Instituto Tecnológico y de Estudios Superiores de Monterrey

Quantum Computing

Reading 8

Computational Complexity for Physicists Computation

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Abstract

In this text, that is based on the paper: "Computational Complexity for Physicists" by Stephan Mertens, two ideas are extracted arbitrarily and discussed, according to the interest of the author.

1 Idea 1

Our understanding of the problem

In the paper, it is shown how the computational complexity of an algorithm can be reduced by having a sufficient understanding of the problem behind it, the example provided is the minimum spanning tree problem. And how a problem that at first sight can be though of as "difficult" becomes easier by realising that an edge that connects two arbitrary vertices within a graph will be part of the Minimum Spanning Tree of the a graph, if this edge has the smallest weight of all edges connecting those vertices. this is something beautiful in itself, how could some problem become so easy just by analysing a tiny part of it. This example, and the Strassen's algorithm shows how beautifully computer science and maths get on. Something even more remarkable, is that our computational power has grown so much to solve certain kind of problems because of two main things: More computational power and better algorithms. We know that computational power grows enormously as explains Moore's observation (aka Moore's law), but the optimisation of algorithms has a greater impact. For example, if we had today's algorithms running on old computers (10 or 20 years old), and we ran some algorithms in today's computers with old algorithms, the old computers would outperform new computers.

2 Idea 2

The importance and the problem of cognition

Following the line of thought to the previous idea, I think that our cognitive abilities are very important to better solve problems, and I mean this in a general way, that is applicable to computer science. The link between problem solving and the development of new abilities has to do even with the theory of natural selection. The individuals with the best cognitive abilities to solve certain problems like getting food, and being able to reproduce efficiently, are the ones more likely to thrive. In this same fashion, life beings have been able to develop cognitive abilities according to our needs. I dare to say that bore doom is also important for cognition. People have found that when a person is bored, the brain begins to explore ideas, and in this way, some cool things can arise, just like the Euler and the Königsberg bridges problem discussed in the paper, furthermore, we can think that Euler or Gauss did not have anything more exciting to do than to play with mathematics, in comparison, today, most scientists have lots of more exciting things to do than sitting all day long thinking about maths.

I finish this reading report with an interesting topic of discussion and a personal opinion:

¿Is our lifestyle stopping us from developing more complex cognitive abilities? Hopefully the fact that nowadays scientists are not as fruitful as before is because making a breakthrough nowadays is more difficult, not because our intelligence has stagnated due to our easy lives where focus is pretty scarce. It would be very sad not becoming the greatest civilisation we can potentially become by fulfilling only our most primary instincts, but, well, it is our nature too...