Outline of a Literary Informatics

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Outline

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A need for Human & Literary Informatics

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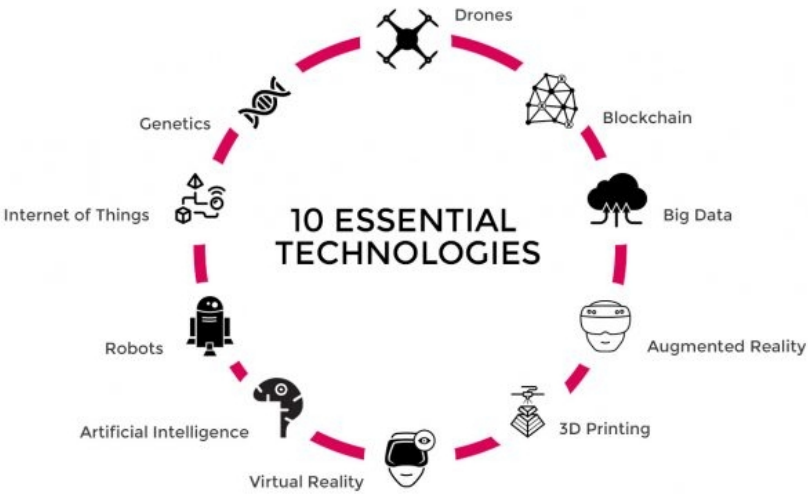
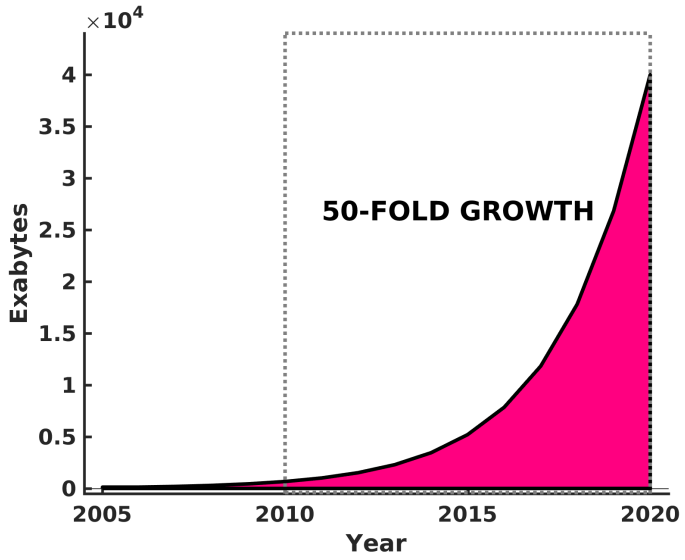
The data deluge





the data deluge is transforming knowledge discovery and understanding in every domain of human inquiry

a large part of these data are soft and unstructured $\Rightarrow$ to get value from these data, humanities (and social sciences) must utilize automation

human informatics - automatic information processing in the humanities

$\Rightarrow$ *literary informatics* $\sim$ *use of automation in literary studies*

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Humanities need informatics

Figure 1: The increase in research publications & databases alone requires computational literacy. Publications related to Gospel of Marc (KJV) $>$ 50K, $\sim$ 16,500 words in 16 chp. on 11 p.

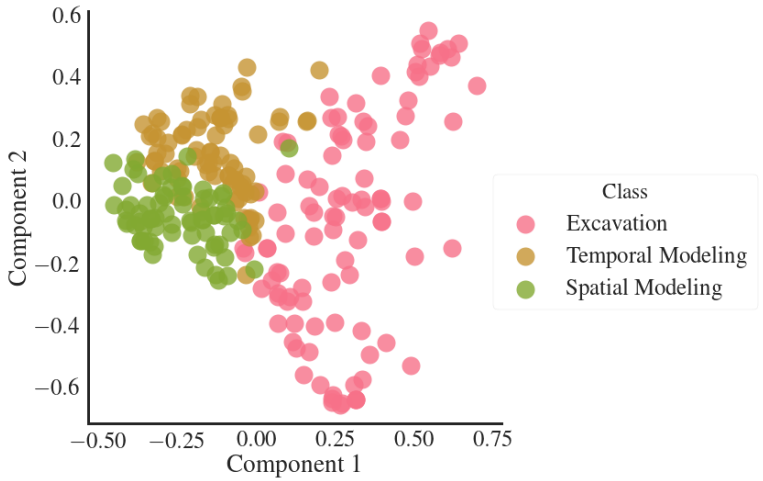

Figure 2: Advanced (human) informatics can merge, aggregate and project hetereogeneous data into lower dimensional spaces that allow visual manipulation

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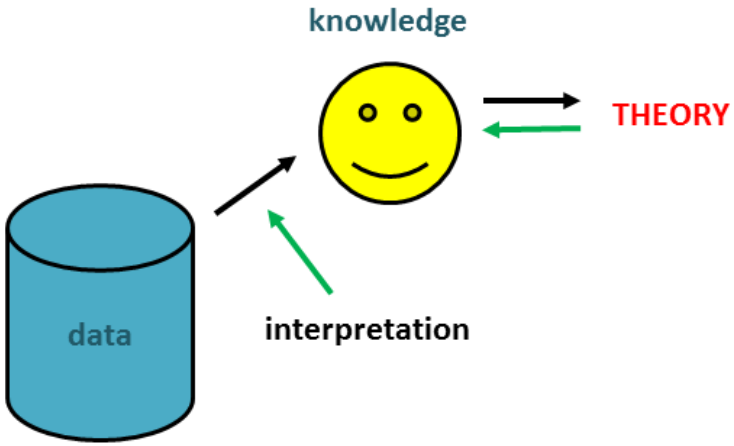
Default workflow



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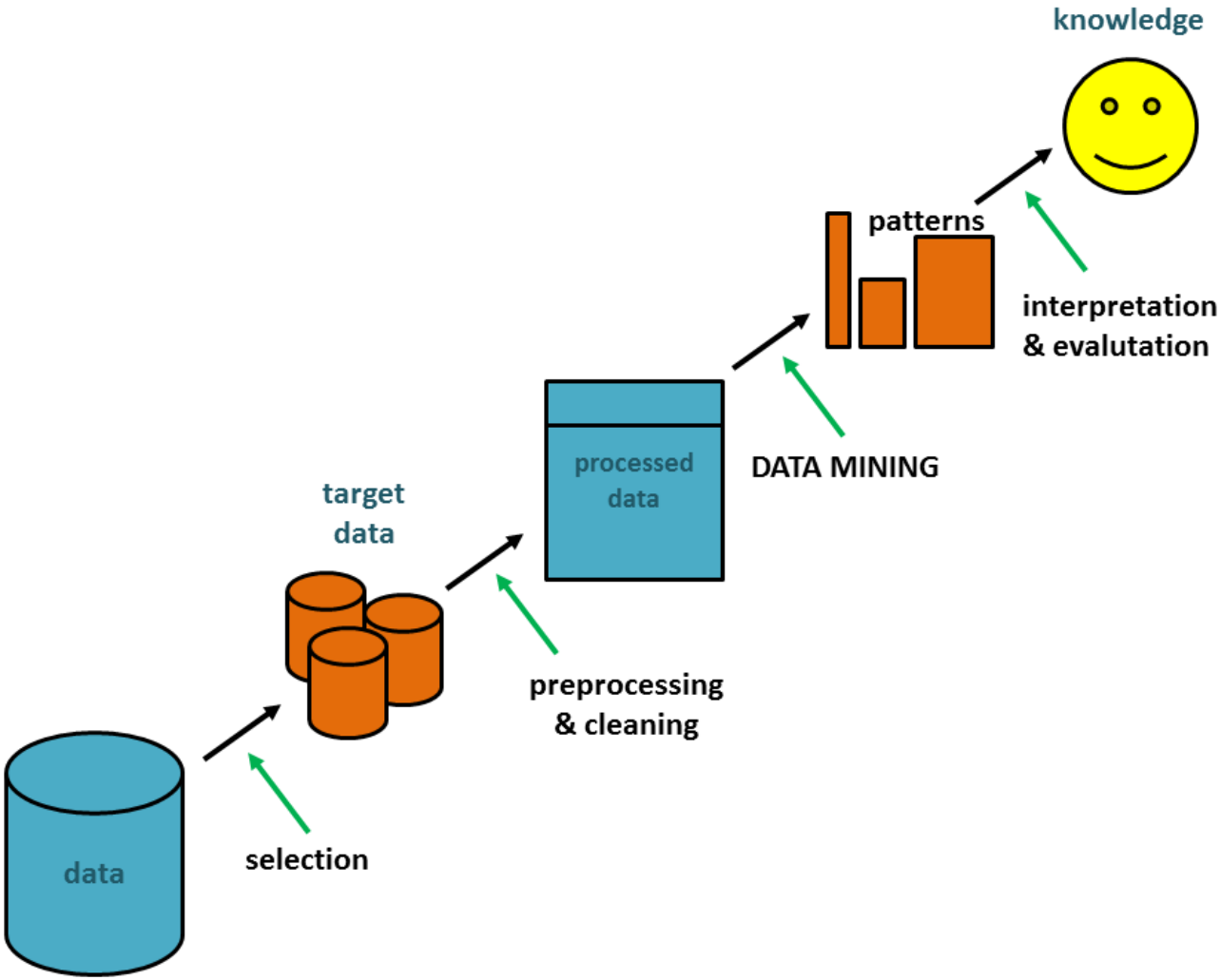
KDD workflow



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Author dynamics

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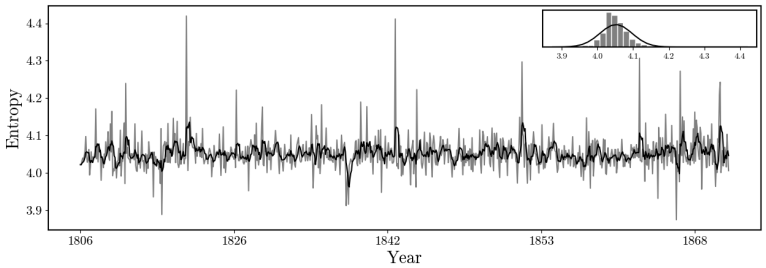
The appropriate formalism

– profile the creative development of authors

– multiple measures that capture aspects of "text complexity" in terms of syllables, word and sentence length $\sim$ characters and ngrams

– IT offers a range of "well-behaved" measures that capture lexical variability, $\sim H[X]$ as the variability of some term-vectors $X \sim$ log of the effective number of values it can take



$$H[X] = -\sum_x \mathbb{P}(X = x) \log \mathbb{P}(X = x)$$
$$= -\mathbf{E}[\log \mathbb{P}(X)]$$

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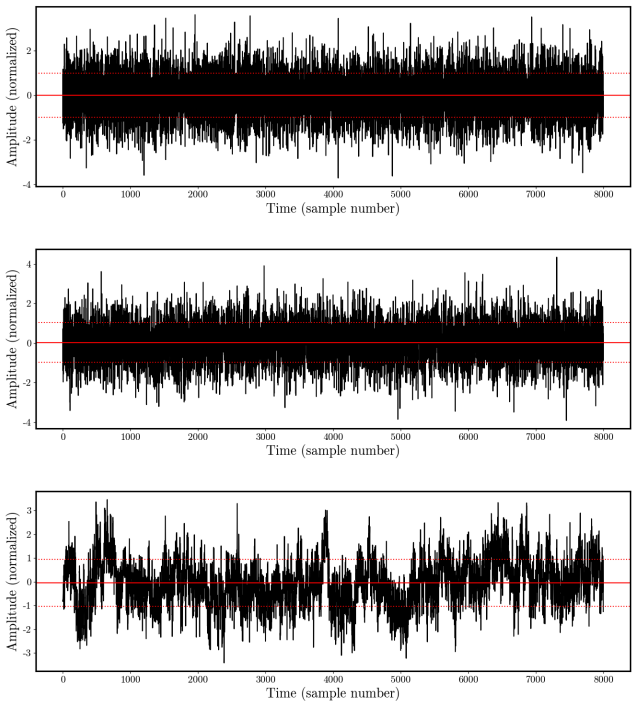
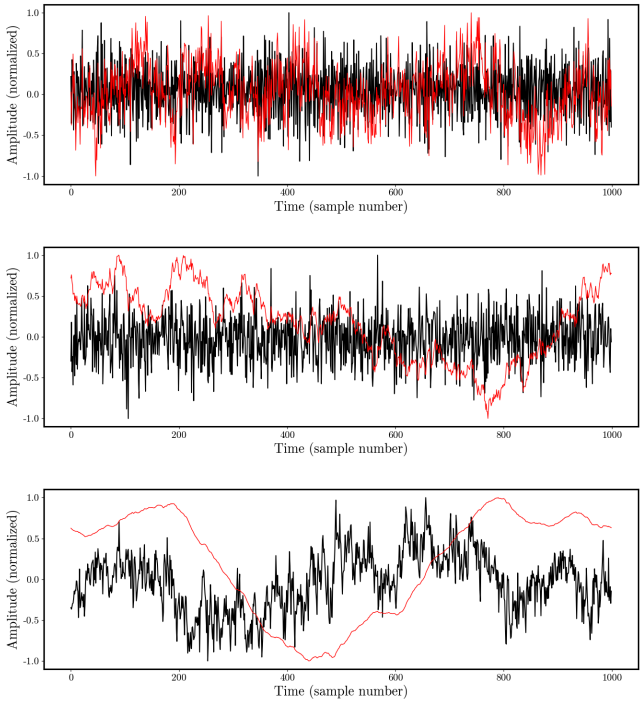
Competing levels of abstraction

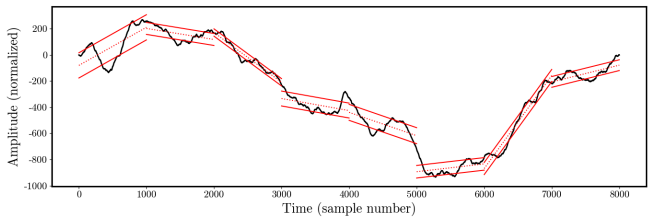


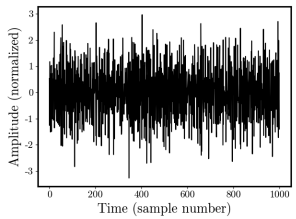


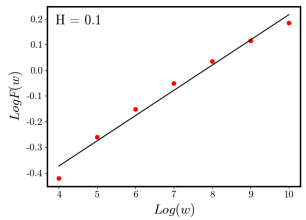
$$F(X) = \left[\frac{1}{N}\sum_{i=1}^{n}(x_n^2)\right]^{1/2}$$

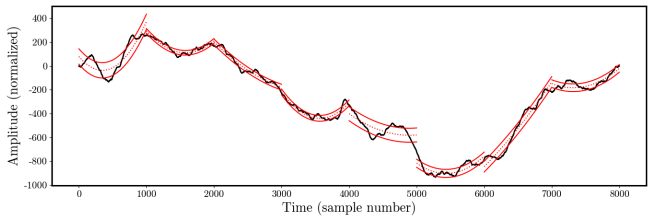
$$u(n) = \sum_{i=1}^{n}(x_i - \overline{x}), \quad n = 1, 2, \cdots, N,$$

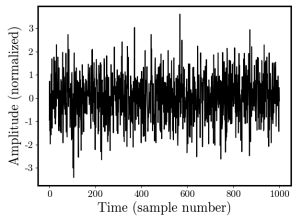
Noise and fractal properties

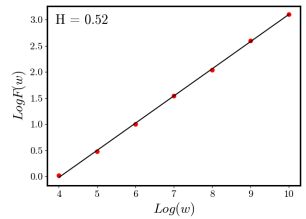


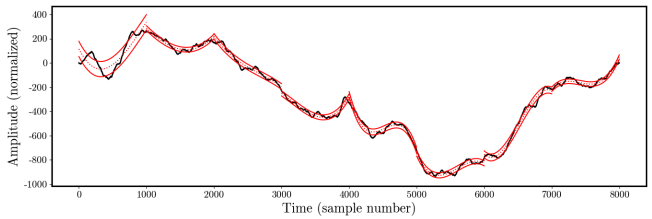


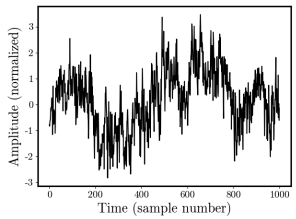


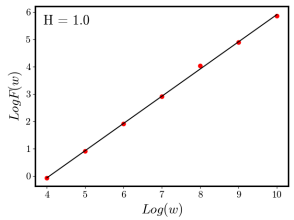












Library available at `https://github.com/knielbo/saffine`

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Author change points

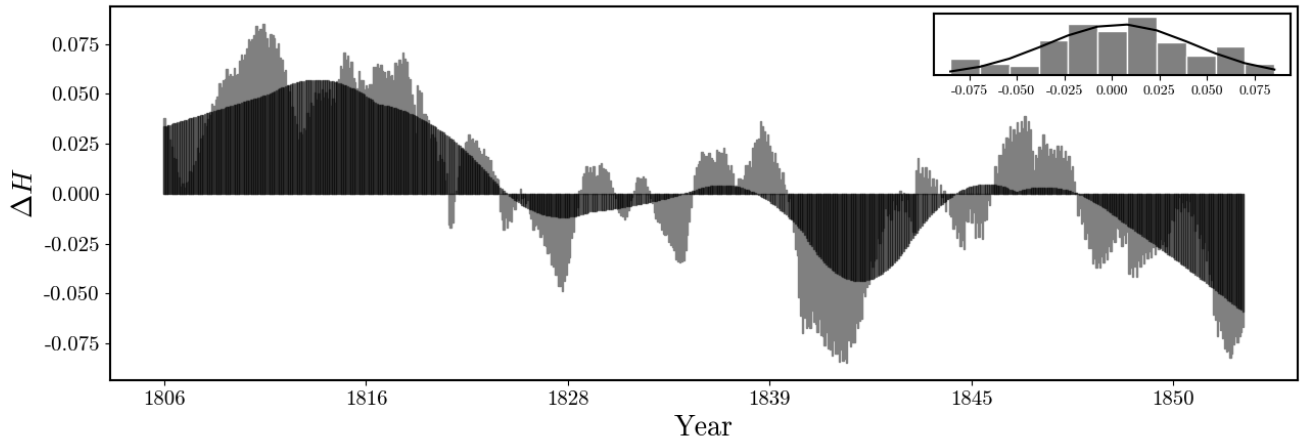

Table 1: Dominant Dynamic in the Phases of N.F.S. Grundtvig's Writings

Time period	Age of onset	$H(X)$	Behavior	Profile
1806-1826	23	$H > 0.5$	*persistent*	theoretician
1826-1839	43	$H \approx 0.5$	*short memory*	pragmatic
1839-1845	56	$H < 0.5$	*anti-persistent*	breakthrough
1845-1848	62	$H \approx 0.5$	*short memory*	disease
1849-1872	65	$H < 0.5$	*anti-persistent*	politician

Nielbo, K. L., K.F. Baunvig, B. Liu & Gao, J. (in print). A Curious Case of Entropic Decay: Persistent Complexity in Textual Cultural Heritage. Digital Scholarship in the Humanities.

Dynamic author profiling

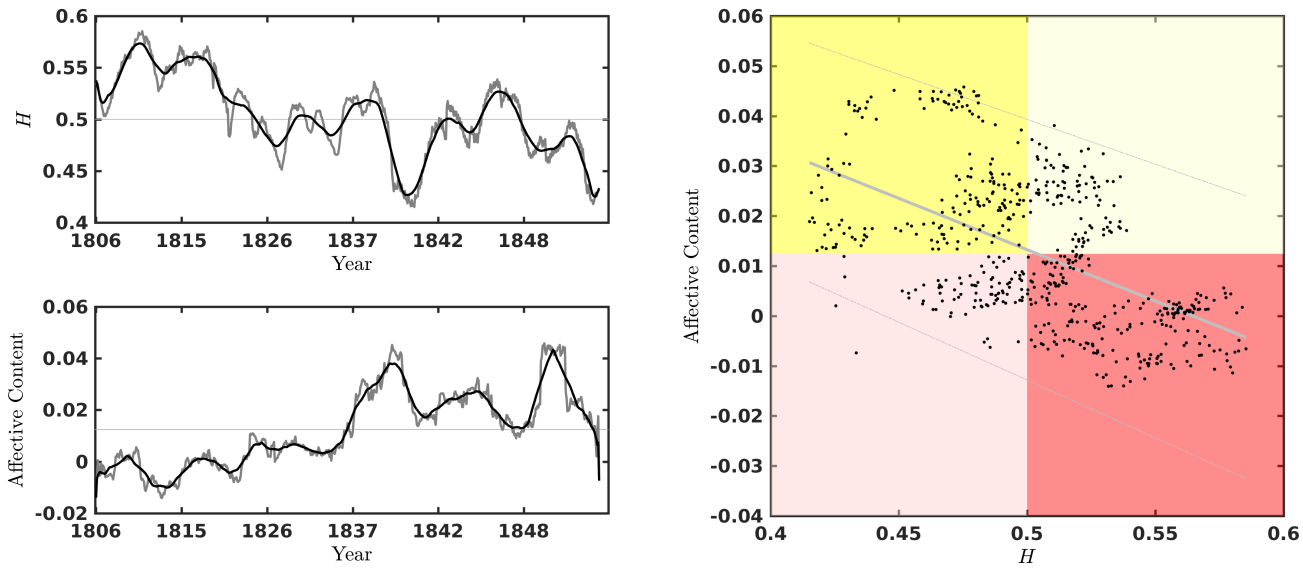

Figure 3: Combining persistent entropic trends with sentiment analysis and causal modeling, we can study **"the tormented artist"** phenomena in intellectual history.

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Narrative dynamics

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Literature and affective computing

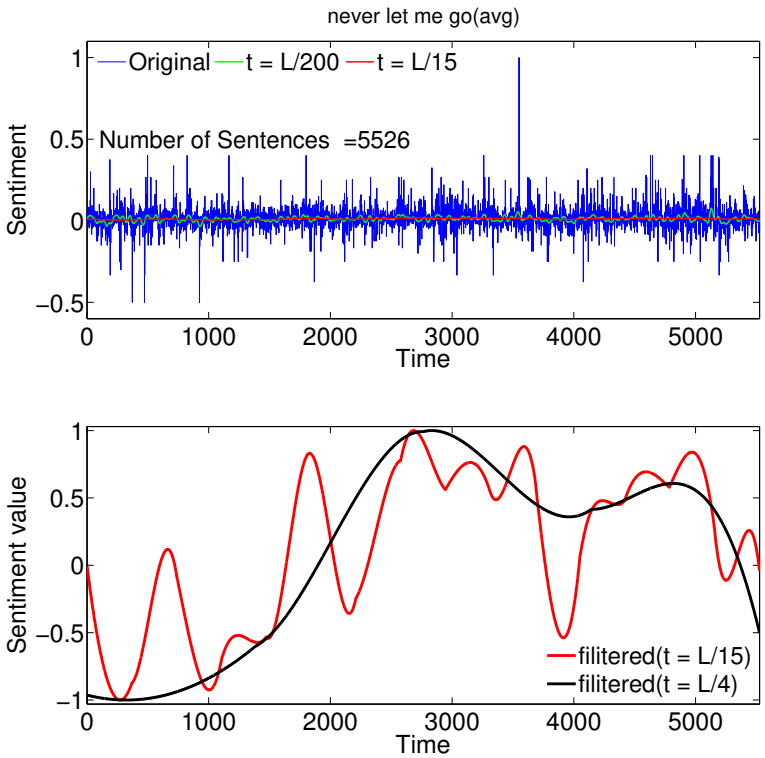

Figure 4: Story arc of Kazuo Ishiguro's 2005 novel *Never let me go*

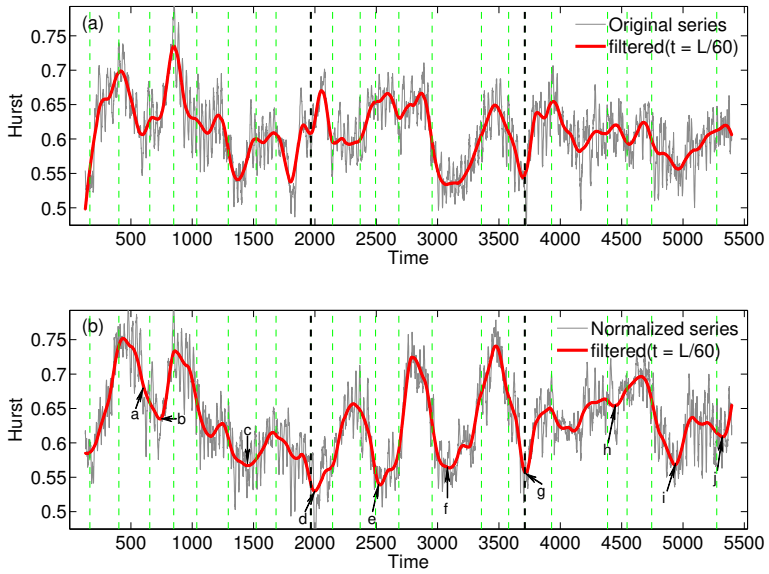

Figure 5: Evolution of the Hurst parameter under 256 window size of original and normalized sentiment time series

Hu, Q., Liu, B. Thomsen, M.R., Gao, J. & Nielbo, K.L. (*in review*). Dynamic evolution of sentiments in *Never Let Me Go*: Insights from multifractal theory and its implications for literary analysis.

Compositional dynamics

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Danish parsing & change detection

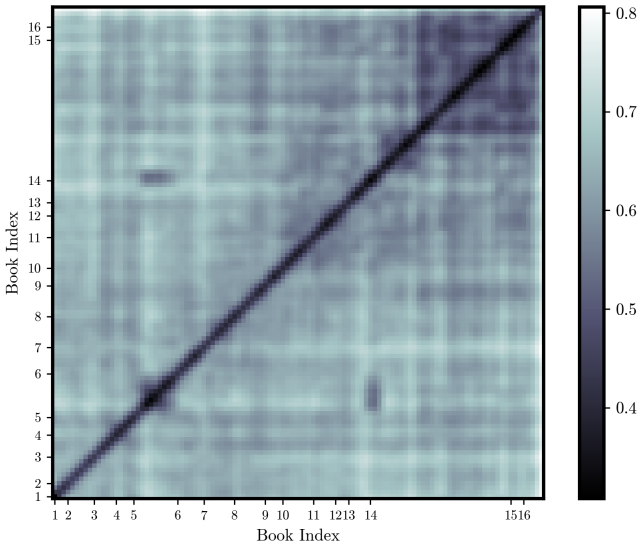

Figure 6: Cosine distance in baseline vector space model shows no evidence of change point.

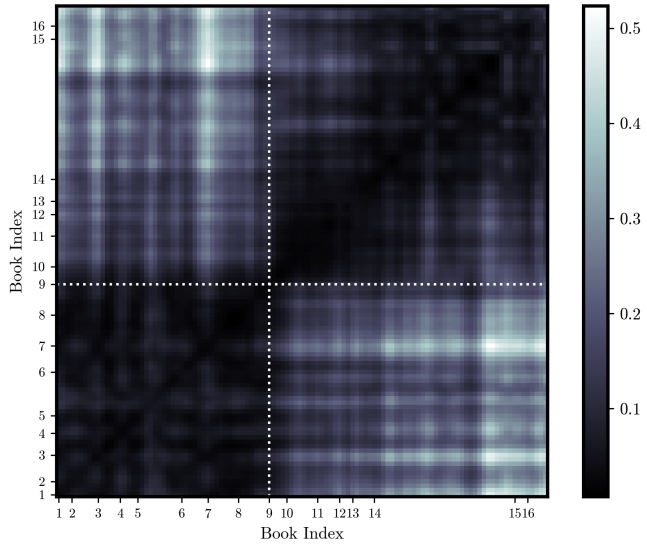

Figure 7: KL-divergence in contrast model indicates a gradual change point in book 9.

Nielbo, K.L., Perner, M.L., Larsen, C., Nielsen, J. & Laursen, D. (*submitted*). Change Detection in *Gesta Danorum*'s Topical Composition

THANK YOU

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slides: http://knielbo.github.io/files/kln_lit_informatics.pdf

& credits to

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Jianbo Gao and Bin Liu, Institute of Complexity Science and Big Data, Guangxi University, CHN
Culture Analytics @ Institute of Pure and Applied Mathematics, UCLA, US

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