Algoridam
Théorie algorithmique de nouveaux modèles de données

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Overview

The traditional computation model:

input $\rightarrow$ algorithm $\rightarrow$ output

no longer fits most applications

New challenges: massive, scattered, disorganized, erroneous, constantly evolving data input.

Theory has fallen behind practice

Need theoretical foundations for the types of algorithms that have emerged

our approach: axiomatic perspective, theoretical models, rigorous theorems

Focus on three settings

A Massive data (data that is too large to fit into memory)
B Noisy data (e.g. the data cannot be reliably accessed and is hence observed with error or noise)
C Dynamic data (e.g. the data evolves constantly)

Snapshots: three examples
Workpackage A: Massive Data
Task 2: Streaming algorithms
Open problem: approximate pattern matching

find all substrings of a given longer string (text) that are close to a given set of short strings (patterns)

motivation: text analysis and bioinformatics

extensively studied for Hamming distance when there is a single pattern

goal: develop streaming algorithms for multiple patterns & other distances
Workpackage B: Noisy and Unreliable Data
Task 5: Data with intervals of uncertainty
Open problem: linear programs with uncertain constraints

input: linear program
\[
\begin{align*}
\min c \times & \text{ subject to } Ax \geq b \text{ and } x \geq 0 \\
& \text{s.t. right hand sides are uncertainty intervals}
\end{align*}
\]
output: optimal solution \(x\)

goal: query as few right hand sides as possible

models: problems where the exact resource capacities are only known after querying \(\rightarrow\) costly inventory or accounting procedures
Let $R(k)$ a Reservoir with $k$ edges

Detection Algorithm. Let $C$ the largest connected component of $R(k)$. If $|C| > 10$, then Accept else Reject.