

Authorship Attribution using Rough Sets based Feature Selection Techniques

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ABSTRACT

This presents an investigation into the usefulness of rough set theory in the context of authorship attribution using writing style. The problem was setup as a standard supervised machine learning problem. The rough set based feature subset computation techniques reduced the dimensionality of the feature space from 346 conditional attributes to an average of 8 features. Experiments were performed experiment using five different subsets of the original attributes computed using rough sets techniques with the results showing that the rough set based techniques improved the performances of neural network (NN) and Support Vector Machines (SVM) models. The overall classification accuracy increased from 8.712 % for on the baseline data to 50.505 % for the NN and from 7.197 % to 28.662 % for the SVM model. The improvements in performance compared to the baseline model are evidenced across all other performance metrics used. However, the NN model performed generally better than the SVM model.

General Terms

Authorship Attribution, Rough Sets Theory, Machine Learning.

Keywords

Stylometry, Feature Selection, Neural Networks, Support Vector Machines, Supervised Machine Learning.

1. INTRODUCTION

The act of writing is a habit and accordingly, it gets mature as the writer/author increases his/her capacity to recognize and store certain characteristics that influence his learning and thereby develops/acquires specific skills of writing that not only tend to reflect him/her but distinguishes him from other writers. Habitual tendencies become irresistible over time and the urge to exhibit the promptings become very hard to control because they are autonomic and are not within the control of the individual [40; 12; 15] and as [40] puts it, "habits are activated in memory in an autonomous fashion without requiring executive control". Writing, skills mature with practise and the writer-specific traits becomes more difficult to obfuscate [42; 38]. Thus, the author or writer, like every other addict, becomes addicted to his style of writing which remain largely invariant across topics/discourses. An author's writing may vary only significantly in the richness of vocabulary as he writes across varying topics. Research has largely proven that authors' personal writing idiosyncrasies remain relatively invariant, regardless of the discourse of writing [33; 6]. This fact is the singular most important source of motivation for the subject of authorship attribution and attribution techniques.

Authorship attribution, sometimes referred to as authorship classification or authorship identification with slight modification of intent, has a major goal of ascribing

authorship to an anonymous or disputed piece of writing. It uses statistics to study the linguistic and computational characteristics of written texts in order to correctly identify the author [37]. Apart from its traditional use in settling authorship disputes of literary texts, authorship attribution has been employed in a number of very important tasks: computer forensic investigation, criminology, plagiarism detection, authorship identification/verification, civil law procedures, detection of the author of malicious computer programs, fraud detection and in e-commerce.

The problem of authorship attribution is age-long [17] and has attracted a lot of research efforts over the last two centuries [18; 35]. Though an old problem, the dynamics of technology and the plethora of technological innovations and inventions have introduced more challenging dimensions to settings by which authorship attribution problems are situated, which has rendered the hitherto prolific traditional solution approaches unattractive. Nowadays, social media platforms have become an integral, indispensable, part of the society. These platforms, though seemingly indispensable and useful have been turned into a platform for profanity, denigration, mudslinging and undue harassments that literally amounts into character assassination and even irredeemable economic losses. While earlier attribution techniques relied on longer texts for statistics, social media texts are often short, with ungrammatical sentences, high rates of abbreviations and spelling contractions. This is a challenge for authorship attribution methods.

Authorship attribution research in the last decade has focused mostly on developing methodologies that scale well on short weakly structured messages by exploring features that tend to talk more of the writer than the subject of the writing [32; 35; 37; 6]. This work explores the power of a feature extraction/dimensionality reduction technique as it applies to the authorship attribution problem. It shows that the Rough Set methodology for feature extraction/selection improves the performance of two algorithms: Support Vector Machines (SVMs) and Artificial Neural Networks (ANNs) in a multi-class authorship classification scenario respectively. A second major intent of this research was to identify a scalable set of features that improves the classification accuracies of algorithms across various genres and topics at the long run. The paper also shows that such set of features improved classification as the number of candidate authors increases as opposed to the current observation by a good number of researchers that performance deteriorates with increasing number of authorship class [35; 37; 6]. An extensive evaluation of the feature subsets computed in this work in a short-length data scenario is on-going. This paper in the meantime presents our initial attempt in the exploration of the rough set based techniques for feature selection in authorship attribution task with experiments involving SVM and NN,

An Enhanced Rough Set Based Technique For Elucidating

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