

# Visualizing Low-Dimensional Word Embeddings with Emoji Annotators

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## ABSTRACT

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**Index Terms:** Human-centered computing—Visualization—Visualization techniques—Treemaps; Human-centered computing—Visualization—Visualization design and evaluation methods

## 1 INTRODUCTION

Word embeddings, especially cross-lingual embeddings, has been successful in multiple NLP applications such as machine translation [?, ?] and cross-lingual document classification [?]. One way of exploring such embeddings is to enable interaction between humans and visualizations. However, there are potential problems of naively displaying the word embeddings projected onto 2D space using t-SNE [?], which is not commonly used in visualizing word embeddings, such as;

- Overlap of words when zoomed out.
- A counter-intuitive features of a t-SNE visualization (e.g., “cluster sizes mean nothing”<sup>1</sup>)
- There are many other alternatives to visualize word embeddings than commonly used t-SNE (e.g., UMAP [?] or *k*-Nearest Neighbor graph), but no thorough comparison conducted.

Figure ?? shows an example of *k*-nearest neighbor graph and Figure ?? shows an example of visualization using t-SNE.

In this project, we would like to accomplish the followings:

- Visualize the change of word vectors while training skip-gram with negative sampling (SGNS) model [?] using t-SNE.
- Compare visualizations of word vectors between t-SNE, UMAP, *k*-nearest neighbor graph, or any other methods (any suggestions are welcome).

## 2 DESCRIPTION OF THE PROJECT

Figure 1 shows the output of our visualization.

Our approach for constructing the visualization is as follows:

1. Train a word embedding

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Figure 1: The visualizaiton of clustered network

2. Run k-means and obtain clusters
3. Assign an emoji to each cluster
4. Visualize using D3

### 2.1 Annotation of Clusters with Emojis

When a human look at emoji, one connects with various possible concepts. Searching for a right word to represent the cluster requires external linguistic resources e.g., WordNet. However, images does not associate a single word. For example, when one looks at 🍅, the possible association of this words are “tomato”, “vegatable”, “food”, or even “object”. Therefore, we decide to use emojis to represent the clusters.

<sup>1</sup><https://distill.pub/2016/misread-tsne/>