computational biologists and bioinformatics experts have different professional careers choices in public and private divisions that is related to biomedical engineering, pharmaceutical, biotech, and bio-organizations. They can find jobs in scientific research organizations, non-legislative and government offices, research centers, and university as biostatistician, computational biologist, geneticist, software developer, and bioinformatics academicians or as professor [5, 7-8, 15-16].

III. CONCLUSION

Applications in biotechnology, biochemistry, pharmaceuticals, medicine, and bio-agriculture are a vital part of biomedical research. Thus, present-day biological and medicinal innovative work is unimaginable without bioinformatics and computational biology. In future, rapid advancement in gene therapy, cancer research, gene editing, drug discovery, drug dealing, and other advancement is expected in this field which will provide a wide range of career opportunities for biomedical engineers[17].

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