

## How does LDA work?

Imagine that you are now discovering topics in documents instead of sentences. Imagine you have 2 documents with the following words:

	Document X		Document Y
	Fish		Fish
	Fish		Fish
	Eat		Milk
	Eat		Kitten
	Vegetables		Kitten

### Step 1

**You tell the algorithm how many topics you think there are.** You can either use an informed estimate (e.g. results from a previous analysis), or simply trial-and-error. In trying different estimates, you may pick the one that generates topics to your desired level of interpretability, or the one yielding the highest statistical certainty (e.g., semantic coherence). In our example above, the number of topics might be inferred just by eyeballing the documents.

### Step 2

**The algorithm will assign every word to a temporary topic.** Topic assignments are temporary as they will be updated in **Step 3**. Temporary topics are assigned to each word in a semi-random manner (according to a Dirichlet distribution, to be exact). This also means that if a word appears twice, each word may be assigned to different topics. Note that in analyzing actual documents, function words (e.g. “the”, “and”, “my”) are removed and not assigned to any topics.

### Step 3 (*iterative*)

**The algorithm will check and update topic assignments, looping through each word in every document.** For each word, its topic assignment is updated based on two criteria:

- How prevalent is that word across topics? (term-topic distribution)
- How prevalent are topics in the document? (document-topic distribution)

To understand how these two criteria work, imagine that we are now checking the topic assignment for the word “fish” in Doc Y:

	Document X		Document Y
F	Fish	?	Fish
F	Fish	F	Fish
F	Eat	F	Milk
F	Eat	P	Kitten
F	Vegetables	P	Kitten

- How prevalent is that word across topics? Since “fish” words across both documents nearly half of remaining Topic F (food) words but 0% of remaining Topic P (pet) words, a “fish” word picked at random would more likely be about Topic F.

	Document X		Document Y
<b>F</b>	<b>Fish</b>	?	Fish
<b>F</b>	<b>Fish</b>	<b>F</b>	<b>Fish</b>
F	Eat	F	Milk
F	Eat	P	Kitten
F	Vegetables	P	Kitten

- How prevalent are topics in the document? Since the words in Doc Y are assigned to Topic F and Topic P in a 50-50 ratio, the remaining “fish” word seems equally likely to be about either topic.

	Document X		Document Y
F	Fish	?	Fish
F	Fish	<b>F</b>	<b>Fish</b>
F	Eat	<b>F</b>	<b>Milk</b>
F	Eat	<b>P</b>	<b>Kitten</b>
F	Vegetables	<b>P</b>	<b>Kitten</b>

Weighing conclusions from the two criteria, we would assign the “fish” word of Doc Y to Topic F. Doc Y might then be a document on what to feed kittens.

The process of checking topic assignment is repeated for each word in every document, cycling through the entire collection of documents multiple times. This iterative updating is the key feature of LDA that generates a final solution (term-topic distribution & document-topic distribution) with coherent topics.

Source: <https://www.quora.com/What-is-a-good-explanation-of-Latent-Dirichlet-Allocation>