

## The Role of Computation in 21<sup>st</sup> Century

Today, perhaps the most desired skill required is computation. We see the application of computation in Physics, Engineering, Computer Science, and Computer aided drug design, financial models, earth observations, computational chemistry, DNA sequence analysis, data science and even in social and management science. Systems designed using the computational models are flexible, low cost, efficient and easy to use. These benefits of computation and availability of large-scale computation system available today makes computation a desired skill of many organizations and we must prepare our students to be a computational expert.

I have worked in many areas that uses computation as a primary tool. For example in drug design, the experimental models are expensive and time consuming. Computational model are flexible, low cost and enable us to do the analysis at an atomic level, build, and test various drugs and their interactions with proteins.

I have also taught Digital signal processing at undergraduate level at COMSATS University Islamabad, Pakistan, Wah Campus in 2017. Digital Signal Processing is considered a difficult course and involves a lot of mathematics. I found that students were very when I use MATLAB to explain the concepts of signal processing. They took active participation in the class when I taught them Fourier Transform, Wavelet Transform, Convolution of Linear Time Invariant Systems and used MATLAB to show them the results. It also triggered their interest as well as made my job much easier. I personally feel that more computational examples are needed in the curriculum and when student do it himself or herself, they have a better understanding of the problem.

However, some of the students were not good at programming and they faced a lot of difficulty in the programming assignment. The documentation of MATLAB is quite extensive and provides a lot of support to the students. I personally think there are many improvement areas, when compared it with Python, Rstudio and other programming environment. We should include some video tutorials, web pages, webinars, trainings and boot camps to make it easier and productive.

Being a teacher, I also observed that one of the most important challenge in today's era is to provoke the thought process of a student to formulate the real life problems into computational models. There are two ways of doing this. First is to design the curriculum that have many real time computational examples and organize computational challenges for undergraduate and graduate students. The second is to organize training, workshops and boot camps of computational thinking. Revising the curriculum and including more interesting computational examples will be a good strategy. Developing computational thinking skills in student is of immense importance because it can bring the most optimized and efficient solution. We have to make it realize in our students.

With the advancement in computational speed and storage, the rise of deep learning and enormous amount of digital data available today, perhaps, the computational models have become an integral part of smart world and we must develop expert computational skills in our graduates.