Novel Machine Learning Methods For Sentiment Analysis

Description:

Sentiment analysis is the computational study of people's appraisals and emotions toward entities, events and their attributes. The goal is to determine whether an opinionated document (e.g. reviews) or sentence expresses a positive or negative opinion. Opinions are important because whenever someone wants to make a decision, he would like to hear other's opinions [1].

A new type of neural networks, called Generative Adversarial Networks (*GANs*), has been developed since 2014. The main idea behind *GANs* is to have two competing neural networks:

- The generator takes noise as input and generates samples;
- The discriminator receives samples from the training set and the generator. It has to distinguish between the two sources.

The simultaneous training can be seen as a game where the generator tries to produce more and more realistic samples and the discriminator tries to distinguish better the generated data from the real data. At the end, we would like that the generator produces samples indistinguishable from real data [2,3].
GANs have achieved great success in generating realistic synthetic real-valued data, like in image classification, object detection, etc. Using such techniques allow to improve not only robustness but also generalization performance for original samples. In the area of natural language processing, *GANs* have not been explored as much as in image related tasks.

The idea of this project would be first to reproduce the results of the sentiment analysis task in [4]. As a second step, we would like to apply these models in the *Yelp* dataset which contains restaurant reviews[1]. Finally, we would like to try and compare different methods of data augmentation in order to generalize better, using simple and advanced methods found in the literature.

Proposed plan:

1. Reproduce the results of the sentiment analysis task with respect to the baselines and the models using adversarial and/or virtual adversarial for the *IMDB* dataset [4][2].

2. Apply the models in [4] to the *Yelp* dataset for reviews[3]. Optionally these can be compared with various performance available in the literature related to the "*Yelp Challenge 2016 Sentiment Classification*".

3. Try different methods of data augmentation in order to generalize better. To accomplish this task, we can also use *GANs* such as [5] but also simpler techniques like [6] (Section 2.4) and [7] (Section 4.3). The goal would be to create new samples by augmented data, use them as additional training examples and observe how the models performs with respect to the step 1).

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[1] https://www.yelp.com/dataset_challenge/dataset
[2] The models are already available in the *Github* of *Tensorflow*
[3] https://www.yelp.com/dataset_challenge/dataset

Prerequisites:

- Knowledge about Machine Learning, especially neural networks (at least feedforward ones). You should have taken at least a ML course.
- Experienced with Python.
- (Optional) experienced with *Tensorflow*.

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References:

(Information about Sentiment Analysis & Generative Adversarial Training)
[1] https://www.cs.uic.edu/~liub/FBS/IEEE-Intell-Sentiment-Analysis.pdf
[2] https://arxiv.org/pdf/1701.00160.pdf
[3] http://blog.aylien.com/introduction-generative-adversarial-networks-code-tensorflow/

(Specified model as well as some data augmentation techniques)
[4] https://arxiv.org/pdf/1605.07725.pdf
[5] https://zhegan27.github.io/Papers/textGAN_nips2016_workshop.pdf
[6] https://arxiv.org/pdf/1502.01710.pdf
[7] https://aclweb.org/anthology/S/S16/S16-1067.pdf