



Unidade Curricular

“Teoria Algorítmica da Informação”

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Outline

Guiding questions

Computability theory

Finite-state machines

Turing machines

Why study computability theory in data compression?

Understand the Limits of Compression

- Some sequences cannot be compressed - computability helps us define what's possible and what's not.

Foundation of Algorithmic Information Theory

- Concepts like Kolmogorov complexity rely on the notion of a universal Turing machine to define the minimal description of data.

Identify Incompressible Data

- Computability theory formalizes the idea that most strings are incompressible, and helps us recognize them.

Distinguish Between Lossy and Lossless Limits

- It helps us understand when perfect reconstruction is fundamentally impossible.

Modeling Compressors as Algorithms

- Every data compressor can be seen as a computable function — understanding Turing machines allows us to analyze their behavior formally.



Guiding questions

What is a computable problem?

What are the components of a finite state machine (FSM)?

What is a finite automaton? What can it recognize, and what can't it?

What is a Turing machine and why is it more powerful than a finite automaton?

Are there problems that no Turing machine can solve?

What is the relationship between Turing machines and the concepts of compression and information?

References

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- Lecture Notes, Armando Pinho, 2023 (elearning)
- <https://brilliant.org/wiki/turing-machines/>

