Language and Gender Author Cohort Analysis of E-mail for Computer Forensics

By

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Language and Gender Author Cohort Analysis of E-mail for Computer Forensics

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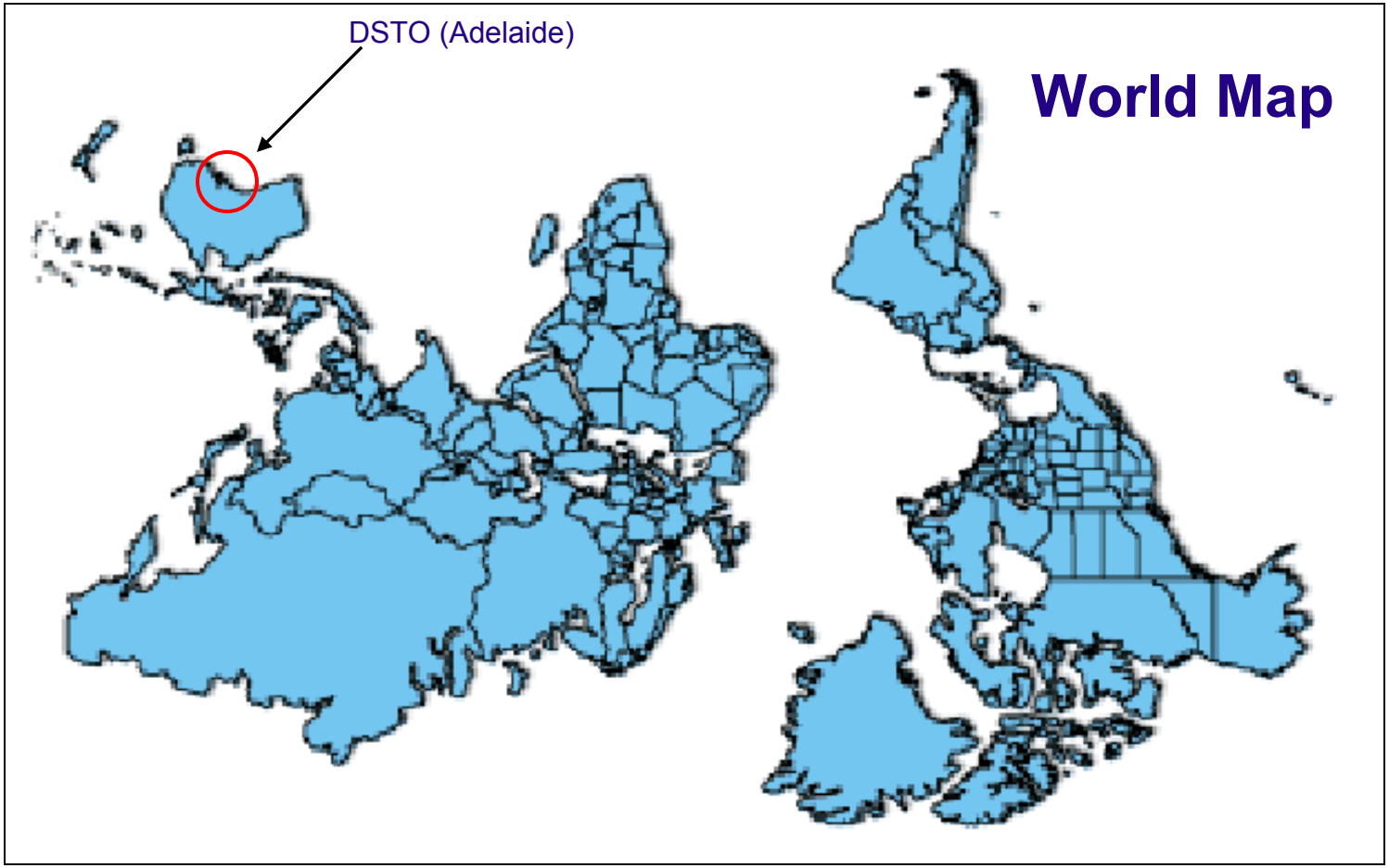
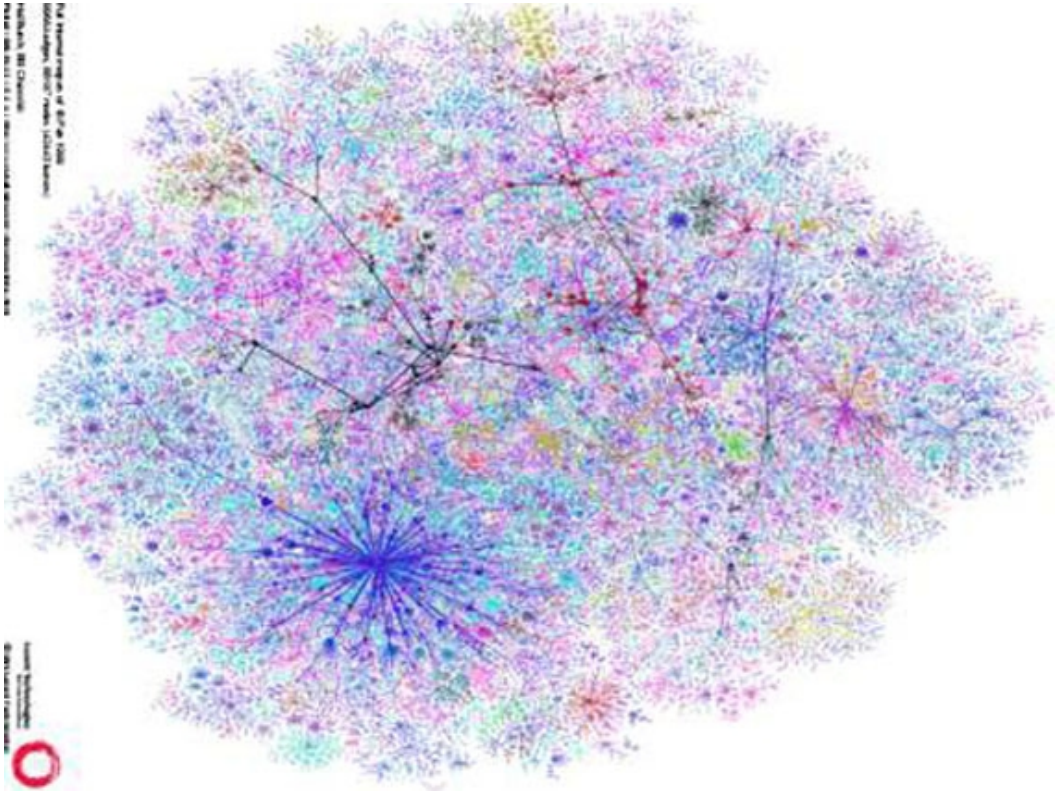

DSTO (Adelaide)
World Map



Presentation:

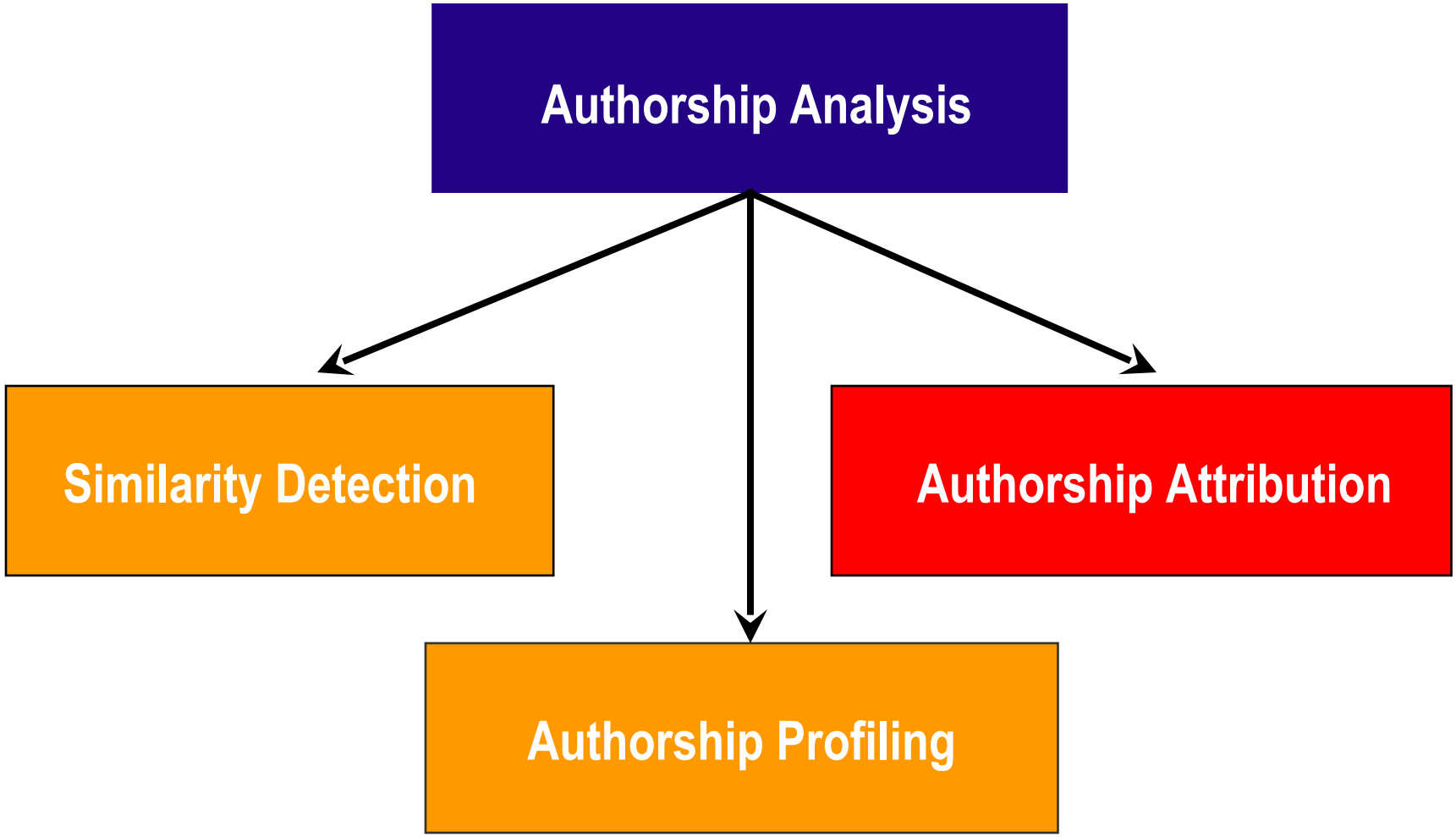
Computer forensics and e-mail authorship analysis

Previous work in authorship attribution

Experimental methodology

Results and Conclusion

Authorship Analysis: Sub-Areas

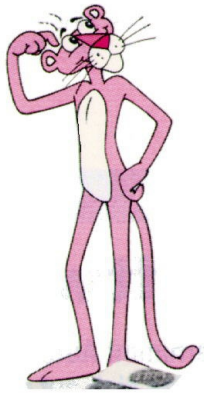


Objective of E-mail Authorship Analysis

Develop algorithms for analysing the style and content of an e-mail message for the purpose of categorising

- its author, or
- its author's cohort type

E-mail authorship analysis is NOT about:



- e-mail document filtering
- e-mail document filing
- e-mail text categorisation
- e-mail topic detection/tracking

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Previous Work in Authorship Attribution

- Shakespeare's works & Federalist papers
- Forensic linguistics
- Code authorship

Previous Work in Authorship Attribution: Issues

Conclusions (so far!):

- a large number of stylometric features (>1000)
- no definite subset of discriminatory stylometric features
- no consensus on methodology
- Questionable analysis
- Hard problem!

Previous Work in Authorship Attribution

Previous work limited to (c.f. e-mails):

- Large sections of text
- Formal text and non-interactive
- Relatively large number of training examples
- Relatively homogeneous style

Previous Work in Authorship analysis: E-mails

E-mail authorship attribution:

- We have investigated the effect of several parameters (eg., text size, number of documents per author) [2000, 2001].
- Thomson *et al* have investigated gender-preferential language styles [2001].

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Experimental Methodology: E-mail Corpus

Difficulty in obtaining e-mail corpus:

- **privacy and ethical concerns,**
- **large % of noise (eg, cross-postings, off-the-topic spam, empty body with attachments),**
- **some difficulty in verifying author cohort class,**
- **non-orthogonality of topics and cohorts.**

Experimental Methodology: E-mail Corpus

Two author cohort experiments (gender and language)

- Two sub-corpuses derived from an E-mail corpus:
  - M/F: 325 authors, 4369 e-mails
  - EFL/ESL: 522 authors, 4932 e-mails

Experimental Methodology: E-mail Corpus

Attributes/features used:

- 183 style markers that are known to have reduced content bias (incl. function words and word freq. distribution),
- 28 e-mail structural attributes,
- 11 gender-preferential language attributes

Experimental Methodology: Classifier

- SVM^{light} as the (two-way) classifier,
- Obtain two-way categorisation matrix for each author category, using 10-fold cross-validation sampling,
- Calculate per-author category performance statistics – precision, recall and F_1 statistics.

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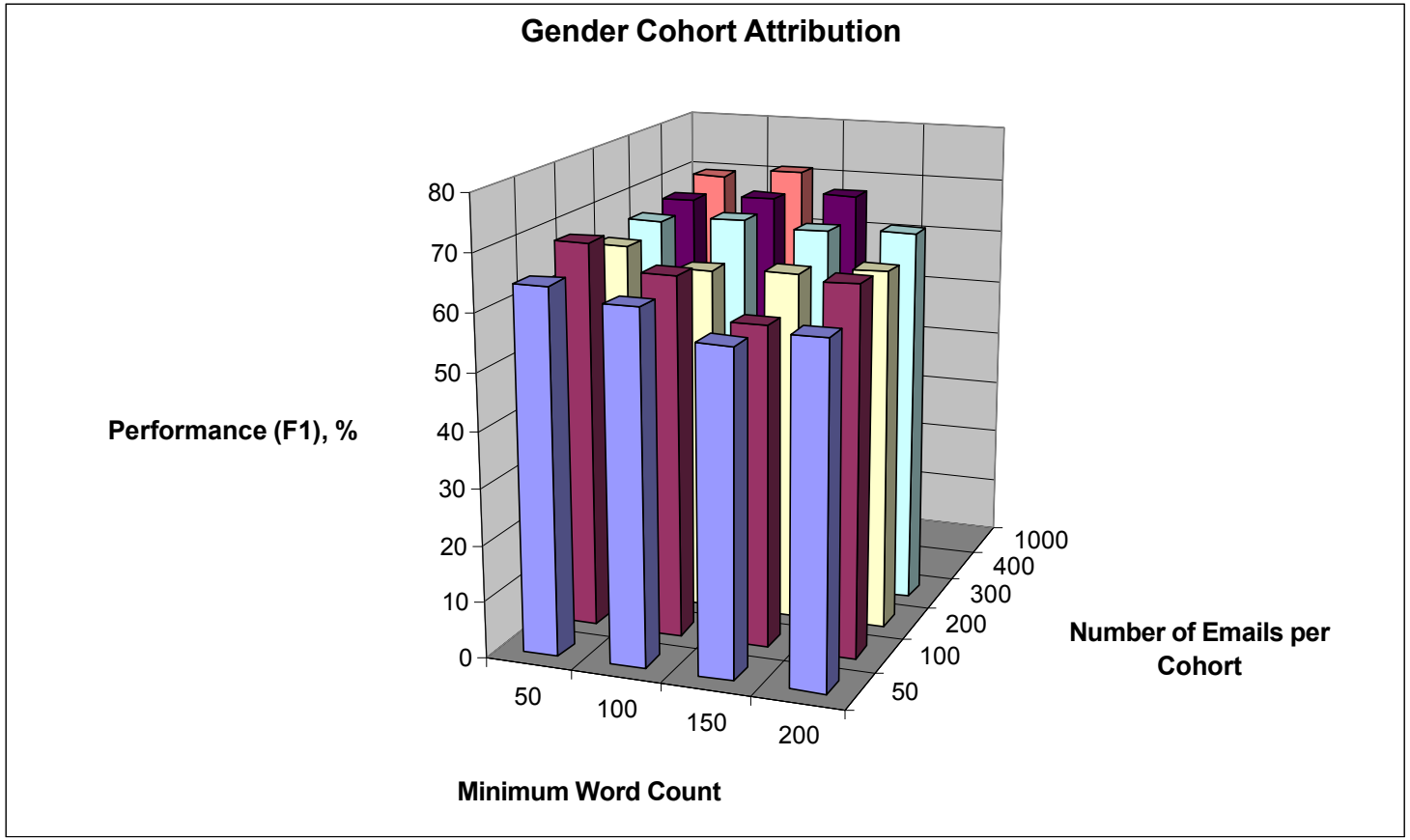
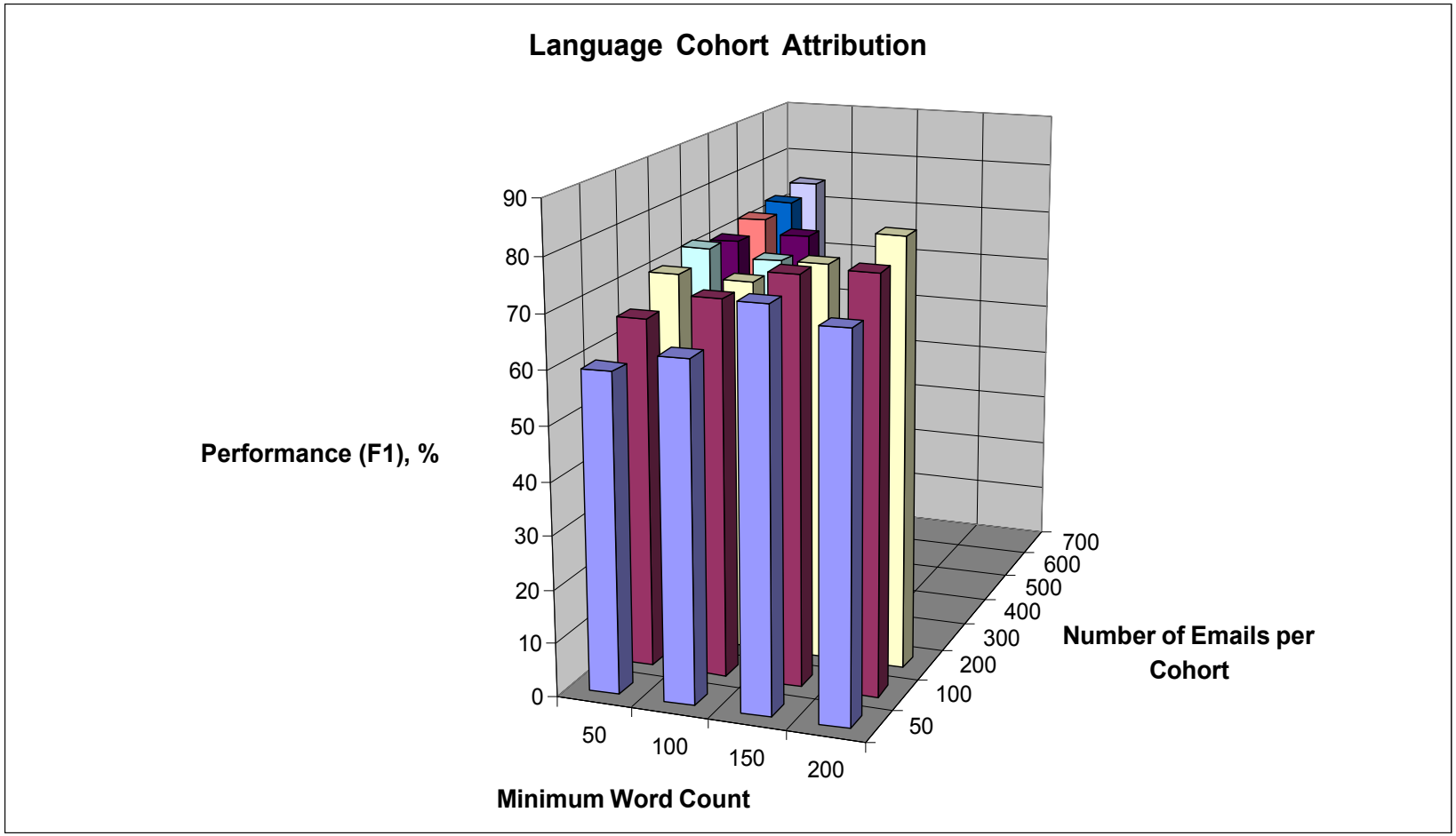
Results: Classification performance

M/F Author Cohort Attribution:



Results: Classification performance

EFL/ESL Author Cohort Attribution:



Conclusions:

- Promising author cohort categorisation results.
- Further experiments:
  - with extended and specific set of cohort-preferential attributes,
  - more within-cohort diversity,
  - subset feature selection (particularly function words).
- Extend to other forms of computer-mediated communications (chat rooms etc.)

Questions ?