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# Leveraging N-grams to Extract Context From Text

A simple intro to a basic but fundamental NLP concept

Aashish Nair · Following
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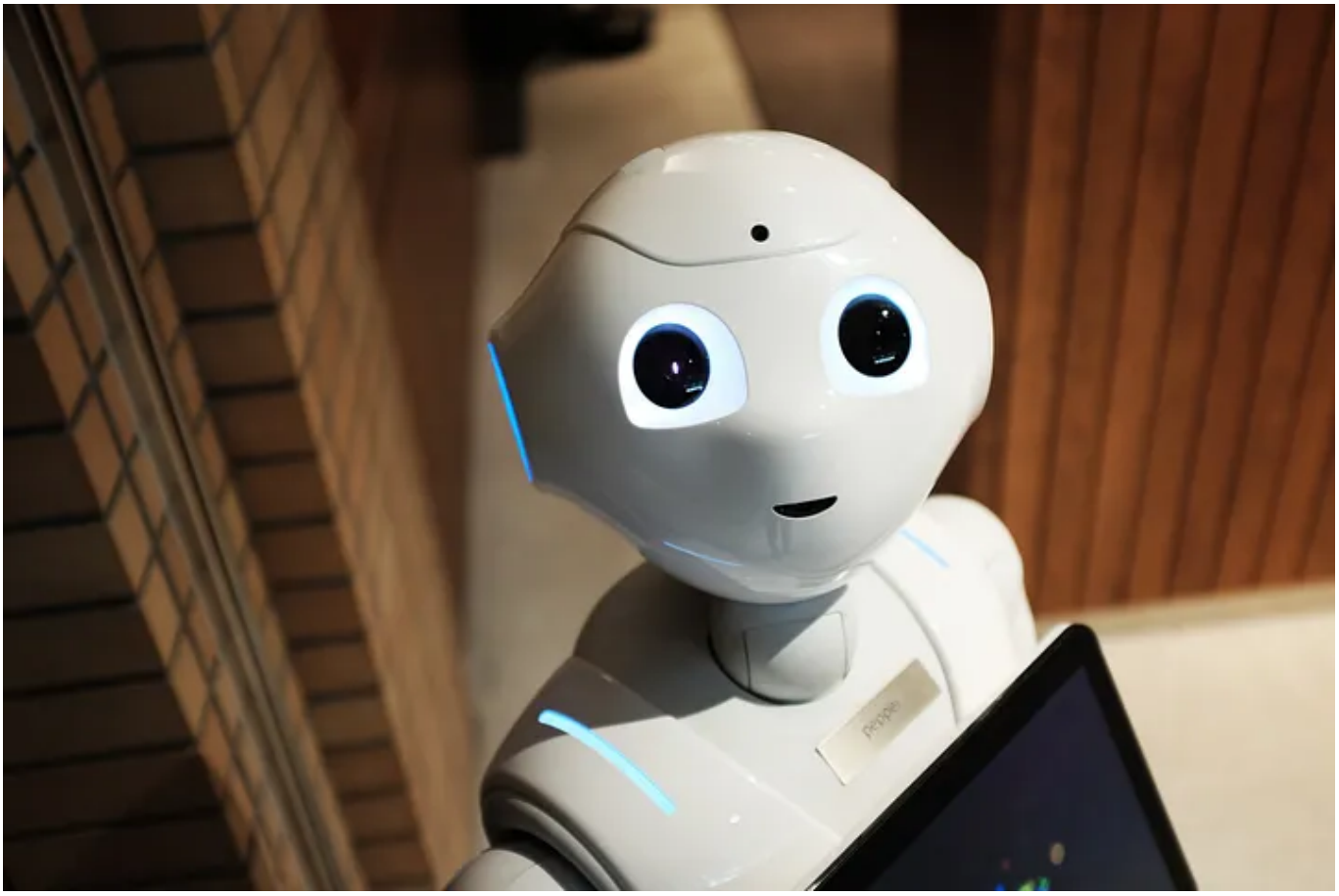

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People will inevitably run into n-grams when learning to deal with textual data. They often play a key role in enabling machines to understand the context of the given text.

As a result, this term is brought up in countless data science projects.

However, instead of treating n-grams as jargon that one can simply gloss over, it is important to take the time to learn about the ins and outs of this concept since it will serve as the foundation for understanding more advanced natural language processing tools and techniques.

So, what are n-grams?

Simply put, n-grams refer to a sequence of N words or characters.

## Example

Let's consider the sentence: "I live in New York".

A unigram model (n=1), stores this text in tokens of 1 word:

["I", "live", "in", "New", "York"]

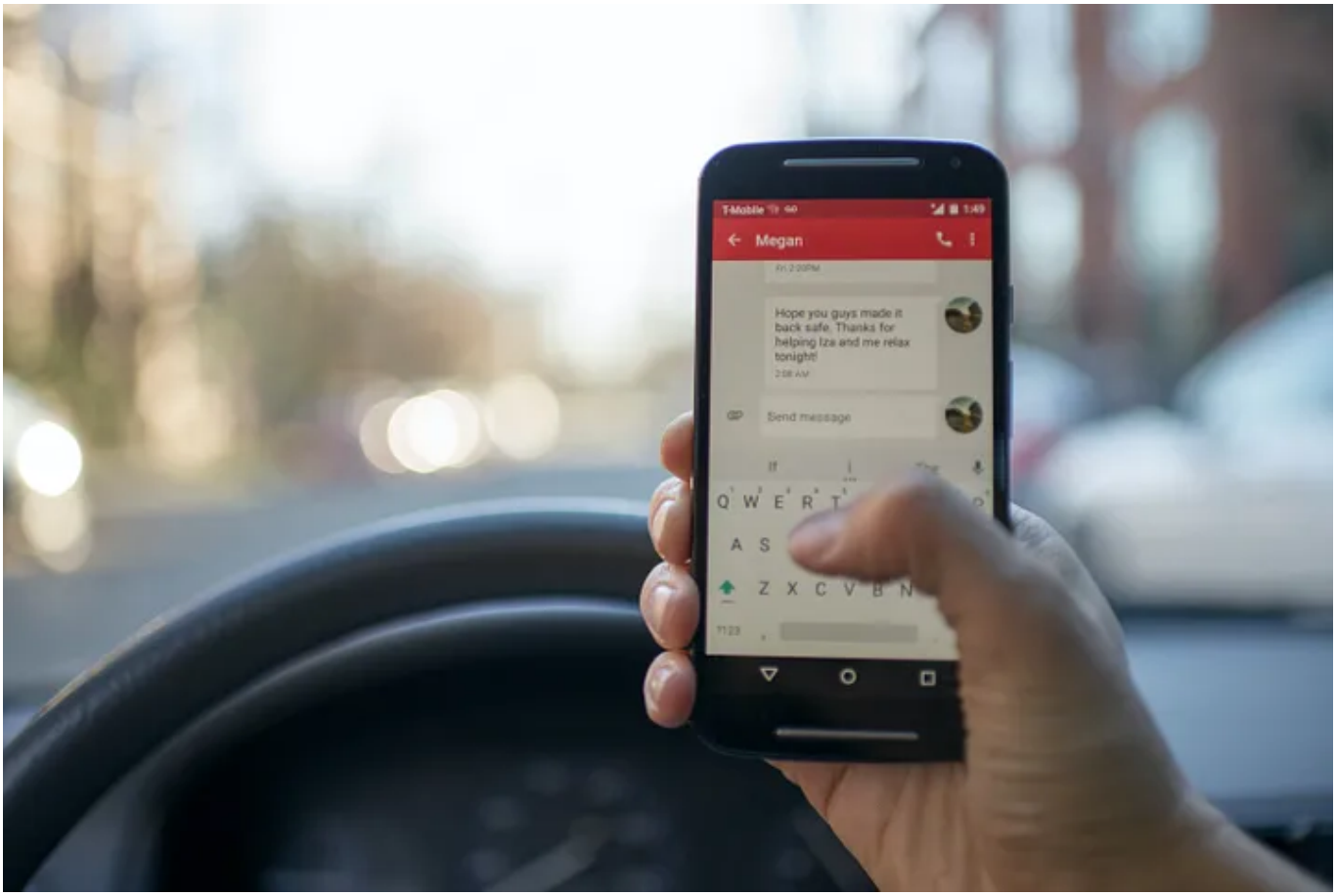
A bigram model (n=2) stores this text in tokens of 2 words:

["I live", "live in", "in New", "New York"]

In this scenario, the city "New York" would not be recognized as an entity with the unigram since each token only stores one word. On the other hand, the bigram joins the words "New" and "York" and allows the machine to

recognize “New York” as a single entity, thereby extracting the context from the text.

## Applications

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N-grams are ubiquitous in natural language processing.

Think of the text suggestion features in your messengers or search engines that you have learned to take for granted. Think of the spam detectors or hate speech detectors that make your experience with social media more pleasant. These features all rely on n-grams to achieve the reliability that they have become known for.

With that being said, there is no specific n-gram model that trumps all the others. The best way to leverage n-grams in your NLP models can only be determined through experimentation.

## Case Study

Let's do a case study to demonstrate the impact n-grams have on model performance.

Here, we will conduct a simple sentiment analysis using a dataset containing reviews of video games (accessible here) along with their corresponding sentiment score.

Loading Dataset

| | 2 | 3 |
|---|---|---|
| 0 | Positive | im getting on borderlands and i will murder yo... |
| 1 | Positive | I am coming to the borders and I will kill you... |
| 2 | Positive | im getting on borderlands and i will kill you ... |
| 3 | Positive | im coming on borderlands and i will murder you... |
| 4 | Positive | im getting on borderlands 2 and i will murder ... |

Code Output (Image By Author)

The data is first cleaned prior to any predictive modeling.

Data Preprocessing

For this case study, the text will be converted to a bag of words with the CountVectorizer object in the sklearn module before being used to train a machine learning classifier.

Bag Of Words With Unigrams

Note: The “ngram_range” parameter refers to the range of n-grams from the text that will be included in the bag of words. An n-gram range of (1,1) means that the bag of words will only include unigrams.

Let’s see how a Naive Bayes model predicts the sentiment of the reviews with an n-gram range of (1,1).

Training a Model With Unigrams

```
F-1 score : 0.752
```

Code Output (Image By Author)

The Naive Bayes classifier registers an f1-score of 0.752.

In general, the bag of words model is a very simple approach to word vectorization and has certain limitations. Mainly, the words are not ordered as they are collected, so a lot of the context from the text is lost.

Using n-grams, in this case, can help address this issue by establishing some order to preserve context.

Let's see how the model performs after adding bigrams (n=2) to the input features. This can be achieved by changing the "ngrams_range" parameter to (1,2).

Training a Model With Unigrams and Bigrams

```
F-1 score : 0.882
```

Code Output (Image By Author)

The model registers a greater f-1 score after the inclusion of bigrams. This can be attributed to the greater context the machine gets when it inputs 2-word sequences instead of just individual words.

That being said, when it comes to n-grams, more is not necessarily better. In some cases, having too many features will result in a less optimal model.

We can prove this by showing how accurately the model predicts the sentiment of the given text with different n-gram ranges.

Here, 10 models with different n-gram ranges are built with the training set and evaluated with the testing set.

Training a Model With 10 N-gram Ranges

```
F-1 score of model with n-gram range of (1, 1): 0.752
F-1 score of model with n-gram range of (1, 2): 0.882
F-1 score of model with n-gram range of (1, 3): 0.8994
F-1 score of model with n-gram range of (1, 4): 0.9017
F-1 score of model with n-gram range of (1, 5): 0.9019
F-1 score of model with n-gram range of (1, 6): 0.9011
F-1 score of model with n-gram range of (1, 7): 0.9006
F-1 score of model with n-gram range of (1, 8): 0.9005
F-1 score of model with n-gram range of (1, 9): 0.9001
F-1 score of model with n-gram range of (1, 10): 0.8998
```

Code Output (Image By Author)

Based on the results, the model performs at its best with the n-gram range of (1,5). This means that training the model with n-grams ranging from unigrams to 5-grams help achieve optimal results, but larger n-grams only result in more sparse input features, which hampers model performance.

## Conclusion


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N-grams are a simple but important concept in natural language processing. Given the variety of applications that require extracting insights from text, n-grams will no doubt play a big role in many machine learning projects.

That is why it is essential to gain a strong understanding of n-grams and its impact on model performance. Harnessing this tool will only improve the capability of your models.

I wish you the best of luck in your machine learning endeavors!

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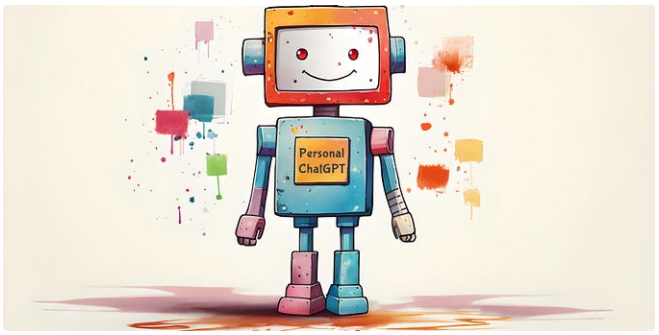


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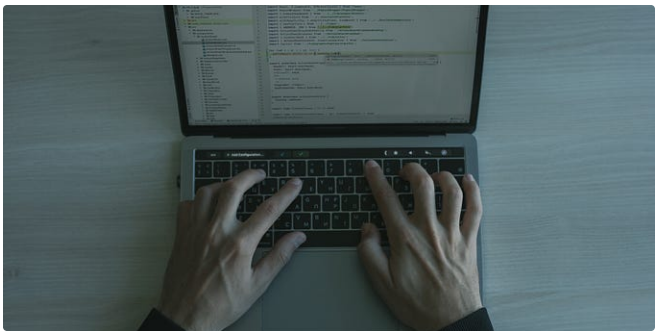

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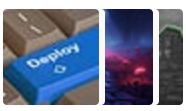

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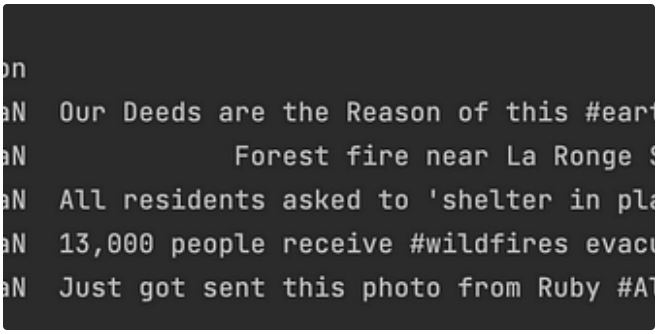


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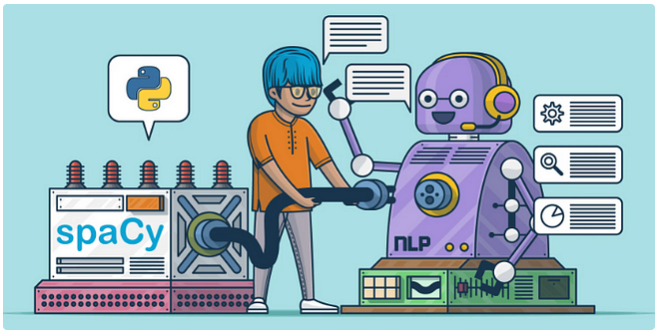


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