Outline of a Literary Informatics

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

Dept. of History & SDU eScience Center
University of Southern Denmark

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Outline

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

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A need for Human & Literary Informatics

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

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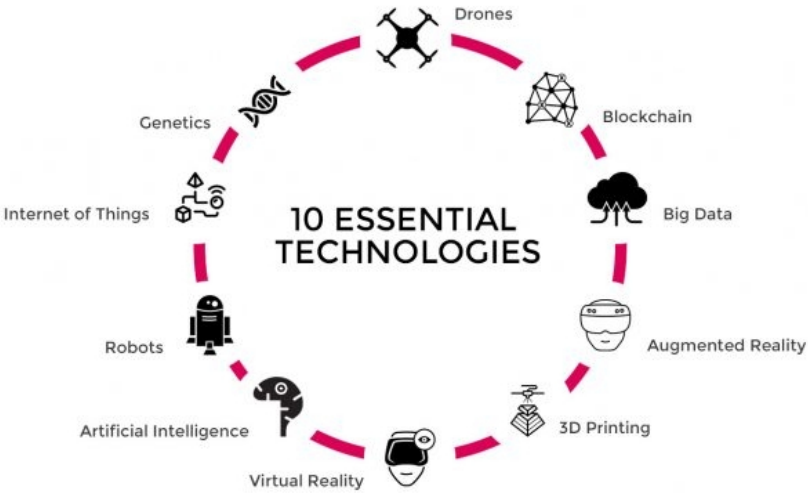
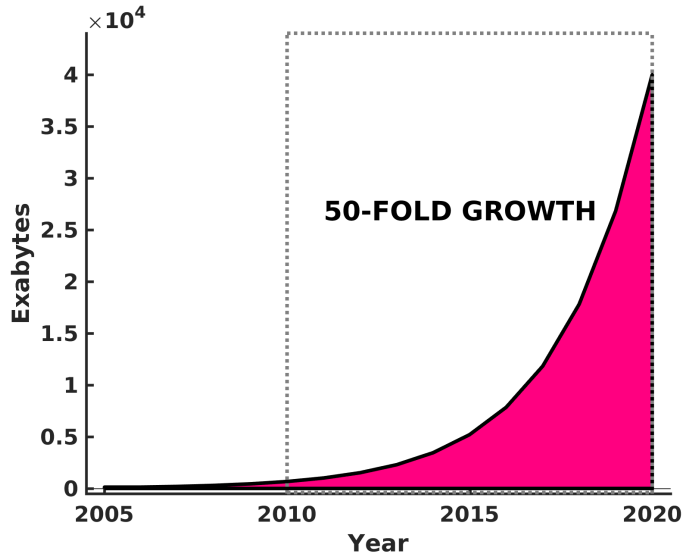
The data deluge





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 ⇒ to get value from these data, humanities (and social sciences) must utilize automation

human informatics - automatic information processing in the humanities

⇒ *literary informatics* ∼ *use of automation in literary studies*

K. Steinbuch (1957) Informatik: Automatische Informationsverarbeitung [Berlin: SEG-Nachrichten]

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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.

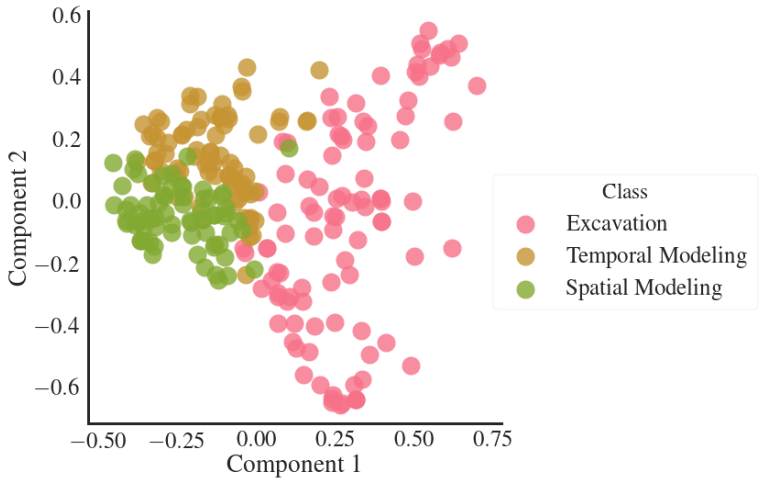

Figure 2: Advanced (human) informatics can merge, aggregate and project hetereogeneous data into lower dimensional spaces that allow visual manipulation

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knielbo@sdu.dk
knielbo.github.io

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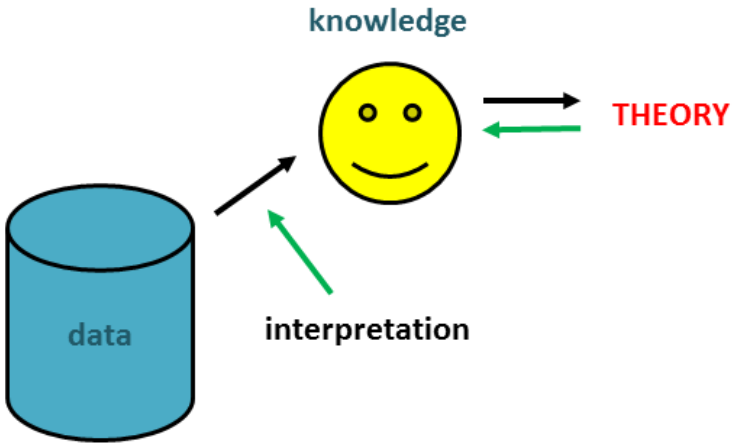
Default workflow



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knielbo@sdu.dk
knielbo.github.io

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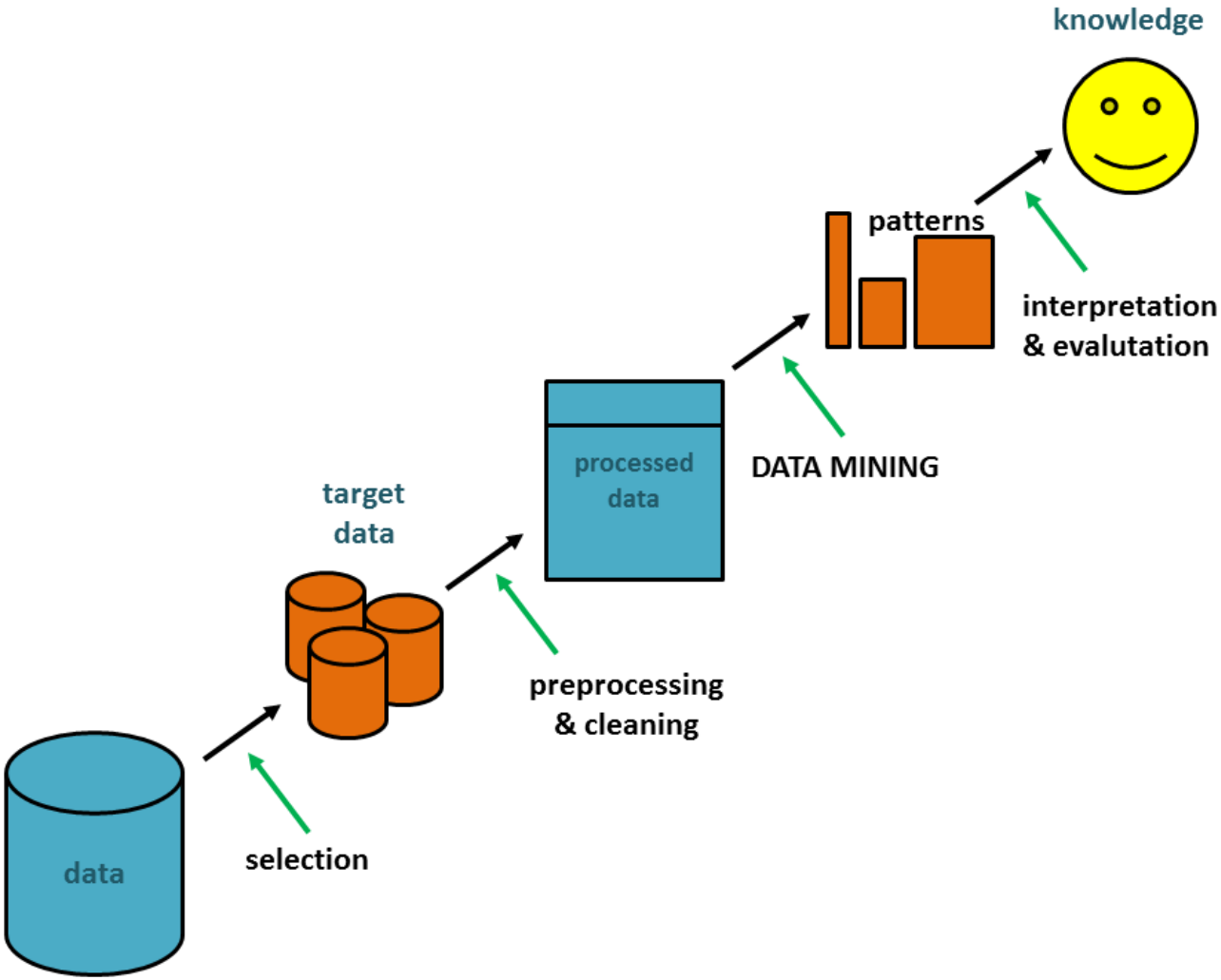
KDD workflow



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knielbo@sdu.dk
knielbo.github.io

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Author dynamics

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

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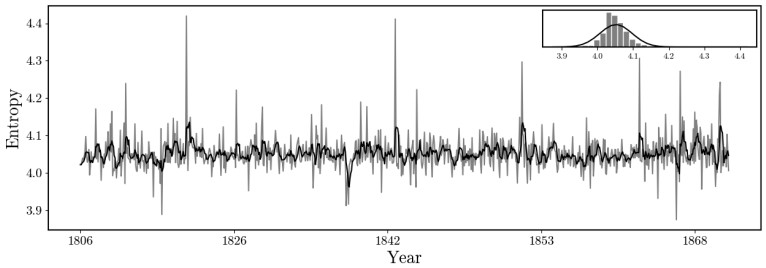
The appropriate formalism

– 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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knielbo@sdu.dk
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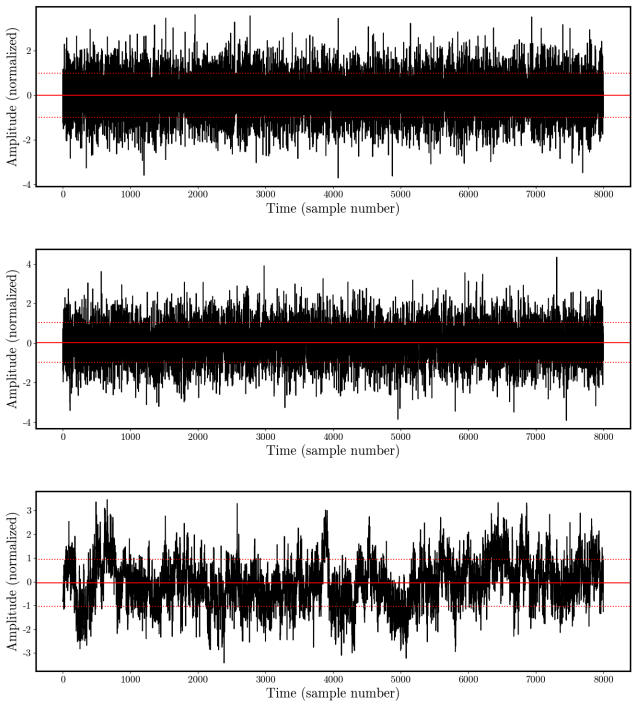
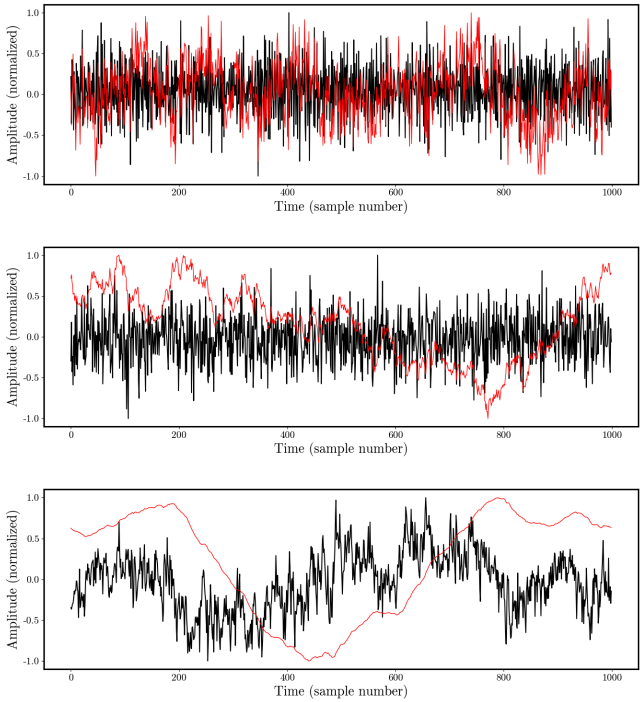
Competing levels of abstraction

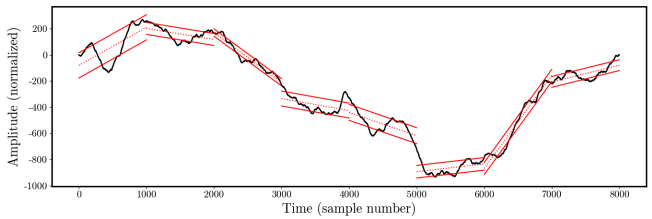


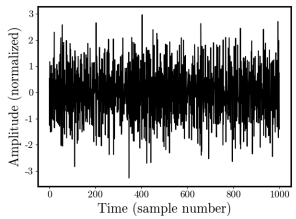


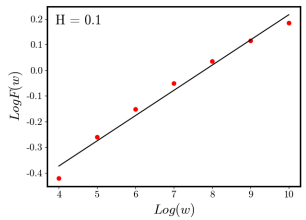
$$F(X) = \left[\frac{1}{N}\sum_{i=1}^{n}(x_n^2)\right]^{1/2}$$

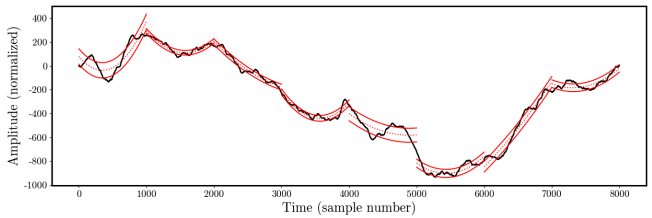
$$u(n) = \sum_{i=1}^{n}(x_i - \overline{x}), \quad n = 1, 2, \cdots, N,$$

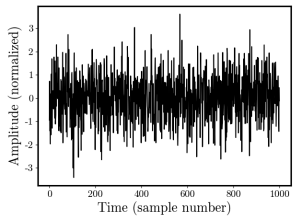
Noise and fractal properties

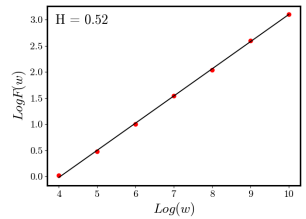


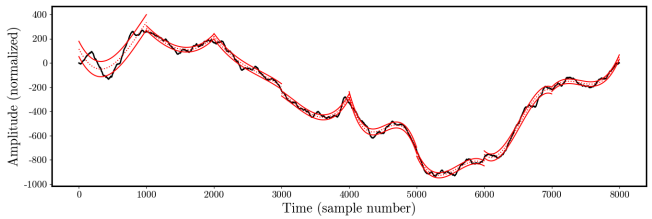


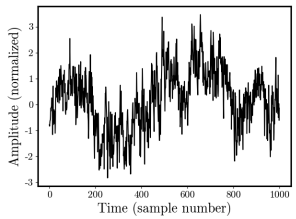


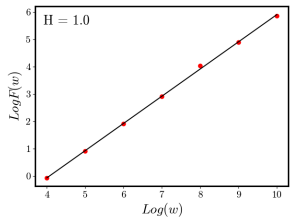












Library available at `https://github.com/knielbo/saffine`

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

Author change points

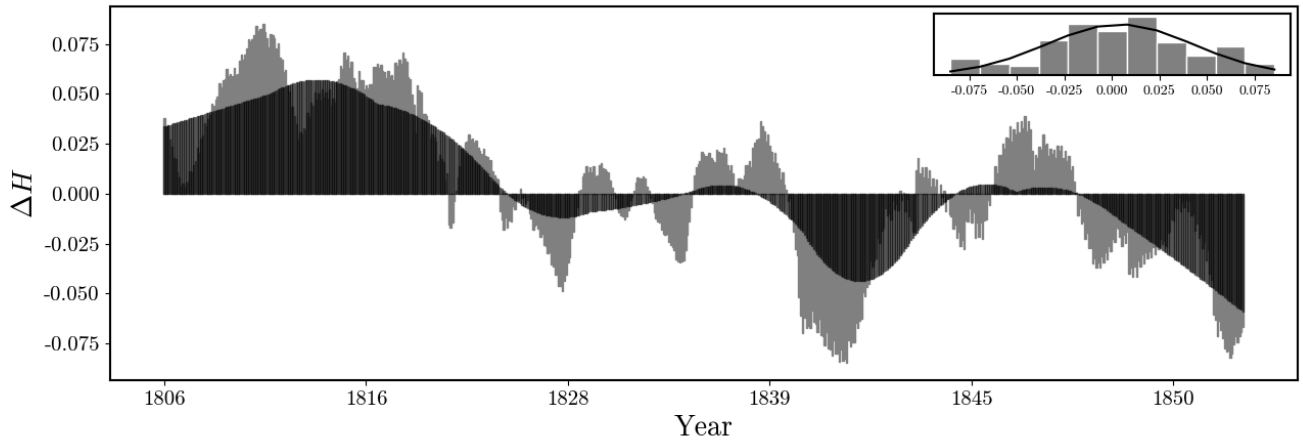


Table 1: Dominant Dynamic in the Phases of N.F.S. Grundtvig's Writings

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

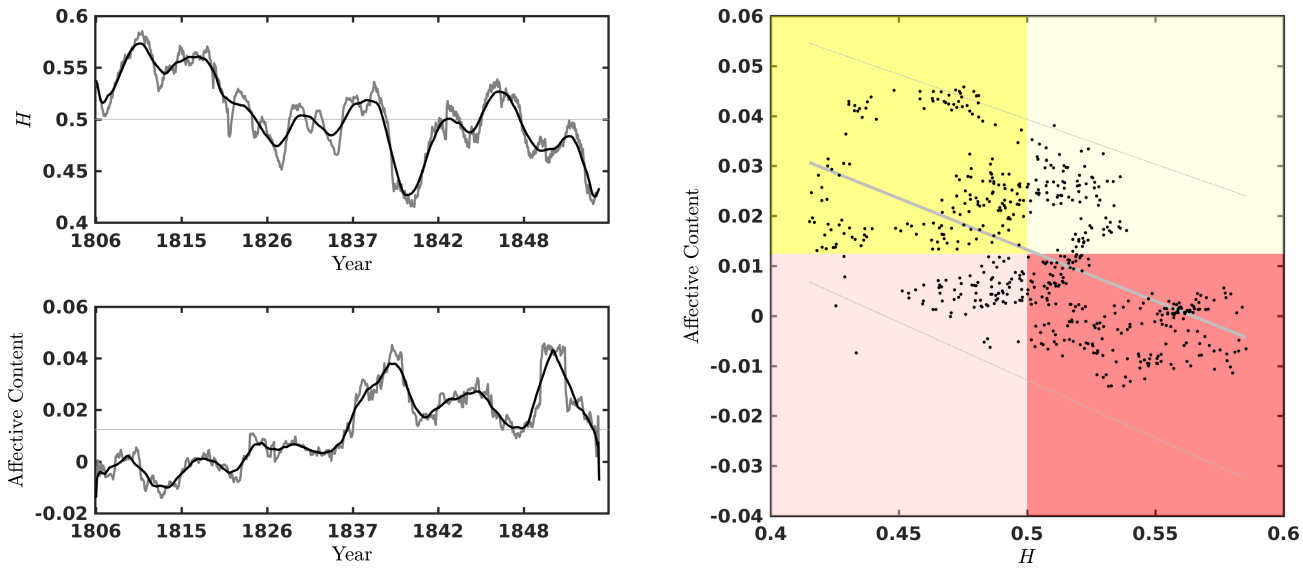


Figure 3: Combining persistent entropic trends with sentiment analysis and causal modeling, we can study **"the tormented artist"** phenomena in intellectual history.

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

Narrative dynamics

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

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Literature and affective computing

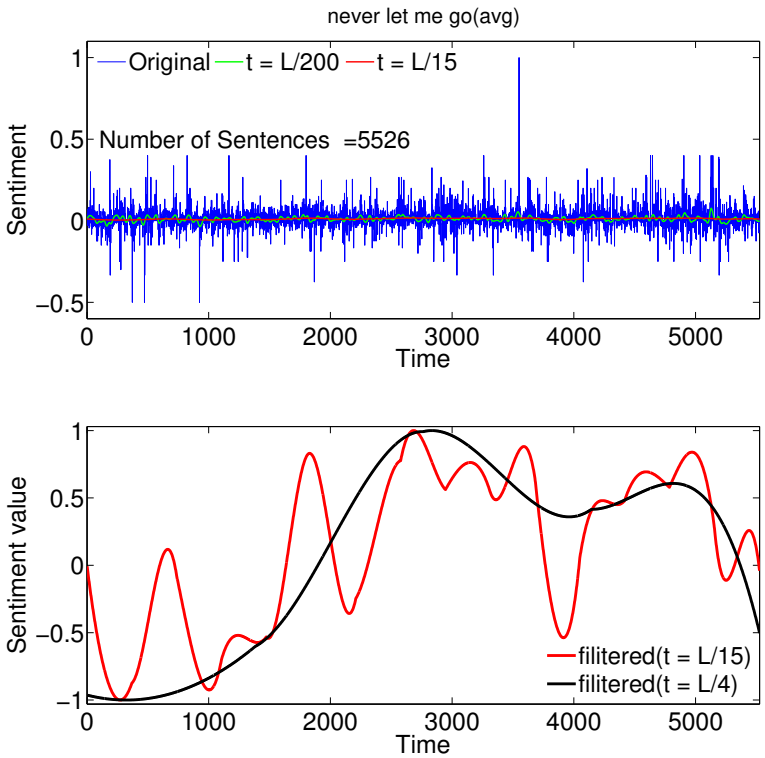

Figure 4: Story arc of Kazuo Ishiguro's 2005 novel *Never let me go*

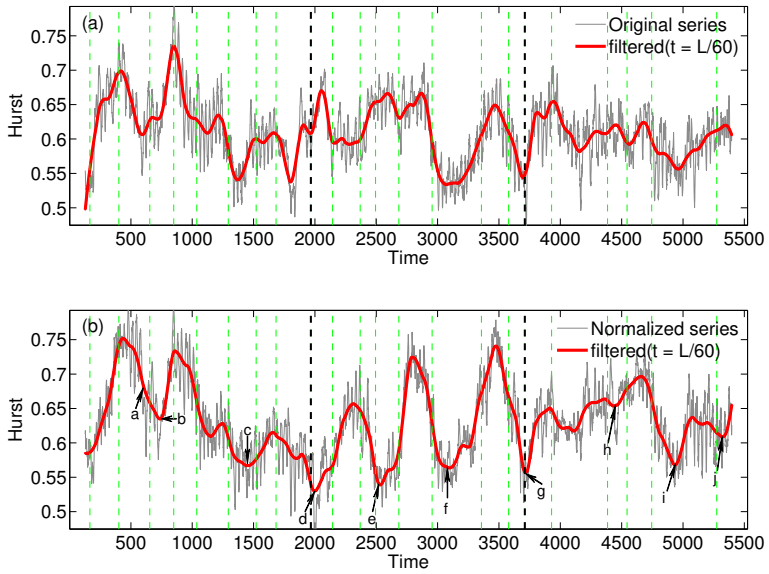

Figure 5: Evolution of the Hurst parameter under 256 window size of original and normalized sentiment time series

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

Kristoffer L Nielbo
knielbo@sdu.dk
knielbo.github.io

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Danish parsing & change detection

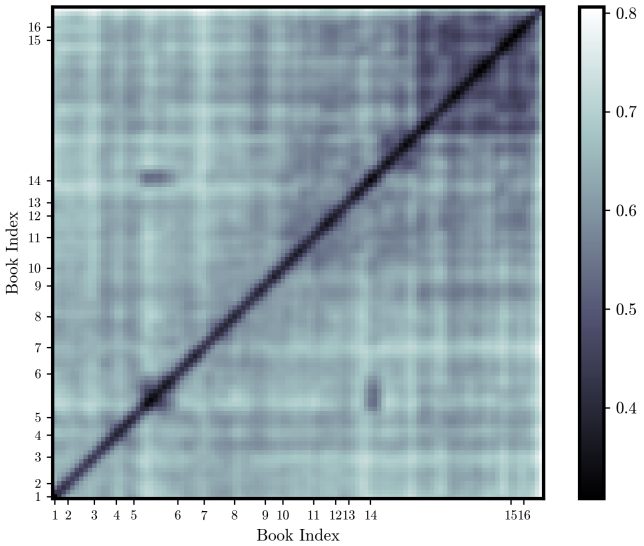

Figure 6: Cosine distance in baseline vector space model shows no evidence of change point.

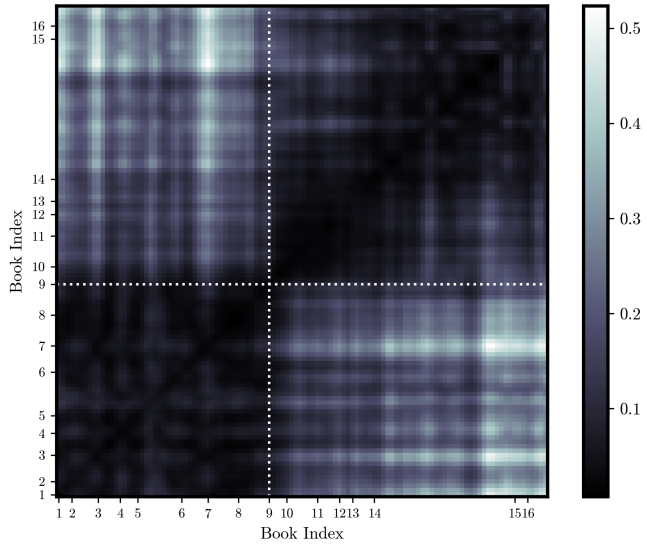

Figure 7: KL-divergence in contrast model indicates a gradual change point in book 9.

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

THANK YOU

knielbo@sdu.dk
knielbo.github.io

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

& credits to

Max R. Echardt and Katrine F. Baunvig, datakube, University of Southern Denmark, DK
Mads Rosendahl Thomsen, Comparative Literature, School of Communication and Culture, Aarhus University, DK
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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