

Implementation of Bioinformatics in UAE Higher Education Institutions

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Abstract. Bioinformatics has recently emerged in response to the needs to handle large amount of biological data. This new field has not only attracted researchers but several universities have recently adopted bioinformatics in their program curricula as well. This paper investigates the implementation of this new field in program curricula of higher education institutions of the United Arab Emirates. (UAE).

Keywords: Bioinformatics, curriculum, UAE universities

1. Introduction

Bioinformatics is a new multidisciplinary field, which mainly combines biology and computer science, in addition to mathematics and statistics, all needed for the analysis of biological data. Bioinformatics has not only attracted a great interest from industry but also from academia, where several worldwide universities have included bioinformatics in their program curricula.

Bioinformatics has been defined in several different ways, but there is a close agreement of most of these definitions that the term bioinformatics combines computer science, biology, mathematics and statistics in one discipline. It is defined as a science that supports the development and the use of computer databases to store, organize, and retrieve the huge amount of biological data.

The main purpose of this paper is to investigate the state of bioinformatics in the academic programs in the UAE higher education institutions since UAE is one of the leading countries in the Middle-East that is using cutting-edge technologies in all domains, especially in the sector of education. Furthermore, UAE has always been one of the leading countries in the region that cares about high quality assurance in education and follows the job market trends to include innovative programs in its higher educational institutions.

The remainder of the paper is organized as follows. Section 2 reviews related work. Section 3 addresses bioinformatics in program curricula of the UAE higher education institutions. Finally, Section 4 concludes this paper.

2. Related Work

There have been significant efforts in the investigation of bioinformatics in the program curricula in different parts of the world. Altman [1] discussed the components of the curriculum for bioinformatics professionals, focusing on postgraduate programs. The author discussed the basic background required for graduate students in bioinformatics. Five major components were suggested, which are biology, computer science, Statistics, a set of core bioinformatics courses, and ethics.

The authors in [2] discussed their experience in implementing bioinformatics in their institution, University of California, Santa Cruz. The authors suggested a list of courses in each component of

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bioinformatics program, namely: math, science, engineering (since the program is offered under the school of engineering), and an introductory component on bioinformatics.

In [3], Counsell discussed bioinformatics programs in UK. He pointed out that bioinformatics is offered at graduate level or for professional development like certificate or training because it is of an intensive focus of research. He added that since it is a multidisciplinary subject, the development of the syllabus should be result of a coordinating effort of computational and biological departments. He argued on the way to design the program curriculum where subjects should be linked by common themes, allowing students to understand and retain the concepts learned. At the end, the author presented an overview on bioinformatics programs in UK universities.

In [4], Cattley has presented a study on bioinformatics degrees in Australian universities. Cattley pointed out that most programs in this field are undergraduate programs, and compared different bioinformatics programs in Australia, focusing the five components, early mentioned.

H. Bukhari et al [5], on the other hand, have investigated bioinformatics literacy among students, researchers, organizations and professionals. Findings of their search indicate that a low rate of students, researchers and professionals are aware of bioinformatics and the tools used in this field.

The state of Bioinformatics in China has been addressed by L. Wei et al [6]. Their main focus was on Chinese contribution in research in this field. In education and from the figure presented in their paper, it shows that most of bioinformatics programs are at postgraduate level.

3. Bioinformatics and UAE Higher Education Institutions

A thorough search on the Internet has been conducted. The first step in our search has been conducted to find the Websites of all higher education institutions in UAE, then in the second step, for each university found in the previous step, a search has been conducted in all departments and faculties in attempt to find one department that may offer bioinformatics program. The search is time consuming, since this new specialty is a multidisciplinary field and from a university to another, it is offered under different departments and faculties. As a result of our search, three Websites have been found [7-9-] listing all universities and colleges in UAE.

In UAE, the Commission for Academic Accreditation (CAA) is a department of the Ministry of Higher Education and Scientific Research (MOHESR), which is responsible for licensure of private higher education institutions and the accreditation of each of their academic programs. Table 1, lists all higher education institutions which are MOHESR recognized [9]. It is worth mentioning that some institutions have been excluded from our study because they either do not have Websites or they have online programs.

Tab.1: List of higher educational institutions in UAE.

UNIVERSITY NAME	UNIVERSITY NAME
Abu Dhabi Polytechnic	Fujairah National University
Abu Dhabi School Of Management	Gulf Medical University
Abu Dhabi University	Hamdan Bin Mohammed E-University
Abudhabi Vocational Education And Training Institute	Higher Colleges Of Technology
Ajman University Of Science And Technology	Horizon International Flight Academy, Al Ain
Al Ain International Aviation Academy	Imam Malik College For Islamic Sharia And Law
Al Ain University Of Science & Technology	Insead- The Business School For The World, Abu Dhabi
Al Ghurair University	Institute Of Management Technology-Dubai
Al Hosn University	Islamic And Arabic Studies College-Dubai
Al Khawarizmi International College	Ittihad University (On Probation, With No New Admissions)

American College Of Dubai	Jumeira University
American Intercontinental University Dubai	Khalifa Bin Zayed Air College Khalifa University Of Science, Technology And Research
American University In Dubai	Masdar Institute Of Science And Technology
American University In The Emirates	Naval College
American University Of Ras Al Khaimah	New York Institute Of Technology
Biotechnology University College	New York University
Boston University Institute For Dental Research & Education	Paris Sorbonne University, Abu Dhabi
British University In Dubai	Petroleum Institute
Canadian University Of Dubai	Police College, Abu Dhabi
Computer College	Police Sciences Academy- Sharjah
Dubai Medical College For Girls	Ras Al Khaimah Medical And Health Sciences University
Dubai Pharmacy College	Rochester Institute Of Technology- Dubai
Dubai Police Academy	Royal College Of Surgeons In Ireland- Dubai
Dubai School Of Government	Skyline University College
Duke University, The Fuqua School Of Business	Syscoms College
Emirates Academy Of Hospitality Management	The Logistics Academy
Emirates Aviation College	Tufts University Friedman School- Rak
Emirates Canadian University College	United Arab Emirates University
Emirates College For Advanced Education	University College Of Mother And Family Sciences
Emirates College For Management And Information Technology	University Of Jazeera
Emirates College Of Technology	University Of Sharjah
Emirates Institute For Banking And Financial Studies	University Of Strathclyde Business School- UAE
European International College	University Of Wollongong In Dubai
European University College	Vocational Education Development Center
Fatima College Of Health Sciences	Zayed university
Fujairah College	

Investigating programs offered for undergraduate students in all higher education institutions listed in table 1. Fig. 1 shows the percentage of institutions listed in Table 1 and other institutions which are not MOHESR recognized, and which offer computer and biology-related programs at the undergraduate level against the percentage of other programs offered by these institutions. By computer and biology-related programs, it is meant all programs which include information technology or computer science/engineering, biology, medicine, chemistry, biotechnology, and biomedical science, live of sciences.

Among 43% of institutions which provide computer and biology-related undergraduate programs, there are more than 50% of institutions which provide computer-related degrees, followed by medicine field, where 14% of UAE institutions offer such degree. The other fields like biomedical, biotechnology, and science of lives represent 7%, 7%, and 5%, respectively. Surprisingly, Biotechnology is a young field in UAE institutions and from statistics; it shows that it is gaining interest in higher education where 7% of these institution implemented such a program at the undergraduate level. However, with regard to bioinformatics field, very few institutions, only 2% of all UAE institutions, have started including bioinformatics either as courses under some program curricula or offer it as a separate program as undergraduate degree.

Furthermore, among these 2% of these institutions, only one is offering an undergraduate degree in this field, which is Manipal University, not in the list of MOHESR recognized list.

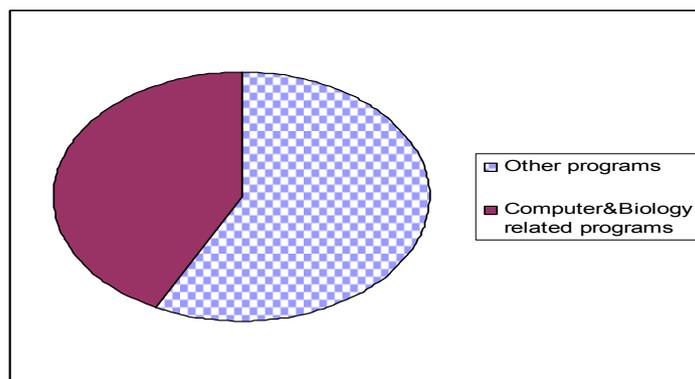


Fig. 1: Computer and biology-related programs versus other programs offered by UAE higher education institutions

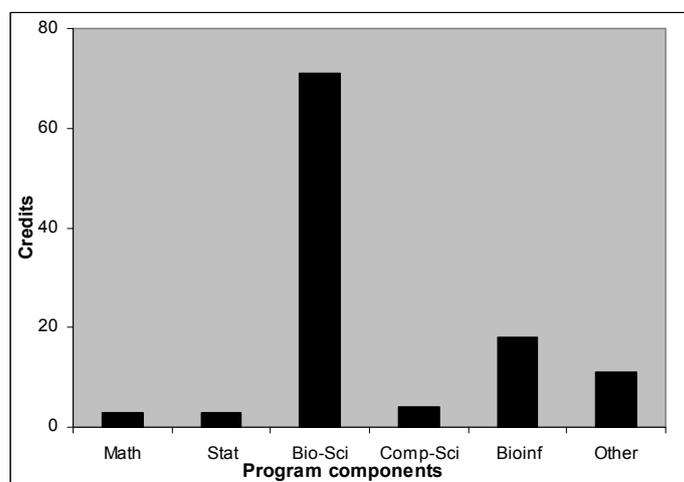


Fig. 2: Components of Bioinformatics program in Manipal University.

From our investigation on bioinformatics programs in Worldwide higher education institutions, there is a total agreement on the program curriculum that is composed of five major components, which are mathematics, statistics, biological sciences, computer science (or engineering), and bioinformatics (combination of biology and computer science). Fig. 2 shows the distribution of the five components in bioinformatics program offered by Manipal University. The component ‘other’ refers to other subjects such as general requirement courses like physics, English, etc. The program is for bachelor degree of three years duration, where students must complete 110 credit hours, a credit hour represents one lecture hour.

From the figure, it can be noticed that the largest percentage of the program focuses on biological sciences followed by bioinformatics subject; the former represents a higher percentage in the program, compared to bioinformatics programs of worldwide higher education institutions. Nevertheless, the two components which are mathematics and computer science represent a very small fraction of the program, and compared to similar programs in other institutions over the world, computer science should not be only an introductory course, but it should include other topics such as databases, graph theory, programming, since all needed skills for bioinformaticians.

4. Conclusion

Bioinformatics is a new field, which encompasses several important fields: biology, mathematics, statistics, and computer science (engineering). Bioinformatics has already gained a great interest in academia where it has been implemented in several worldwide universities at undergraduate and/or postgraduate levels. Our investigation on the state of bioinformatics as program curricula in UAE higher educational institutions shows that very few institutions have started considering this field in their programs as courses, and only one university which offers it as undergraduate program. As UAE has always been one of the leading countries

in the Middle-East, using cutting technologies in education and caring of high quality education as well as innovation in program curricula, and following job market trends, there is a need to promote such a field in education. This can be achieved through seminars, trainings, and organization of conferences on bioinformatics in UAE.

5. References

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