CERIAS
The Center for Education and Research in Information Assurance and Security

Using Frame Semantics In Authorship Attribution

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Abstract

Authorship attribution is a stylometric technique that associates text to authors based on the type of writing styles. Researchers have looked for ways to analyze the context of these texts, however, these techniques have limited results. In addition, most of these approaches view information more heavily at the syntactic and physical levels than semantic levels. Therefore, we present a new technique that incorporates the use of semantic frames for authorship attribution as it provides a deeper view into the semantic level of texts. We will use a variety of online resources in a pipeline fashion to extract information about frames within the text. We believe this is an effective method for this task and at the very least, provides the community with a new view on how to approach to the problem of authorship attribution.

A. Intuition

Many studies have focused on **properties of an author's text**:

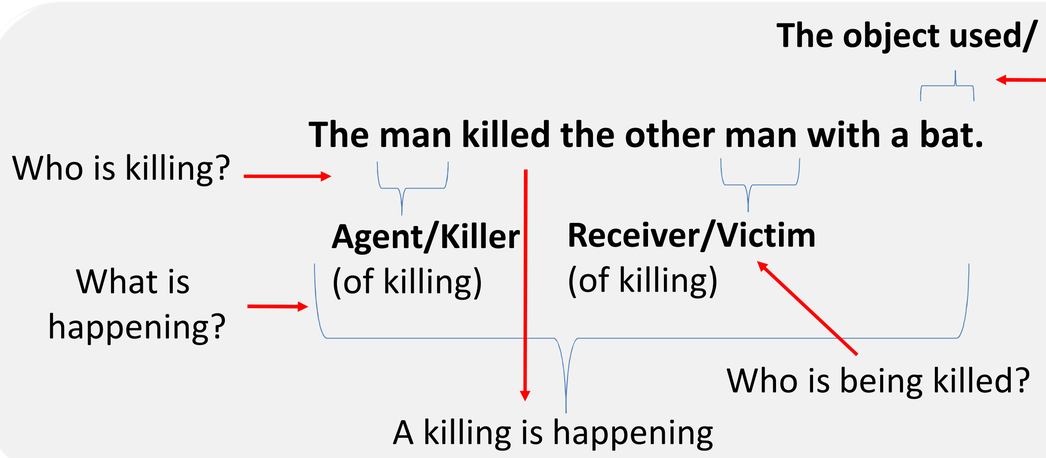
- Sentence length
- Size of vocabulary
- N-grams
- Syntactical features

However, little work has been done to view **sentences at the semantic level**

- (Gamon, 2004), (McCarthy, et al., 2006), (Argamon, et al., 2007)

B. Backgrounds

Frame semantics provides predefined sentence structures that are allowed in the sentence.



Can more information be provided?

- Where, When, and Why.

- **What types of descriptions (frames)** authors tend to use**?**
- And **how much details (frame elements)**?
- Is it a consistent pattern?

C. Methodology

Corpus
The Extended-Brennan-Greenstadt Adversarial Stylometry Corpus (45 authors)

Extract frames used per sentence
Sentence splitting: Stanford CoreNLP | **Semantic parser**: SEMAFOR

Compare with frame information
FrameNet 1.5

Extract semantic features
10 feature metrics

Data Analysis (Machine Learning)
SVM | Comparison baseline

SVM on the same dataset using "the basic-9 **syntactic** feature set" (Brennan, et al., 2012)

D. Features

Counts – Frame

- Total number of frames count
- Total number of unique frames count
- Total number of duplicate frames count

Average number

- Avg. num. of FE used per frame
- Avg. num. of duplicate FE per sentence
- Avg. num. of frames per sentence

Counts – Frame element (FE)

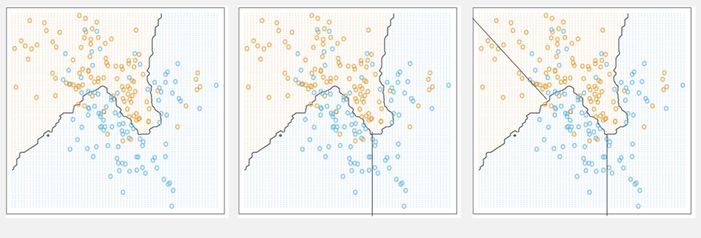
- Num. of unique FE type count
- Num. of total FE type count

Bag of frames

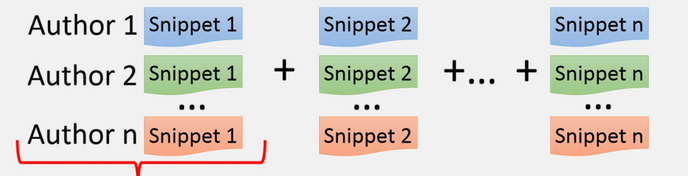
- For each frame, seeing if it exists
- For each frame, seeing the ratio of FE's (FE's used/Total FE's for frame)

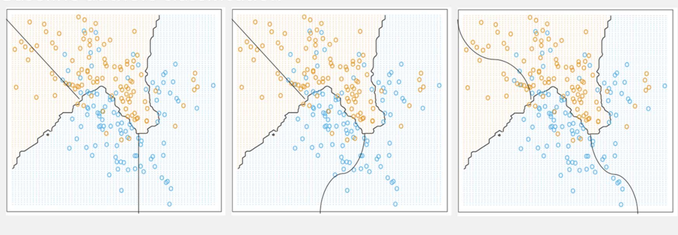
E. Experiments

1) Increment by author
(open world assumption)



2) Increment by snippet of each author
(closed world assumption)





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