Axiomatic issues of unconventional computation

Computation can be defined as unconventional based on:
1. Novel hardware, (e.g., quantum systems)
2. Novel algorithms, (e.g., super-recursive algorithms)
3. Novel organization, (e.g., evolutionary computation or self-optimizing computation).

We discuss unconventional computation based on novel algorithmic approaches and address related philosophical and methodological problems, making a distinction between three classes of algorithms: recursive, sub-recursive, and super-recursive algorithms.

We first describe how the algorithmic universe developed and analyze why it has become closed in the conventional approach to computation.

Then we explain how the new models of algorithms changed the algorithmic universe, making it open and allowing higher flexibility and increased creativity.

As Gödel undecidability theorems imply, the closed algorithmic universe restricts essential forms of human cognition, while the open algorithmic universe eliminates such restrictions.

We address the following topics:

• The closed universe of Turing machines and other recursive algorithms
• The open world of super-recursive algorithms
• Absolute prohibition in the closed universe and unlimited opportunities in the open world
• The open world and the internet

Conclusions

This paper shows how the universe (world) of algorithms became open with the discovery of super-recursive algorithms, providing more tools for human cognition and artificial intelligence.

We consider some consequences of the open algorithmic world environment for human cognition in general and mathematical cognition in particular.

It is known that not all quantum mechanical events are Turing-computable. It would be interesting to find a class of super-recursive algorithms that compute all such events or to prove that such a class does not exist.

Paper can be found under: http://www.idt.mdh.se/personal/gdc