

Accepted Manuscript

A study of the effectiveness of machine learning methods for classification of clinical interview fragments into a large number of categories

Mehedi Hasan, Alexander Kotov, April Carcone, Ming Dong, Sylvie Naar, Kathryn Brogan Hartlieb

PII: S1532-0464(16)30034-X
DOI: <http://dx.doi.org/10.1016/j.jbi.2016.05.004>
Reference: YJBIN 2569

To appear in: *Journal of Biomedical Informatics*

Received Date: 16 January 2016
Revised Date: 12 May 2016
Accepted Date: 12 May 2016

Please cite this article as: Hasan, M., Kotov, A., Carcone, A., Dong, M., Naar, S., Hartlieb, K.B., A study of the effectiveness of machine learning methods for classification of clinical interview fragments into a large number of categories, *Journal of Biomedical Informatics* (2016), doi: <http://dx.doi.org/10.1016/j.jbi.2016.05.004>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



A study of the effectiveness of machine learning methods for classification of clinical interview fragments into a large number of categories

Mehedi Hasan^{a,1}, Alexander Kotov^{a,1,*}, April Carcone^b, Ming Dong^a, Sylvie Naar^b, Kathryn Brogan Hartlieb^c

^aDepartment of Computer Science, Wayne State University, 5057 Woodward Ave, Detroit, MI 48202, USA

^bPediatric Prevention Research Center, School of Medicine, Wayne State University, 540 E Canfield St, Detroit, MI 48201, USA

^cDepartment of Dietetics and Nutrition, Florida International University, 11200 SW 8th St, Miami, FL 33199, USA

Abstract

This study examines the effectiveness of state-of-the-art supervised machine learning methods in conjunction with different feature types for the task of automatic annotation of fragments of clinical text based on codebooks with a large number of categories. We used a collection of motivational interview transcripts consisting of 11,353 utterances, which were manually annotated by two human coders as the gold standard, and experimented with state-of-art classifiers, including Naïve Bayes, J48 Decision Tree, Support Vector Machine (SVM), Random Forest (RF), AdaBoost, DiscLDA, Conditional Random Fields (CRF) and Convolutional Neural Network (CNN) in conjunction with lexical, contextual (label of the previous utterance) and semantic (distribution of words in the utterance across the Linguistic Inquiry and Word Count dictionaries) features. We found out that, when the number of classes is large, the performance of the CNN and CRFs is inferior to SVM. When only lexical features were used, interview transcripts were automatically annotated by SVM with the highest classification accuracy among all classifiers of 70.8%, 61% and 53.7% based on the codebooks consisting of 17, 20 and 41 codes, respectively. Using contextual and semantic features, as well as their combination, in addition to lexical ones improved the accuracy of SVM for annotation of utterances in motivational interview transcripts with a codebook consisting of 17 classes to 71.5%, 74.2%, and 75.1%, respectively. Our results demonstrate the potential of using machine learning methods in conjunction with lexical, semantic and contextual features for automatic annotation of clinical interview transcripts with near-human accuracy.

Keywords: machine learning, deep learning, text classification, annotation of clinical text, motivational interviewing

1. Introduction

Annotation (or labeling) of fragments of clinical text with the codes from a predefined codebook is an integral part of qualitative research. It can also be viewed as a classification of textual fragments into a predefined number of classes (or categories). It has been traditionally performed manually by trained coders,

which is a tedious, costly and time-consuming process. Furthermore, manual annotation increases the likelihood of errors due to coder fatigue and bias associated with human subjectivity. To automate tedious cognitive tasks, such as classification, supervised machine learning methods (including interpretable ones [1]) have been recently proposed. Although these methods have been shown to be successful at binary (two-class) classification [2, 3] (e.g. classifying textual fragments as neutral or opinionated), we are not aware of any prior studies that evaluate their performance for textual classification tasks involving a large number of classes. Such tasks, however, are fairly common in a clinical setting (e.g. annotation of clinical interviews,

*Corresponding author: Alexander Kotov, Department of Computer Science, Wayne State University, 5057 Woodward Ave Suite 14001.6, Detroit, MI 48202, United States.

Email addresses: mehedi@wayne.edu (Mehedi Hasan),

kotov@wayne.edu (Alexander Kotov)

URL: <http://www.cs.wayne.edu/kotov/> (Alexander Kotov)

¹The first two authors provided equal contribution

Download English Version:

<https://daneshyari.com/en/article/6927701>

Download Persian Version:

<https://daneshyari.com/article/6927701>

[Daneshyari.com](https://daneshyari.com)