Authorship Obfuscation
Using Heuristic Search

Master's Thesis Defence by Janek Bevendorff on 20 June 2018

Supervisors: Prof. Dr. Benno Stein, PD Dr. Andreas Jakoby

Contributions

- Unmasking for short texts
- Obfuscation against unmasking
- Obfuscation against compression models
- Authorship verification quality measure proposal
- Obfuscation safety analysis and definitions
- Side effect analysis
- JS_{Δ} as authorship metric
- Adaptive obfuscation
- Design of an admissible obfuscation heuristic
- Analysis of consistency and monotonicity properties
- Design and implementation of an efficient obfuscation framework
- Development of obfuscation operators
- Inspection of search space challenges and solutions

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SHERLOCK HOLMES
MẬT MÃ MAYA
THIÊN THẦN VÀ ÁC QUỶ
CUỐN THEO CHIỀU GIÓ
ĐỒI GIÓ HÚ
THẦN THOẠI HY LẠP
MONG TO CRIXTO
NELSON DEMILLE
Chiến tranh và hòa bình
NGUYÊN HUY
Việt Nam Phong Tục
Mark Twain
TAY SUNG
CON

Authorship

Authorship Verification

Authorship Verification

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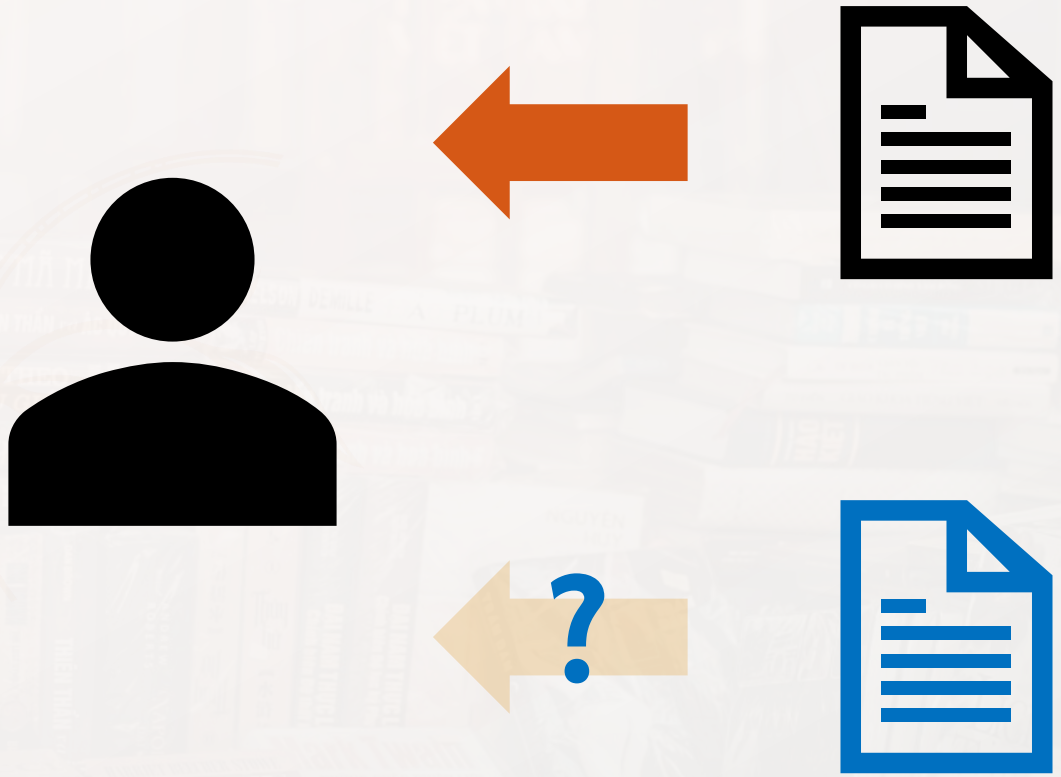

Unmasking

Koppel and Schler, Authorship verification as a one-class problem, 2004

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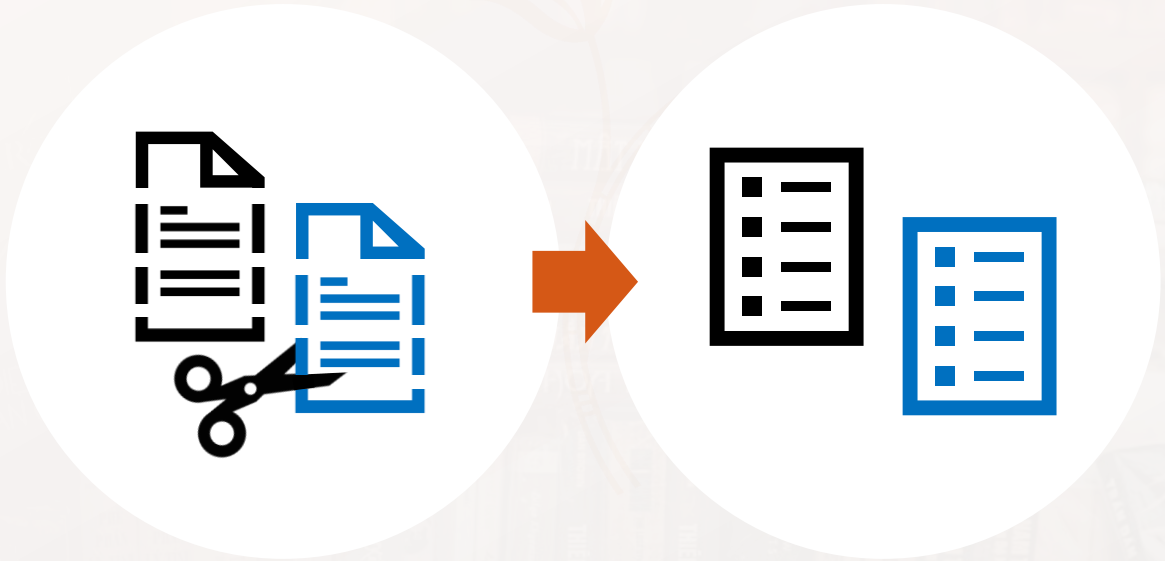

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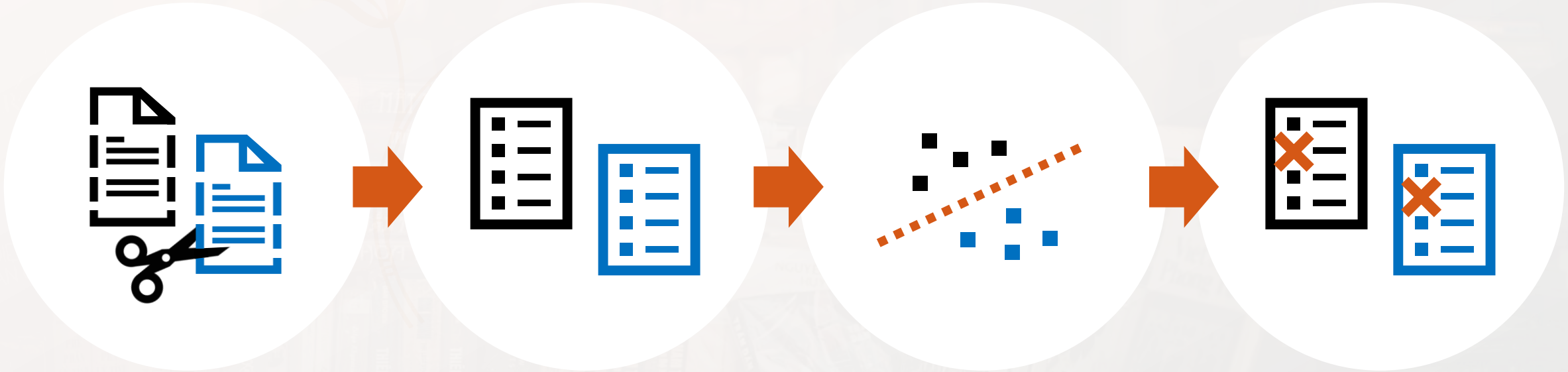

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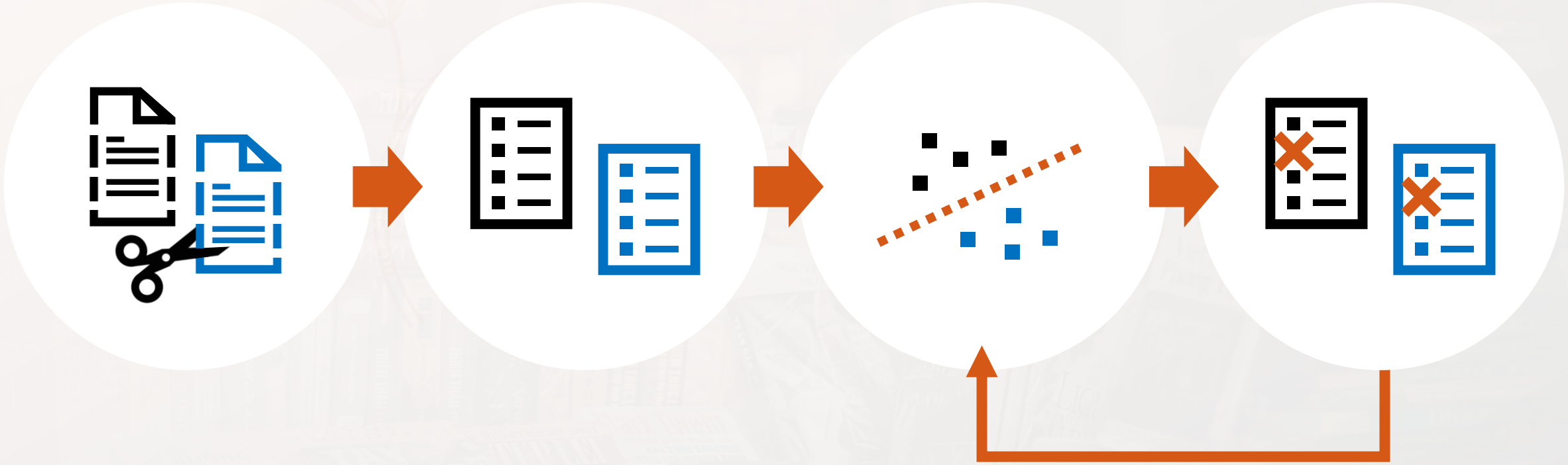

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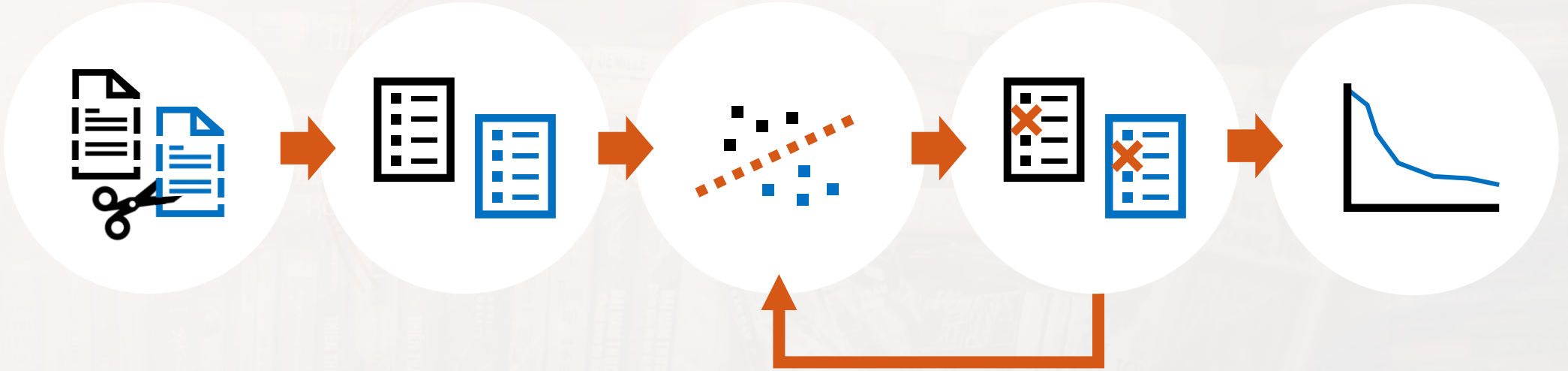
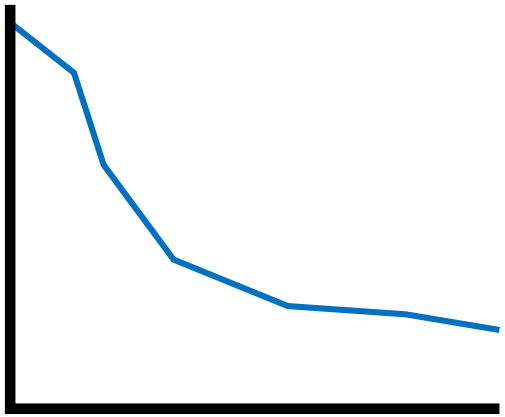


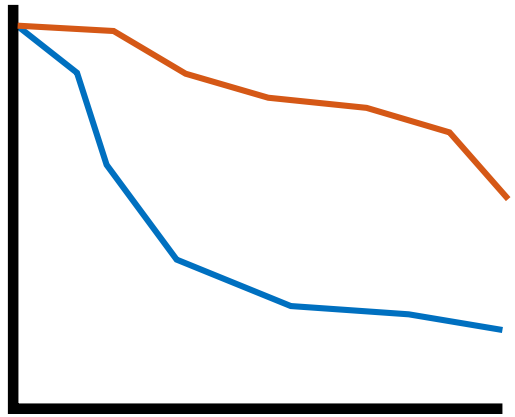
Unmasking



Same author

Unmasking

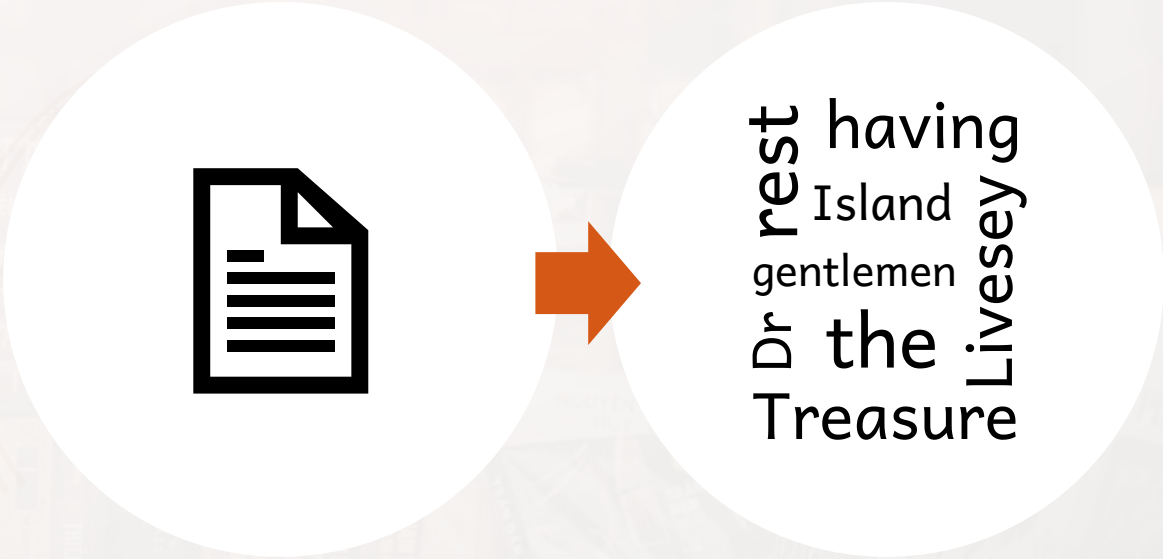
Different authors



Same author

Chunk Expansion

Chunk Expansion



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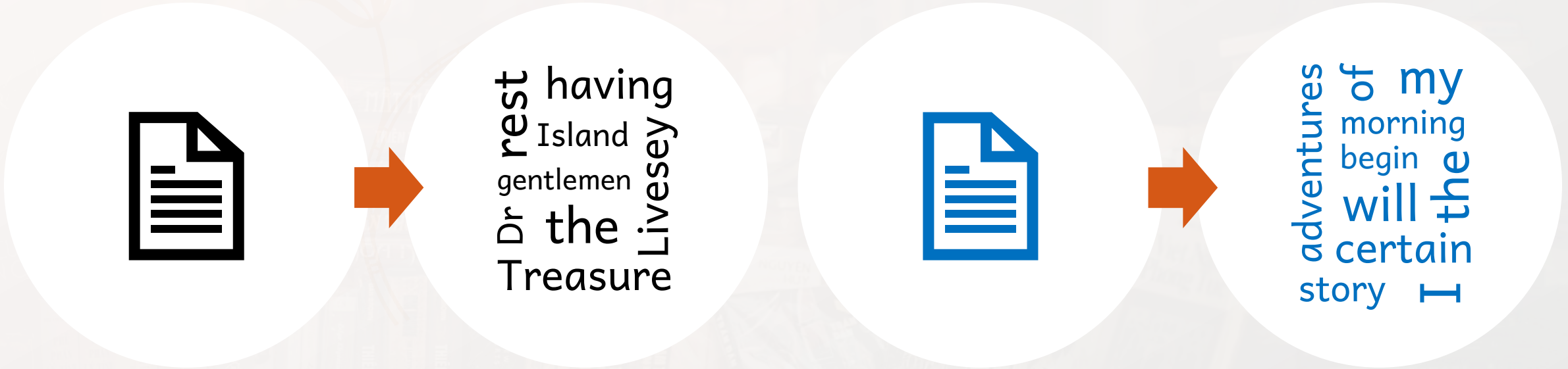
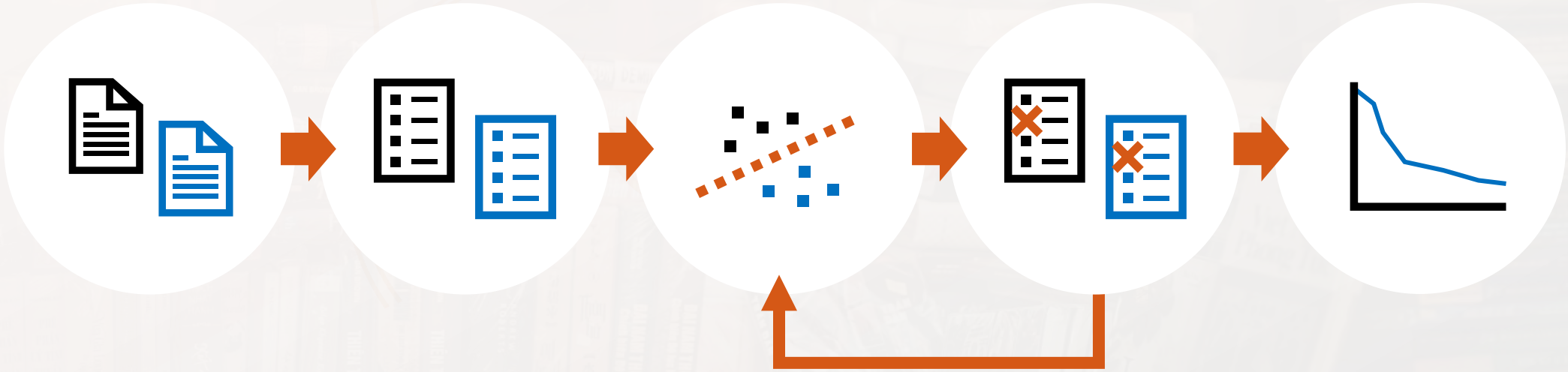
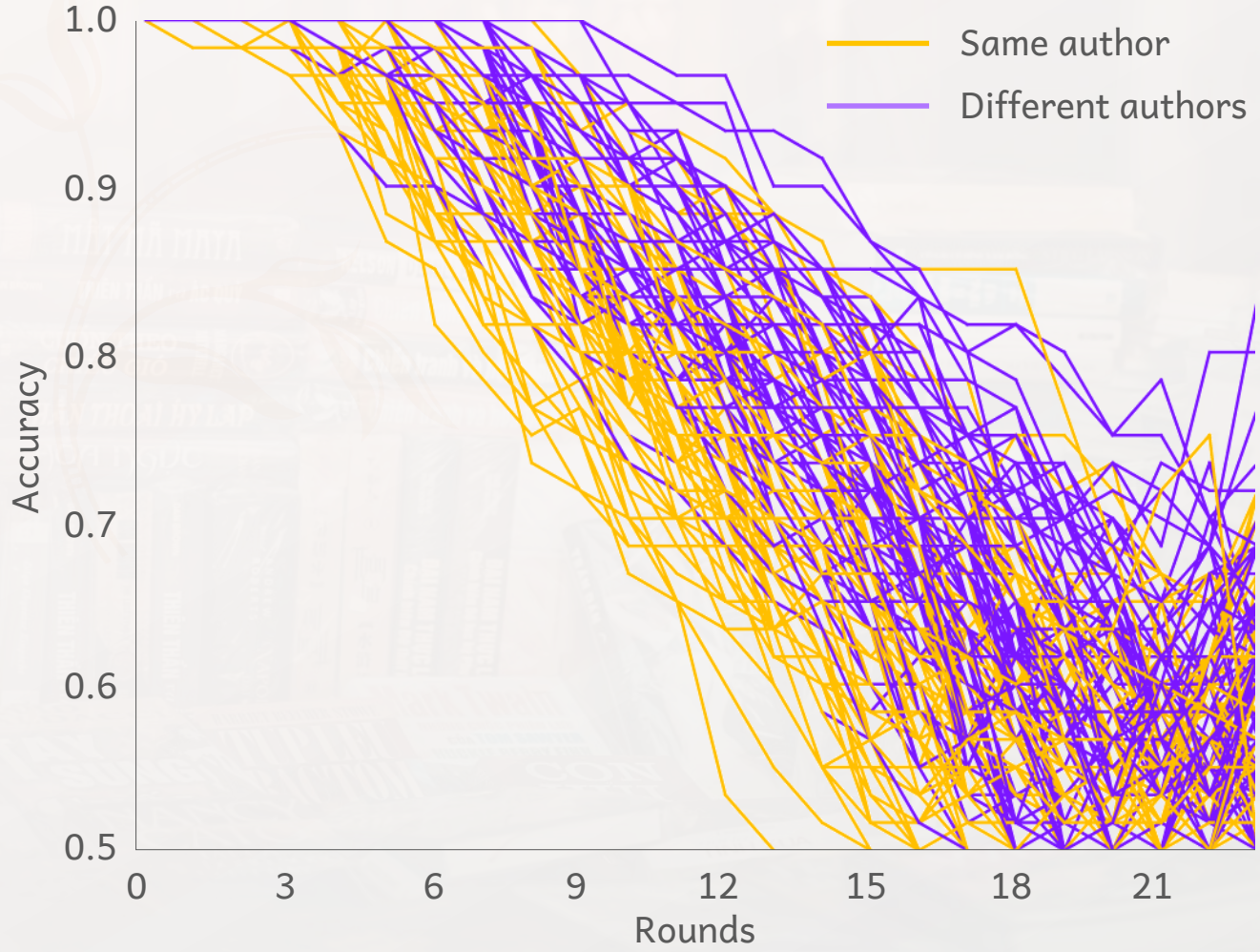


Chunk Expansion



Unmasking with Chunk Expansion



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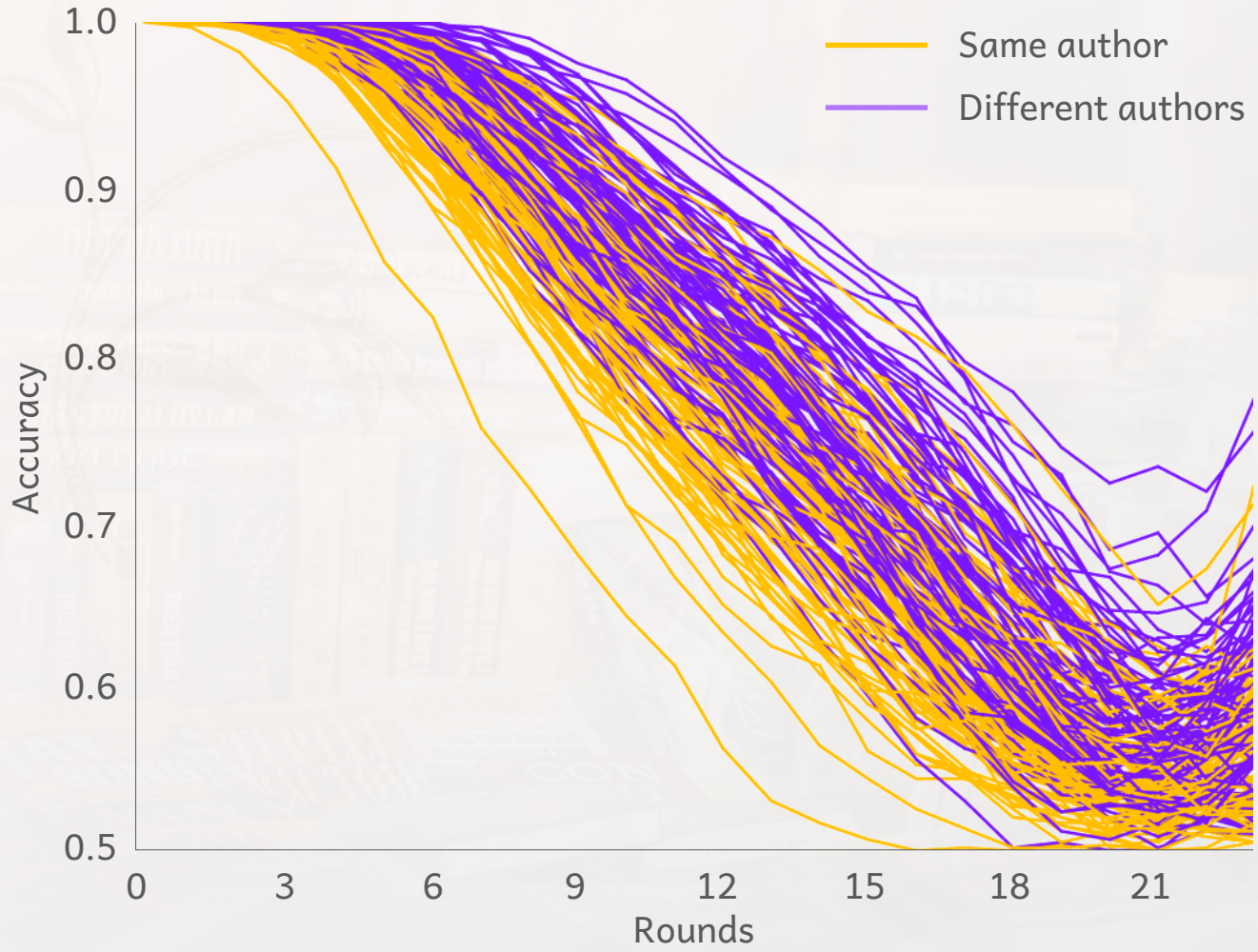

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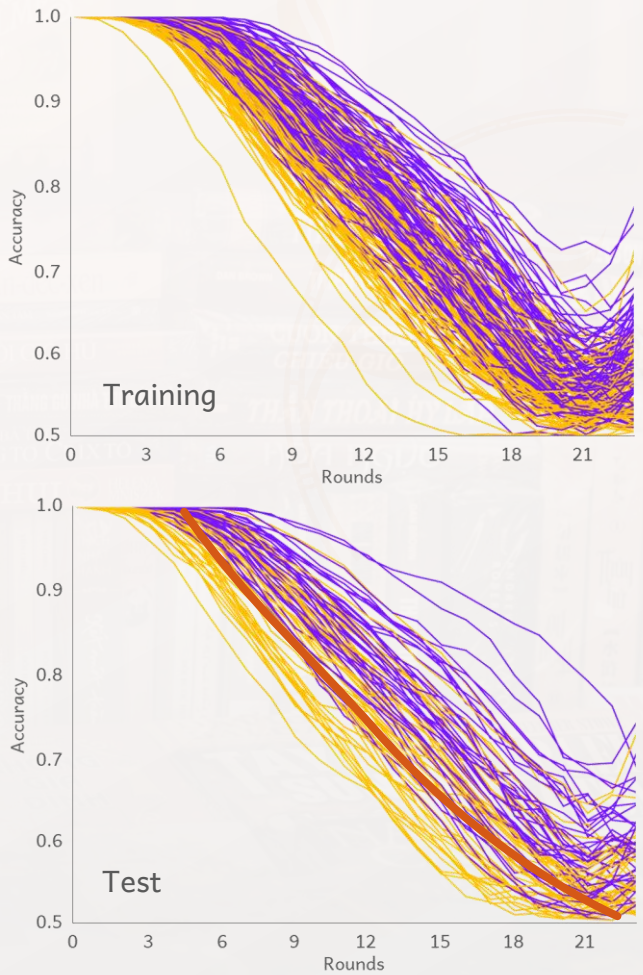

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	0.0	0.76	100.0

Obfuscation

Authorship Obfuscation

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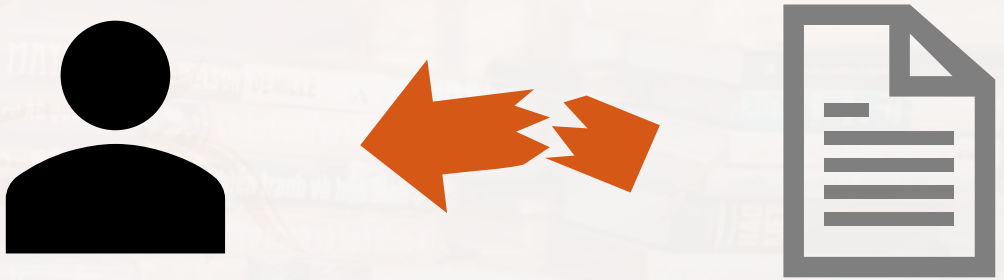
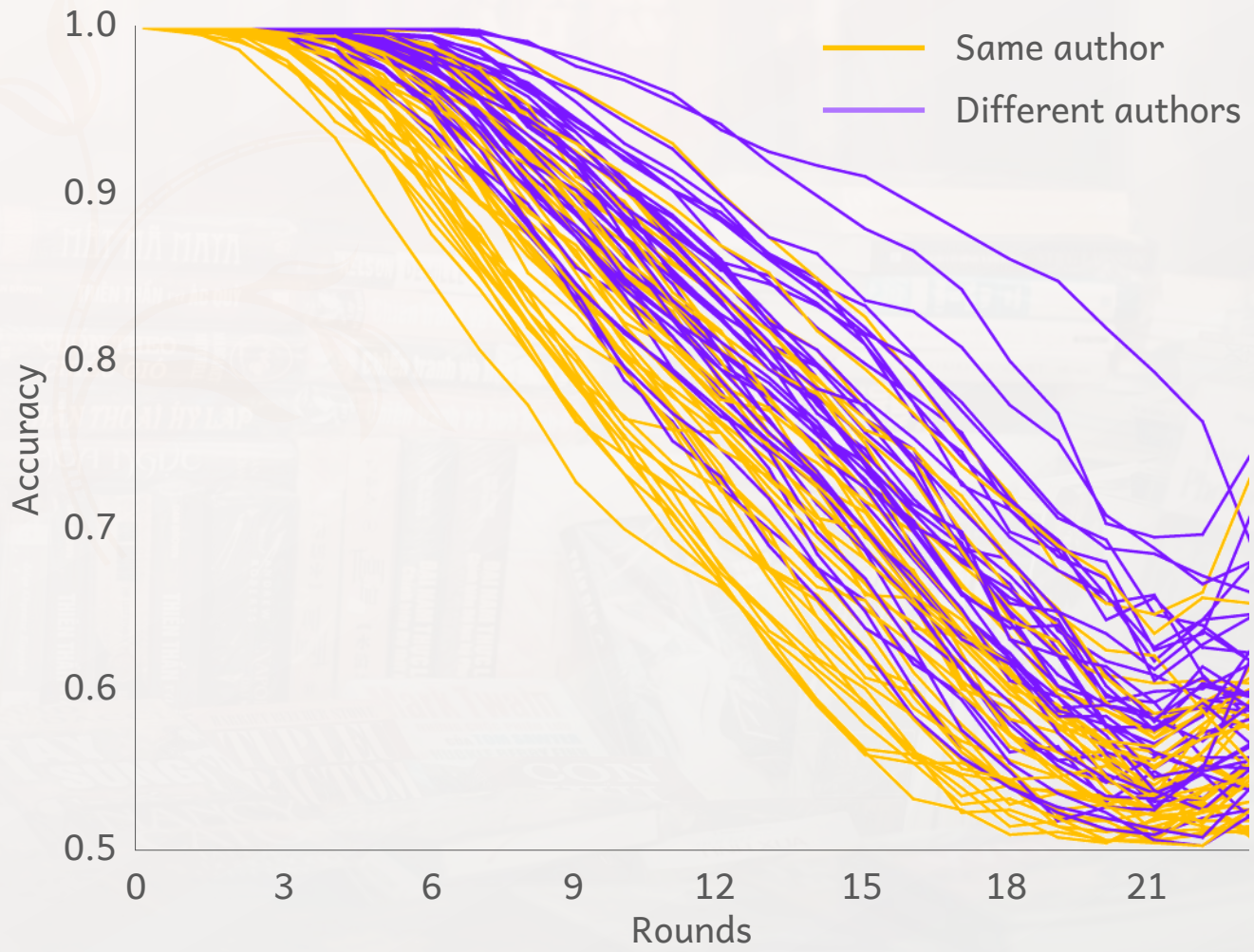


Authorship Obfuscation



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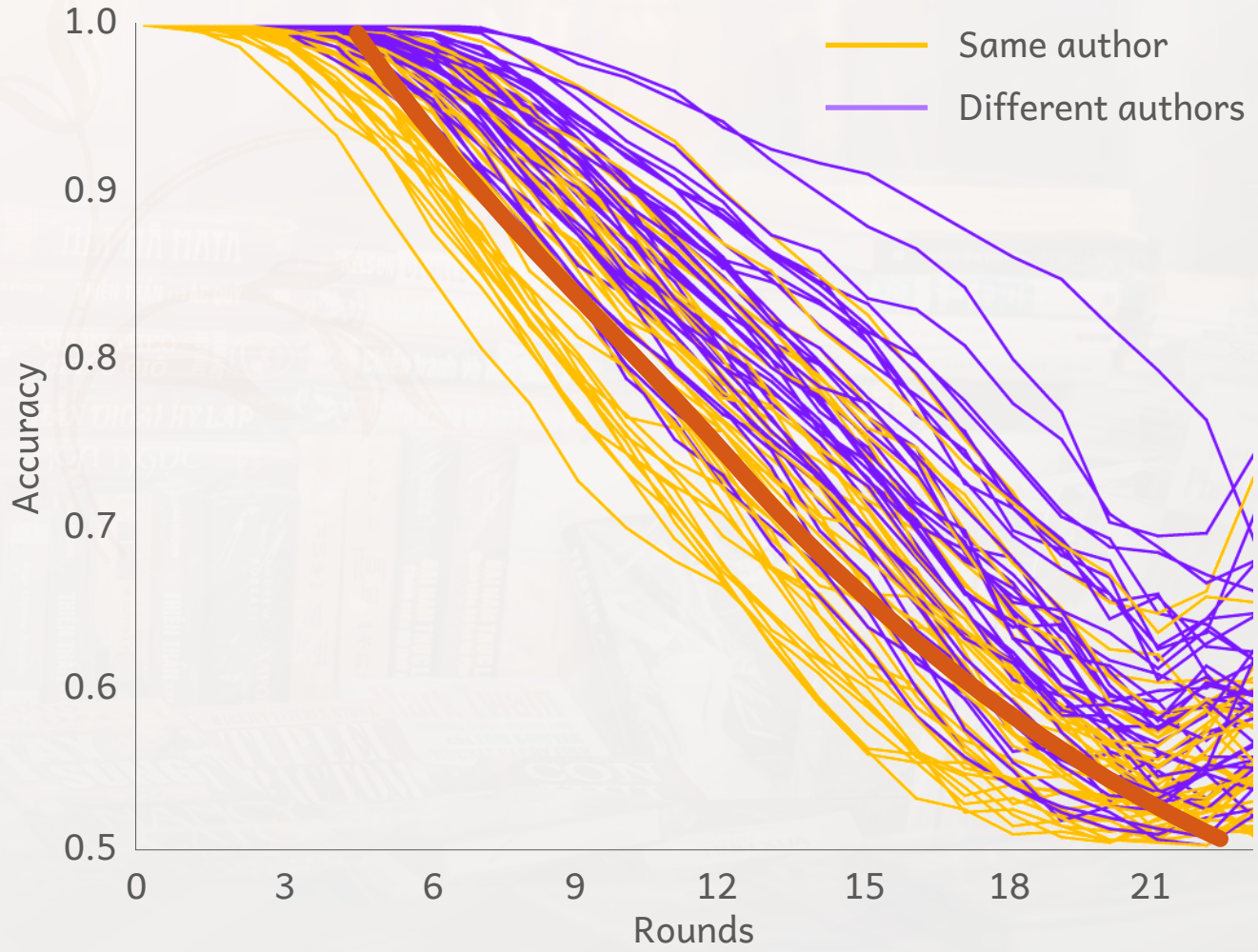
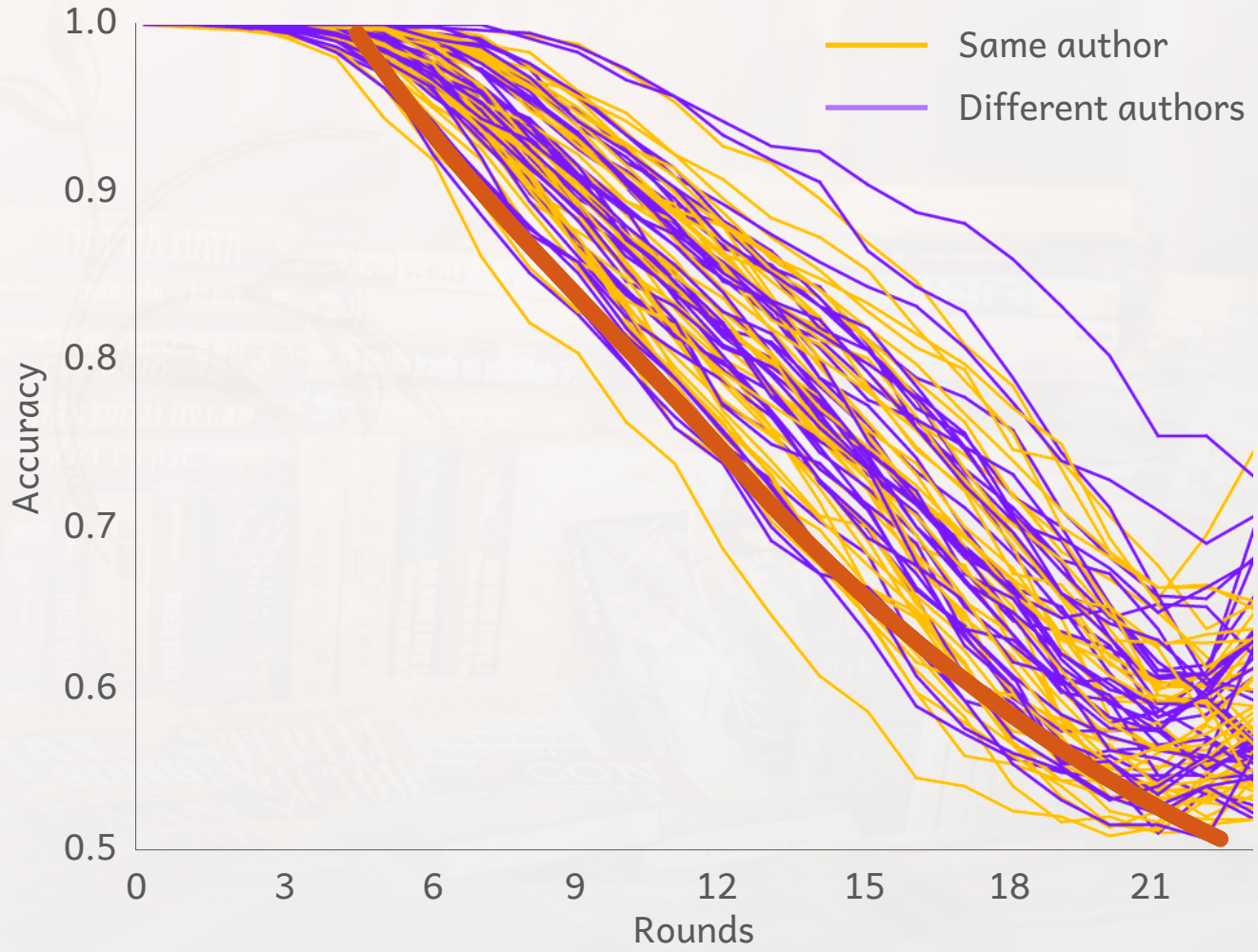


Authorship Obfuscation



Kullback-Leibler Divergence

$$\mathrm{KLD}(P\|Q) = \sum_i P[i] \log_2 \frac{P[i]}{Q[i]}$$

Jensen-Shannon Divergence

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$$\mathrm{JSD}(P\|Q) = \frac{\mathrm{KLD}(P\|M) + \mathrm{KLD}(Q\|M)}{2}$$

$$M = \frac{P + Q}{2}$$

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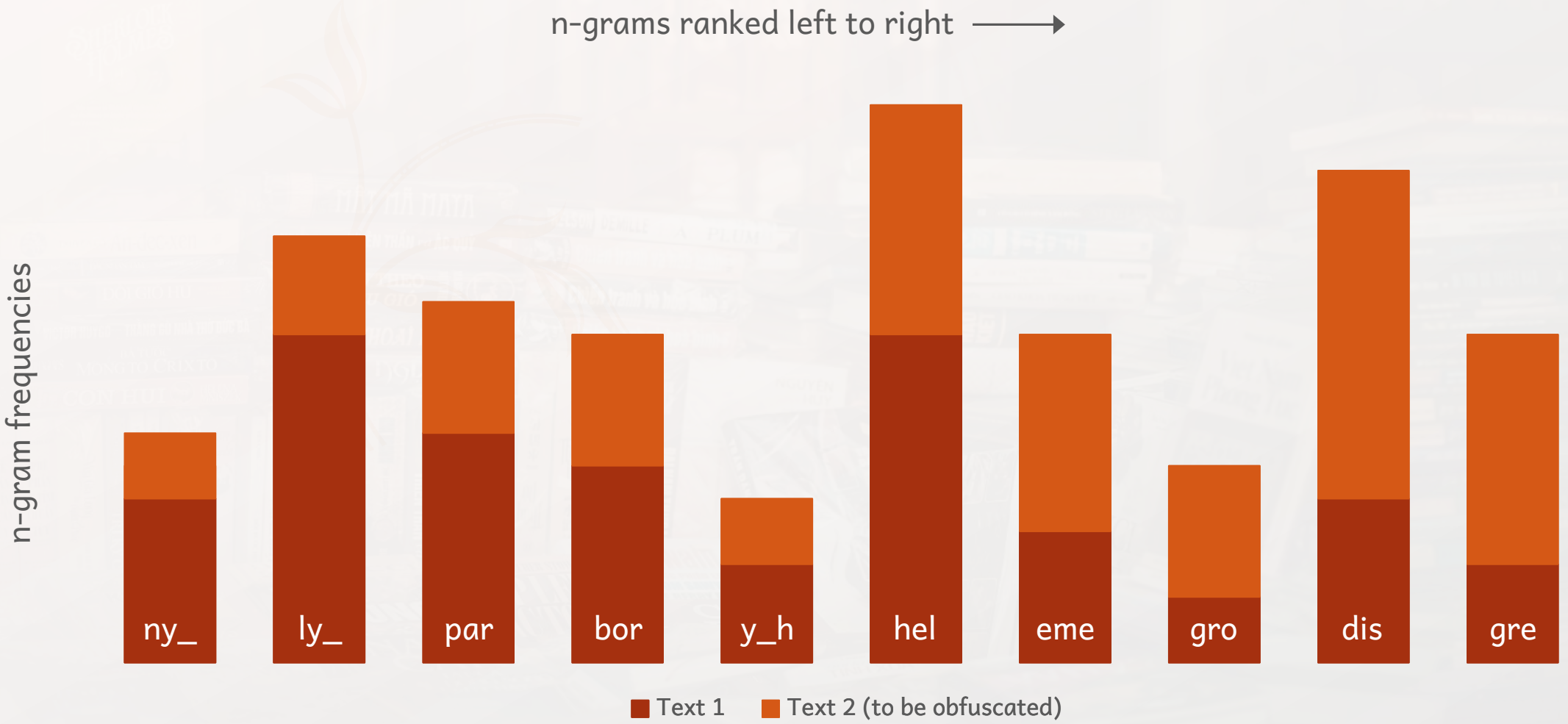

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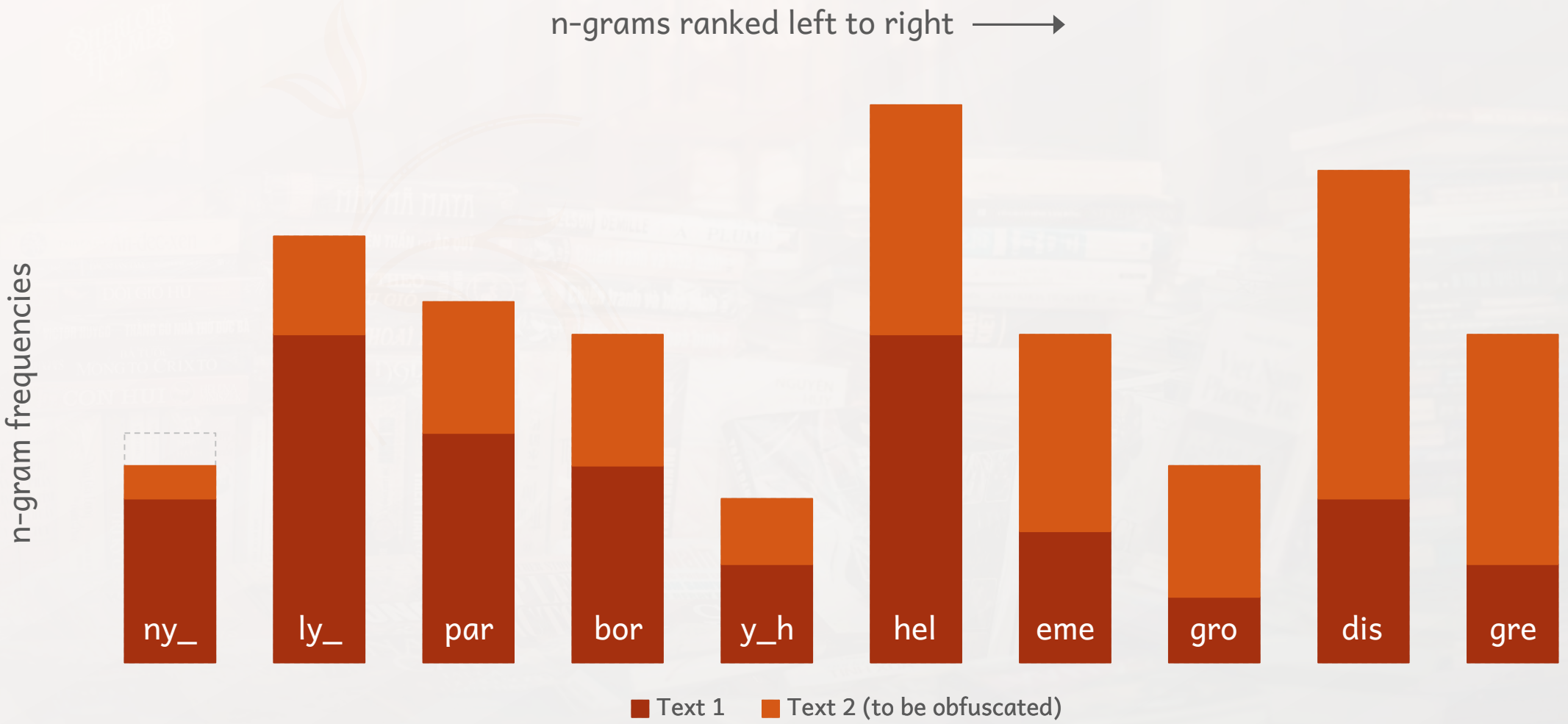

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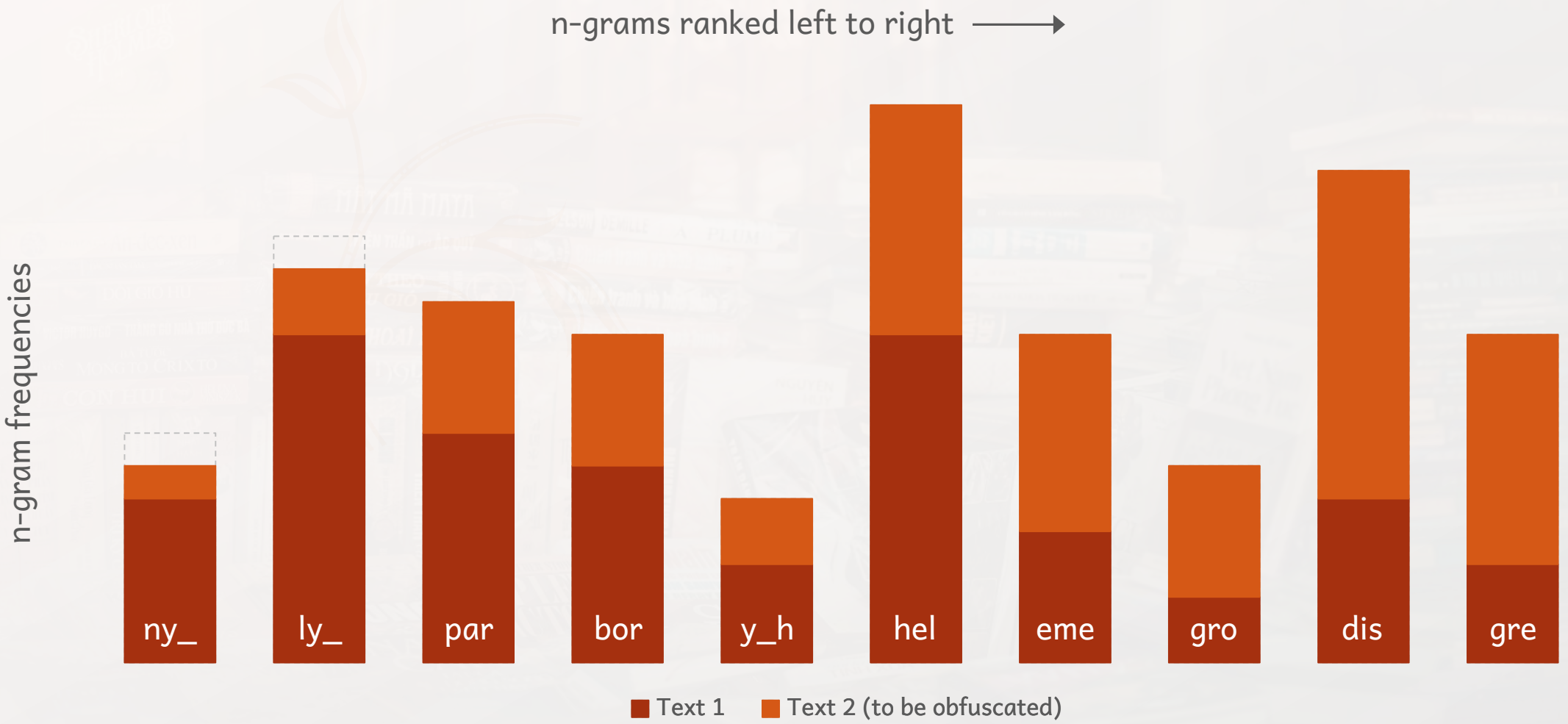

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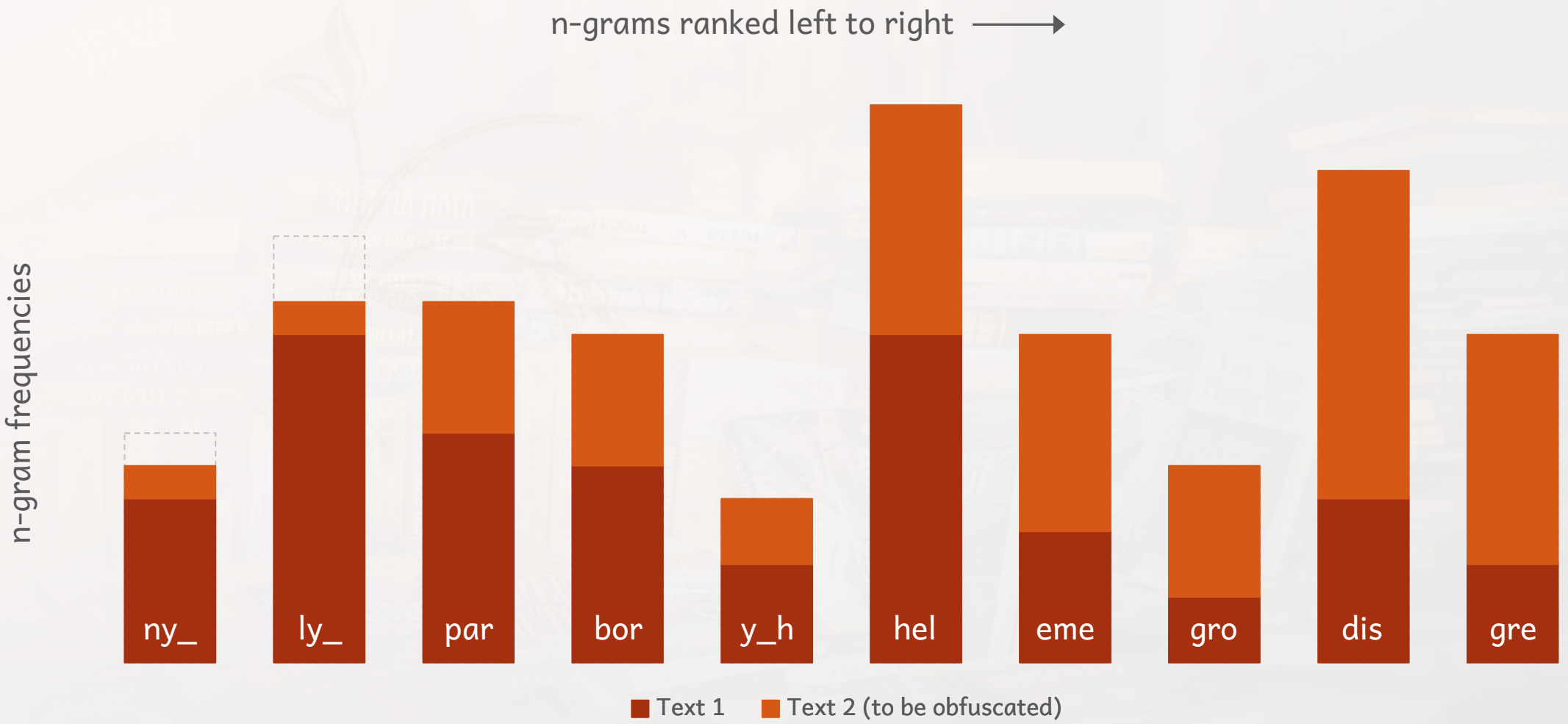

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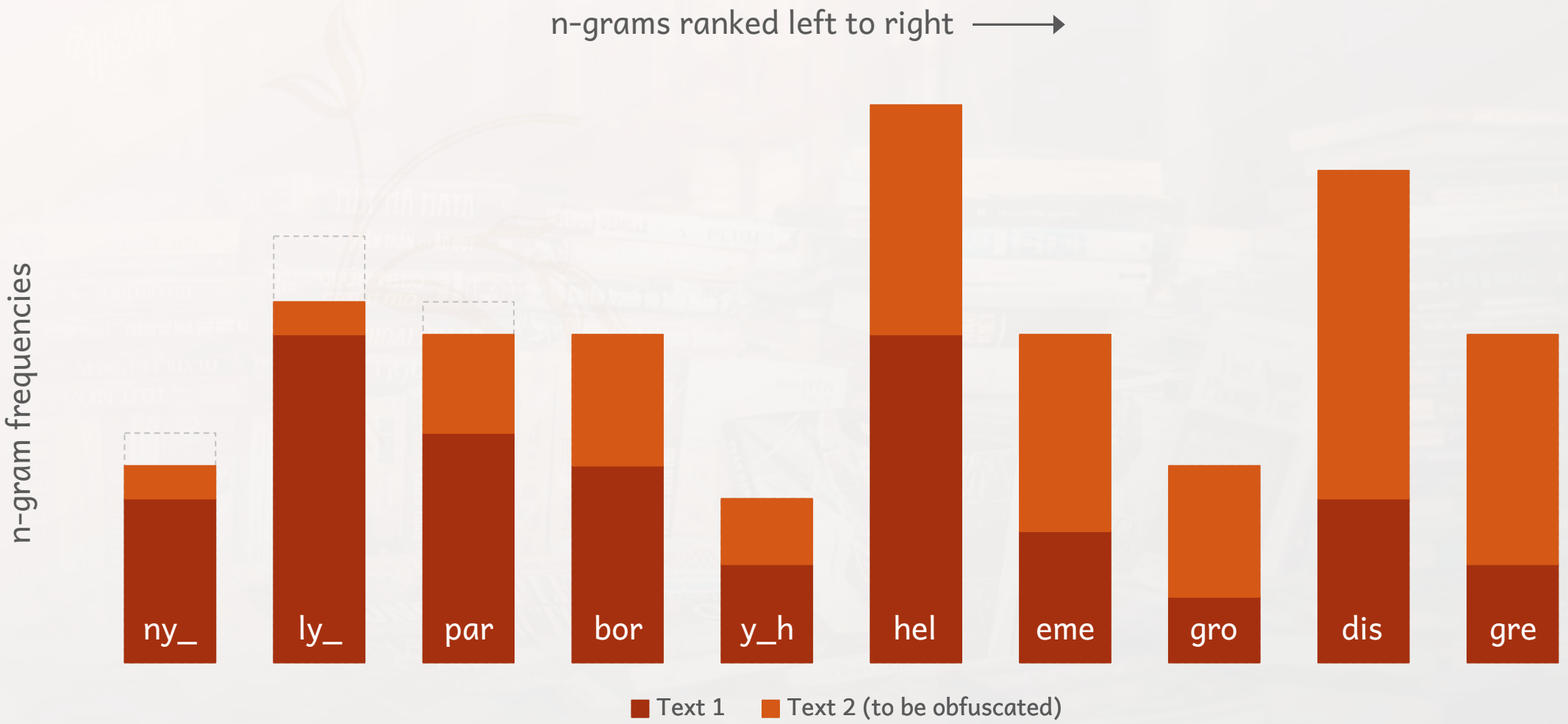

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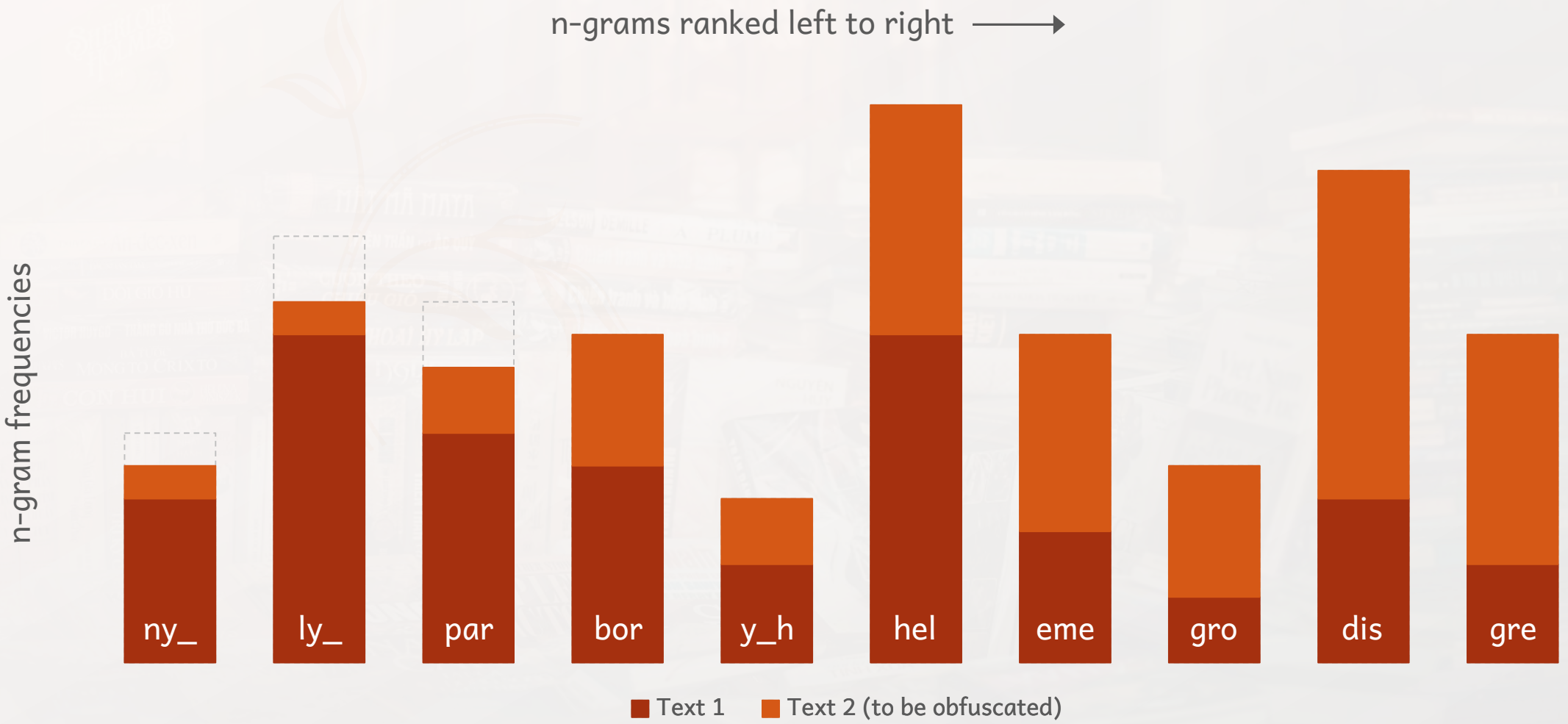

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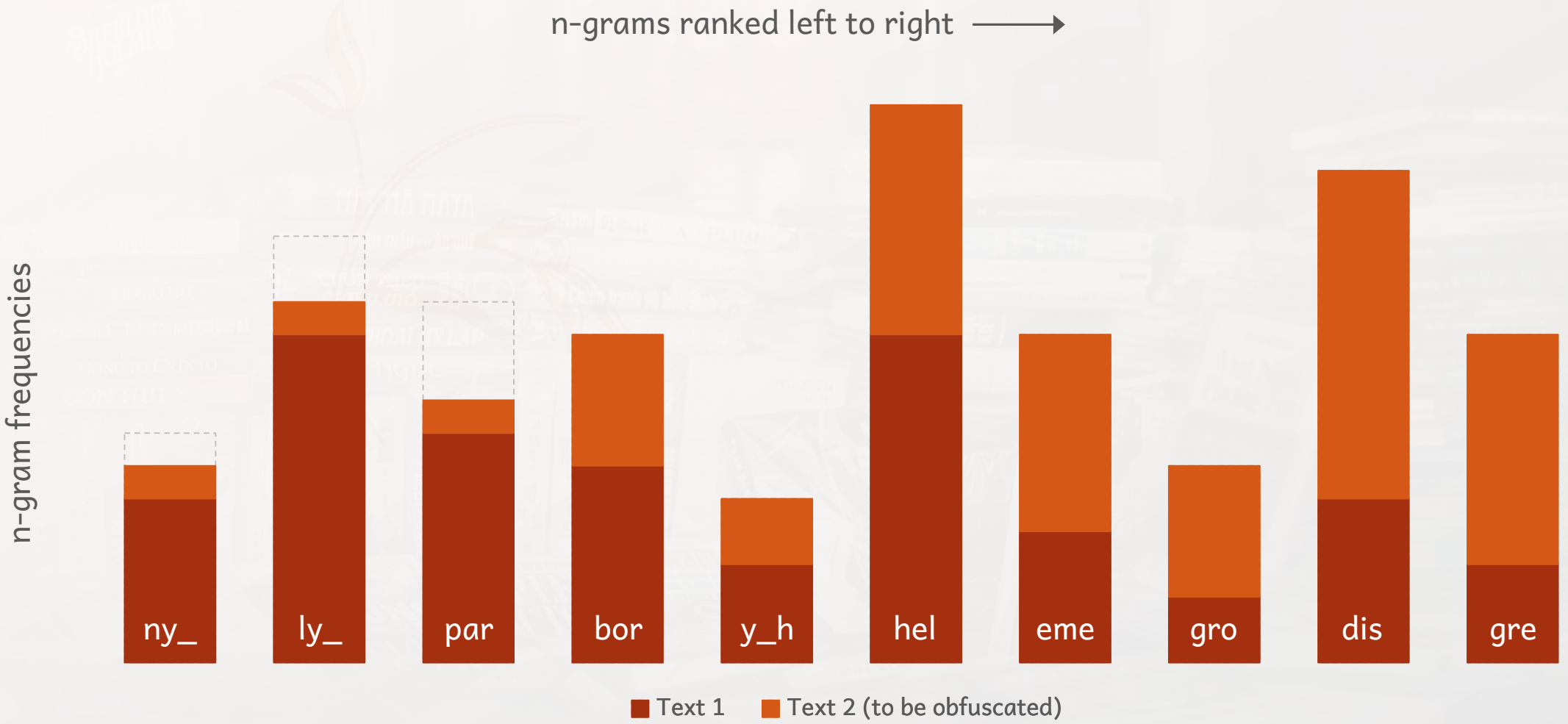
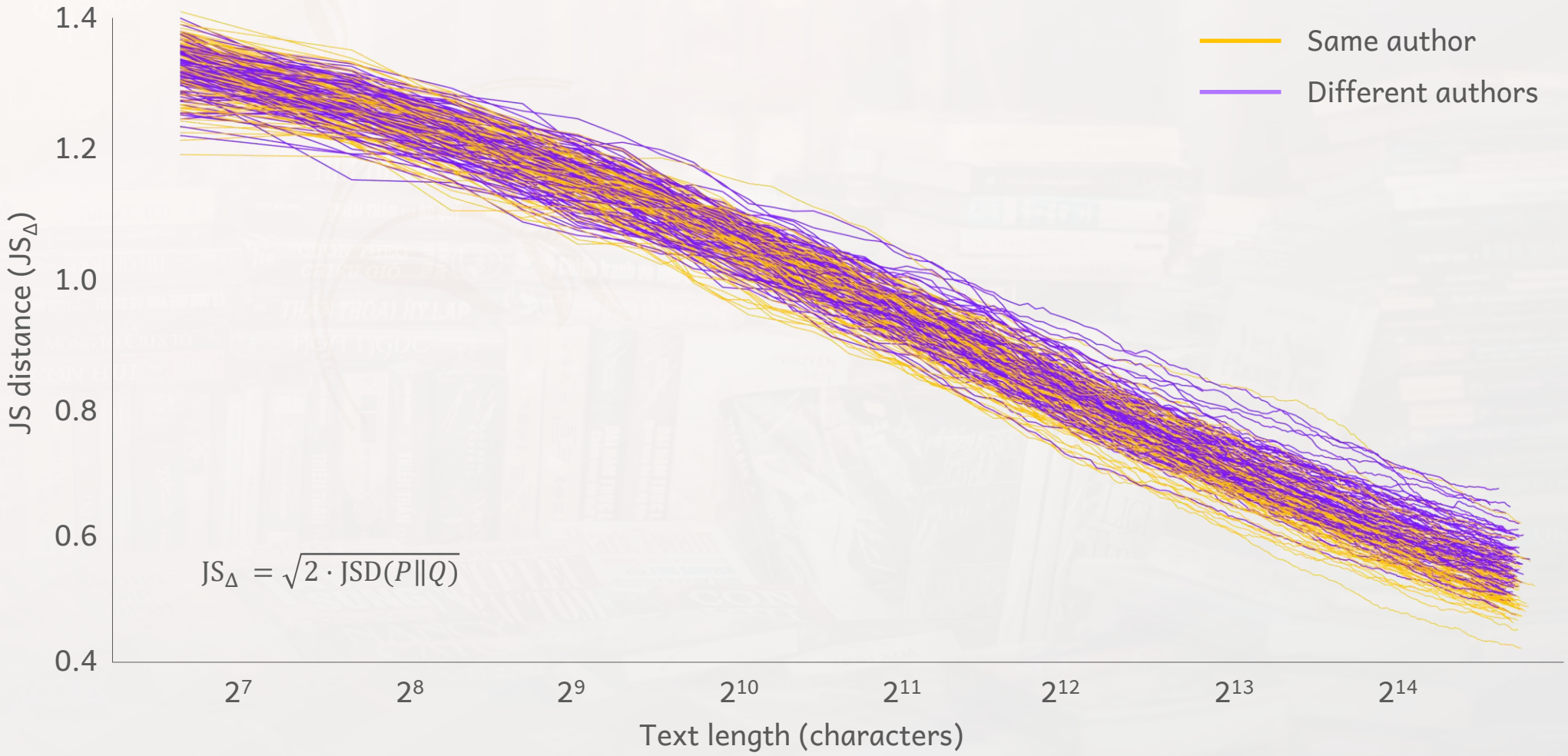


Adaptive Obfuscation



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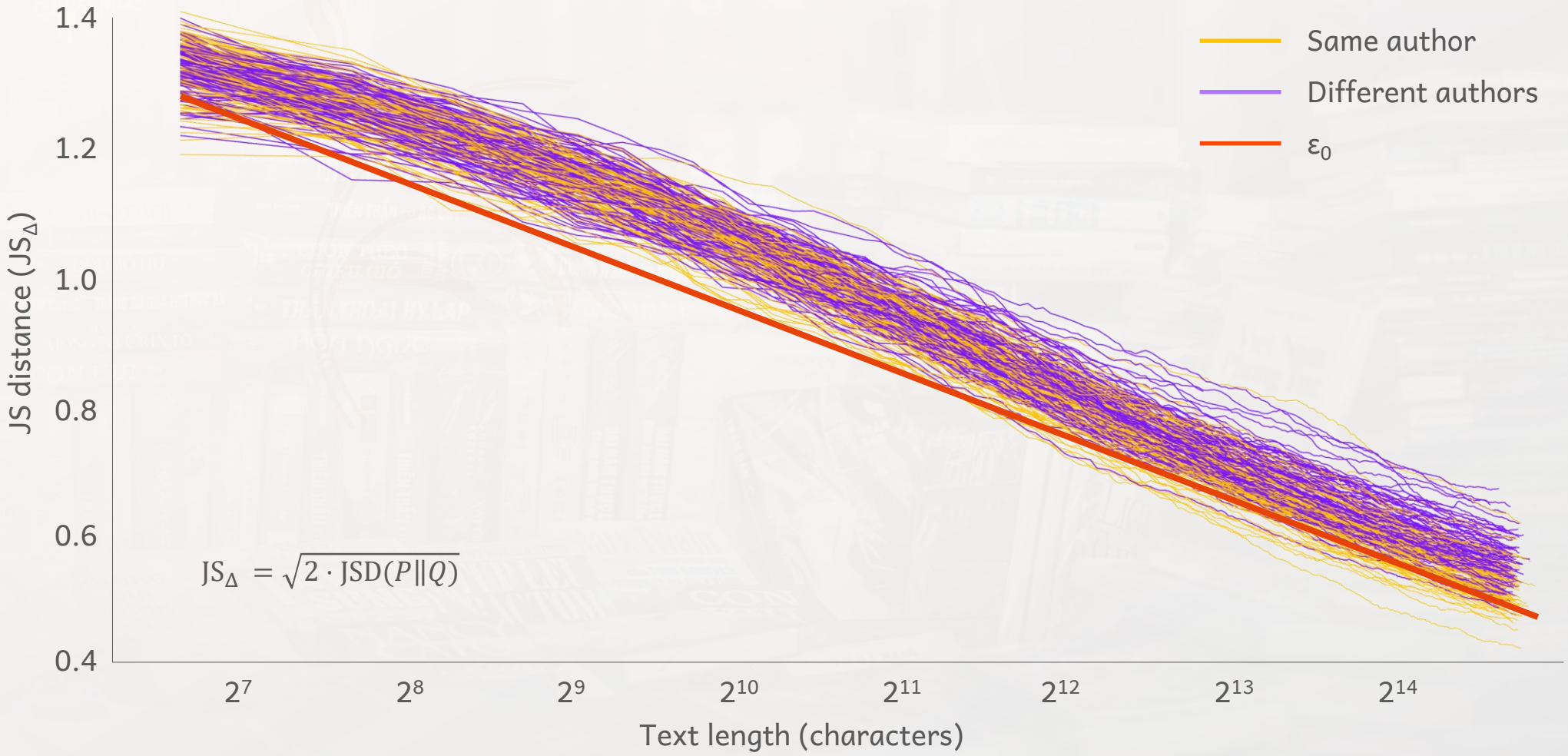

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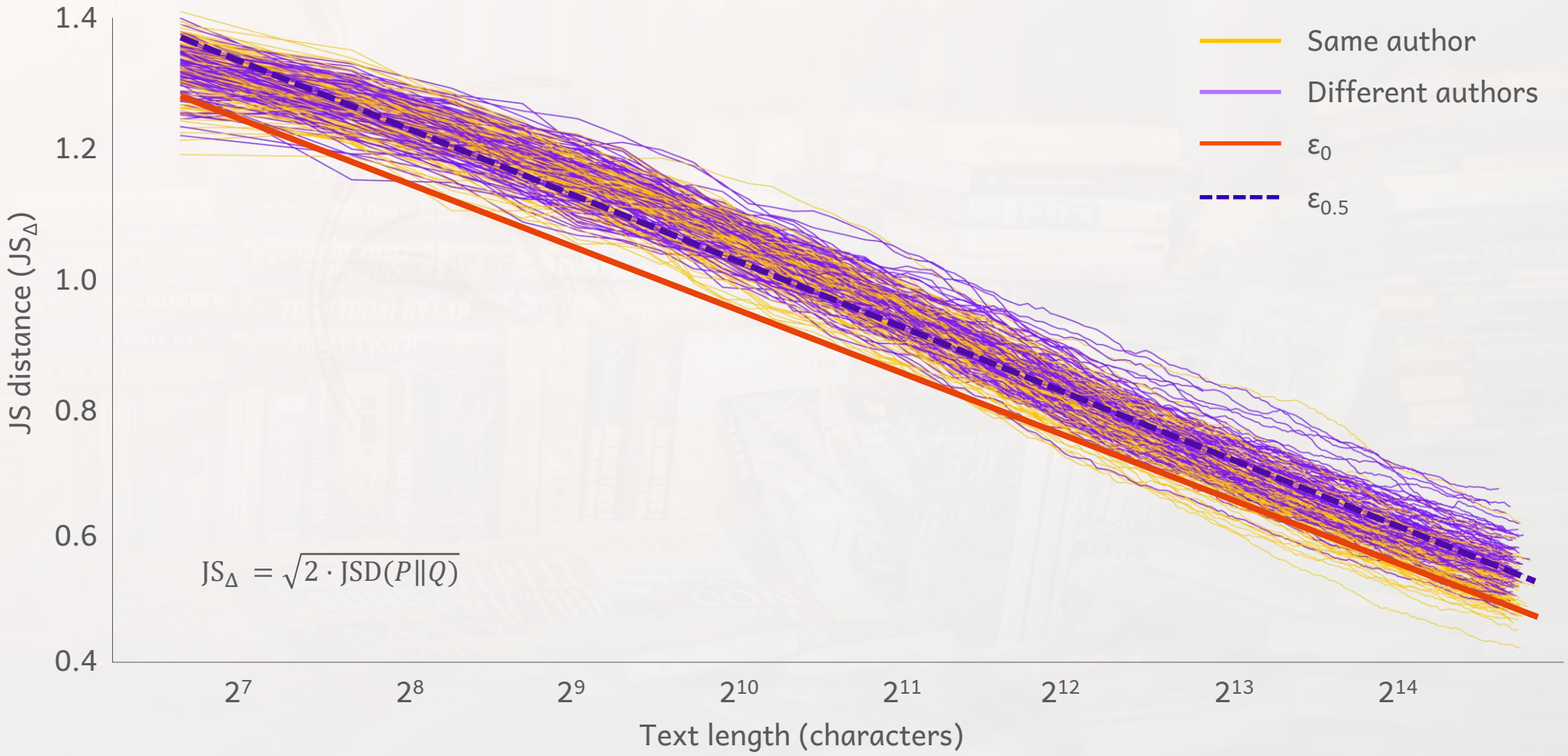

Obfuscation Results

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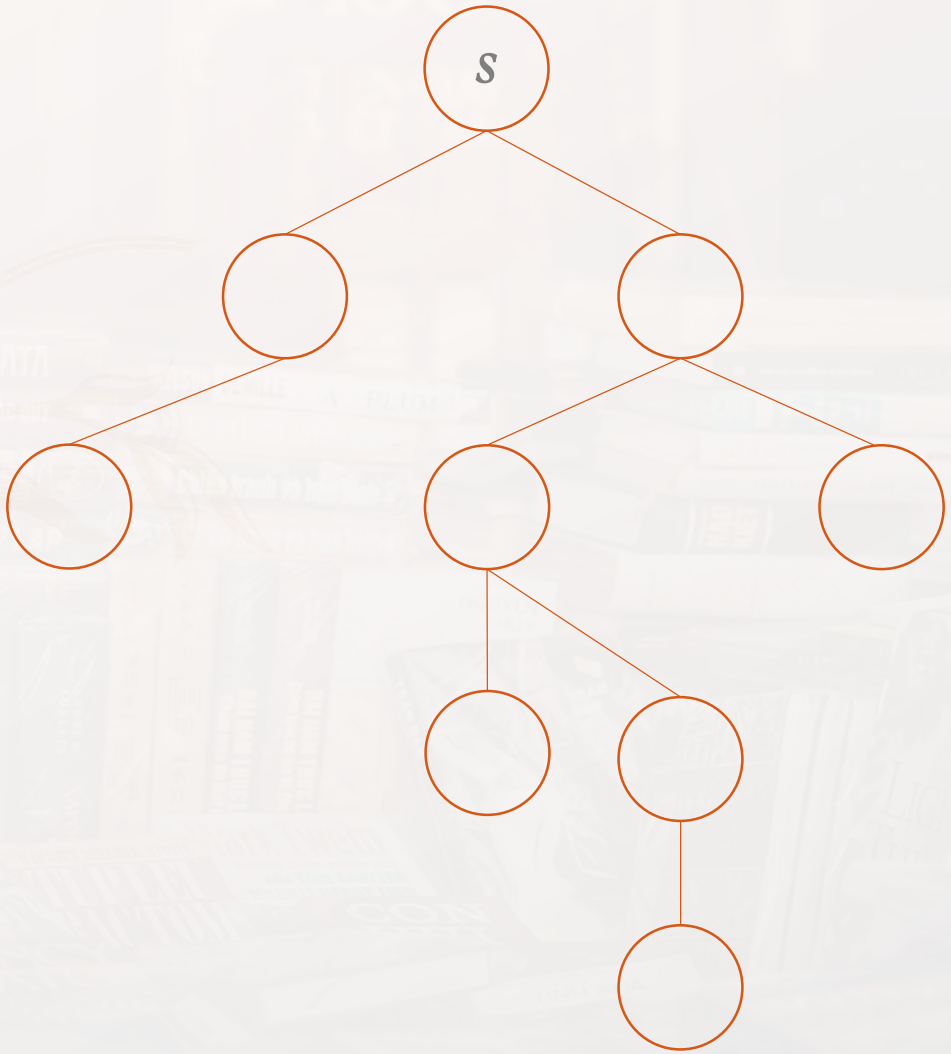
	0.5	0.00	27.5
Moderate	0.4	0.00	42.5
	0.3	0.67	66.7
	0.2	0.50	70.0
Low	0.1	0.42	85.0
	0.0	0.53	100.0

Heuristic Search

Best-first Search



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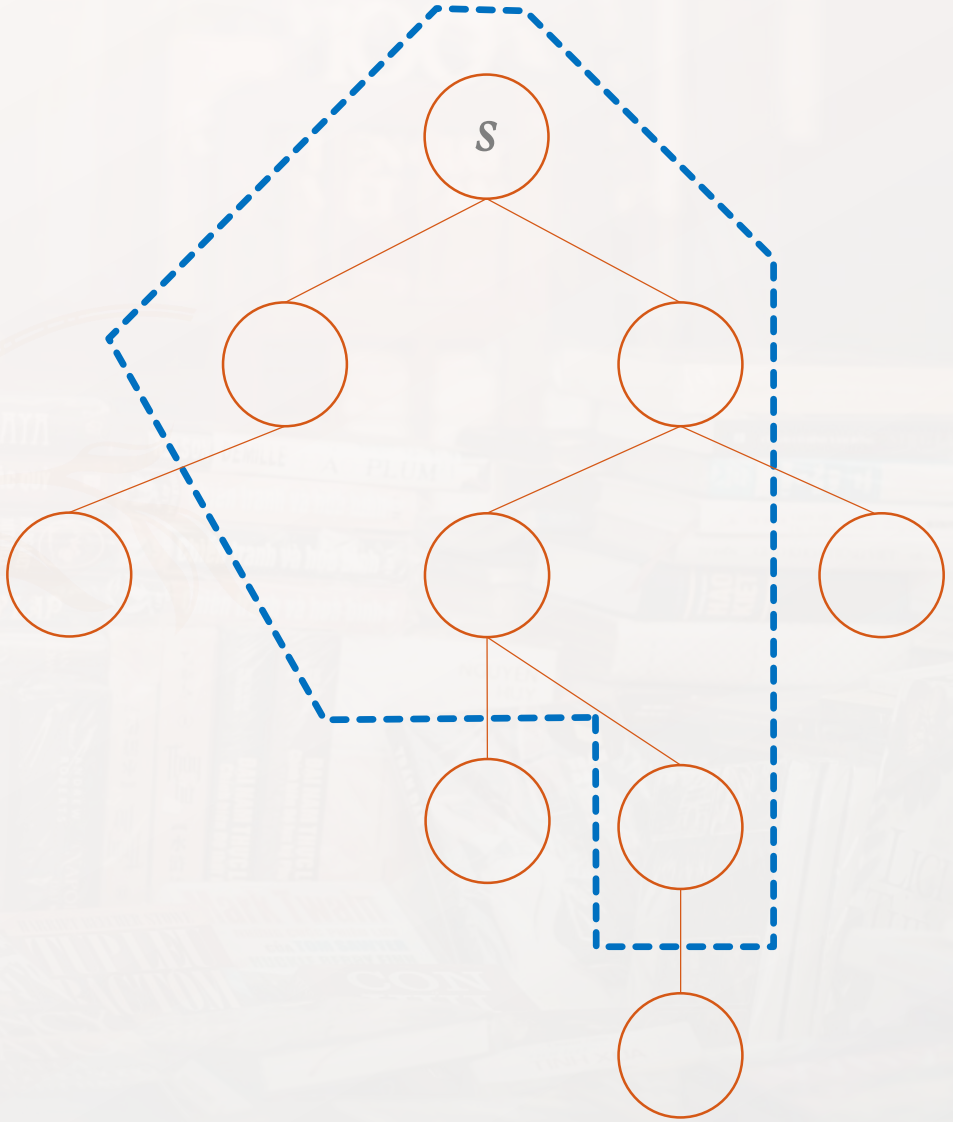
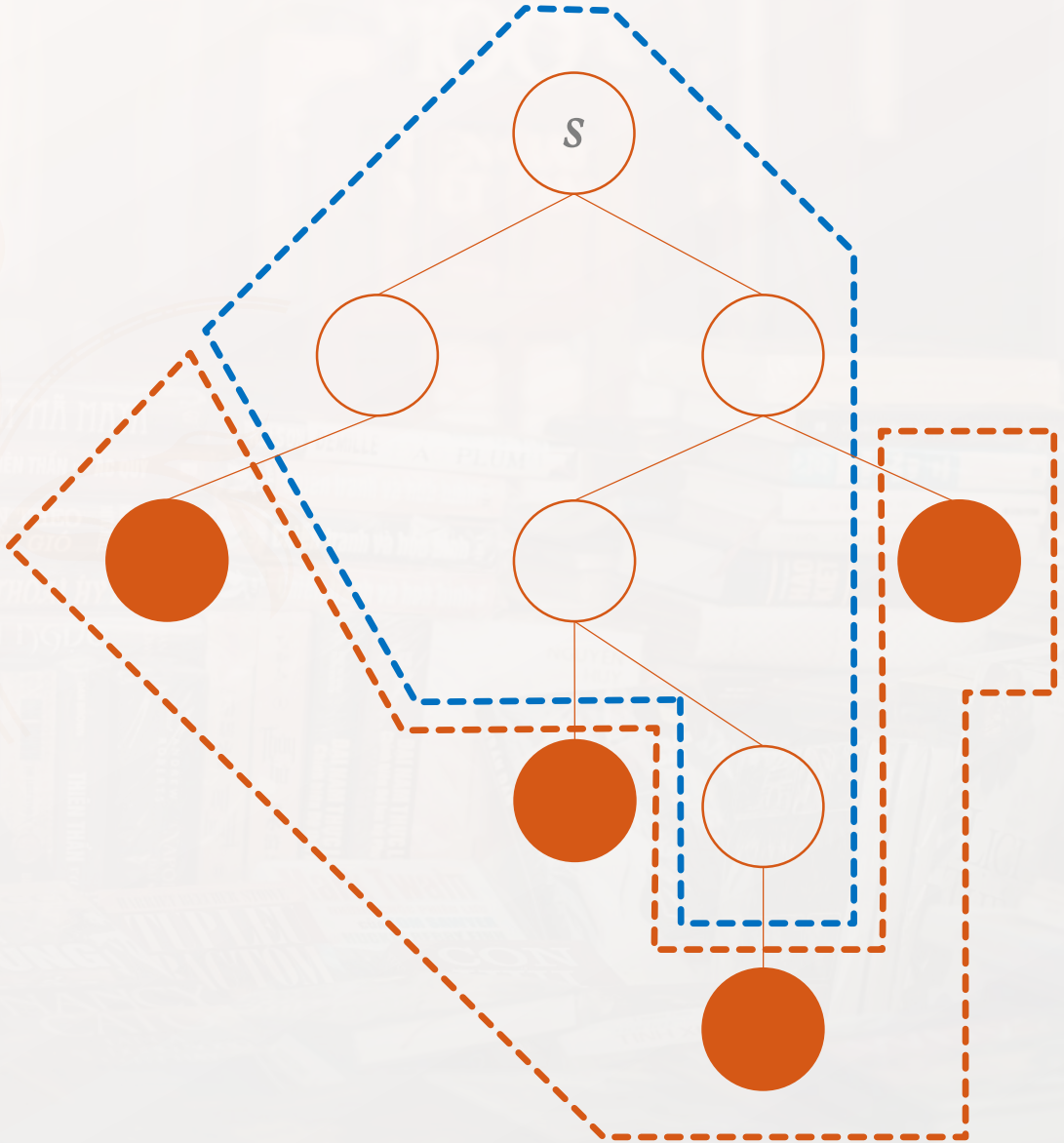


CLOSED

Best-first Search

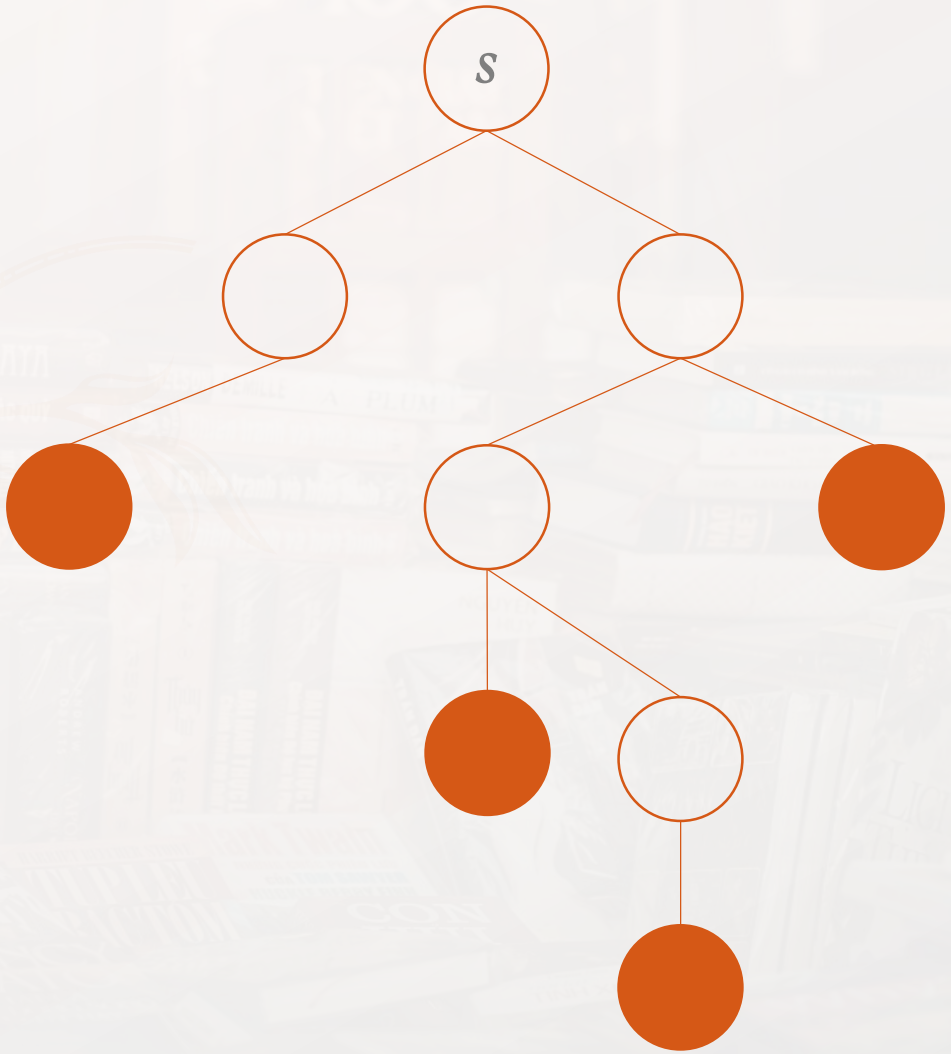


CLOSED

OPEN

Best-first Search

$f(n)$



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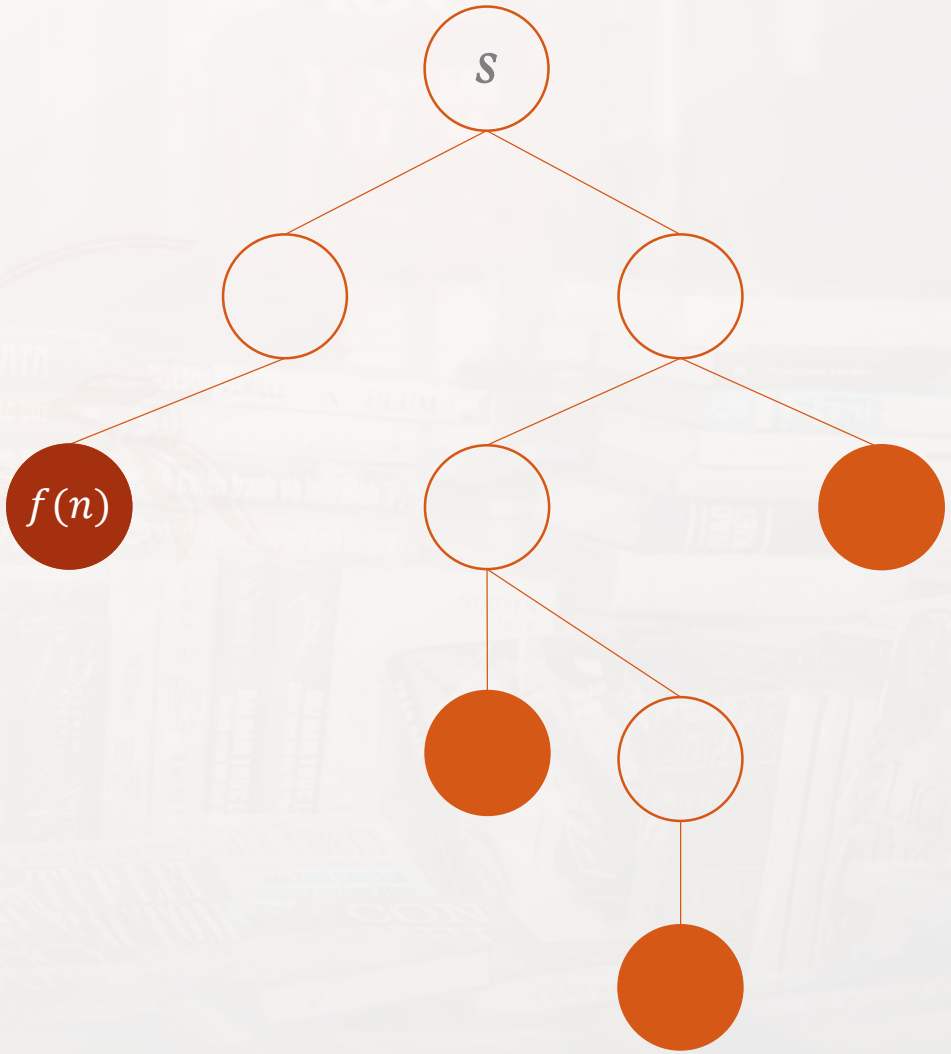

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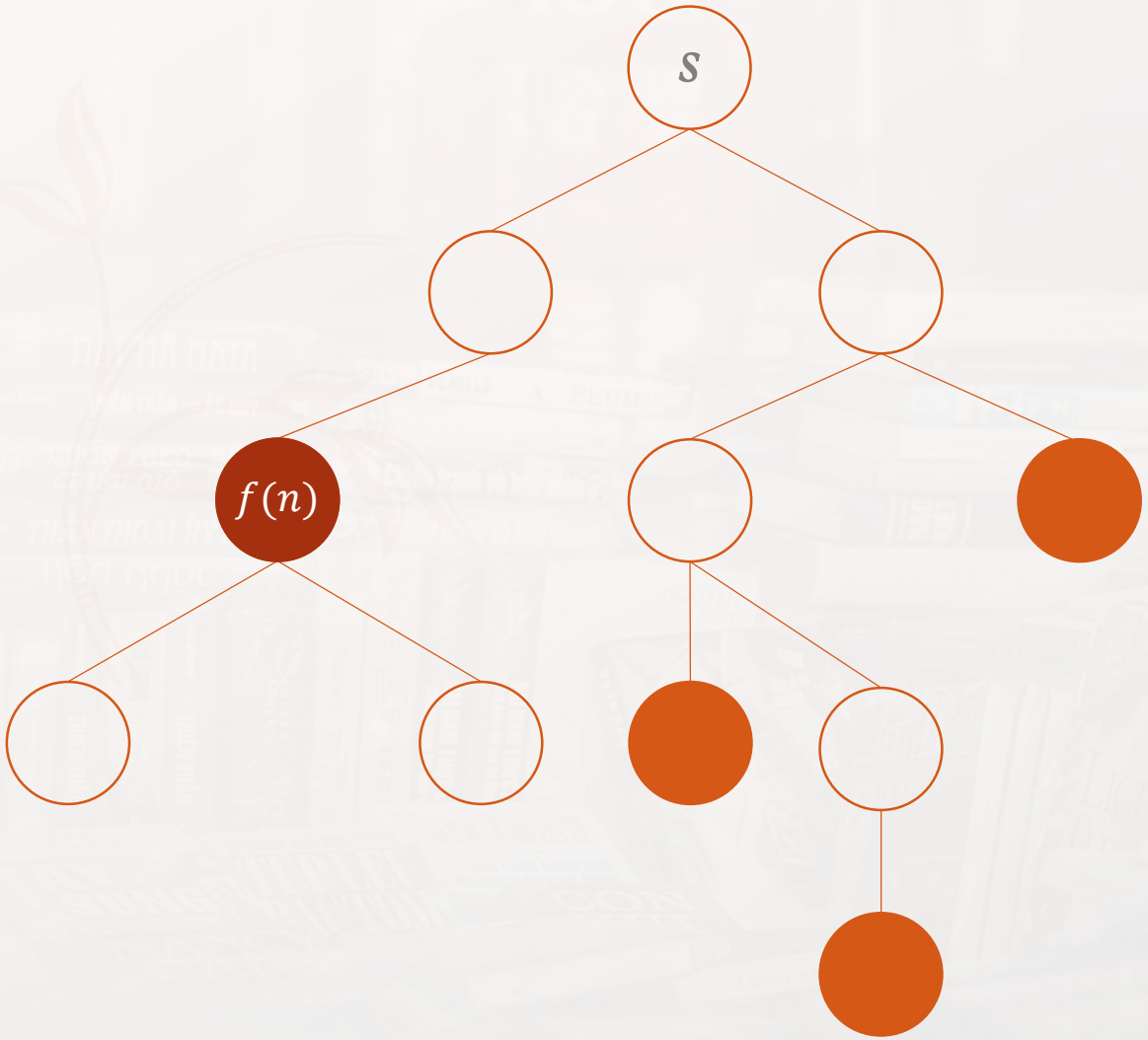

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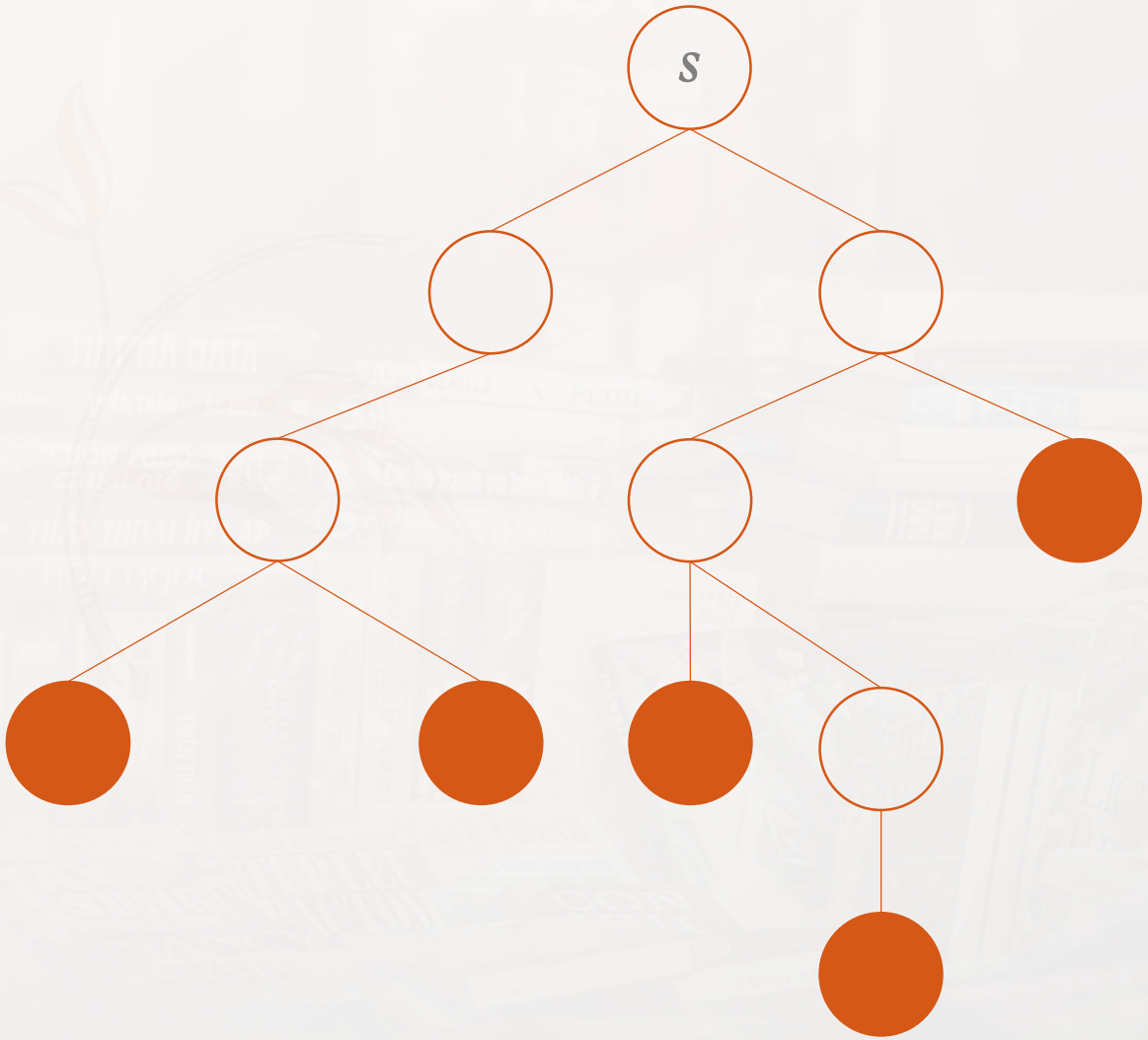

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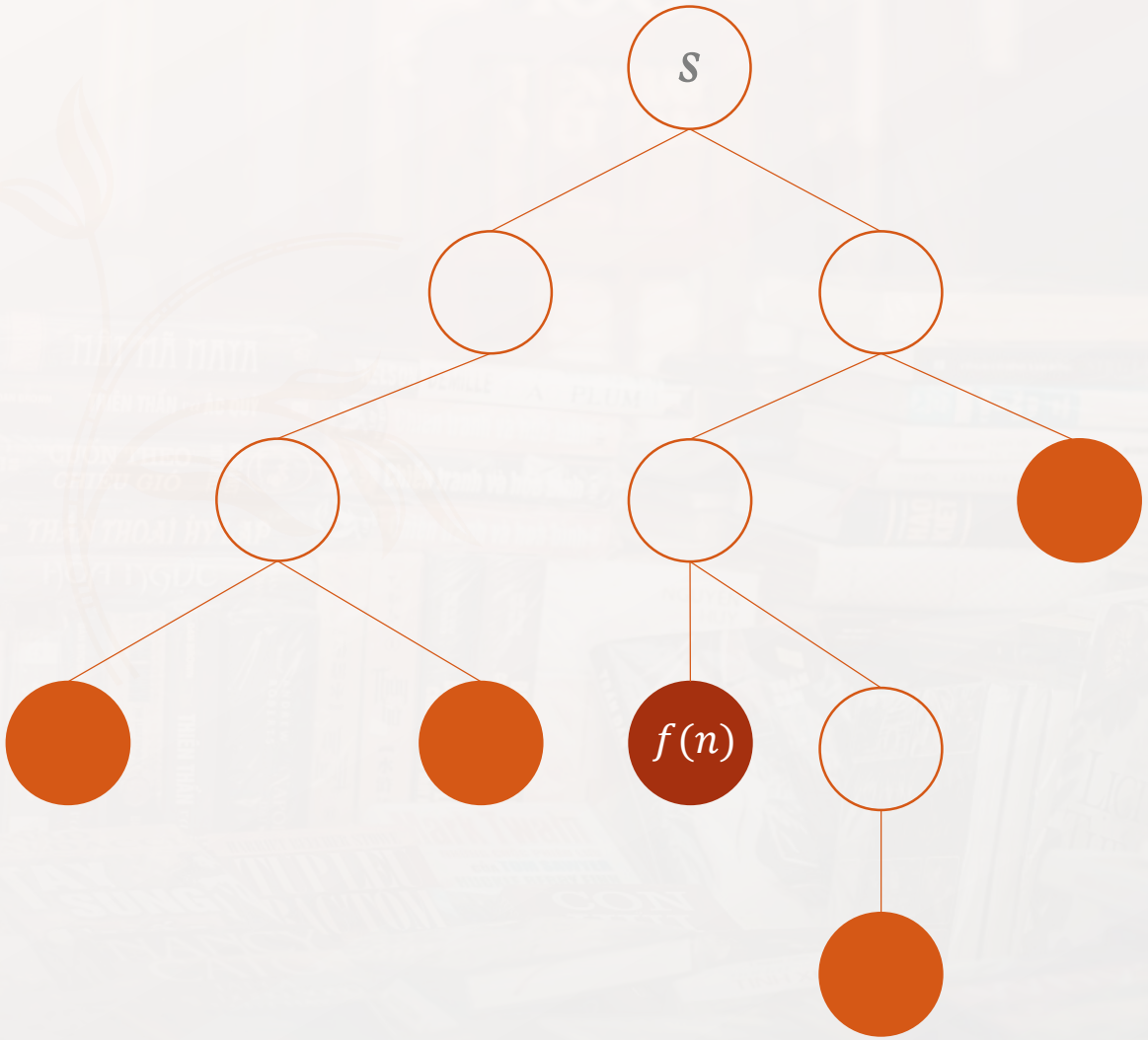

The A Algorithm*

$$f(n) = g(n) + h(n)$$

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$$h(n) \leq h^*(n)$$

The Heuristic

$$h_{prior}(n) = \varepsilon - \mathrm{JS}_{\Delta_n}$$

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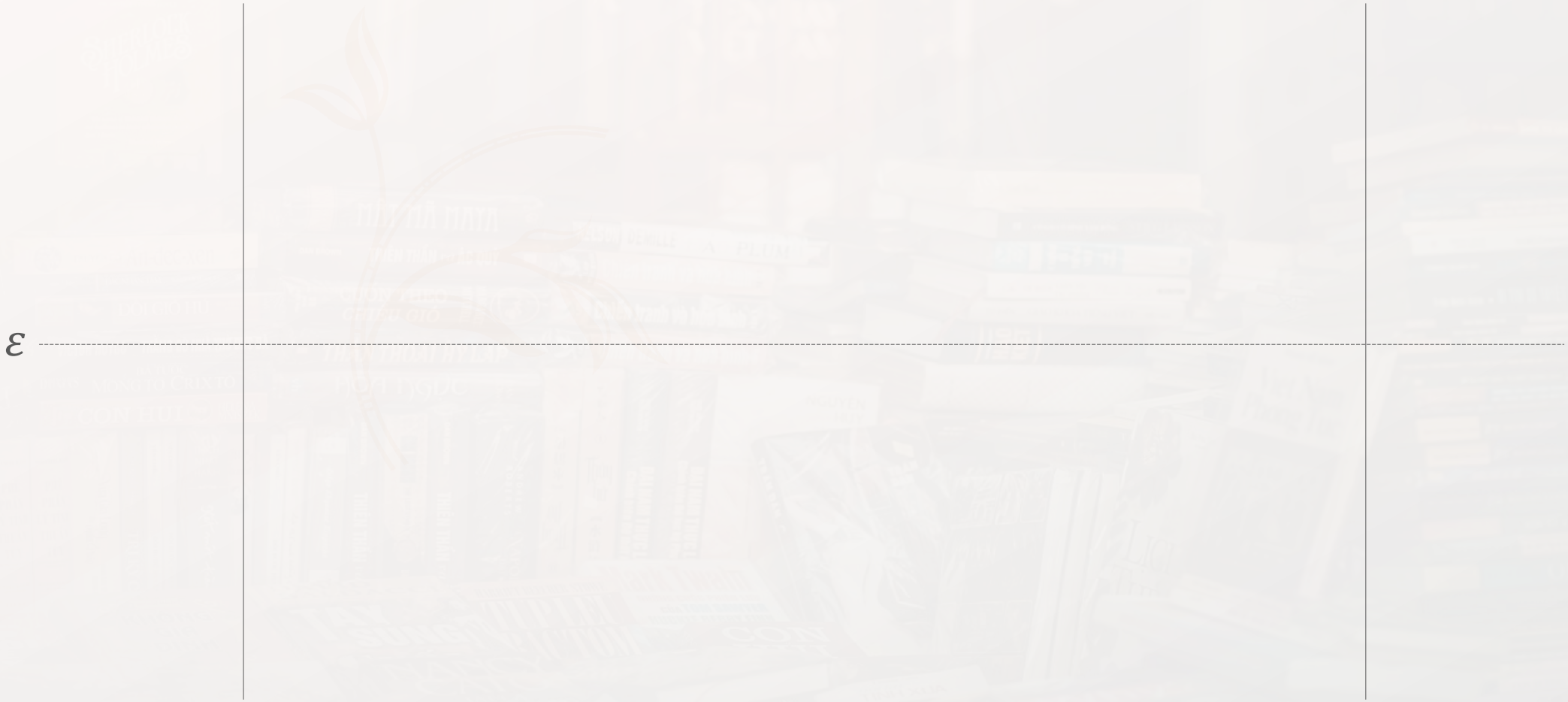
$$g_{norm}(n) = \frac{g(n)}{\mathrm{JS}_{\Delta_n} - \mathrm{JS}_{\Delta_0}}$$

The Heuristic

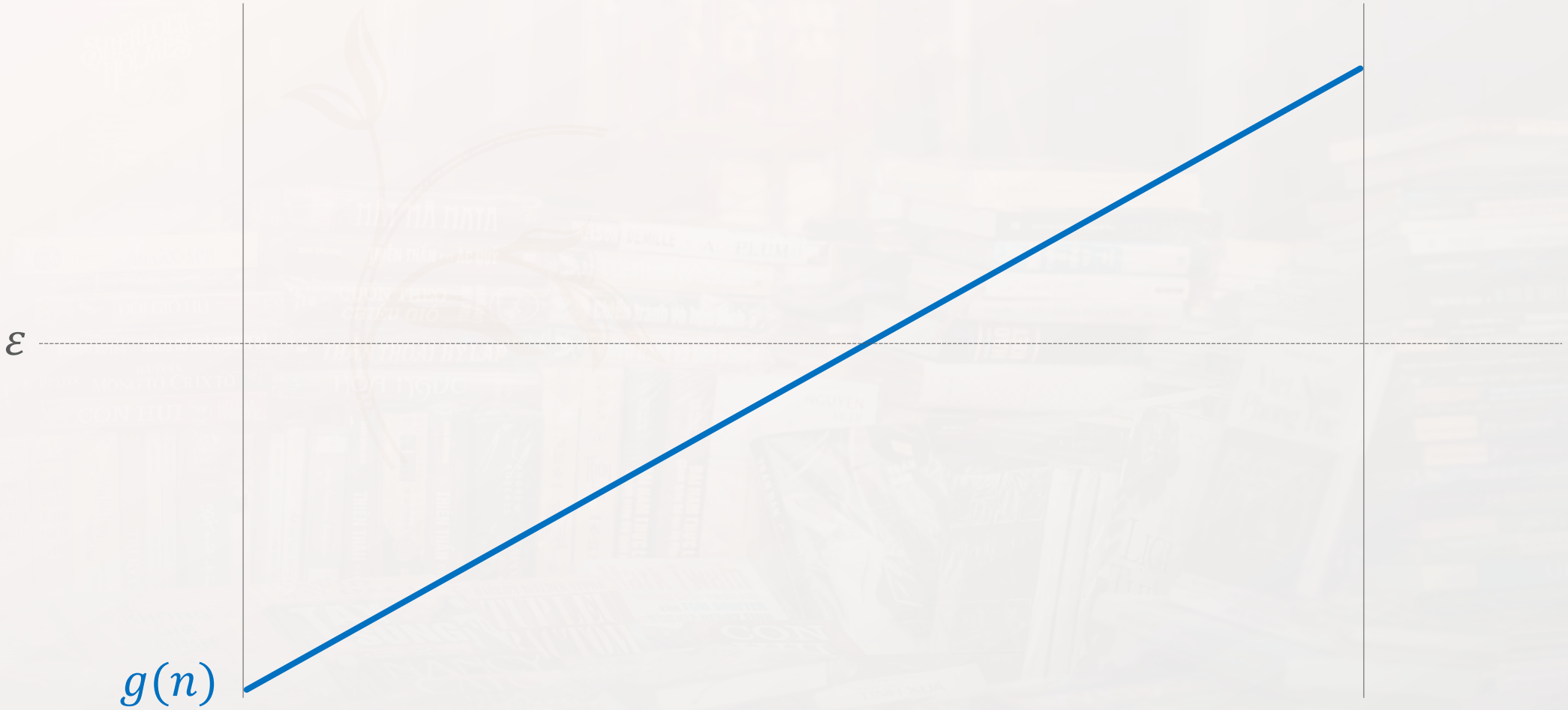
$$h(n) = h_{prior}(n) \cdot g_{norm}(n)$$

The Heuristic



Linear Gain

The Heuristic



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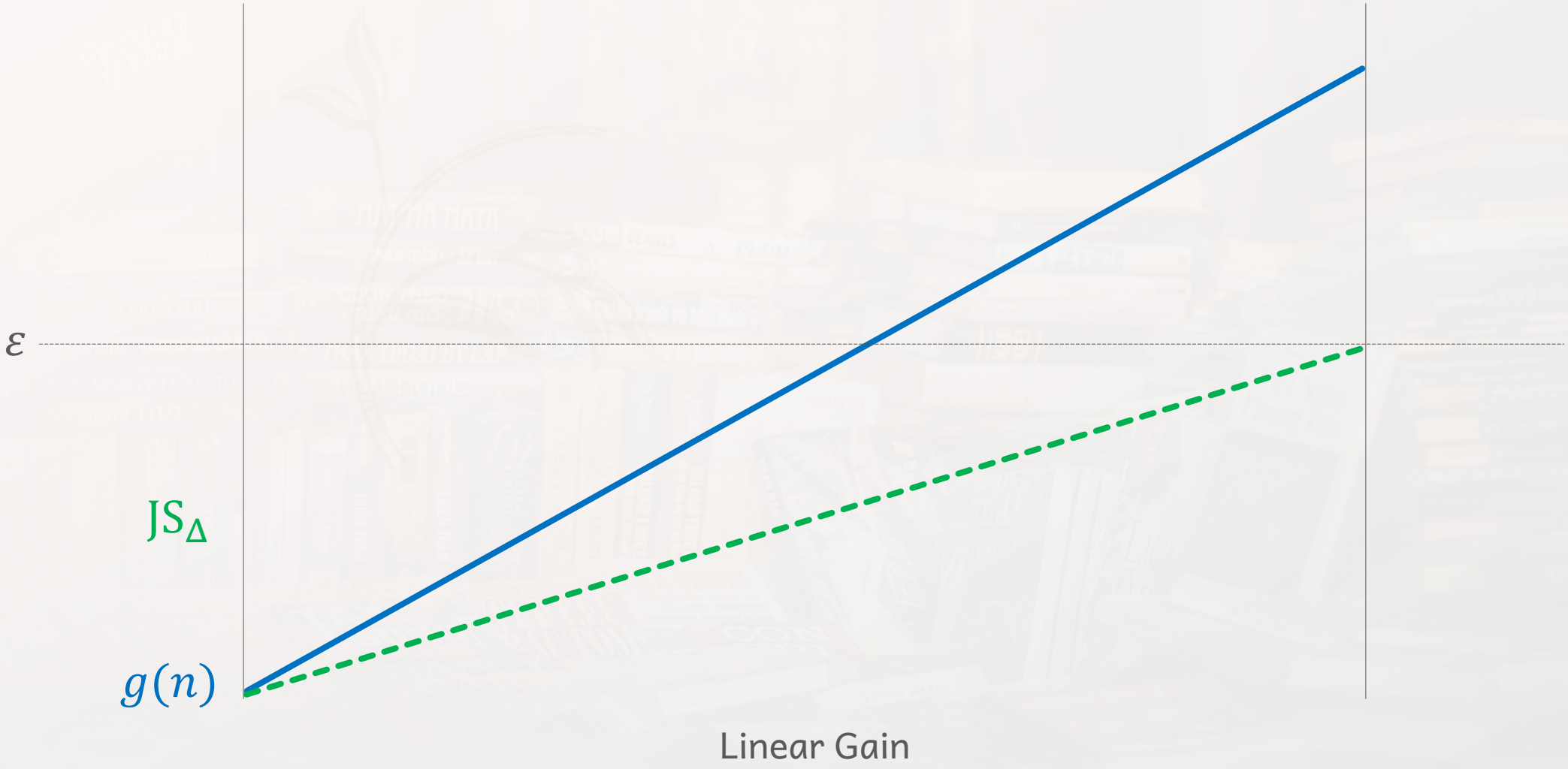

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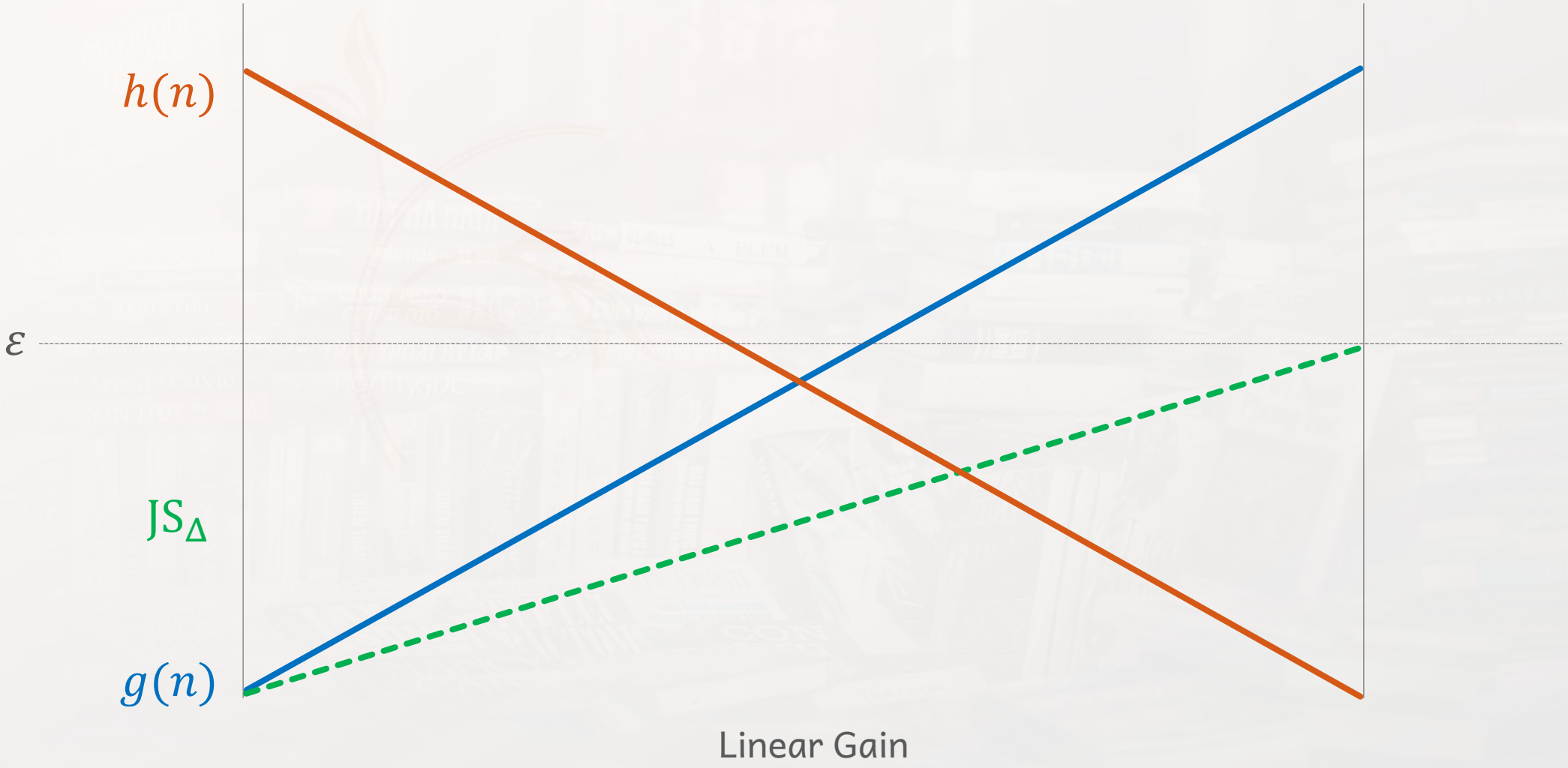
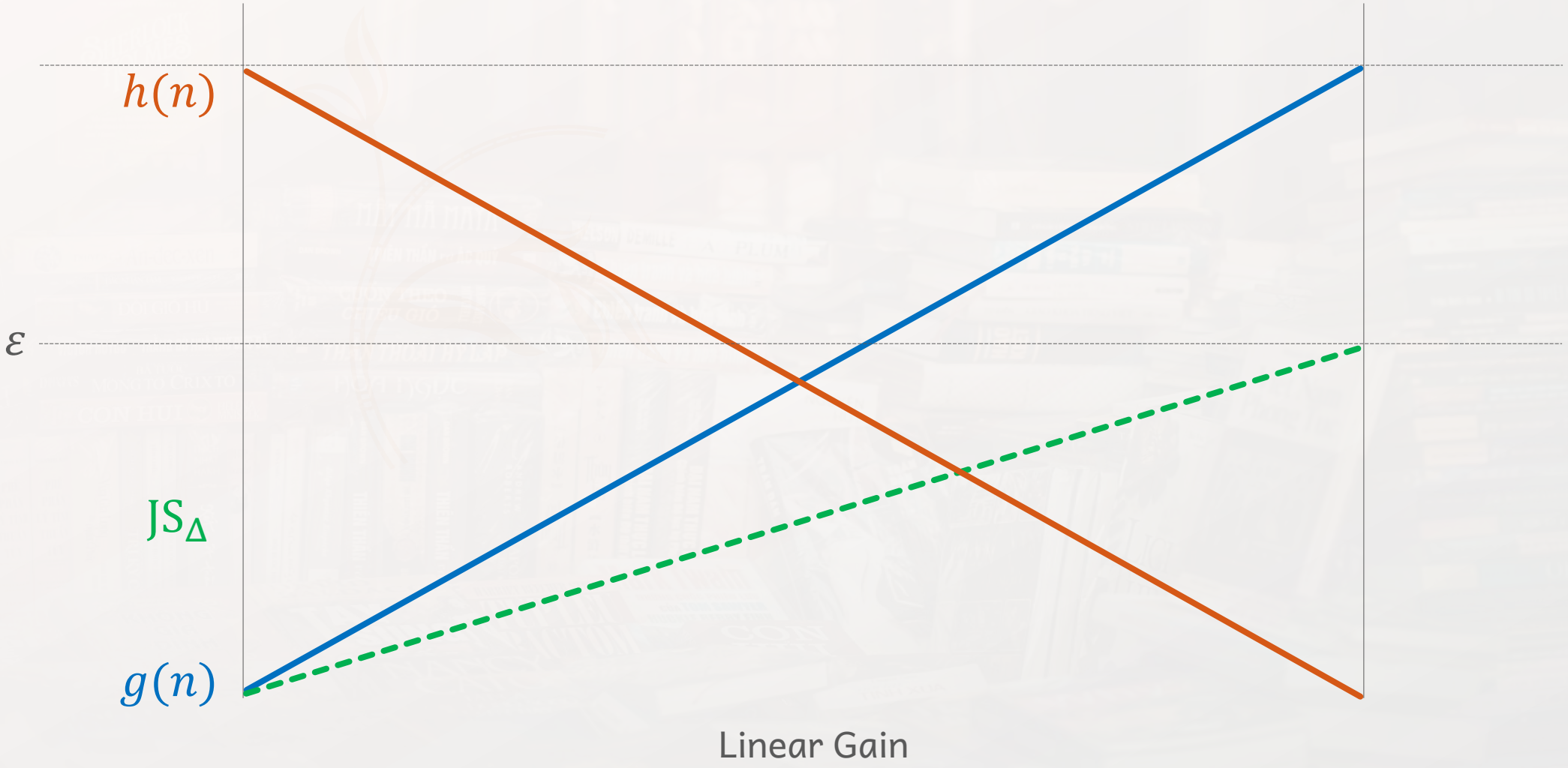


The Heuristic



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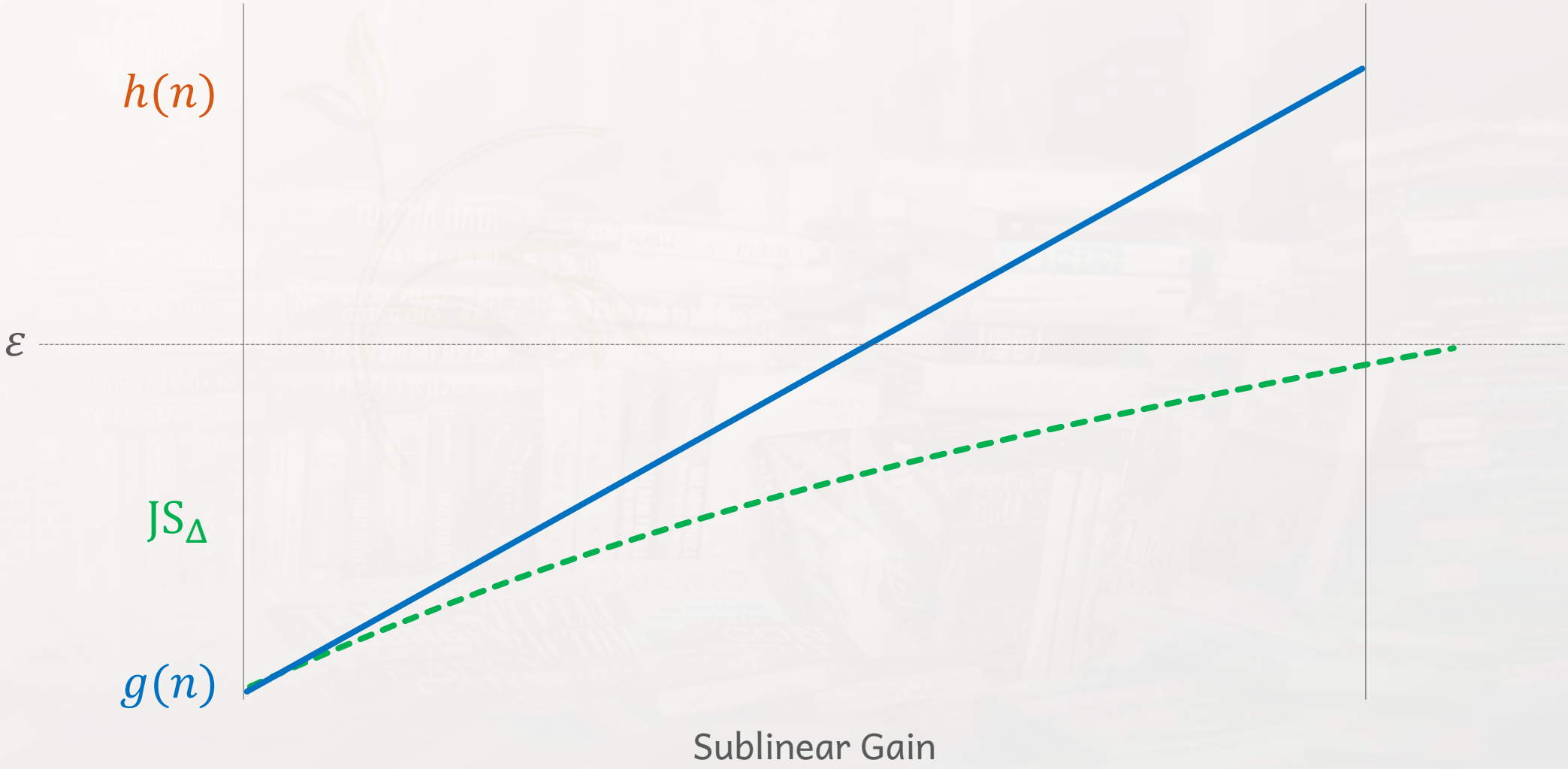

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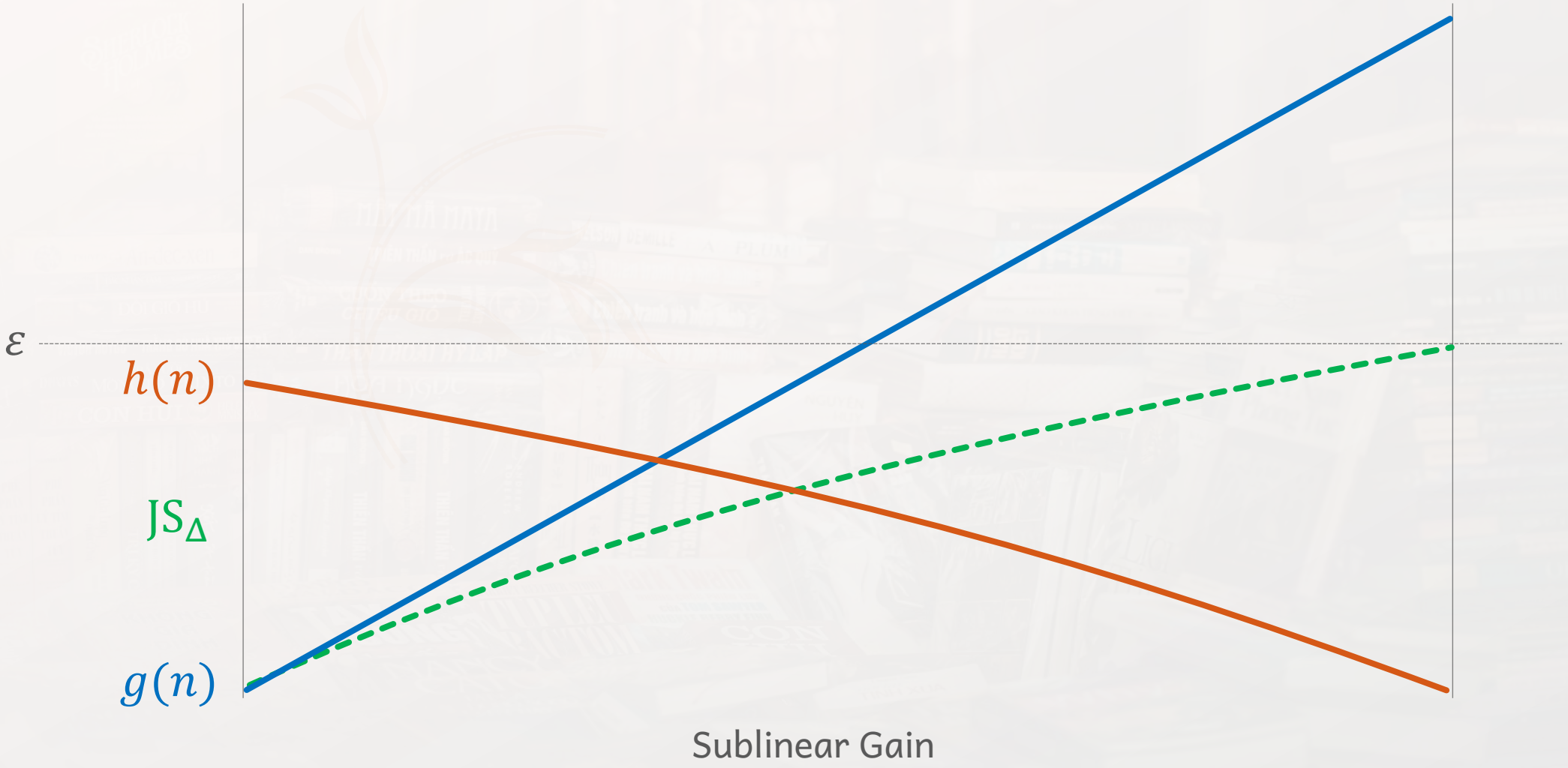

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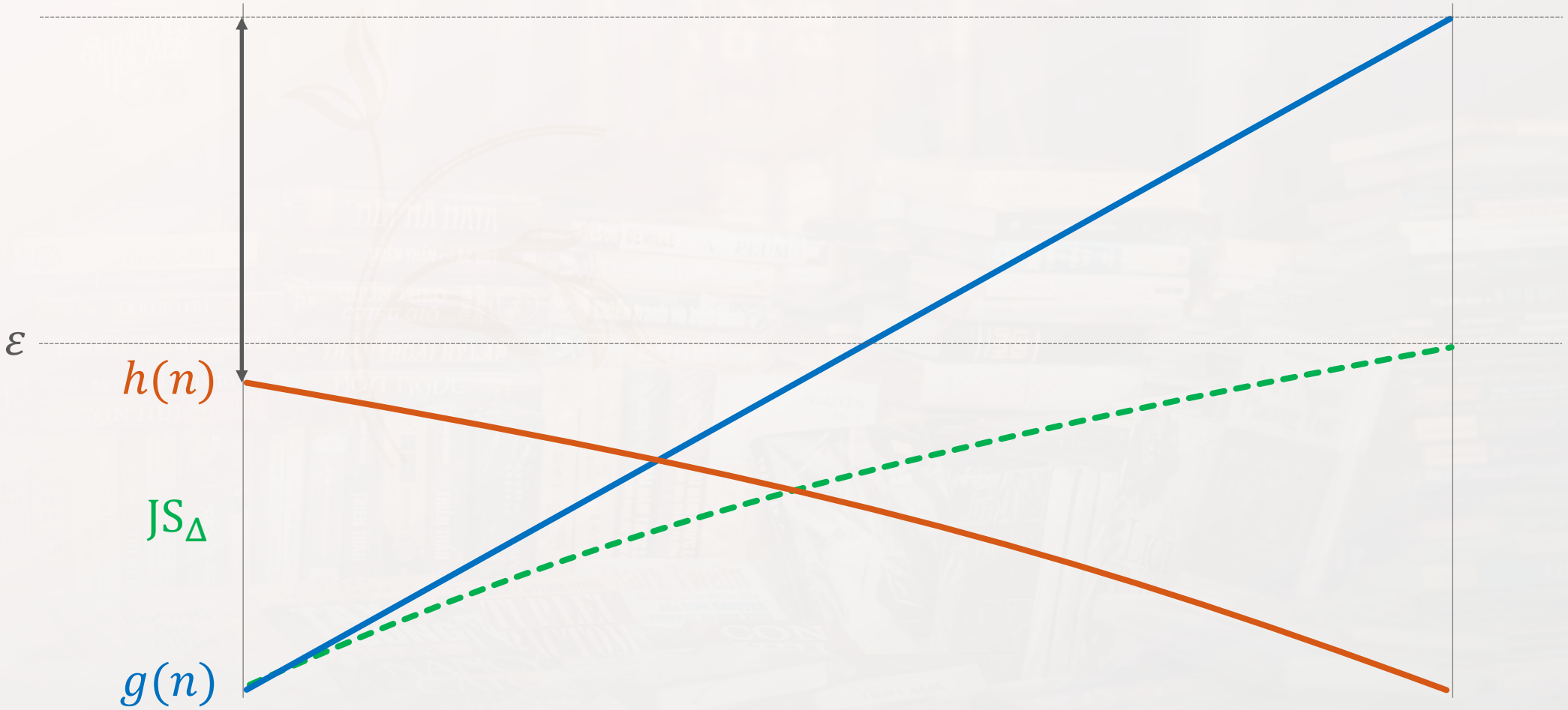
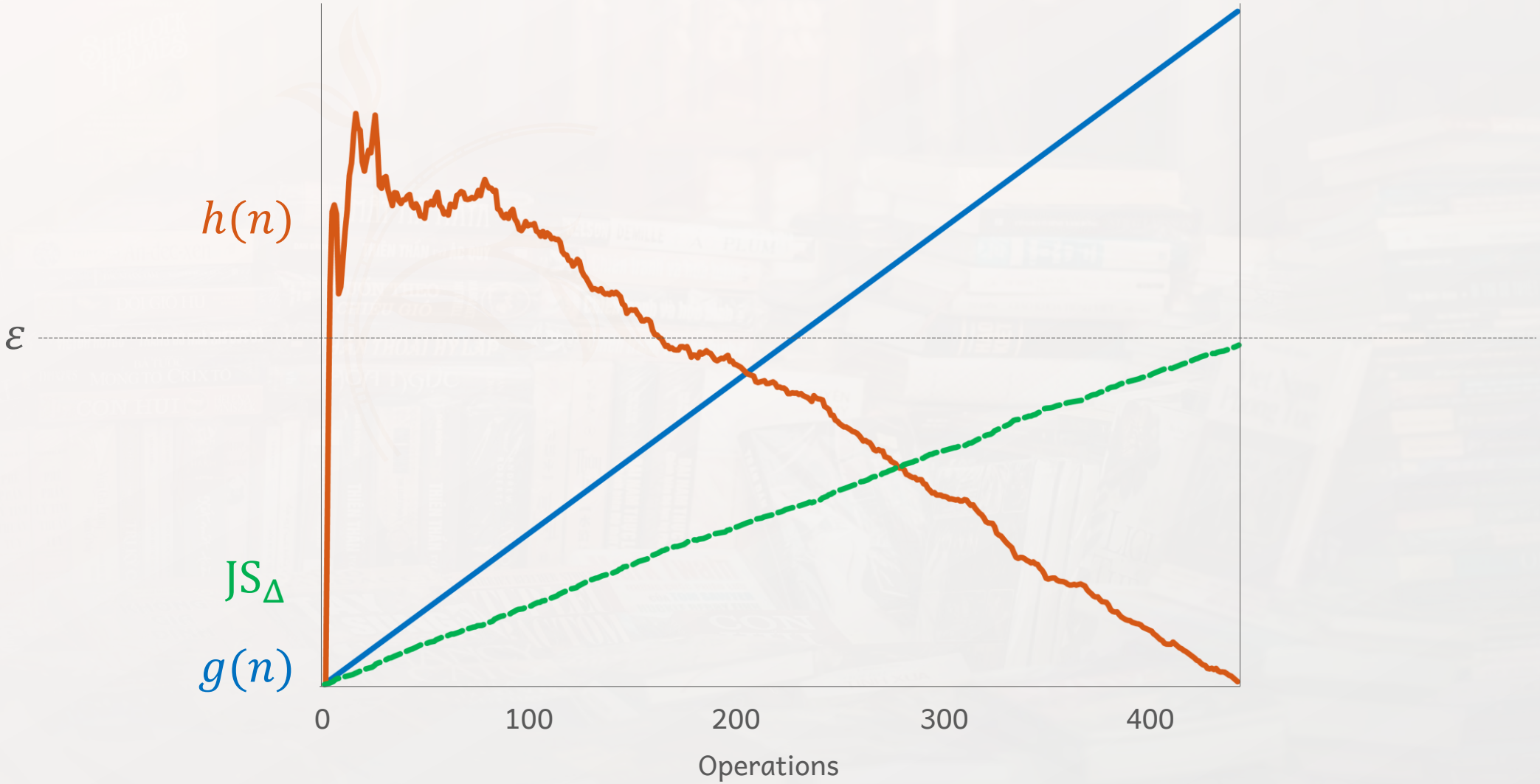


Sublinear Gain

The Heuristic – Actual Example



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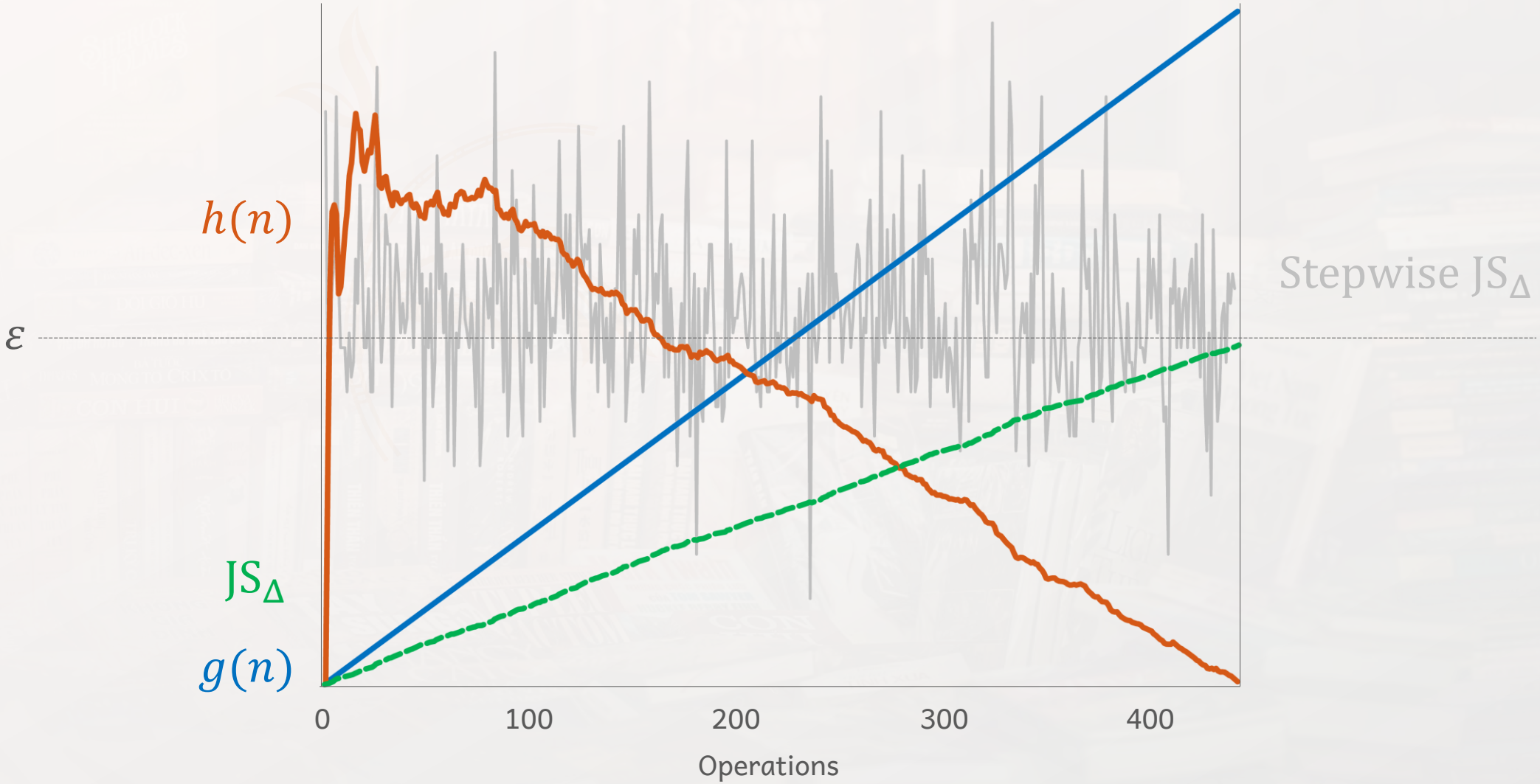

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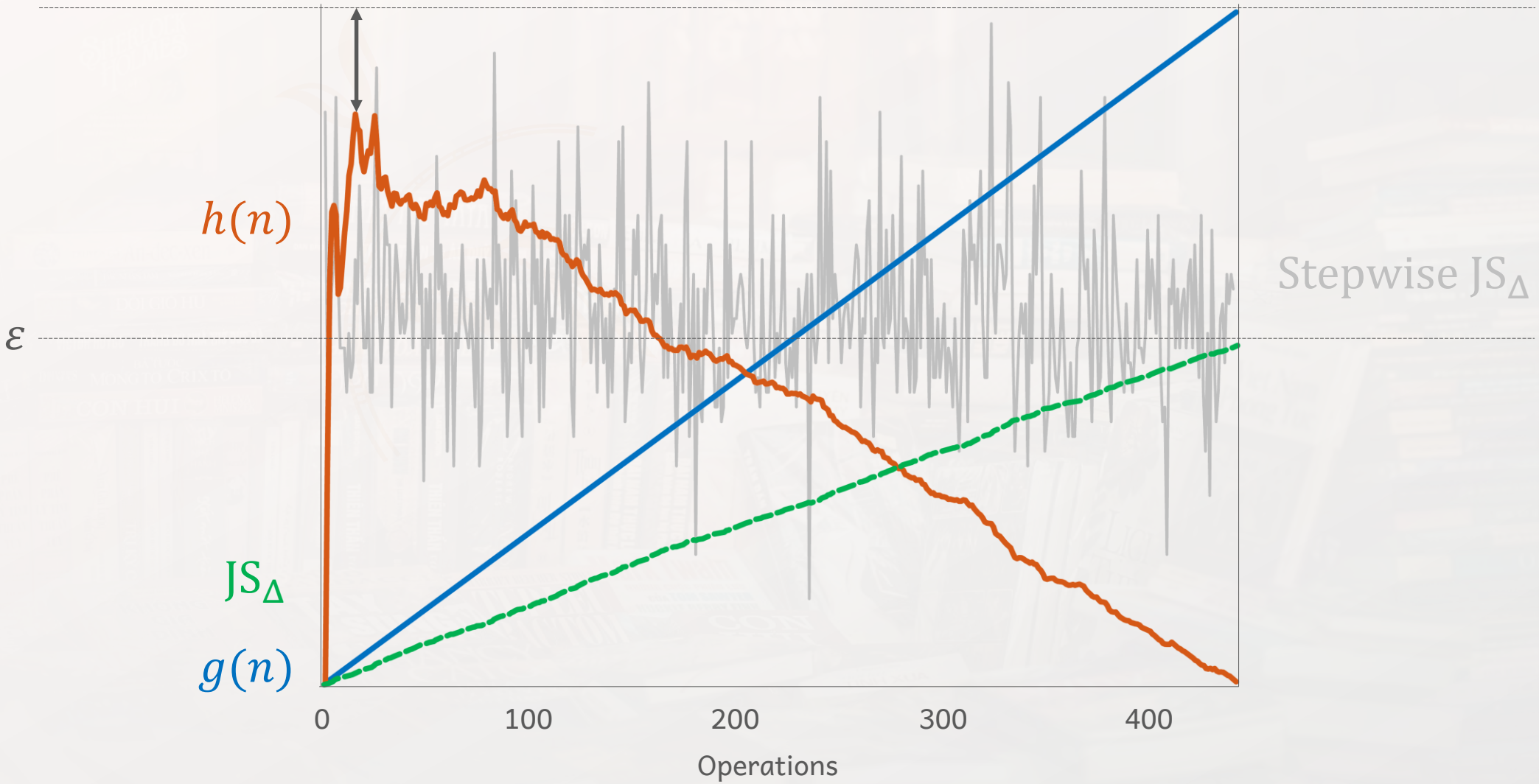

Operators

n-gram removal

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n-gram removal

abfg

Operators

n-gram removal

abfg

character flip

wizard

Operators

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abfg

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wiazrd

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character map

The End.

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wiazrd

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house

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wiazrd

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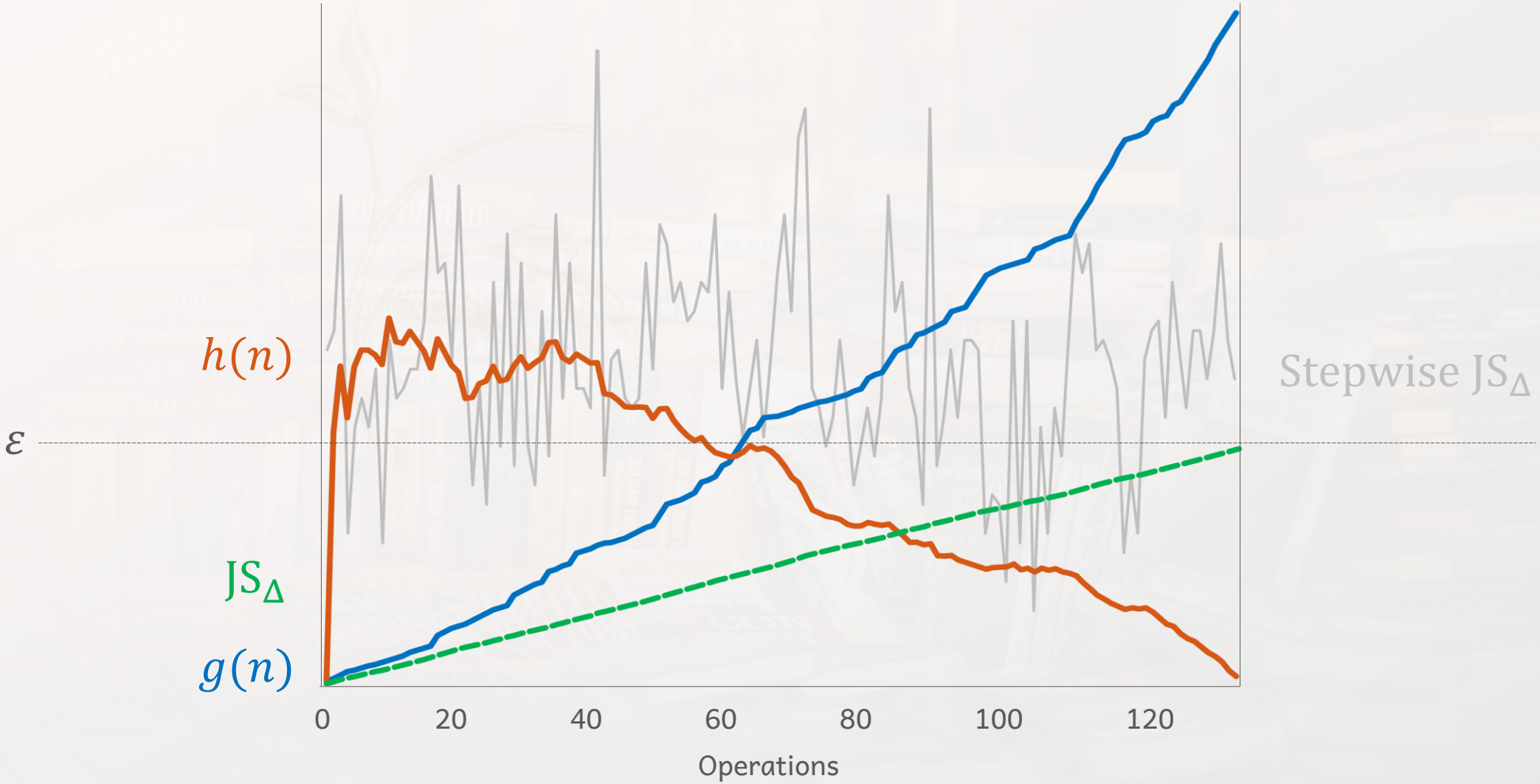
Obfuscation Using Heuristic Search



Obfuscation Using Heuristic Search

> ‘With a furtive glance around him, he clapped the other half of the clay sphere over the filled hemisphere and then stood up. The patients lined up at the door, waiting for the walk back across the green hills to the main hospital. The attendants made a quick count and then unlocked the door. The group shuffled out into the warm, afternoon sunlight and the door closed behind them. Miss Abercrombie gazed around the cluttered room and picked up her chart book of patient progress. Moving slowly down the line of benches, she made short, precise notes on the day’s work accomplished by each patient. […]’

A Filbert Is a Nut by Rick Raphael

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  - better text quality.

Thank you

for your attention

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