ABCDH
https://abcdh.eu/

Distant Reading in R

Stylometry

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THE IDEA

«Measuring» authorial style

(Mendenhall, 1887)

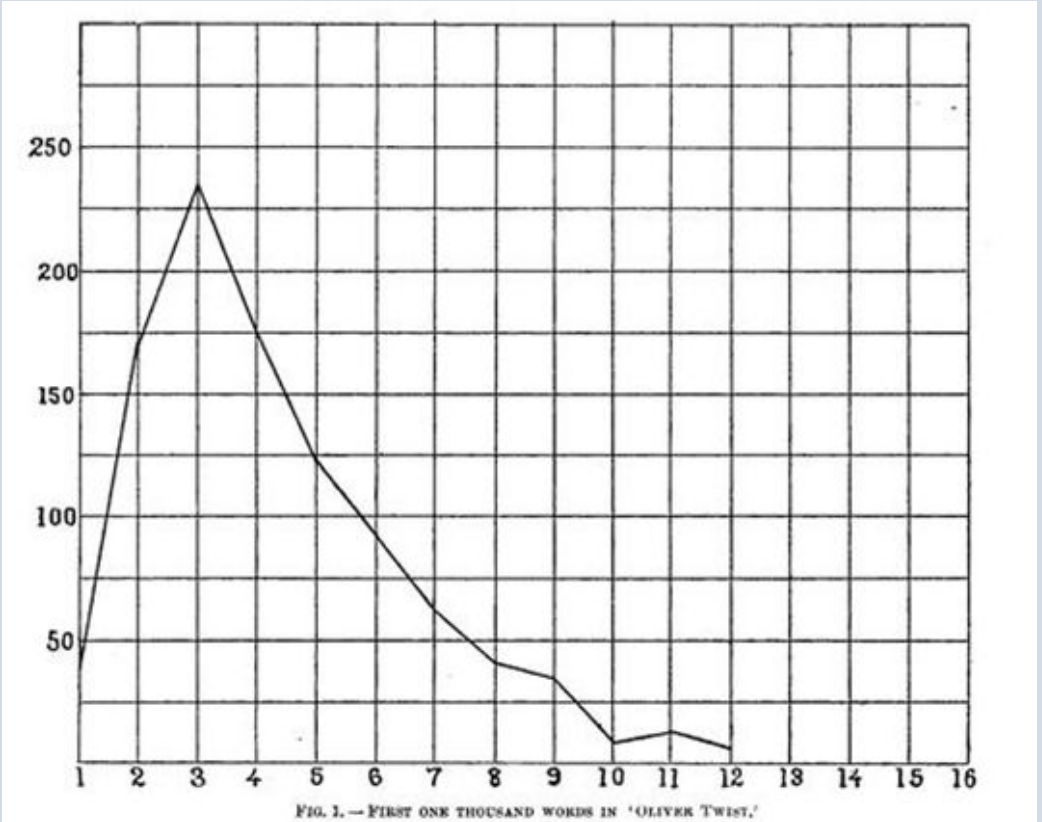


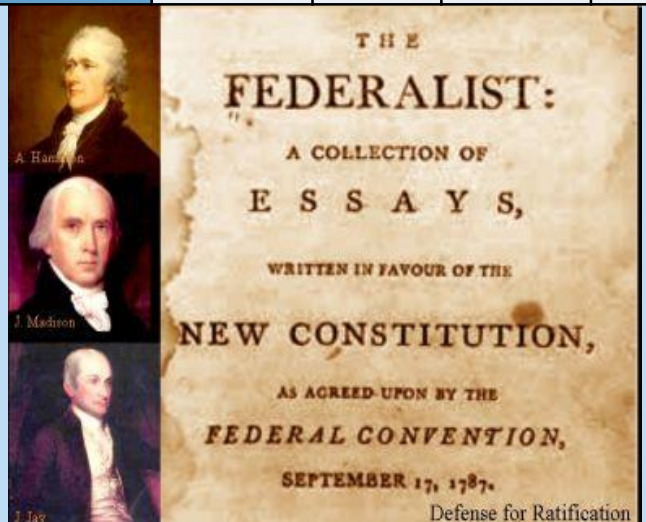
FIG. 1. — FIRST ONE THOUSAND WORDS IN 'OLIVER TWIST.'

THE IDEA

«Measuring» authorial style

Successes

	enough	while	whilst	upon
Hamilton	0.59	0.26	0	2.93
Madison	0	0	0.47	0.16
Disputed texts	0	0	0.34	0.08
Co-authored texts	0.18	0	0.36	0.36



(Mosteller and Wallace 1964)

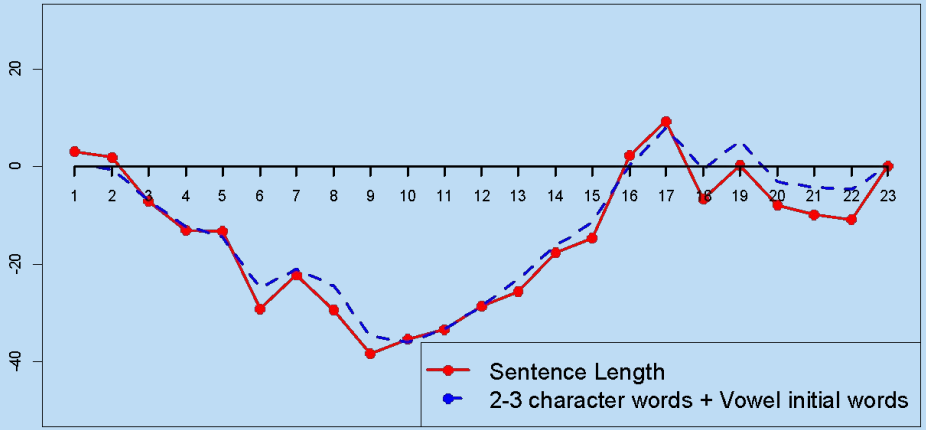
THE IDEA

«Measuring» authorial style

Failures

Andrew Morton in the early ‘60 adapted **Cu**mulative **Sum** – CUSUM or QSUM

During a BBC live show (1993):
Documents of convicted criminals were attributed to … the Secretary of State for Justice!!!



THE (PLETHORA OF) METHODS FOR STYLOMETRY AND AUTHORSHIP ATTRIBUTION

- Character-level analysis
- Syntax-level analysis
- Multi-method analysis (e.g. JGAAP, PAN competition software…)
- …and many others
- In this workshop, just two methods:
  - Delta method (for authorship attribution)
  - Keyness analysis (for the quantitative analysis of style)

WORD-FREQUENCY BASED STYLOMETRY

‘Delta’: a Measure of Stylistic Difference and a Guide to Likely Authorship[1]

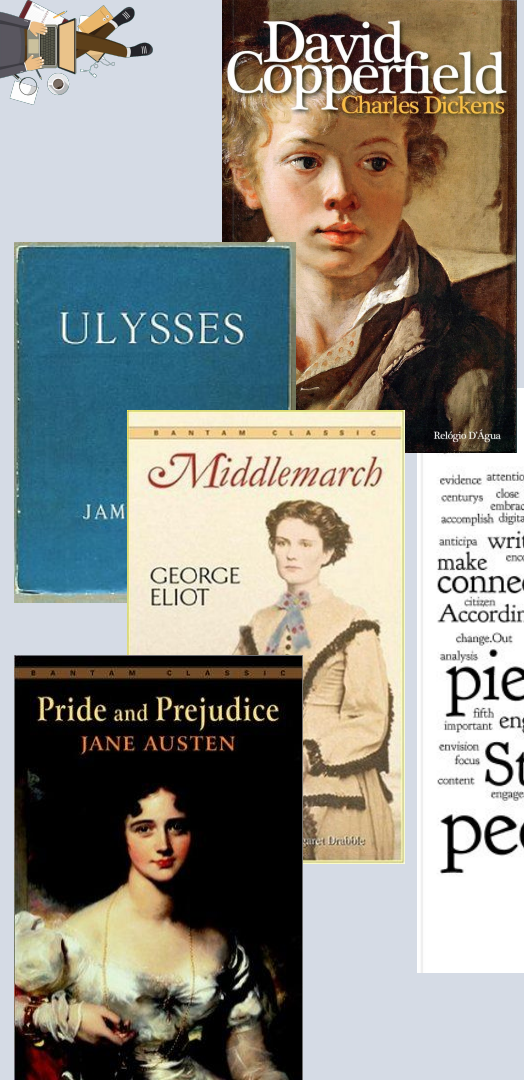
John Burrows
University of Newcastle, Australia

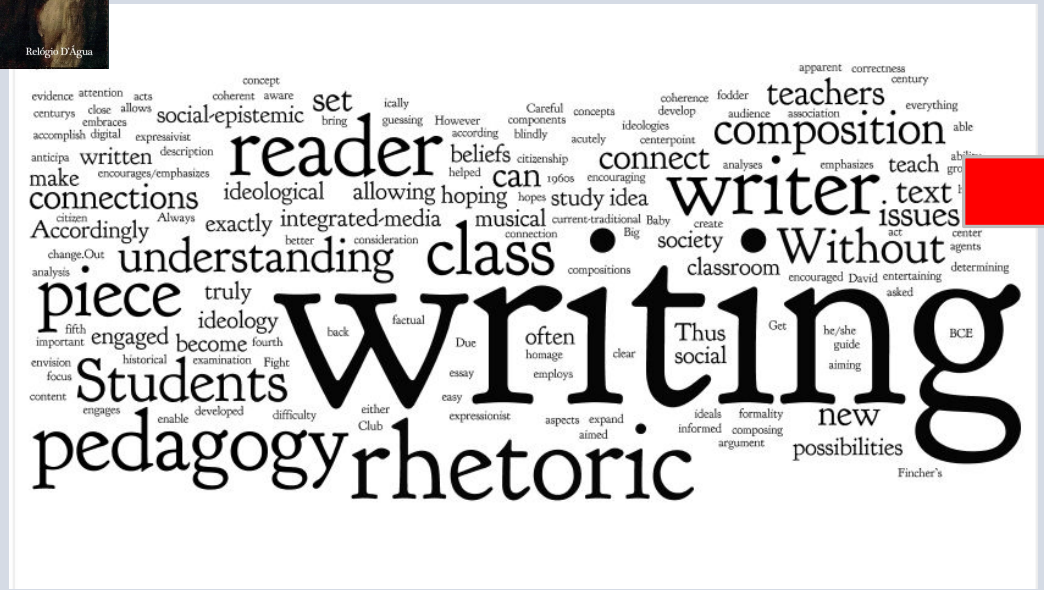
"Literary and Linguistic Computing" 17, no. 3 (2002): 267–87

Abstract

This paper is a companion to my ‘Questions of authorship: attribution and beyond’, in which I sketched a new way of using the relative frequencies of the very common words for comparing written texts and testing their likely authorship. The main emphasis of that paper was not on the new procedure but on the broader consequences of our increasing sophistication in making such comparisons and the increasing (although never absolute) reliability of our inferences about authorship. My present objects, accordingly, are to give a more complete account of the procedure itself; to report the outcome of an extensive set of trials; and to consider the strengths and limitations of the new procedure. The procedure offers a simple but comparatively accurate addition to our current methods of distinguishing the most likely author of texts exceeding about 1,500 words in length. It is of even greater value as a method of reducing the field of likely candidates for texts of as little as 100 words in length. Not unexpectedly, it

DELTA DISTANCE





1. the
2. and
3. of
4. to
5. a
6. i
7. in
8. he
9. was
10. it
11. that
12. you
13. his
14. her
15. with
16. as
17. had
18. she
19. for

1. the
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3. of
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6. i
7. in
8. he
9. was
10. it
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12. you
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14. her
15. with
16. as
17. had
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2.7%

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2.4%
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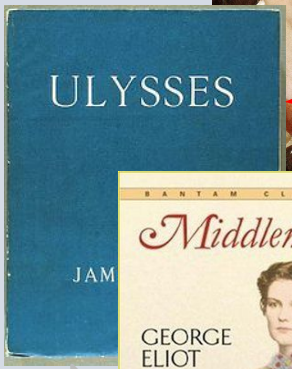
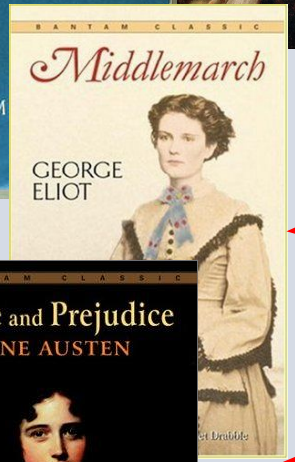
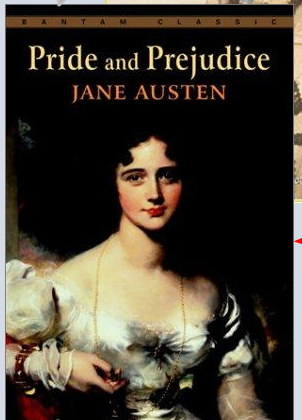




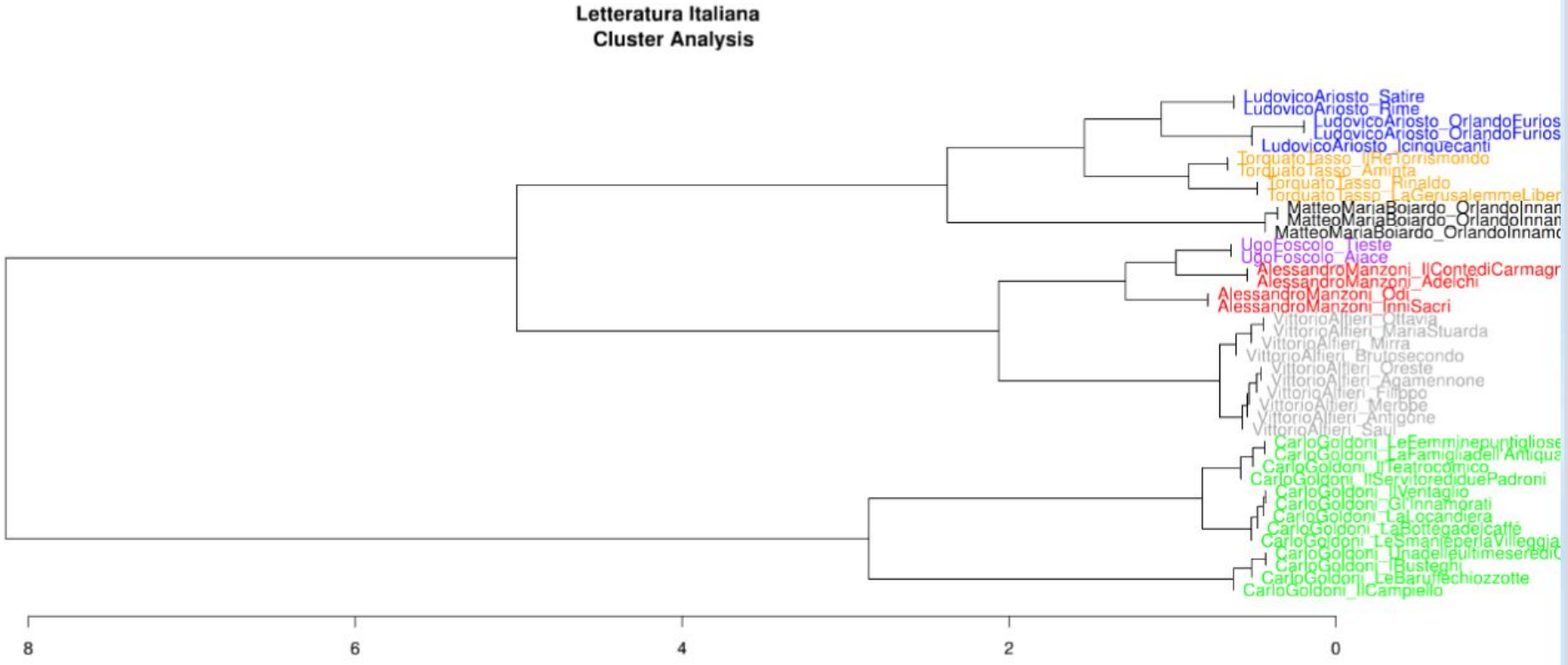


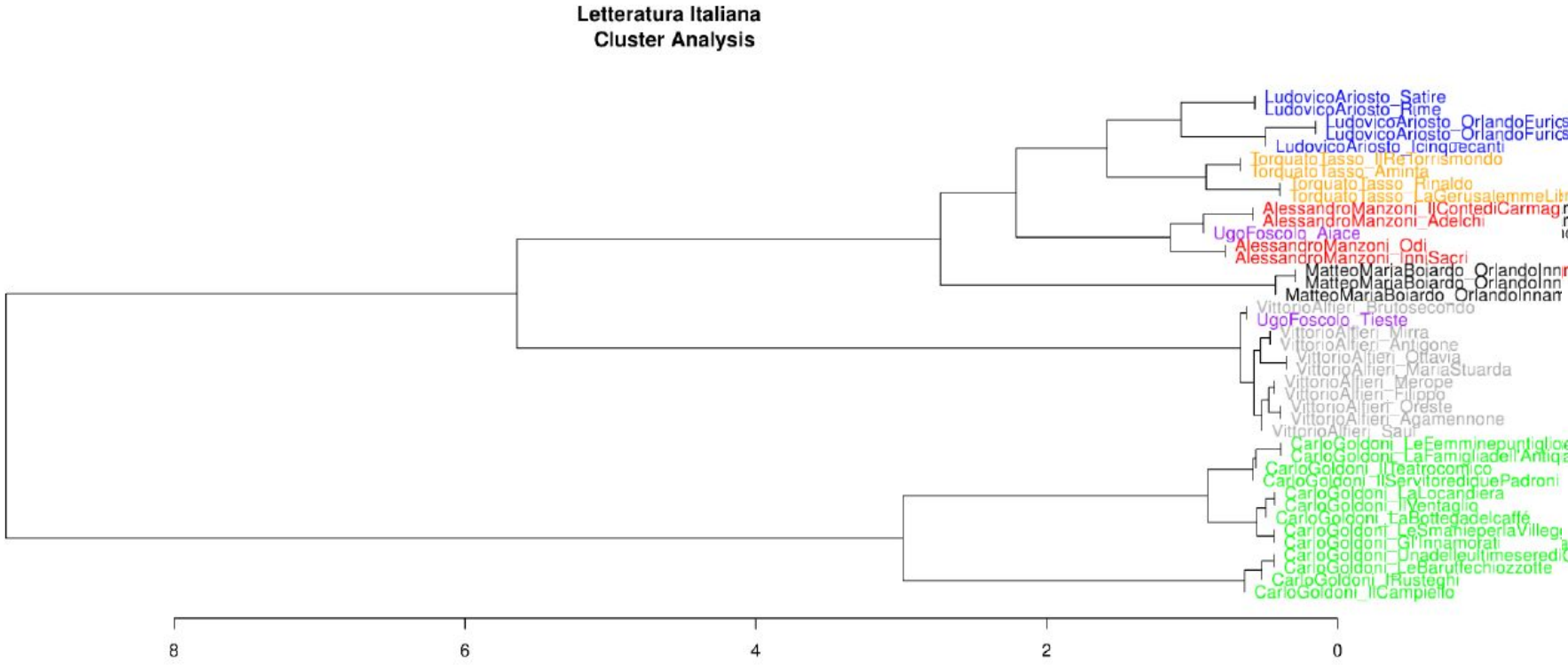
	A	B	C	D	E	F
1		AlessandroManzoni_Adelchi	AlessandroManzoni_IlContediCarmagnola	AlessandroManzoni_InniSacri	AlessandroManzoni_Odi	AlessandroManzoni_Poesiegio
2	AlessandroManzoni_Adelchi	0	0,481290655	0,666926925	0,738545533	0,568
3	AlessandroManzoni_IlContediCarmagnola	0,481290655	0	0,746348745	0,814261157	0,654
4	AlessandroManzoni_InniSacri	0,666926925	0,746348745	0	0,633663965	0,634
5	AlessandroManzoni_Odi	0,738545533	0,814261157	0,633663965	0	0,733
6	AlessandroManzoni_Poesiegiovanili	0,568820863	0,654375023	0,634854567	0,733827682	
7	CarloGoldoni_Gl'Innamorati	0,980786338	0,936018177	1,013723738	1,101305203	0,950
8	CarloGoldoni_IlCampiello	1,016924762	1,031300757	1,018625104	1,092680684	0,929
9	CarloGoldoni_IlServitorediduePadroni	0,94860233	0,926662976	0,976288639	1,080804722	0,918
10	CarloGoldoni_IlTeatrocomico	0,915941412	0,896367382	0,971870697	1,085346366	0,898
11	CarloGoldoni_IlVentaglio	1,011953514	1,00041649	1,074888328	1,131792245	0,997
12	CarloGoldoni_IRusteghi	1,089096895	1,124315967	1,047451935	1,1240649	0,977
13	CarloGoldoni_LaBottegadelcaffé	0,997940632	0,980781404	1,069965126	1,139058754	0,993
14	CarloGoldoni_LaFamigliadell'Antiquario	0,97647637	0,968110166	1,038499373	1,080510085	0,953
15	CarloGoldoni_LaLocandiera	0,97946604	0,952399004	1,052505983	1,110322738	0,956
16	CarloGoldoni_LeBaruffechiozzotte	1,051753673	1,103993387	1,018834132	1,082447143	0,942
17	CarloGoldoni_LeFemminepuntigliose	0,940334542	0,938723973	1,008461186	1,076438004	0,917
18	CarloGoldoni_LeSmanieperlaVilleggiatura	1,023938091	0,964832878	1,056736183	1,148650567	1,007
19	CarloGoldoni_UnadelleultimeserediCarnovale	1,045847956	1,085480986	1,047945641	1,10681856	0,948
20	VittorioAlfieri_Agamennone	0,684514153	0,743793265	0,829452563	0,905939302	0,7
21	VittorioAlfieri_Antigone	0,73781244	0,801189414	0,824156384	0,91495815	0,721
22	VittorioAlfieri_Brutosecondo	0,675393312	0,675937144	0,830722082	0,910174086	0,668
23	VittorioAlfieri_Filippo	0,69672213	0,73856813	0,806194725	0,93419818	0,669
24	VittorioAlfieri_MariaStuarda	0,693145931	0,715015202	0,806081448	0,948928306	0,673
25	VittorioAlfieri_Merope	0,735463235	0,783055974	0,855979157	0,971583955	0,709
26	VittorioAlfieri_Mirra	0,76329317	0,819104452	0,864045202	0,9659327	0,760
27	VittorioAlfieri_Oreste	0,70530237	0,777981376	0,829335057	0,930970217	0,715
28	VittorioAlfieri_Ottavia	0,762895099	0,791949819	0,874379901	0,96265065	0,722
29	VittorioAlfieri_Saul	0,645417404	0,735038238	0,760393582	0,871007648	0,666
30						

VISUALIZATIONS

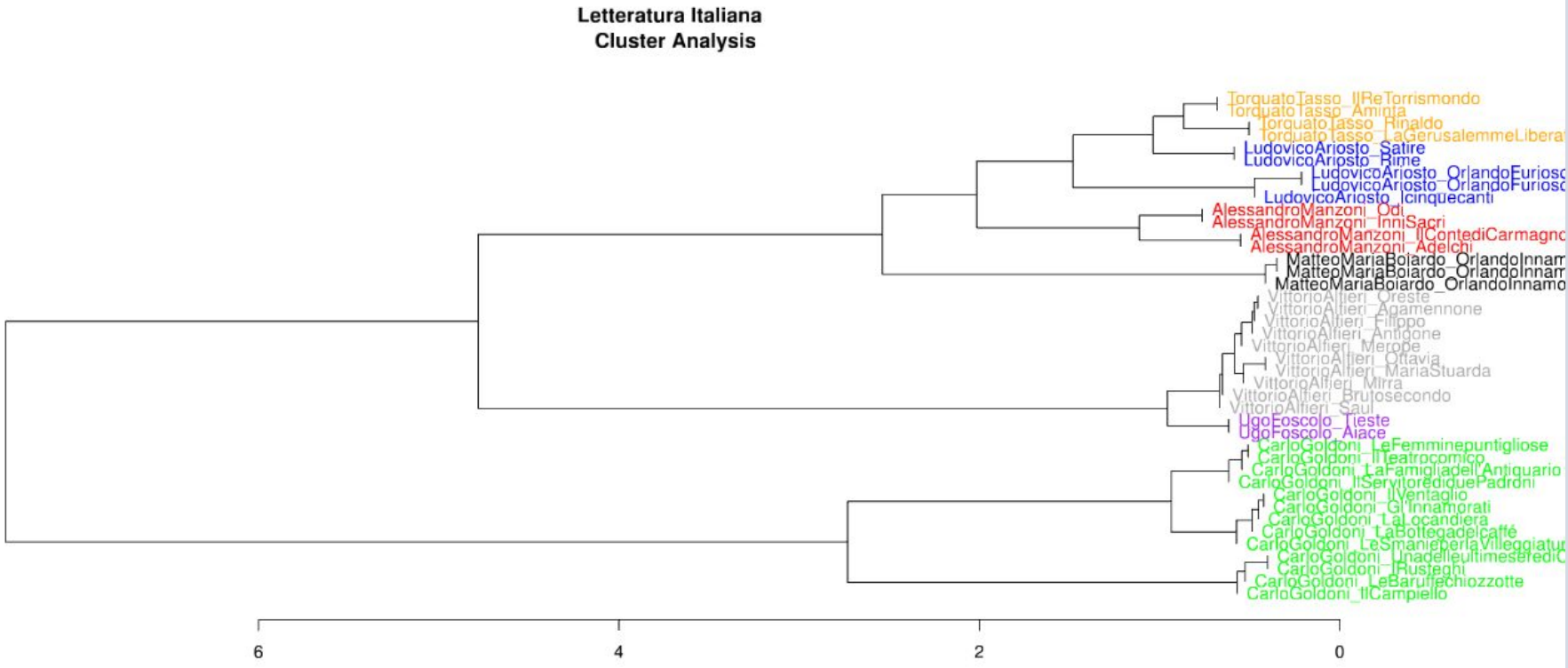
1. Dendrograms

Ward's clustering algorithm (Ward, 1963)

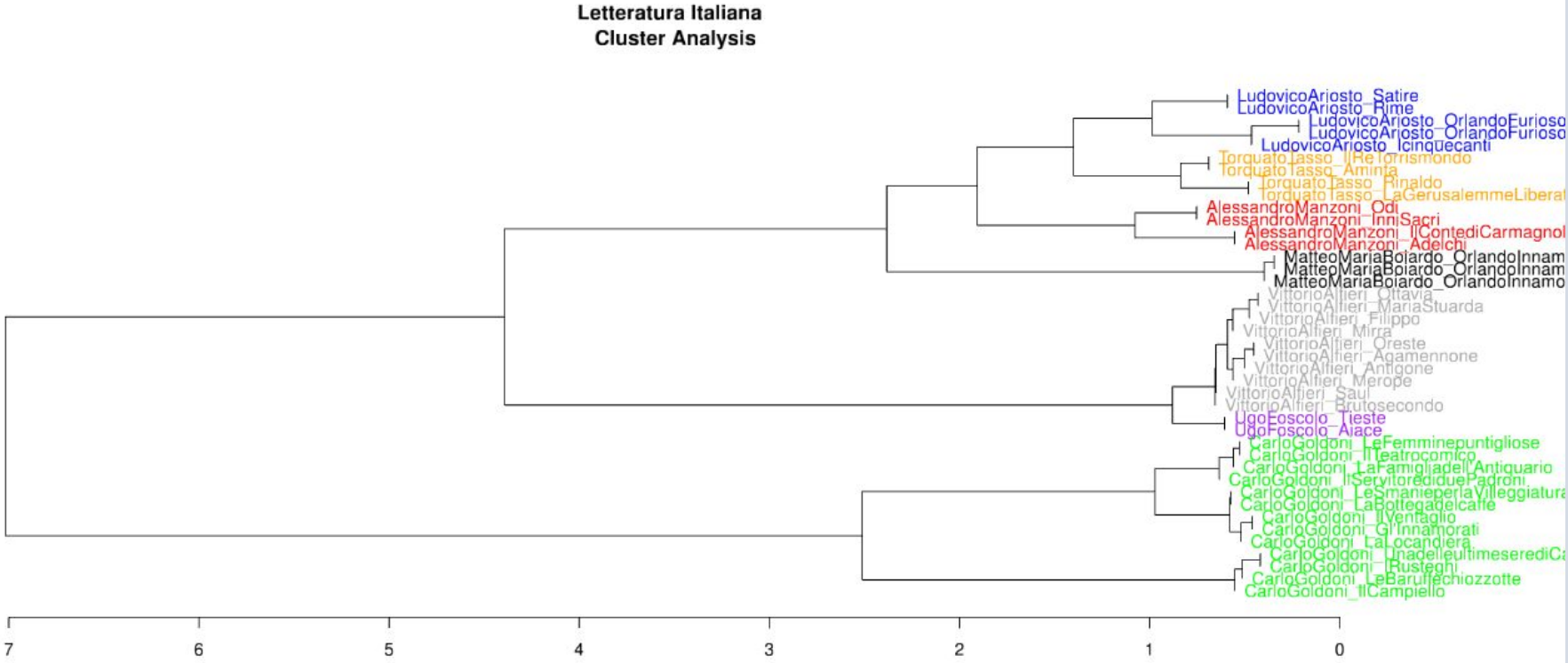

Letteratura Italiana
Cluster Analysis
LudovicoAriosto_Satire
LudovicoAriosto_Rime
LudovicoAriosto_OrlandoFurios
LudovicoAriosto_OrlandoFurios
LudovicoAriosto_Icinquecanti
TorquatoTasso_IlRetorrismondo
TorquatoTasso_Aminta
TorquatoTasso_Rinaldo
TorquatoTasso_LaGerusalemmeLiber
MatteoMariaBoiardo_OrlandoInnam
MatteoMariaBoiardo_OrlandoInnam
MatteoMariaBoiardo_OrlandoInnamo
UgoFoscolo_Tieste
UgoFoscolo_Ajace
AlessandroManzoni_IlContediCarmagn
AlessandroManzoni_Adelchi
AlessandroManzoni_Odi
AlessandroManzoni_InniSacri
VittorioAlfieri_Ottavia
VittorioAlfieri_MariaStuarda
VittorioAlfieri_Mirra
VittorioAlfieri_Brutosecondo
VittorioAlfieri_Oreste
VittorioAlfieri_Agamennone
VittorioAlfieri_Filippo
VittorioAlfieri_Merope
VittorioAlfieri_Antigone
VittorioAlfieri_Saul
CarloGoldoni_LeFemminepuntigliose
CarloGoldoni_LaFamigliadell'Antiqua
CarloGoldoni_IlTeatrocomico
CarloGoldoni_IlServitoreediduePadroni
CarloGoldoni_IlVentaglio
CarloGoldoni_GlInnamorati
CarloGoldoni_LaLocandiera
CarloGoldoni_LaBottegadelcaffè
CarloGoldoni_LeSmanieperlaVilleggia
CarloGoldoni_Unadelleultimeseredi
CarloGoldoni_IBusteghi
CarloGoldoni_LeBaruffechiozzotte
CarloGoldoni_IlCampiello
8
6
4
2
0
Burrows Delta
with 100 most frequent words (MFW)



Burrows Delta
with 200 most frequent words (MFW)



Cosine Delta
with 100 most frequent words (MFW)



My Weird Distance Measure
with 1,000,000 most frequent words (MFW)

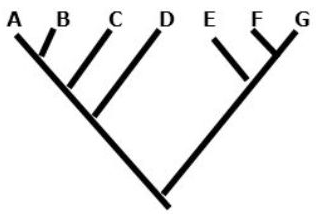
VISUALIZATIONS

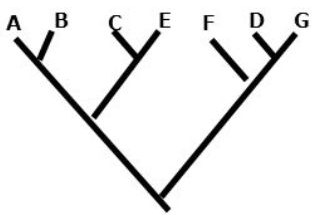
2. Consensus Trees

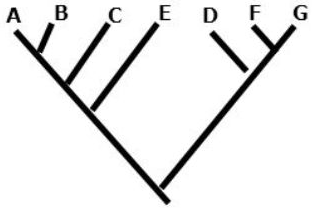
Method developed in philogenetics
(see Paradis et al. 2004)

Consensus Trees

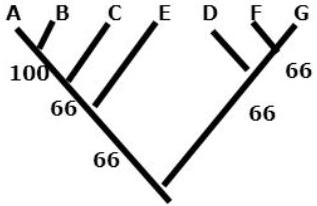
Majority rule consensus





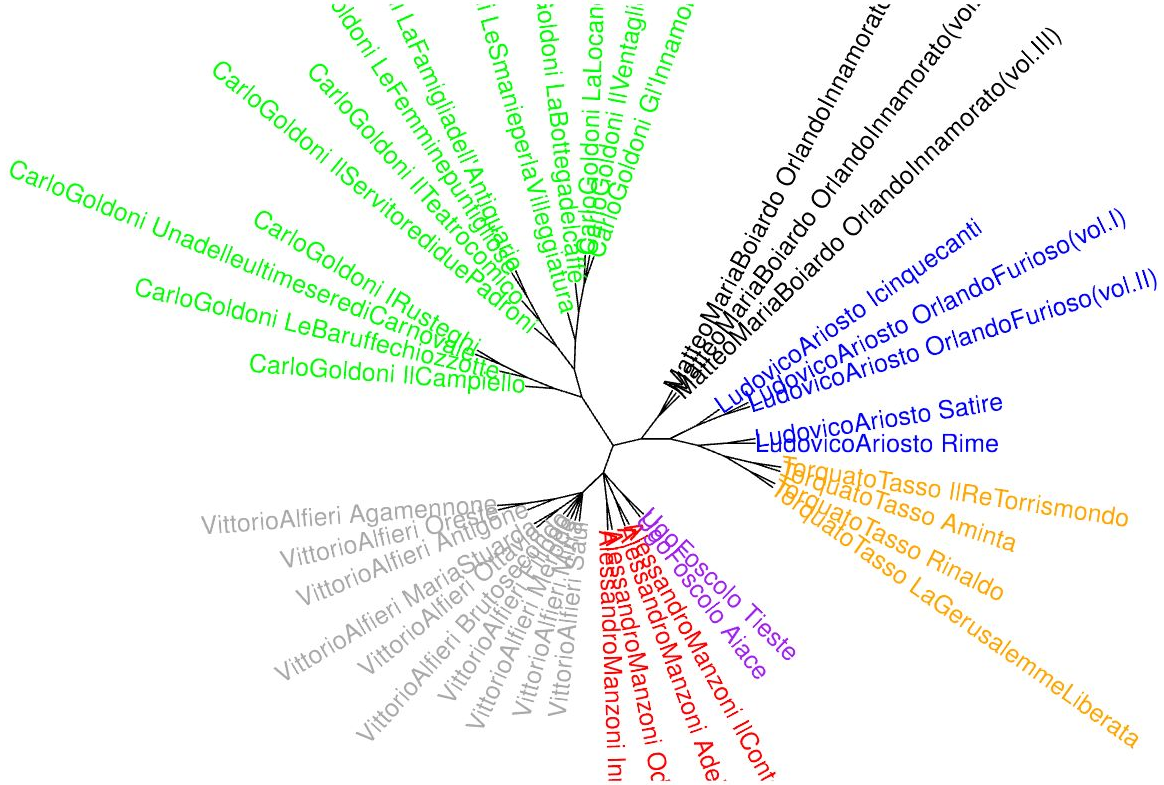


Numbers indicate frequency of clades in the fundamental trees



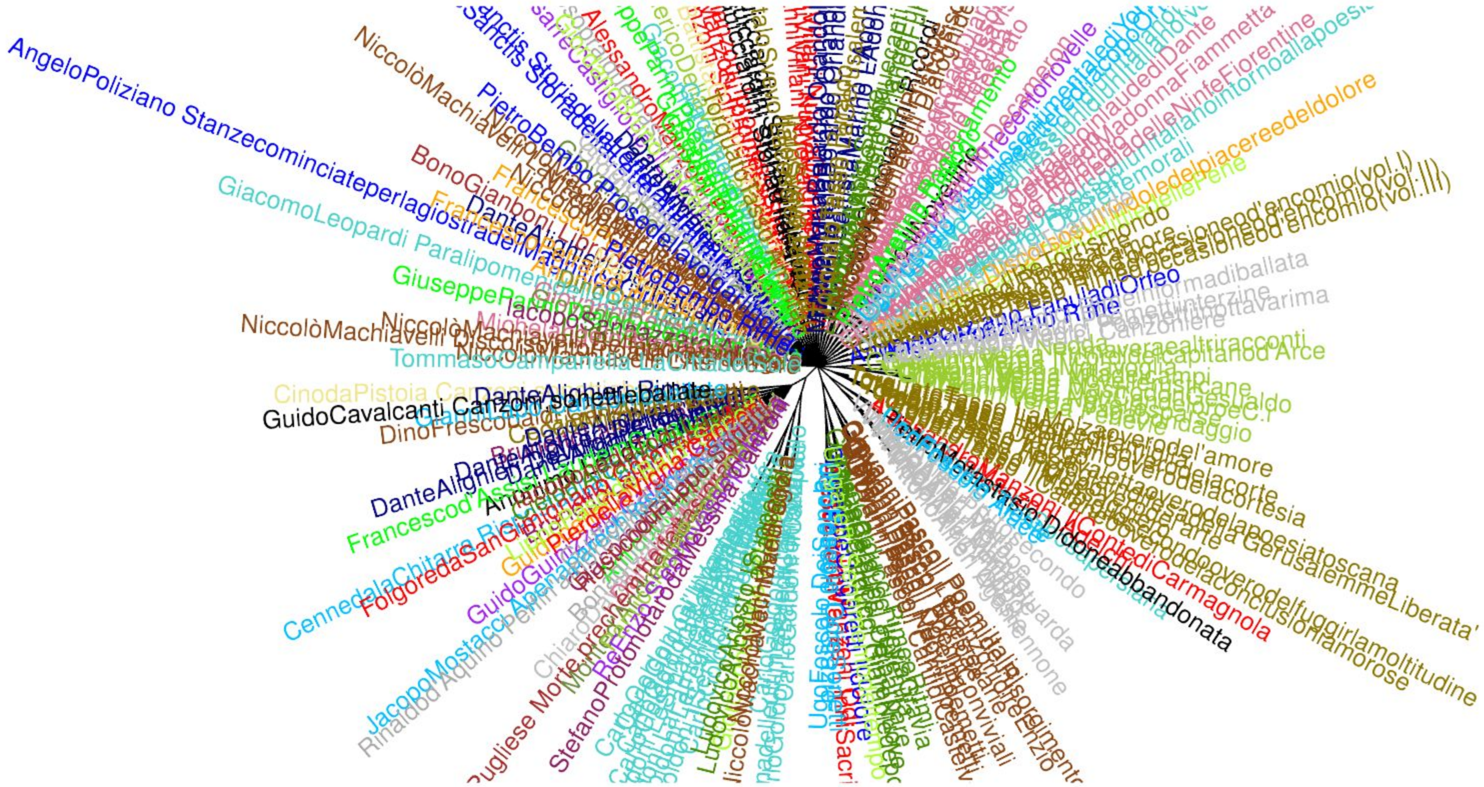
MAJORITY-RULE CONSENSUS TREE

Letteratura Italiana
Bootstrap Consensus Tree



100–1000 MFW Culled @ 0%
Classic Delta distance Consensus 0.5

Letteratura Italiana
Bootstrap Consensus Tree



100–1000 MFW Culled @ 0%

Classic Delta distance Consensus 0.5

VISUALIZATIONS

3. Network Graphs

See Eder, 2017

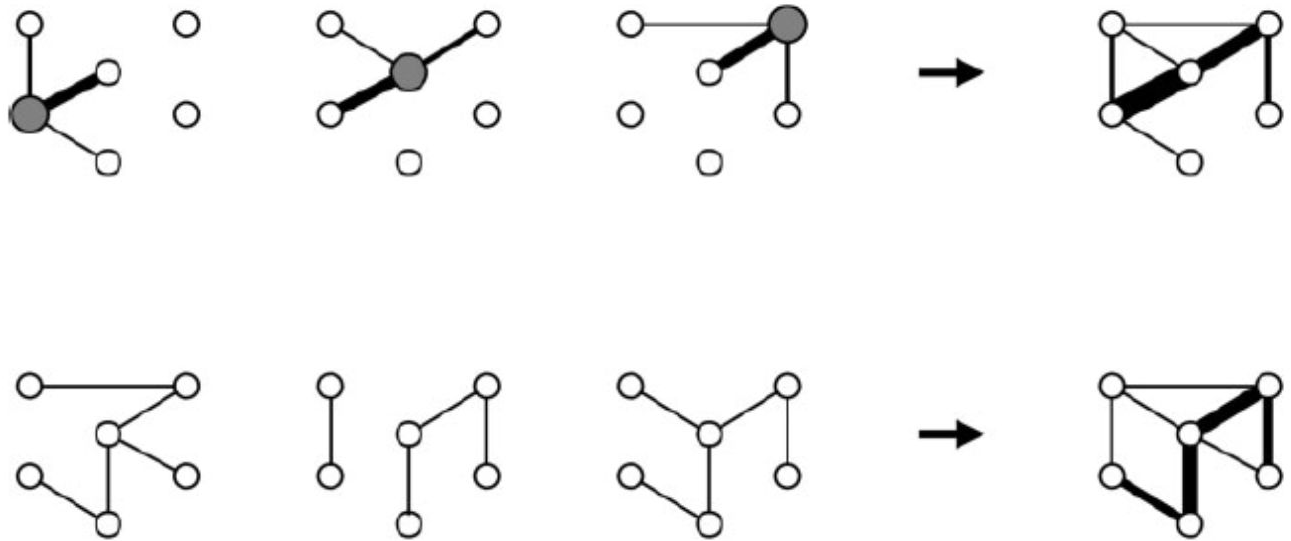
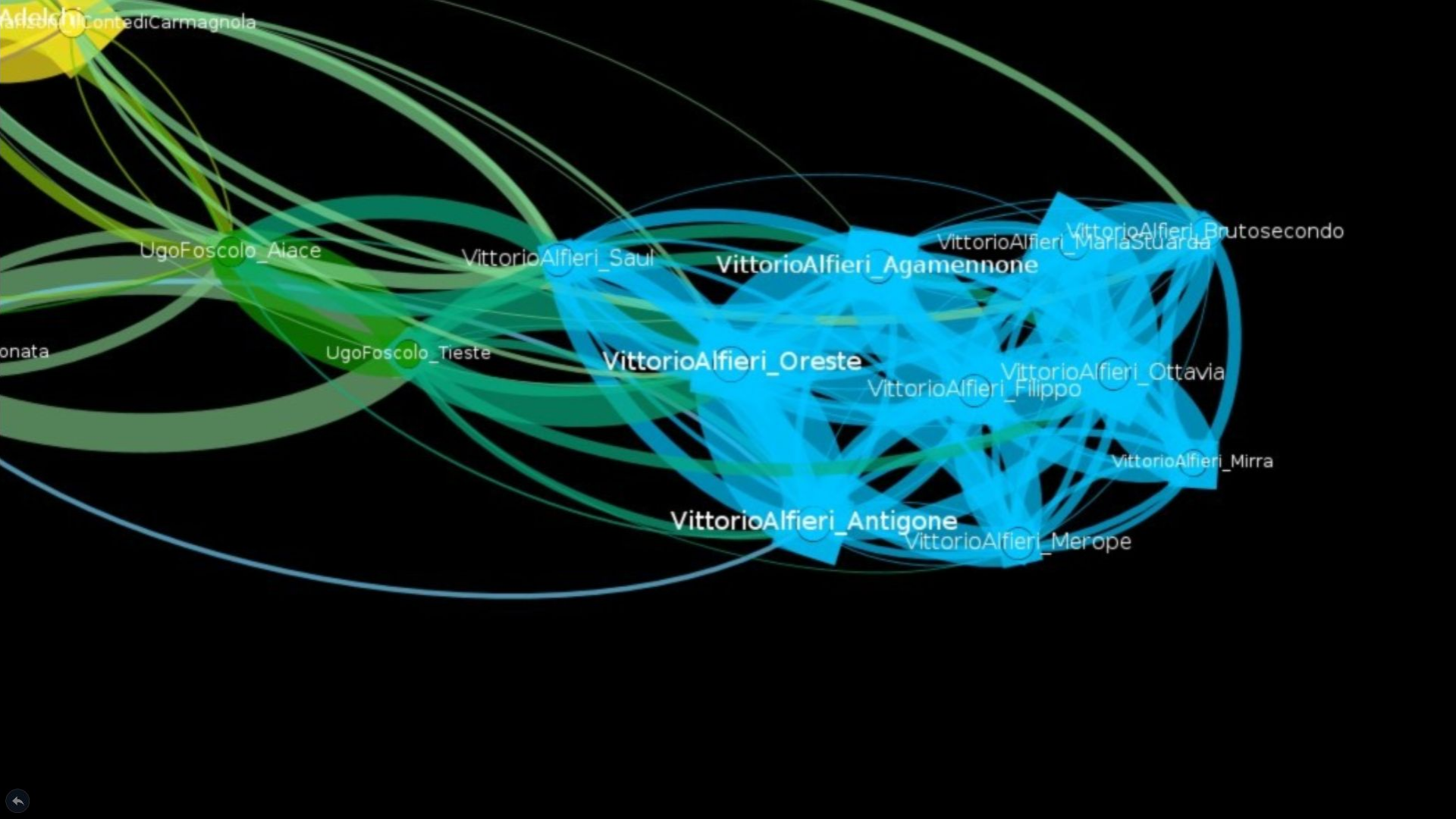
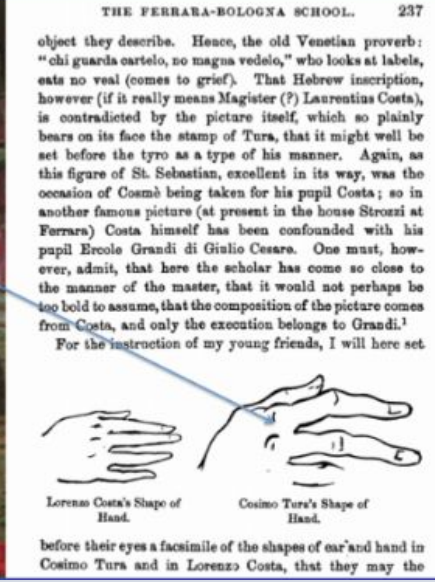


Fig. 6. Two algorithms of mapping textual relations: establishing weighted links to a nearest neighbor and two runners-up (top); producing a consensus network (bottom).


Adelchi
ContediCarmagnola
UgoFoscolo_Aiace
VittorioAlfieri_Saul
VittorioAlfieri_Agamennone
VittorioAlfieri_MariaStuarda
VittorioAlfieri_Brutosecondo
onata
UgoFoscolo_Tieste
VittorioAlfieri_Oreste
VittorioAlfieri_Ottavia
VittorioAlfieri_Filippo
VittorioAlfieri_Mirra
VittorioAlfieri_Antigone
VittorioAlfieri_Merope

WHY DOES IT WORK?



THE FERRARA-BOLOGNA SCHOOL. 237

object they describe. Hence, the old Venetian proverb: "chi guarda cartelo, no magna vedelo," who looks at labels, eats no veal (comes to grief). That Hebrew inscription, however (if it really means Magister (?) Laurentius Costa), is contradicted by the picture itself, which so plainly bears on its face the stamp of Tura, that it might well be set before the tyro as a type of his manner. Again, as this figure of St. Sebastian, excellent in its way, was the occasion of Cosmè being taken for his pupil Costa; so in another famous picture (at present in the house Strozzi at Ferrara) Costa himself has been confounded with his pupil Ercole Grandi di Giulio Cesare. One must, however, admit, that here the scholar has come so close to the manner of the master, that it would not perhaps be too bold to assume, that the composition of the picture comes from Costa, and only the execution belongs to Grandi.[1]

For the instruction of my young friends, I will here set

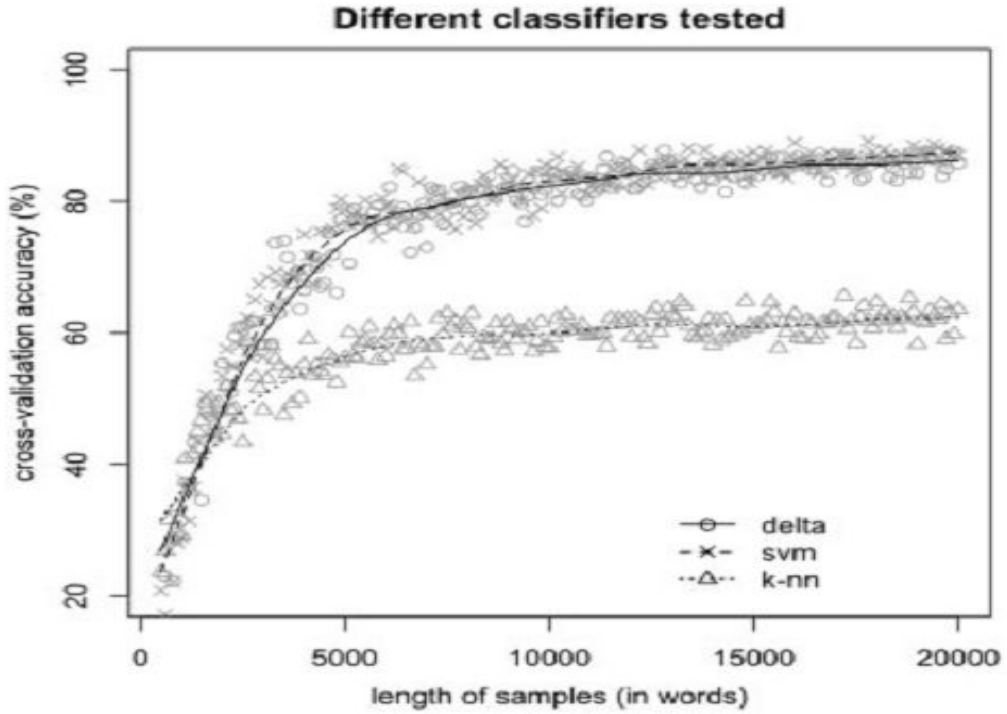
Lorenzo Costa's Shape of Hand.

Cosimo Tura's Shape of Hand.

before their eyes a facsimile of the shapes of ear and hand in Cosimo Tura and in Lorenzo Costa, that they may the

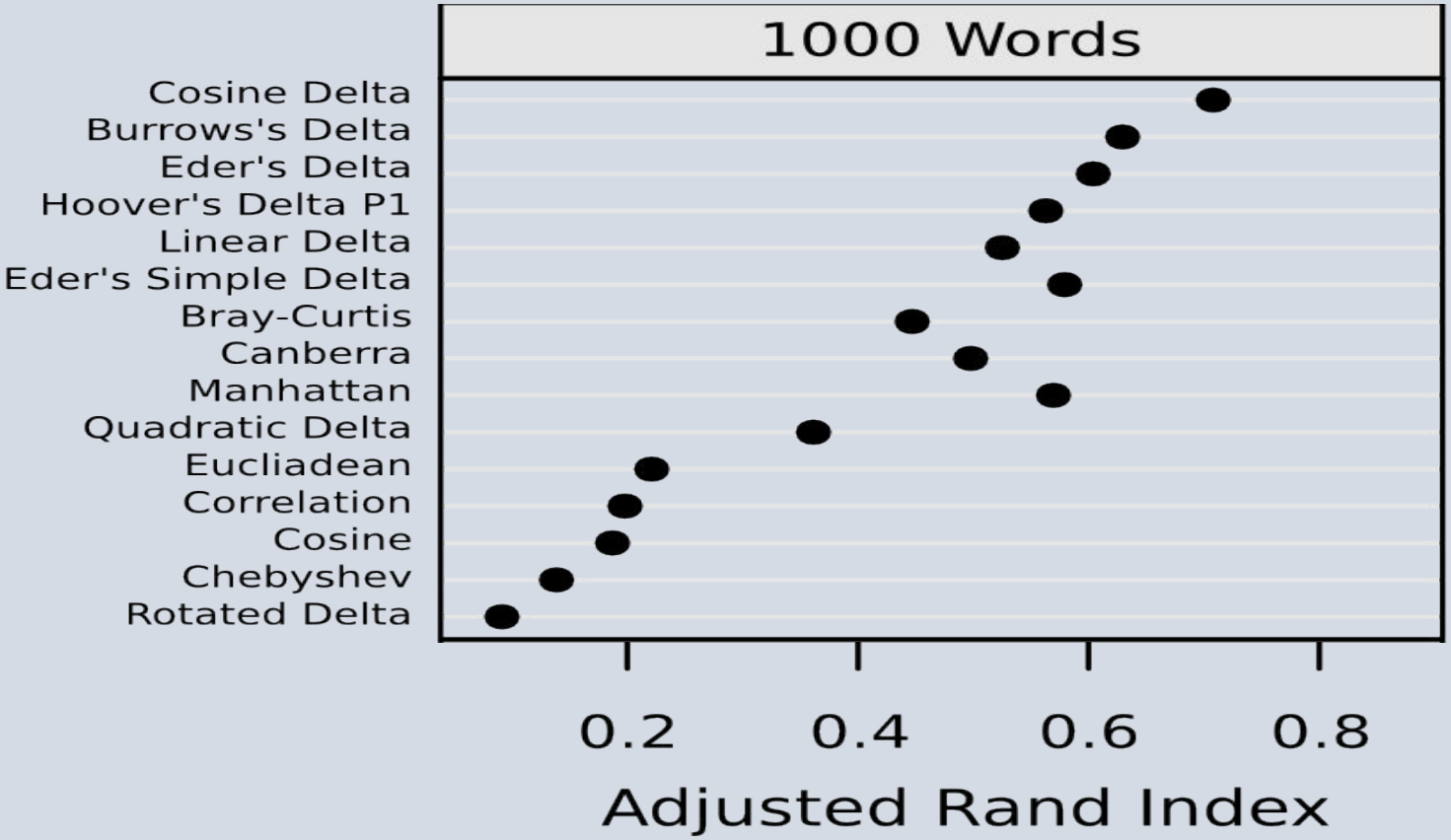
"It has been noted that the switch from content words to function words in authorship attribution studies has an interesting historic parallel in art-historic research. […] Giovanni Morelli (1816-1891) was among the first to suggest that the attribution of, for instance, a Quattrocento painting to some Italian master, could not happen based on 'content' […] Morelli thought it better to restrict an authorship analysis to discrete details such as ears, hands and feet" (Kestemont 2014)

CORPUS SELECTION (TEXT DIMENSIONS)



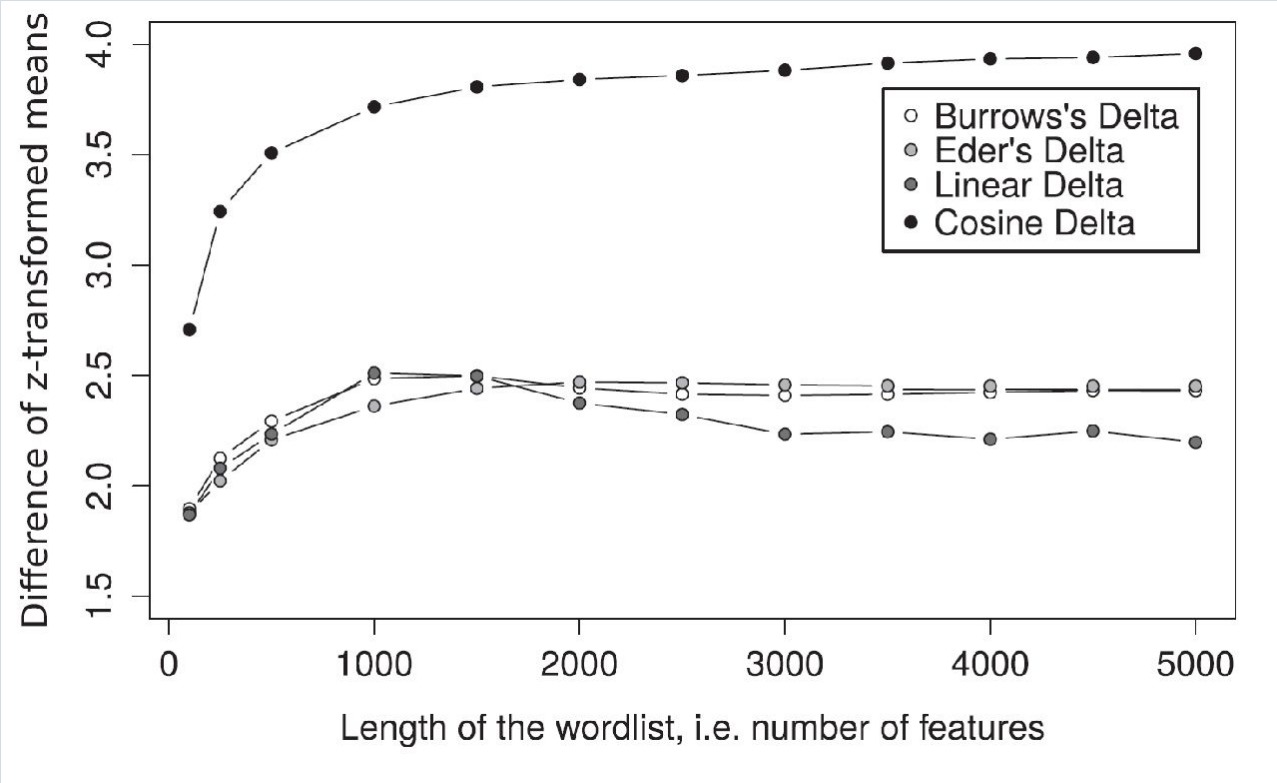
Minumun text length for a reliable stylometric analysis is about 5,000 words (Eder 2015)

CORPUS SELECTION (DISTANCE MEASURE)



Cosine Delta is the best performing distance (Evert et al. 2017)

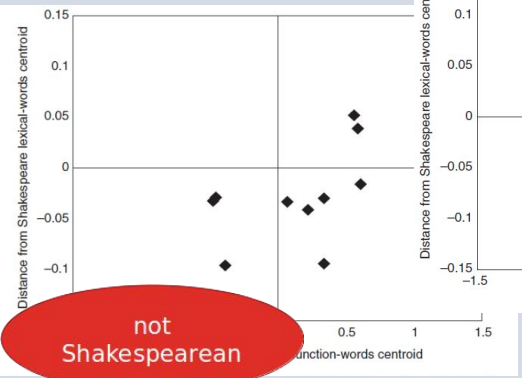
FEATURES SELECTION (MFW)



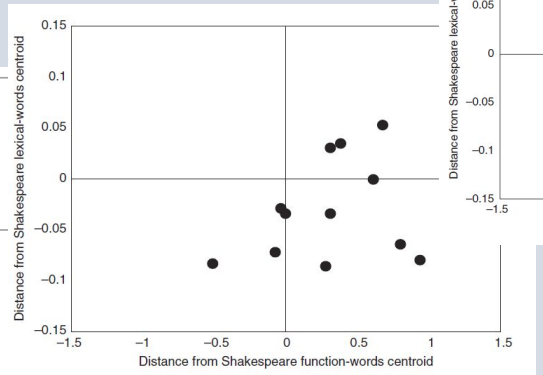
About
1,000-2,000
MFW produce the
best results
(Evert et al. 2017)

APPLICATIONS

Stylometry and the three parts of *Henry VI* (Craig and Kinney 2009)



1



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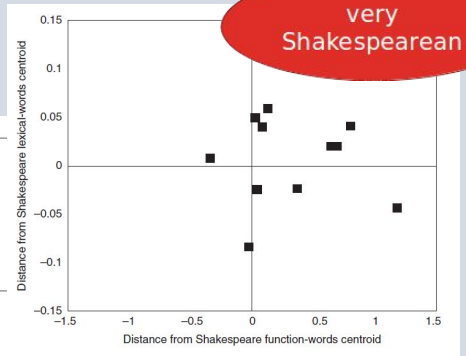
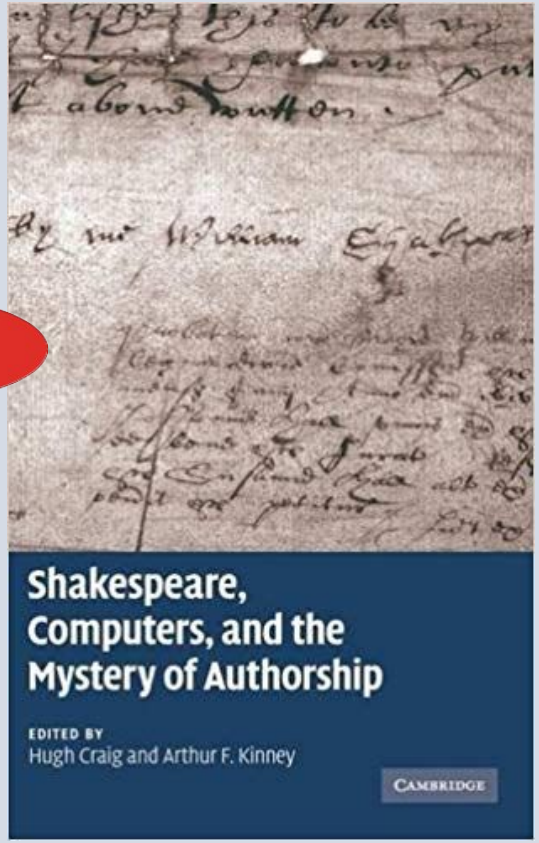
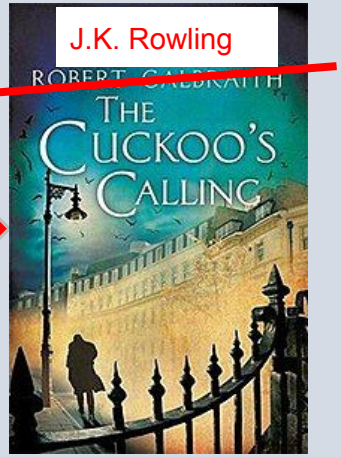


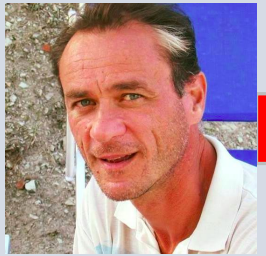
3



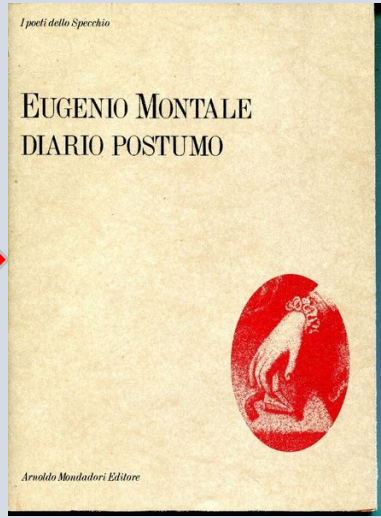
APPLICATIONS

(Patrick Juola)

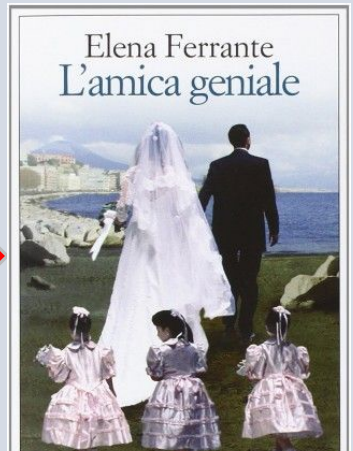




(Paolo Canettieri)

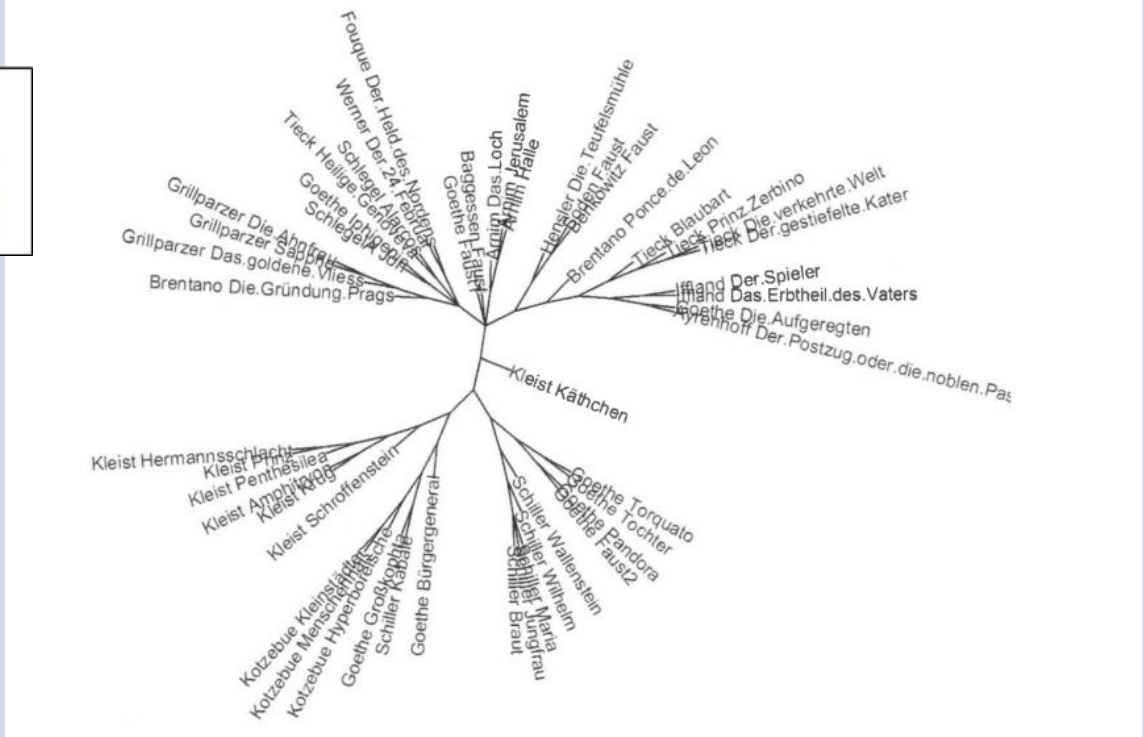


(Arjuna Tuzzi)



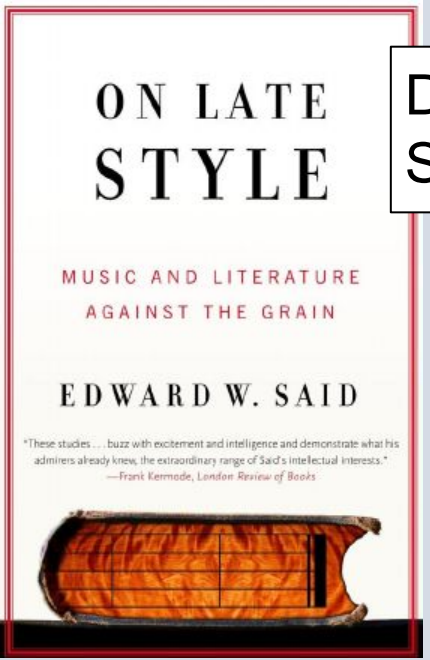
APPLICATIONS

Is Kleist a classicist or a romantic?



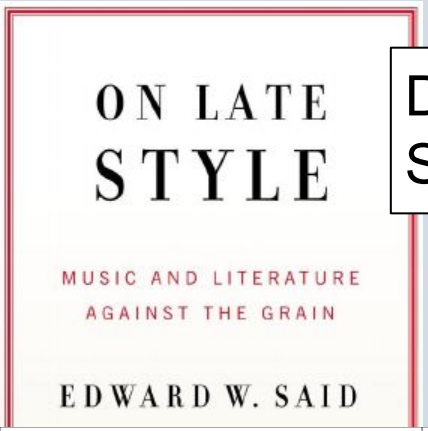
(Jannidis and Lauer, 2014)

APPLICATIONS



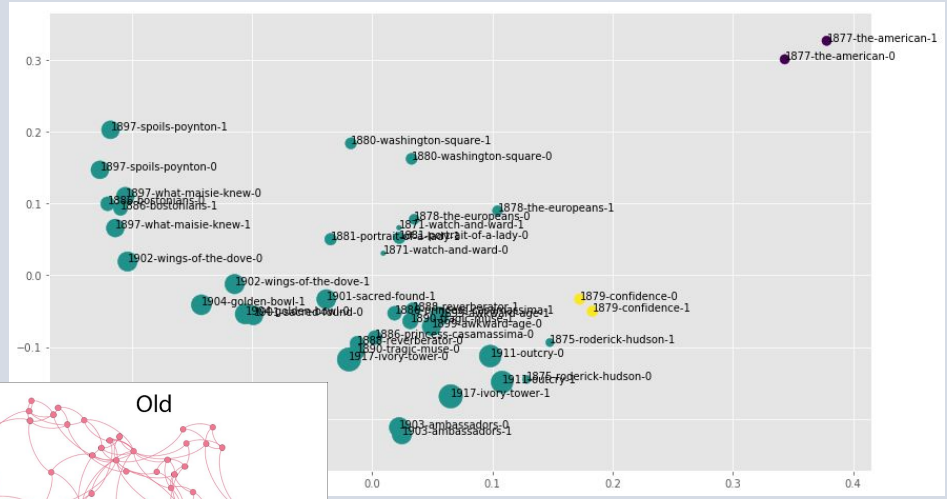
Does Late Style Exist?

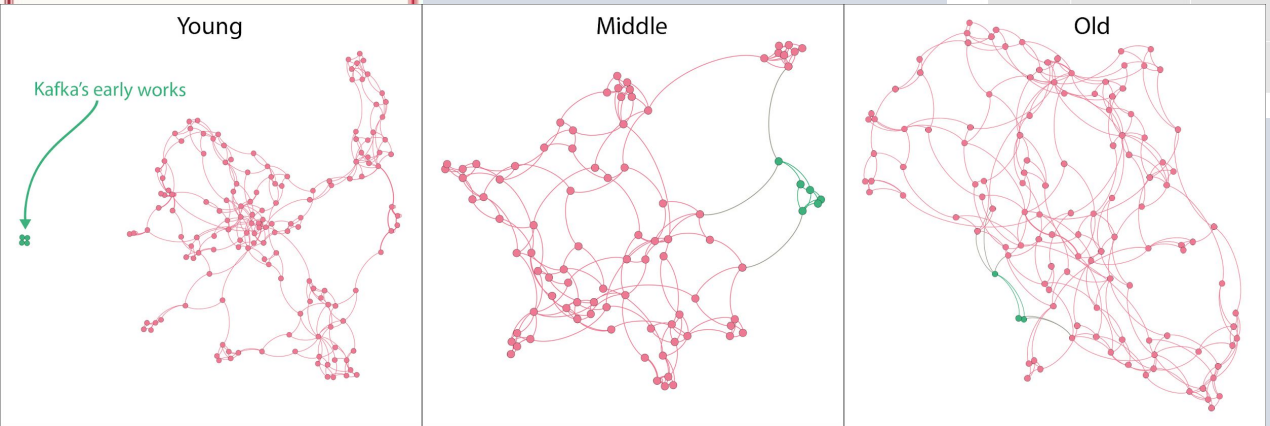
APPLICATIONS



Does Late Style Exist?

(Reeve, 2018)





(Rebora and Salgaro, 2018)

WHAT MAKES THESE THREE SENTENCES «SHAKESPEAREAN»?

I meant indeed to pay you with this, which if like an ill venture it come unluckily home, I break, and you, my gentle creditors, lose. Here I promised you I would be, and here I commit my body to your mercies. Bate me some, and I will pay you some, and (as most debtors do) promise you infinitely.

2 Henry IV

But since you have made the days and nights as one,
To wear your gentle limbs in my affairs,
Be bold you do so grow in my requital
As nothing can unroot you.

All's Well that Ends Well

This is a sleepy tune. O murd'rous slumber!
Layest thou thy leaden mace upon my boy,
That plays thee music? Gentle knave, good night;
I will not do thee so much wrong to wake thee.

Julius Caesar

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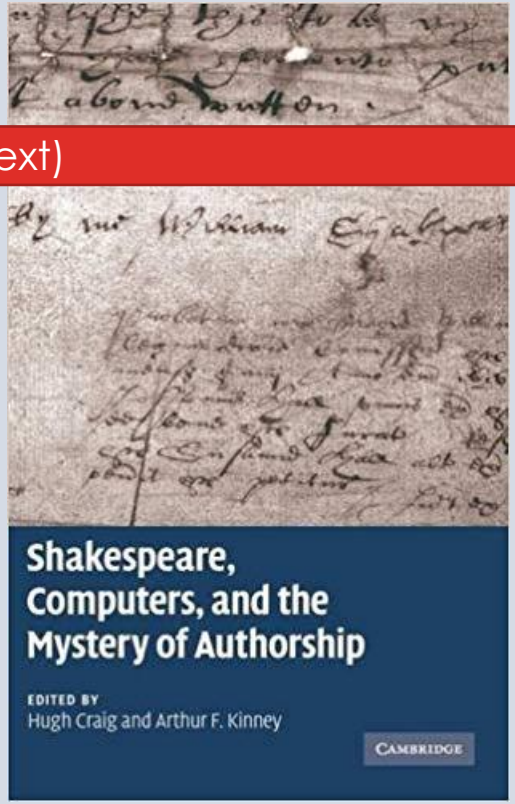
Julius Caesar

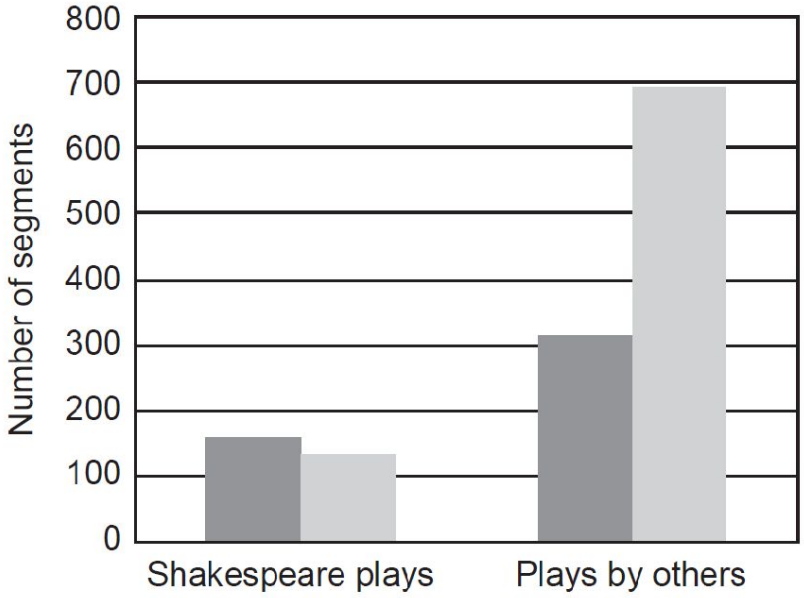
STYLOMETRY AND SHAKESPEARE

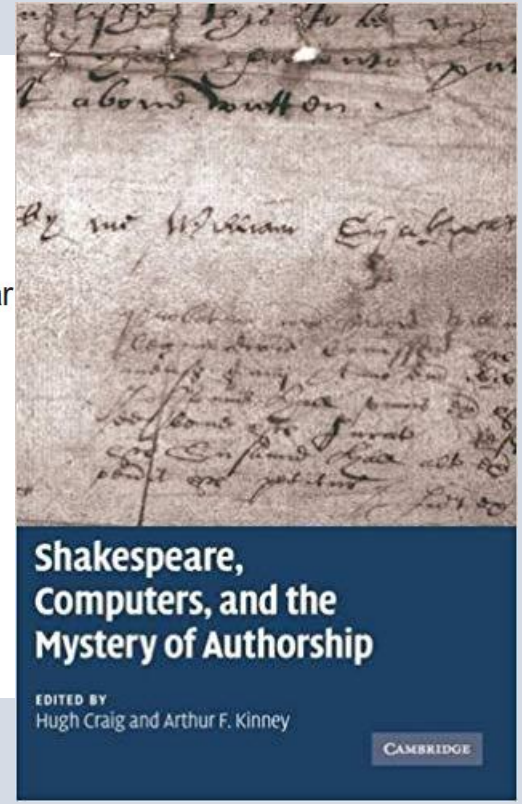
3,000 words
3,000 words
3,000 words
etc.

How many of the slices contain the word «Gentle»?



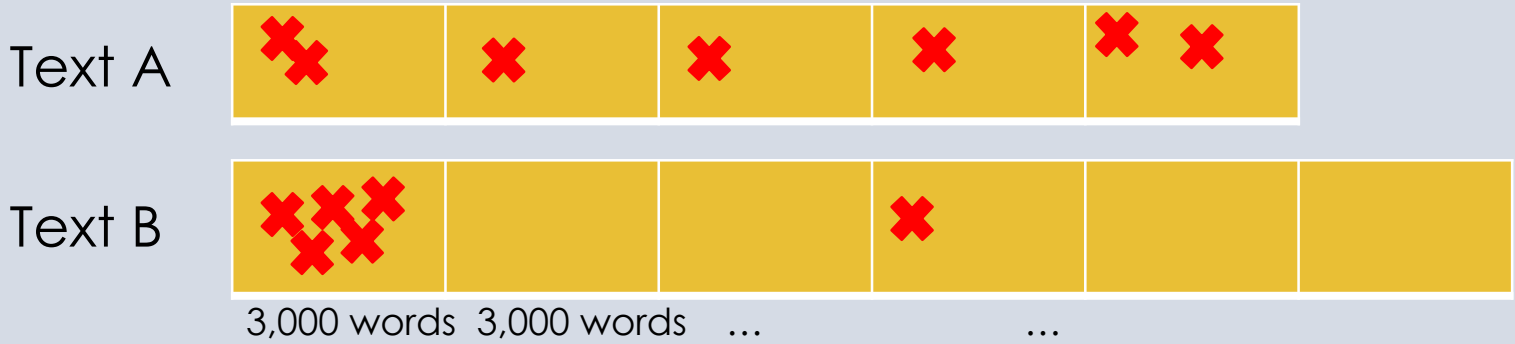
STYLOMETRY AND SHAKESPEARE



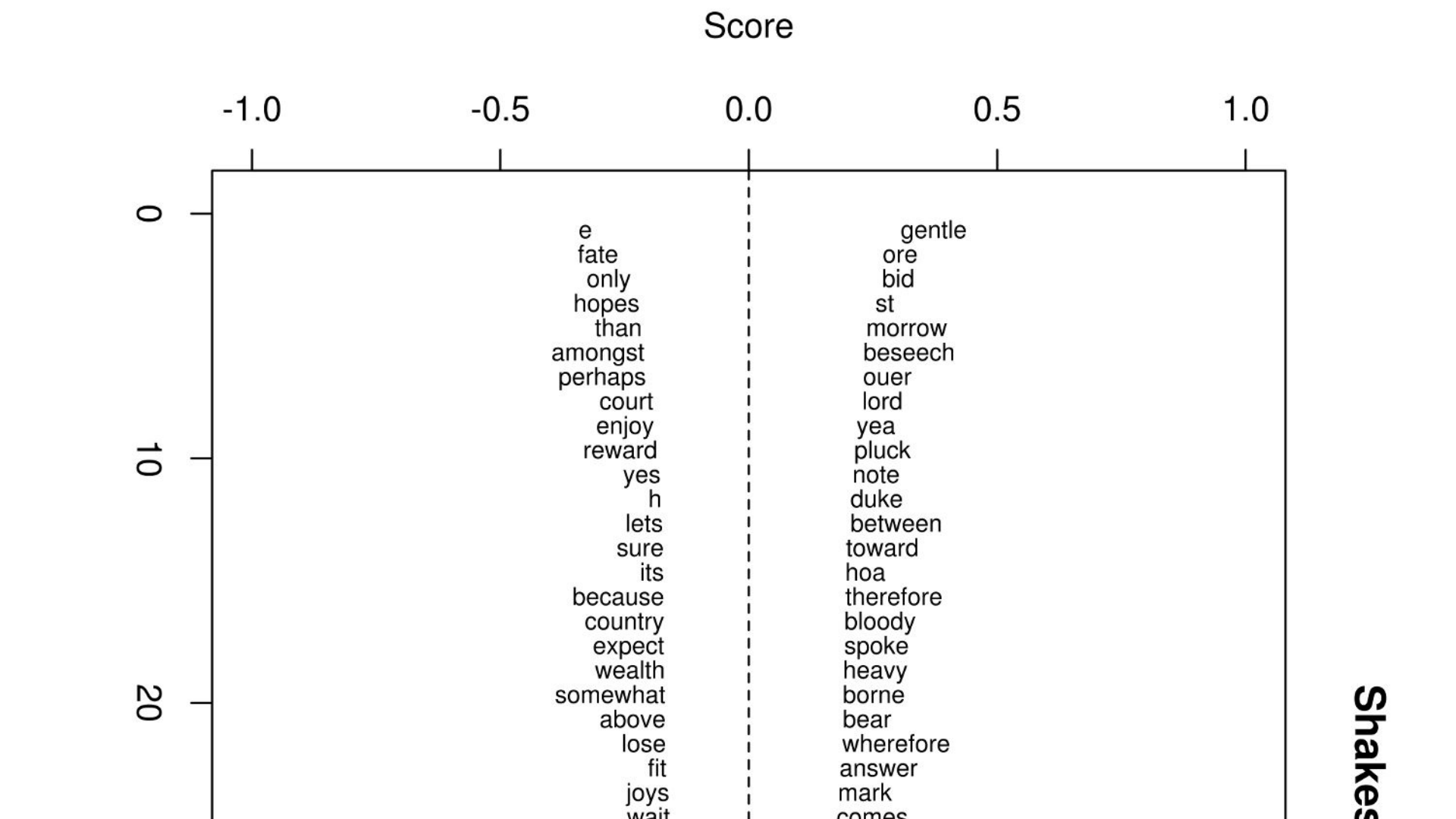


THE “ZETA” METHOD

Pick up a word:
«gentle» (for example)



- Count in how many slices of the text the word «gentle» appears
- Calculate the proportion
  Text A: 1 (100%); text B: 0.33 (33%)
- Subtract the two values
  (so the word «gentle» has Zeta = 0.66 for Text A)
- Repeat the operation for all the words in the two texts


Score
-1.0
-0.5
0.0
0.5
1.0
0
10
20
e
fate
only
hopes
than
amongst
perhaps
court
enjoy
reward
yes
h
lets
sure
its
because
country
expect
wealth
somewhat
above
lose
fit
joys
gentle
ore
bid
st
morrow
beseech
ouer
lord
yea
pluck
note
duke
between
toward
hoa
therefore
bloody
spoke
heavy
borne
bear
wherefore
answer
mark
Shakes

APPLICATIONS (GENDER)

DSH Digital Scholarship in the Humanities

eadh European Association for Digital Humanities

ADHO Alliance of Digital Humanities Organizations

Volume 31, Issue 4
December 2016

Article Contents

Vive la différence: Tracing the (authorial) gender signal by multivariate analysis of word frequencies

Jan Rybicki ✉

Digital Scholarship in the Humanities, Volume 31, Issue 4, December 2016, Pages 746–761, https://doi.org/10.1093/llc/fqv023

Published: 08 July 2015

Multivariate analysis of word frequencies is used to identify the gender of authors in a corpus of 18th- and early 19th-century English sentimentalist and Gothic fiction. Results obtained with most frequent words are compared to those produced with medium-frequency Burrows's Zeta words characteristic for both genders. Gender-sensitive words from two periods (18th/19th c. and