

Adaptations of Multidimensional Search Engines for Bioinformatic Problems in Medicine: Optimization of Biomarkers for Cancer and other Disease

Dr. Víctor Manuel Treviño Alvarado

Abstract

The technological advances in molecular biology and genetics have exponentially expanded the knowledge of all living beings generating an unprecedented amount of data. To analyze and make sense of this information, adaptations and novel computational methodologies have been proposed. In this talk, we will show some examples of these innovations developed by our research group for some of the problems in medicine and cancer that use genetic information. We will start by introducing the well-known problem of the curse of dimensionality, the technique of variable selection, and what is a biomarker in cancer. We will then describe the first example where common multidimensional search methods, such as genetic algorithms, can be very effective. However, in a second example, we will show that other techniques, such as swarm intelligence, require substantial modifications to be effective. Moreover, we will explain that more specific and efficient heuristics can be designed when we take advantage of information about possible associations between variables (variable selection under interaction networks). With these examples, we hope to stimulate critical thinking and innovation of computational methods for artificial intelligence, pattern recognition, and in general, in data analysis.

Short bio

Dr. Victor Manuel Trevino Alvarado is professor and researcher in the areas of computational biology and bioinformatics at Tecnológico de Monterrey. He began specialized studies in 1989 as a Technician in Data Processing at Tecnológico de Monterrey. He then finished a bachelor degree as an Engineer in Electronic Systems in 1994 also at Tec de Monterrey. Then, he explored biology in a Master of Science related to Molecular Biology and Genetic Engineering at the School of Medicine in the Universidad Autónoma de Nuevo León in 1999 where he received cum laude. In 2007 he finished doctoral studies at the University of Birmingham in the United Kingdom.

Dr. Treviño worked in the industry of software development since 1987 implementing solutions for business administration, distance education, and biological research. He began working for Tecnológico de Monterrey in 1999 as a software developer and since 2007 he moved to the academy as professor and researcher in the area of bioinformatics also teaching engineering, computing, biotechnology, and medicine to both undergraduate and postgraduate students. He has directed a research group in bioinformatics since 2009 where he has graduated at least 3 doctors and 11 master's students at Tecnológico de Monterrey. He is an active member of the National Science Council (CONACyT) since 2007 being S.N.I. level 2. He has published more than 40 research articles accounting for more than 500 citations. He is currently professor and researcher and coordinates a research group in bioinformatics at the School of Medicine of the Tecnológico de Monterrey.