# Revisiting Automatically-Generated Adjectival Scales with Continuous Space Word Representations

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## Abstract

The goal of this study is to examine, replicate, and extend the model proposed by Kim and de Marneffe (2013). Their model uses the continuous space word representations described by Mikolov et al. (2010) to vectorize adjectives and discuss their relationships, with regards to their adjectival scale and relative intensity, in the new, high-dimensional, continuous space.

This study reviews and critiques a number of alternative approaches to generating an adjectival scale, and evaluates the performance of the original model on an expanded dataset and on the datasets of alternative models. The conclusion is clear: continuous space word representations are meaningful, but are inconsistent in determining adjectival scales.

## 1 Introduction

Continuous space word representations generated by neural networks capture syntactic and semantic meaning. The continuous model creates an n-dimensional space to represent a word, as compared to an n-gram model, which more directly bounds words to their discrete contexts. This makes them ideal to examine more complex relationships between words.

This paper attempts to use that meaning to construct a scale for adjective word representations. Using precomputed word representations, we map out the relationships between adjectives, under the assumption that the relationship is linear. There are a number of distance metrics one can use, depending on what attributes one wants to highlight.

Cosine similarity is one way to measure where a particular word fits on the scale (or what word fits at a particular point on the scale). Another is simple Euclidean distance. For example, to find the comparative adjective, one can find the word closest to the middle of the superlative and base adjective. Similarly, one can determine which adjective best fits a scale, when given a number of options, by measuring their similarity to words on the scale.

Our model trains the word2vec model developed by Mikolov et al. (2013), on the Google News data set (1B words, 3M word vectors with 300 dimensions). Our test set includes adjectival scales introduced by Wilkinson and Oates (2016) and de Melo and Bansal (2013), as well as a more expansive dataset generated using the intensity scales introduced by Taboada et al. (2011).

We generate both *full* and *half* scales using the datasets and test the performance of our model on both. The difference between a *full* adjectival scale and a *half* adjectival scale is a matter of extremes. We define a *full* adjectival scale as an adjectival scale that goes from antonym to antonym, centering around a neutral or transitioning adjective. By contrast, we define a *half* adjectival scale as an adjectival scale that only has increasing intensity, centering around a comparative adjective. So, for example, *hot*, *lukewarm*, *cold* versus *tepid*, *warmer*, *hot* are full scale and half scale, respectively.

We compare our approach and results to those of Wilkinson and Oates (2016) and de Melo and Bansal (2013). Notably, we do not use the question-answer approach used by Kim and de Marneffe (2013) nor their IQAP data-set to determine accuracy, opting instead for a more explicit generation of an adjectival scale.

## 2 Model and previous work

The paper on which study is based (de Marneffe 2013), used the recurrent neural network language model (RNNLM) described by (Mikolov 2011), and expanded on in (mikolov 2013) to generate continuous word representations. We use a

similar model, trained on Google News data set, xxx words with dimensionality 300. (de Marneffe 2013) uses the Broadcast news dataset (320M words) with dimensionality 1,600.

The RNNLM described by

## 3 Data

## 4 Approach

## 5 Evaluation

## 6 Discussion and Conclusion

## 7 General Instructions

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### 7.2 Electronically-available resources

NAACL-HLT provides this description in LaTeX2e (`naaclhlt2019.tex`) and PDF format (`naaclhlt2019.pdf`), along with the LaTeX2e style file used to format it (`naaclhlt2019.sty`) and an ACL bibliography style (`acl_natbib.bst`) and example bibliography (`naaclhlt2019.bib`). These files are all available at `http://naacl2019.org/downloads/naaclhlt2019-latex.zip`. We strongly recommend the use of these style files, which have been appropriately tailored for the NAACL-HLT 2019 proceedings.

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It is of utmost importance to specify the **A4 format** (21 cm x 29.7 cm) when formatting the paper. When working with `dvips`, for instance, one should specify `-t a4`. Or using the command `\special{papersize=210mm,297mm}` in the latex preamble (directly below the `\usepackage` commands). Then using `dvipdf` and/or `pdflatex` which would make it easier for some.

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Format manuscripts two columns to a page, in the manner these instructions are formatted. The exact dimensions for a page on A4 paper are:

- Left and right margins: 2.5 cm
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For reasons of uniformity, Adobe's **Times Roman** font should be used. In LaTeX2e this is accomplished by putting

| Type of Text | Font Size | Style |
|---|---|---|
| paper title | 15 pt | bold |
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| author affiliation | 12 pt | |
| the word "Abstract" | 12 pt | bold |
| section titles | 12 pt | bold |
| document text | 11 pt | |
| captions | 10 pt | |
| abstract text | 10 pt | |
| bibliography | 10 pt | |
| footnotes | 9 pt | |

Table 1: Font guide.

```
\usepackage{times}
\usepackage{latexsym}
```

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### 7.6 Sections

**Headings**: Type and label section and subsection headings in the style shown on the present document. Use numbered sections (Arabic numerals) in order to facilitate cross references. Number subsections with the section number and the subsection number separated by a dot, in Arabic numerals. Do not number subsubsections.

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We suggest that instead of

> "(Gusfield, 1997) showed that ..."

you use

| output | natbib | previous ACL style files |
|---|---|---|
| (Gusfield, 1997) | `\citep` | `\cite` |
| Gusfield (1997) | `\citet` | `\newcite` |
| (1997) | `\citeyearpar` | `\shortcite` |

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> "Gusfield (1997) showed that ..."

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As reviewing will be double-blind, the submitted version of the papers should not include the authors' names and affiliations. Furthermore, self-references that reveal the author's identity, *e.g.*,

> "We previously showed (Gusfield, 1997) ..."

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- Example citing an arxiv paper: (Rasooli and Tetreault, 2015).
- Example article in journal citation: (Ando and Zhang, 2005).
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## Acknowledgments

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`\bibliography{naaclhlt2019}`
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