A Deep Learning Anomaly Detection Method in Textual Data

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Abstract

In this article, we propose using deep learning and transformer architectures combined with classical machine learning algorithms to detect and identify text anomalies in texts. Deep learning model provides a very crucial context information about the textual data which all textual context are converted to a numerical representation. We used multiple machine learning methods such as Sentence Transformers, Auto Encoders, Logistic Regression and Distance calculation methods to predict anomalies. The method are tested on the texts data and we used syntactic data from different source injected into the original text as anomalies or use them as target. Different methods and algorithm are explained in the field of outlier detection and the results of the best technique is presented. These results suggest that our algorithm could potentially reduce false positive rates compared with other anomaly detection methods that we are testing.

I. Introduction

Identifying anomalous sentiment patterns, or unique textual characteristics of such patterns in a set of textual data, is known as anomaly detection in text mining. The identified anomalies could be the result of abrupt changes in decision-making for text classification problem types. If these abnormalities go unnoticed or are improperly handled, consequences could result, such as a poor performance in text classification systems [1].

Anomaly, outlier or novelty detection are a complex problem in a variety of application domains where identifying outlying data is often crucial and necessary [2]. A pattern that is not compatible with most of the data in a dataset is named a novelty, outlier, or anomaly. An abnormal behavior can be caused for several reasons, such as data from different sources, natural variation and measurement or human errors. There is very tiny line to distinguish between novel sample or outlier/abnormal sample.

There are numerous examples in different domains and fields which they analyze the anomalies methods [3]. Many web applications can benefit from the capacity to spot anomalies in streams of text data. It can be used, for instance, to identify significant events from Twitter streams, fraudulent email exchanges, and even inaccurate descriptions in maintenance logs [4].

In [5], authors tried to provide a solid and comprehensive overview of on anomaly detection. Existing methods in anomaly detection and categorized them into different groups based on the techniques. For each category, they identified key points that identify between normal and anomalous behavior.

Spectral anomaly detection techniques are one of many ways for detecting outliers. They produce a lower dimensional embeddings of the original data where anomalies and regular data are predicted to be separated from one another. The process of producing the original data after creating these lower dimensional embeddings is known as reconstruction model. In [6], they propose an anomaly detection method using variational autoencoders.