Machine Learning - CS582

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Sentiment Analysis

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Project idea

We are going to develop a mobile app that tells if someone is pessimistic or optimistic using Sentiment Analysis based on his/her Facebook posts history. A user must log in to the app via Facebook and must allow required access permissions. Our app considers the person who usually posts positive things as optimistic, otherwise as pessimistic.

We will use various Machine learning algorithms from naive to advanced and compared their results. The best algorithm (or combined) was used for our mobile app.

Data set

We will be using "Sentiment Labelled Sentences Data Set" from UCI machine learning repository that was created for the Paper "From Group to Individual Labels using Deep Features", Kotzias et. al, KDD 2015.

It contains sentences labeled with positive (1) or negative sentiment (0). There are 500 positive and 500 negative sentences that come from IMDB, Amazon, and Yelp about movies, products, and restaurants.

Softwares

Machine learning algorithms:

- Word2Vec
- Gradient descent
- Deep learning
- Recurrent Neural Networks
- Long Short Term Memory

Programming language: Python, Javascript

Frameworks: Tensorflow, Node.js, React Native

Additional libraries: NumPy, Jupyter, matplotlib, Facebook API

Papers

1. Word2Vec

   Word2vec is a two-layer neural net that processes text. Its input is a text corpus and its output is a set of vectors: feature vectors for words in that corpus. It was introduced in 2013 by team of researchers led by Tomas Mikolov at Google - Read the paper from https://papers.nips.cc/paper/5021-distributed-representations-of-words-and-phrases-and-their-compositionality.pdf

   Additional reading from
   https://www.analyticsvidhya.com/blog/2017/06/word-embeddings-count-word2veec/.

2. Visualizing and Understanding Recurrent Networks

   Andrej Karpathy, Justin Johnson, Li Fei-Fei
   (Submitted on 5 Jun 2015 (v1), last revised 17 Nov 2015 (this version, v2))

   Recurrent Neural Networks (RNNs), and specifically a variant with Long Short-Term Memory (LSTM), are enjoying renewed interest as a result of successful applications in a wide range of machine learning problems that involve sequential data. However, while LSTMs provide exceptional results in practice, the source of their performance and their limitations remain rather poorly understood. Using character-level language models as an interpretable testbed, we aim to bridge this gap by providing an analysis of their representations, predictions and error types. In particular, our experiments reveal the existence of interpretable cells that keep track of long-range dependencies such as line lengths, quotes and brackets.

   https://arxiv.org/pdf/1506.02078.pdf

3. Long Short Term Memory

   Long Short Term Memory networks – usually just called "LSTMs" – are a special kind of RNN, capable of learning long-term dependencies. They were introduced by Sepp Hochreiter and Jürgen Schmidhuber in 1997.

   http://www.bioinf.jku.at/publications/older/2604.pdf

   Additional reading from http://colah.github.io/posts/2015-08-Understanding-LSTMs/.

4. Automated Hyperparameter Tuning for Effective Machine Learning

   Patrick Koch, Brett Wujek, Oleg Golovidov, and Steven Gardner
   SAS Institute Inc, 2017

   Machine learning predictive modeling algorithms are governed by "hyperparameters" that have no clear defaults agreeable to a wide range of applications. The depth of a decision tree, number of trees in a forest, number of hidden layers and neurons in each layer in a neural network, and degree of regularization to prevent overfitting are a few examples of quantities that must be prescribed for these algorithms. Not only do ideal settings for the hyperparameters dictate the performance of the training process, but more importantly they govern the quality of the resulting predictive models. Recent efforts to move from a manual or random adjustment of these parameters include rough grid search and intelligent numerical optimization strategies.

   https://pdfs.semanticscholar.org/ce60/a2a90be9ba9088f91b1bd51a2c1cabade1ae.pdf

   Additional reading from
   https://papers.nips.cc/paper/4443-algorithms-for-hyper-parameter-optimization.pdf.

5. An overview of gradient descent optimization algorithms

Sebastian Ruder

(Submitted on 15 Sep 2016 (v1), last revised 15 Jun 2017 (this version, v2))

Gradient descent optimization algorithms, while increasingly popular, are often used as black-box optimizers, as practical explanations of their strengths and weaknesses are hard to come by. This article aims to provide the reader with intuitions with regard to the behaviour of different algorithms that will allow her to put them to use. In the course of this overview, we look at different variants of gradient descent, summarize challenges, introduce the most common optimization algorithms, review architectures in a parallel and distributed setting, and investigate additional strategies for optimizing gradient descent.

https://arxiv.org/pdf/1609.04747.pdf

Additional reading from http://ruder.io/optimizing-gradient-descent/.

Expected result

Various machine learning algorithms will be used for Sentiment Analysis (Positive or Negative). The best resulting algorithm will be chosen for a mobile app that generates the list of the optimistic and pessimistic friends of the user on Facebook.

- Machine Learning algorithms comparisons
- A Mobile application that uses the best resulting algorithm

Milestone

By 11th of May, we will have done our first naive approach using just word2vec.

By 18th of May, we will have implemented improved approach using Recurrent Neural Networks and LSTM.

By 22nd of May, we will have finished developing our mobile phone app. Then we will start preparing presentation and preparing code, snippets to submit.

Sentiment analysis

Project Start: Mon, 4/30/2018
Display Week: 1

TASK	PROGRESS	START	END
Project proposal	100%	4/30/18	5/4/18
Naïve approach (Word2Vec)	10%	5/5/18	5/11/18
Improved approach (RNN & LSTM)	0%	5/12/18	5/18/18
Mobile app	0%	5/19/18	5/22/18
Project deliever	0%	5/23/18	5/25/18