A COMPUTATIONAL MODEL

DEHELEAN CATALIN

Keywords: *Computational Model; Exact Sciences; Humanities; Computational Linguistics.*

Computational Models

In order to fully grasp the importance of viewing Computational Linguistics as a computational model, let us elaborate on this topic.

Computational Science (which is linked but not identical to Computer Science) deals with Computational Modelling which in turn is used to produce Computational Models (see Figure 1).

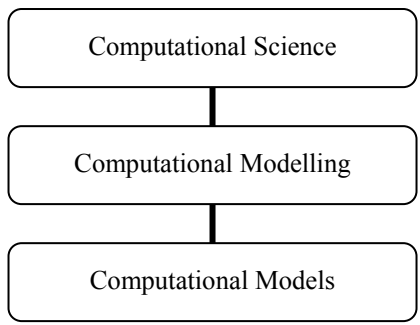


Figure 1: A Graphic Representation of the Lineage of Computational Models

A Computational Model is a logical description of a system. This process helps the development of the system without its assimilation into Computational Science.

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The idea of creating computational models for various systems emerged at the dawn of computation devices, as a possible application. However, due to the initial limitations in the resources of computation devices, as well as due to the inherent limitations of systems themselves, it took the entire second half of the twentieth century to develop working computational models. But it was exactly this large time span which enabled the development of a large array of Computational Models.

Types of Computational Models

Currently, there are Computational Models for both Exact Sciences and Humanities. (see Figure 2)

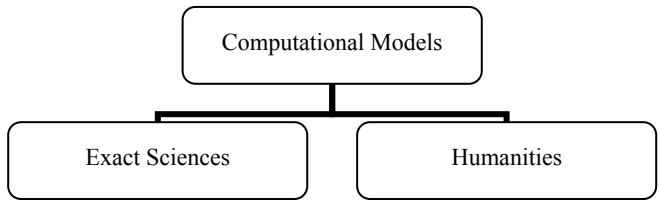


Figure 2: A Graphic Representation of the Spectrum of Computational Models

Computational Models for Exact Sciences

While it is not the intent of this article to provide a complete and thorough list of computational models for exact sciences it imperative to mention that the spectrum of Computational Models for Exact Sciences includes Computational Biology, Computational Chemistry, Computational Finance, Computational Mathematics, Computational Medicine, and Computational Physics. (see Figure 3)

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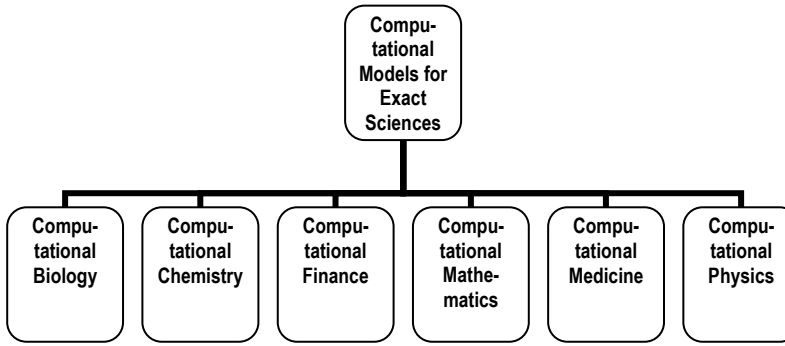


Figure 3: A Graphic Representation of the Spectrum of Computational Models for Exact Sciences

In order to understand the complexity of Computational Models for Exact Sciences, a brief survey may prove useful.

Computational Biology is logical model used to describe biological issues. Plant and animal Anatomy, Physiology, Diseases, and so on may be better understood if modelled.

Computational Chemistry is a logical model used to describe chemical issues. It is used to describe chemical structures, to simulate experiments, and solve problems. It's highly useful in the pharmaceutical research and development.

Computational Finance is a logical model used to describe financial issues. It may simulate the whole chain of decision-making and virtually assess risks.

Computational Mathematics is a logical model used to describe mathematical issues. T simulates and studies algorithms, numerical and symbolic methods. It can solve problems with almost 100% accuracy.

Computational Medicine is a logical model used to describe medicinal issues. It simulates and studies the development of human diseases. It is useful in the advancement of diagnosis. Computational Physics is a logical model used to describe physical issues. This model is positioned between theoretical and experimental physics. It may be used to solve quantitative problems.

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Computational Models for Humanities

The spectrum of Computational Models for Humanities includes Computational Linguistics (which is linked to Computational Dialectology) and Computational Semiotics. (see Figure 4)

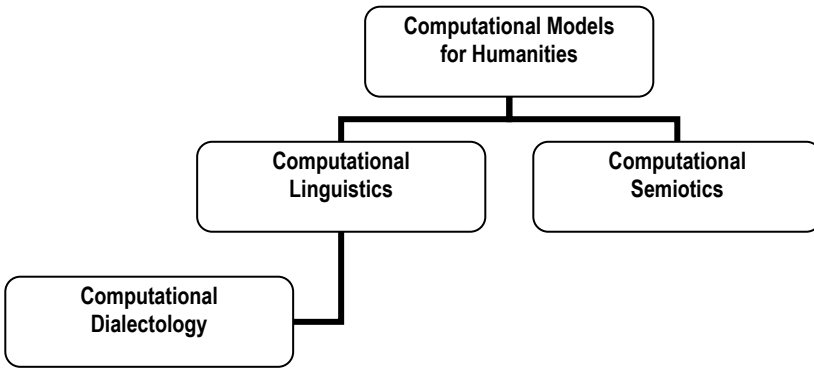


Figure 4: A Graphic Representation of the Spectrum of Computational Models for Humanities

Computational Linguistics is a logical model used to describe linguistic issues. It simulates and studies language phenomena on all levels. It is also the stepping stone for Computational Dialectology. It is a logical model used to describe dialectal issues. It simulates and studies dialectal features within a historical language at a certain point in time.

Computational Semiotics is a logical model used to describe semiotic issues. It simulates and studies signs within the communication process.

A Computational Model for Linguistics

Computational Linguistics is a divided in Computational Phonology, Computational Lexicology (which is linked to Computational Lexicography), Computational Morphology, Computational Syntax, and Computational Semantics. (see Figure 5)

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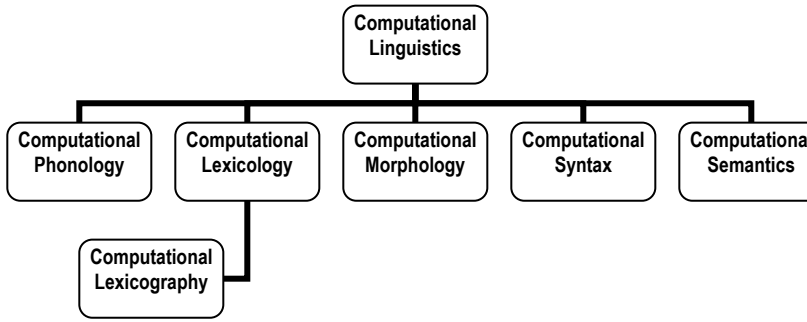


Figure 5: A Graphic Representation of the Spectrum of Computational Linguistics

Let us now take some time to skim the surface of the spectrum of Computational Linguistics.

Computational Phonology is a logical model used to describe phonological issues. It simulates and studies spoken language segments. It is very useful in machine dialogue.

Computational Lexicology is a logical model used to describe lexicological issues. It simulates and studies corpora and the criteria which they are built on. It enables the existence of Computational Lexicography which is a logical model used to describe lexicographical issues. It creates and studies electronic dictionaries.

Computational Morphology is a logical model used to describe morphologic issues. It simulates and studies the whole spectrum of morphemes and the manner they combine. Its usefulness is proven by grammar check software.

Computational Syntax is a logical model used to describe syntactic issues. It simulates and studies the ways words combine into phrases and phrases into sentences. The most obvious use is in software such as word and sentence order check and pattern recognition.

Computational Semantics is a logical model used to describe semantic issues. It simulates and studies patterns of understanding in phrases, sentences, paragraphs and texts. It is highly useful in machine translation.

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Conclusions

In the end, this article has proven its usefulness twice.

Firstly, it has shown that Computational Linguistics, while unique in itself, may be considered to be a part of a broader concept produced by a movement which actively seeks to revise the entire spectrum of human knowledge by computational means, which was its stated objective.

Secondly, since it ends with a representation of the components of the field of Computational Linguistics, it sets the stage for future discussions on the theoretical background of this field.

Bibliography

Barr, V., Stephenson, C. (May 2011). Defining Computational Thinking for K-12. *CSTA Voice* **7** (2): 3–4.

Mitkov, R. (2003). *The Oxford Handbook of Computational Linguistics*. Oxford : Oxford University Press.

Taylor, R. G. (1998). *Models of Computation and Formal Languages.* New York: Oxford University Press.

Yang X. S. (2008). *Introduction to Computational Mathematics*. New York: World Scientific Publishing.

UN MODEL COMPUTAŢIONAL

(Rezumat)

Acest articol se bazează pe ideea că simpla definire şi prezentare a evoluţiei Lingvisticii Computaţionale nu sunt suficiente pentru a asigura o bună înţelegere a acestei ramuri a Lingvisticii. Lingvistica Computaţională trebuie văzută ca un model computaţional.

Modelele computaţionale sunt în esenţă modele logice. Ele sunt rezultatul modelării computaţionale care nu le modifică esenţa.

Astăzi există modele computaţionale atât pentru ştiinţele exacte, cât şi pentru disciplinele umaniste. Dintre modelele aplicate ştiinţelor exacte putem menţiona Fizica Computaţională, Matematica Computaţională, Biologia Computaţională, Medicina Computaţională etc. În ceea ce priveşte ramura umanistă putem identifica Lingvistica Computaţională care ne introduce în Dialectologia Computaţională, precum şi Semiotica Computaţională.

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La rândul său Lingvistica Computaţională este compusă din Fonologia Computaţională, Lexicologia Computaţională, Morfologia Computaţională, Sintaxa Computaţională şi Semantica Computaţională.

După cum putem observa din această scurtă trecere in revistă, Lingvistica Computaţională este realizare a unei încercări de a remodela întregul spectru al gândirii umane.

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