Orange3 Text Mining Documentation

Biolab

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Contents

1 Widgets 1
2 Scripting 47
3 Indices and tables 49
1.1 Corpus

Load a corpus of text documents, (optionally) tagged with categories, or change the data input signal to the corpus.

**Inputs**

- Data: Input data (optional)

**Outputs**

- Corpus: A collection of documents.

**Corpus** widget can work in two modes:

- When no data on input, it reads text corpora from files and sends a corpus instance to its output channel. History of the most recently opened files is maintained in the widget. The widget also includes a directory with sample corpora that come pre-installed with the add-on. The widget reads data from Excel (.xlsx), comma-separated (.csv) and native tab-delimited (.tab) files.

- When the user provides data to the input, it transforms data into the corpus. Users can select which features are used as text features.
1. Browse through previously opened data files, or load any of the sample ones.

2. Browse for a data file.

3. Reloads currently selected data file.

4. Select the variable that is shown as a document title in Corpus Viewer.

5. Features that will be used in text analysis.

6. Features that won’t be used in text analysis.

7. Browse through the datasets that come together with an add-on.

8. Access help, make a report and get information on the loaded data set.

You can drag and drop features between the two boxes and also change the order in which they appear.

### 1.1.1 Example

The first example shows a very simple use of Corpus widget. Place Corpus onto canvas and connect it to Corpus Viewer. We’ve used book-excerpts.tab data set, which comes with the add-on, and inspected it in Corpus Viewer.
The second example demonstrates how to quickly visualize your corpus with Word Cloud. We could connect Word Cloud directly to Corpus, but instead, we decided to apply some preprocessing with Preprocess Text. We are again working with book-excerpts.tab. We’ve put all text to lowercase, tokenized (split) the text to words only, filtered out English stopwords and selected 100 most frequent tokens.
1.2 Import Documents

Import text documents from folders.

Inputs

• None

Outputs

• Corpus: A collection of documents from the local machine.

Import Documents widget retrieves text files from folders and creates a corpus. The widget reads .txt, .docx, .odt, .pdf and .xml files. If a folder contains subfolders, they will be used as class labels.

1. Folder being loaded.
2. Load folder from a local machine.
3. Reload the data.
4. Number of documents retrieved.

If the widget cannot read the file for some reason, the file will be skipped. Files that were successfully retrieved will still be on the output.

1.2.1 Example

To retrieve the data, select the folder icon on the right side of the widget. Select the folder you wish to turn into corpus. Once the loading is finished, you will see how many documents the widget retrieved. To inspect them, connect the widget to Corpus Viewer. We’ve used a set of Kennedy’s speeches in a plain text format.
Now let us try it with subfolders. We have placed Kennedy’s speeches in two folders - pre-1962 and post-1962. If I load the parent folder, these two subfolders will be used as class labels. Check the output of the widget in a Data Table.

1.3 The Guardian

Fetching data from The Guardian Open Platform.

Inputs

• None

Outputs

• Corpus: A collection of documents from the Guardian newspaper.
Guardian retrieves articles from the Guardian newspaper via their API. For the widget to work, you need to provide the API key, which you can get at their access platform.

1. Insert the API key for the widget to work.

2. Provide the query and set the time frame from which to retrieve the articles.

3. Define which features to retrieve from the Guardian platform.

4. Information on the output.

5. Press `Search` to start retrieving the articles or `Stop` to stop the retrieval.

1.3.1 Example

Guardian can be used just like any other data retrieval widget in Orange, namely NY Times, Wikipedia, Twitter or PubMed.

We will retrieve 240 articles mentioning slovenia between september 2017 and september 2018. The text will include article headline and content. Upon pressing `Search`, the articles will be retrieved.

We can observe the results in the Corpus Viewer widget.
1.4 NY Times

Loads data from the New York Times’ Article Search API.

**Inputs**
- None

**Outputs**

NYTimes widget loads data from New York Times’ Article Search API. You can query NYTimes articles from September 18, 1851 to today, but the API limit is set to allow retrieving only a 1000 documents per query. Define which features to use for text mining, *Headline* and *Abstract* being selected by default.

To use the widget, you must enter your own API key.
1. To begin your query, insert NY Times’ Article Search API key. The key is securely saved in your system keyring service (like Credential Vault, Keychain, KWallet, etc.) and won’t be deleted when clearing widget settings.

2. Set query parameters:
   - *Query*
   - Query time frame. The widget allows querying articles from September 18, 1851 onwards. Default is set to 1 year back from the current date.

3. Define which features to include as text features.

4. Information on the output.

5. Produce report.

6. Run or stop the query.
1.4.1 Example

*NYTimes* is a data retrieving widget, similar to *Twitter* and *Wikipedia*. As it can retrieve geolocations, that is geographical locations the article mentions, it is great in combination with *Document Map* widget.

![Image of NYTimes widget](image.png)

First, let’s query *NYTimes* for all articles on Slovenia. We can retrieve the articles found and view the results in *Corpus Viewer*. The widget displays all the retrieved features, but includes on selected features as text mining features.

Now, let’s inspect the distribution of geolocations from the articles mentioning Slovenia. We can do this with *Document Map*. Unsurprisingly, Croatia and Hungary appear the most often in articles on Slovenia (discounting Slovenia itself), with the rest of Europe being mentioned very often as well.

1.5 Pubmed

Fetch data from *PubMed* journals.

**Inputs**

- None

**Outputs**

- Corpus: A collection of documents from the PubMed online service.

*PubMed* comprises more than 26 million citations for biomedical literature from MEDLINE, life science journals, and online books. The widget allows you to query and retrieve these entries. You can use regular search or construct
advanced queries.

1. Enter a valid e-mail to retrieve queries.

2. Regular search:
   - **Author**: queries entries from a specific author. Leave empty to query by all authors.
   - **From**: define the time frame of publication.
   - **Query**: enter the query. **Advanced search** enables you to construct complex queries. See PubMed’s website to learn how to construct such queries. You can also copy-paste constructed queries from the website.

3. **Find records** finds available data from PubMed matching the query. Number of records found will be displayed above the button.

4. Define the output. All checked features will be on the output of the widget.

5. Set the number of record you wish to retrieve. Press **Retrieve records** to get results of your query on the output.
Below the button is an information on the number of records on the output.

1.5.1 Example

PubMed can be used just like any other data widget. In this example we’ve queried the database for records on orchids. We retrieved 1000 records and kept only ‘abstract’ in our meta features to limit the construction of tokens only to this feature.

![PubMed and Preprocess Text](image)

We used Preprocess Text to remove stopword and words shorter than 3 characters (regexp `\b\w{1,2}\b`). This will perhaps get rid of some important words denoting chemicals, so we need to be careful with what we filter out. For the sake of quick inspection we only retained longer words, which are displayed by frequency in Word Cloud.

1.6 Twitter

Fetching data from The Twitter Search API.

**Inputs**
- None

**Outputs**
- Corpus: A collection of tweets from the Twitter API.

Twitter widget enables querying tweets through Twitter API. You can query by content, author or both and accumulate results should you wish to create a larger data set. The widget only supports REST API and allows queries for up to two weeks back.
1. To begin your queries, insert Twitter key and secret. They are securely saved in your system keyring service (like Credential Vault, Keychain, KWallet, etc.) and won’t be deleted when clearing widget settings. You must first create a Twitter app to get API keys.

2. Set query parameters:
   - Query word list: list desired queries, one per line. Queries are automatically joined by OR.
   - Search by: specify whether you want to search by content, author or both. If searching by author, you must enter proper Twitter handle (without @) in the query list.
   - Language: set the language of retrieved tweets. Any will retrieve tweets in any language.
   - Max tweets: set the top limit of retrieved tweets. If box is not ticked, no upper bound will be set - widget will retrieve all available tweets.
   - Allow retweets: if ‘Allow retweets’ is checked, retweeted tweets will also appear on the output. This might duplicate some results.
   - Collect results: if ‘Collect results’ is ticked, widget will append new queries to the previous ones. Enter new queries, run Search and new results will be appended to the previous ones.

3. Define which features to include as text features.

4. Information on the number of tweets on the output.

5. Run query.
1.6.1 Examples

First, let’s try a simple query. We will search for tweets containing either ‘data mining’ or ‘machine learning’ in the content and allow retweets. We will further limit our search to only a 100 tweets in English.

First, we’re checking the output in Corpus Viewer to get the initial idea about our results. Then we’re preprocessing the tweets with lowercase, url removal, tweet tokenizer and removal of stopword and punctuation. The best way to see the results is with Word Cloud. This will display the most popular words in field of data mining and machine learning in the past two weeks.

Our next example is a bit more complex. We’re querying tweets from Hillary Clinton and Donald Trump from the presidential campaign 2016.
Then we’ve used Preprocess Text to get suitable tokens on our output. We’ve connected Preprocess Text to Bag of Words in order to create a table with words as features and their counts as values. A quick check in Word Cloud gives us an idea about the results.

Now we would like to predict the author of the tweet. With Select Columns we’re setting ‘Author’ as our target variable. Then we connect Select Columns to Test & Score. We’ll be using Logistic Regression as our learner, which we also connect to Test & Score.

We can observe the results of our author predictions directly in the widget. AUC score is quite ok. Seems like we can to some extent predict who is the author of the tweet based on the tweet content.

1.7 Wikipedia

Fetching data from MediaWiki RESTful web service API.

Inputs

- None

Outputs

- Corpus: A collection of documents from the Wikipedia.

Wikipedia widget is used to retrieve texts from Wikipedia API and it is useful mostly for teaching and demonstration.
1. Query parameters:
   - Query word list, where each query is listed in a new line.
   - Language of the query. English is set by default.
   - Number of articles to retrieve per query (range 1-25). Please note that querying is done recursively and that disambiguations are also retrieved, sometimes resulting in a larger number of queries than set on the slider.

2. Select which features to include as text features.

3. Information on the output.

4. Produce a report.
5. Run query.

1.7.1 Example

This is a simple example, where we use Wikipedia and retrieve the articles on ‘Slovenia’ and ‘Germany’. Then we simply apply default preprocessing with Preprocess Text and observe the most frequent words in those articles with Word Cloud.

Wikipedia works just like any other corpus widget (NY Times, Twitter) and can be used accordingly.

1.8 Preprocess Text

Preprocesses corpus with selected methods.

**Inputs**

- Corpus: A collection of documents.

**Outputs**

- Corpus: Preprocessed corpus.

**Preprocess Text** splits your text into smaller units (tokens), filters them, runs normalization (stemming, lemmatization), creates n-grams and tags tokens with part-of-speech labels. Steps in the analysis are applied sequentially and can be turned on or off.
1. **Information on preprocessed data.** *Document count* reports on the number of documents on the input. *Total tokens* counts all the tokens in corpus. *Unique tokens* excludes duplicate tokens and reports only on unique tokens in the corpus.

2. **Transformation** transforms input data. It applies lowercase transformation by default.
   - *Lowercase* will turn all text to lowercase.
   - *Remove accents* will remove all diacritics/accents in text. naïve → naive
   - *Parse html* will detect html tags and parse out text only. `<a href...>`Some text</a> → Some text
   - *Remove urls* will remove urls from text. This is a http://orange.biolab.si/ url. → This is a url.

3. **Tokenization** is the method of breaking the text into smaller components (words, sentences, bigrams).
   - *Word & Punctuation* will split the text by words and keep punctuation symbols. This example. → (This), (example), (.)
   - *Whitespace* will split the text by whitespace only. This example. → (This), (example)
• **Sentence** will split the text by full stop, retaining only full sentences. This example. Another example. → (This example.), (Another example.)

• **Regexp** will split the text by provided regex. It splits by words only by default (omits punctuation).

• **Tweet** will split the text by pre-trained Twitter model, which keeps hashtags, emoticons and other special symbols. This example. :-) #simple → (This), (example), (.), (:-)), (#simple)

### 4. Normalization
Applies stemming and lemmatization to words. (I've always loved cats. → I have alway love cat.) For languages other than English use Snowball Stemmer (offers languages available in its NLTK implementation).

• **Porter Stemmer** applies the original Porter stemmer.

• **Snowball Stemmer** applies an improved version of Porter stemmer (Porter2). Set the language for normalization, default is English.

• **WordNet Lemmatizer** applies a networks of cognitive synonyms to tokens based on a large lexical database of English.

### 5. Filtering
Removes or keeps a selection of words.

• **Stopwords** removes stopwords from text (e.g. removes ‘and’, ‘or’, ‘in’…). Select the language to filter by, English is set as default. You can also load your own list of stopwords provided in a simple *.txt file with one stopword per line.

Click ‘browse’ icon to select the file containing stopwords. If the file was properly loaded, its name will be displayed next to pre-loaded stopwords. Change ‘English’ to ‘None’ if you wish to filter out only the provided stopwords. Click ‘reload’ icon to reload the list of stopwords.

• **Lexicon** keeps only words provided in the file. Load a *.txt file with one word per line to use as lexicon. Click ‘reload’ icon to reload the lexicon.

• **Regexp** removes words that match the regular expression. Default is set to remove punctuation.

• **Document frequency** keeps tokens that appear in not less than and not more than the specified number / percentage of documents. If you provide integers as parameters, it keeps only tokens that appear in the specified number of documents. E.g. DF = (3, 5) keeps only tokens that appear in 3 or more and 5 or less documents. If you provide floats as parameters, it keeps only tokens that appear in the specified percentage of documents. E.g. DF = (0.3, 0.5) keeps only tokens that appear in 30% to 50% of documents. Default returns all tokens.

• **Most frequent tokens** keeps only the specified number of most frequent tokens. Default is a 100 most frequent tokens.

### 6. N-grams Range
Creates n-grams from tokens. Numbers specify the range of n-grams. Default returns one-grams and two-grams.

### 7. POS Tagger
Runs part-of-speech tagging on tokens.

• **Averaged Perceptron Tagger** runs POS tagging with Matthew Honnibal’s averaged perceptron tagger.

• **Treebank POS Tagger (MaxEnt)** runs POS tagging with a trained Penn Treebank model.

• **Stanford POS Tagger** runs a log-linear part-of-speech tagger designed by Toutanova et al. Please download it from the provided website and load it in Orange. You have to load the language-specific model in Model and load stanford-postagger.jar in the Tagger section.

8. Produce a report.

9. If **Commit Automatically** is on, changes are communicated automatically. Alternatively press **Commit**.
**Note!** Preprocess Text applies preprocessing steps in the order they are listed. This means it will first transform the text, then apply tokenization, POS tags, normalization, filtering and finally constructs n-grams based on given tokens. This is especially important for WordNet Lemmatizer since it requires POS tags for proper normalization.

### 1.8.1 Useful Regular Expressions

Here are some useful regular expressions for quick filtering:

- `\bword\b`: matches exact word
- `\w+`: matches only words, no punctuation
- `\b(B|b)\w+\b`: matches words beginning with the letter b
- `\w{4,}`: matches words that are longer than 4 characters
- `\b\w+(Y|y)\b`: matches words ending with the letter y

### 1.8.2 Examples

In the first example we will observe the effects of preprocessing on our text. We are working with `book-excerpts.tab` that we’ve loaded with Corpus widget. We have connected Preprocess Text to Corpus and retained default preprocessing methods (lowercase, per-word tokenization and stopword removal). The only additional parameter we’ve added as outputting only the first 100 most frequent tokens. Then we connected Preprocess Text with Word Cloud to observe words that are the most frequent in our text. Play around with different parameters, to see how they transform the output.

The second example is slightly more complex. We first acquired our data with Twitter widget. We quired the internet for tweets from users @HillaryClinton and @realDonaldTrump and got their tweets from the past two weeks, 242 in total.
In **Preprocess Text** there’s *Tweet* tokenization available, which retains hashtags, emojis, mentions and so on. However, this tokenizer doesn’t get rid of punctuation, thus we expanded the Regexp filtering with symbols that we wanted to get rid of. We ended up with word-only tokens, which we displayed in **Word Cloud**. Then we created a schema for predicting author based on tweet content, which is explained in more details in the documentation for **Twitter** widget.

### 1.9 Bag of Words

Generates a bag of words from the input corpus.

**Inputs**

- Corpus: A collection of documents.

**Outputs**

- Corpus: Corpus with bag of words features appended.

**Bag of Words** model creates a corpus with word counts for each data instance (document). The count can be either absolute, binary (contains or does not contain) or sublinear (logarithm of the term frequency). Bag of words model is required in combination with **Word Enrichment** and could be used for predictive modelling.
1. Parameters for bag of words model:

   - Term Frequency:
     - Count: number of occurrences of a word in a document
     - Binary: word appears or does not appear in the document
     - Sublinear: logarithm of term frequency (count)
   
   - Document Frequency:
     - (None)
     - IDF: inverse document frequency
     - Smooth IDF: adds one to document frequencies to prevent zero division.
   
   - Regulariation:
     - (None)
     - L1 (Sum of elements): normalizes vector length to sum of elements
     - L2 (Euclidean): normalizes vector length to sum of squares

2. Produce a report.

3. If Commit Automatically is on, changes are communicated automatically. Alternatively press Commit.

### 1.9.1 Example

In the first example we will simply check how the bag of words model looks like. Load book-excerpts.tab with Corpus widget and connect it to Bag of Words. Here we kept the defaults - a simple count of term frequencies. Check what the Bag of Words outputs with Data Table. The final column in white represents term frequencies for each document.
In the second example we will try to predict document category. We are still using the `book-excerpts.tab` data set, which we sent through Preprocess Text with default parameters. Then we connected Preprocess Text to Bag of Words to obtain term frequencies by which we will compute the model.
Connect **Bag of Words** to **Test & Score** for predictive modelling. Connect **SVM** or any other classifier to **Test & Score** as well (both on the left side). **Test & Score** will now compute performance scores for each learner on the input. Here we got quite impressive results with **SVM**. Now we can check, where the model made a mistake.

Add **Confusion Matrix** to **Test & Score**. Confusion matrix displays correctly and incorrectly classified documents. **Select Misclassified** will output misclassified documents, which we can further inspect with **Corpus Viewer**.

### 1.10 Similarity Hashing

Computes documents hashes.

**Inputs**

- Corpus: A collection of documents.

**Outputs**

- Corpus: Corpus with simhash value as attributes.

**Similarity Hashing** is a widget that transforms documents into similarity vectors. The widget uses **SimHash** method from from Moses Charikar.
1. Set Simhash size (how many attributes will be on the output, corresponds to bits of information) and shingle length (how many tokens are used in a shingle).

2. Commit Automatically output the data automatically. Alternatively, press Commit.

1.10.1 Example

We will use deerwester.tab to find similar documents in this small corpus. Load the data with Corpus and pass it to Similarity Hashing. We will keep the default hash size and shingle length. We can observe what the widget outputs in a Data Table. There are 64 new attributes available, corresponding to the Simhash size parameter.

1.10.2 References


1.11 Sentiment Analysis

Predict sentiment from text.

Inputs

- Corpus: A collection of documents.
Outputs

- Corpus: A corpus with information on the sentiment of each document.

**Sentiment Analysis** predicts sentiment for each document in a corpus. It uses Liu Hu and Vader sentiment modules from NLTK. Both of them are lexicon-based. For Liu Hu, you can choose English or Slovenian version.

1. Method:
   - **Liu Hu**: lexicon-based sentiment analysis (supports English and Slovenian)
   - **Vader**: lexicon- and rule-based sentiment analysis

2. Produce a report.

3. If **Auto commit is on**, sentiment-tagged corpus is communicated automatically. Alternatively press **Commit**.

1.11.1 Example

**Sentiment Analysis** can be used for constructing additional features with sentiment prediction from corpus. First, we load *Election-2016-tweets.tab* in Corpus. Then we connect Corpus to **Sentiment Analysis**. The widget will append 4 new features for Vader method: positive score, negative score, neutral score and compound (combined score).

We can observe new features in a **Data Table**, where we sorted the *compound* by score. Compound represents the total sentiment of a tweet, where -1 is the most negative and 1 the most positive.

Now let us visualize the data. We have some features we are currently not interested in, so we will remove them with **Select Columns**.
Then we will make our corpus a little smaller, so it will be easier to visualize. Pass the data to **Data Sampler** and retain a random 10% of the tweets.

Now pass the filtered corpus to **Heat Map**. Use **Merge by k-means** to merge tweets with the same polarity into one line. Then use **Cluster by rows** to create a clustered visualization where similar tweets are grouped together. Click on a cluster to select a group of tweets - we selected the negative cluster.
To observe the selected subset, pass the tweets to Corpus Viewer.
1.11.2 References


1.12 Tweet Profiler

Detect Ekman’s, Plutchik’s or Profile of Mood States’ emotions in tweets.

**Inputs**

- Corpus: A collection of tweets (or other documents).

**Outputs**

- Corpus: A corpus with information on the sentiment of each document.

**Tweet Profiler** retrieves information on sentiment from the server for each given tweet (or document). The widget sends data to the server, where a model computes emotion probabilities and/or scores. The widget support three classifications of emotion, namely Ekman’s, Plutchik’s and Profile of Mood States (POMS).

![Tweet Profiler widget](image)

1. Options:

   - Attribute to use as content.
   - Emotion classification, either Ekman’s, Plutchik’s or Profile of Mood States. Multi-class will output one most probable emotion per document, while multi-label will output values in columns per each emotion.
   - The widget can output classes of emotion (categorical), probabilities (numeric), or embeddings (an emotional vector of the document).

2. **Commit Automatically** automatically outputs the result. Alternatively, press **Commit**.

1.12.1 Example

We will use election-tweets-2016.tab for this example. Load the data with Corpus and connect it to Tweet Profiler. We will use Content attribute for the analysis, Ekman’s classification of emotion with multi-class option and we will output the result as class. We will observe the results in a **Box Plot**. In the widget, we have selected to observe the Emotion variable, grouped by Author. This way we can see which emotion prevails by which author.
1.12.2 References


1.13 Topic Modelling


**Inputs**
- Corpus: A collection of documents.

**Outputs**
- Corpus: Corpus with topic weights appended.
- Topics: Selected topics with word weights.
- All Topics: Token weights per topic.

**Topic Modelling** discovers abstract topics in a corpus based on clusters of words found in each document and their respective frequency. A document typically contains multiple topics in different proportions, thus the widget also reports on the topic weight per document.

The widget wraps gensim’s topic models (LSI, LDA, HDP).

The first, LSI, can return both positive and negative words (words that are in a topic and those that aren’t) and concurrently topic weights, that can be positive or negative. As stated by the main gensim’s developer, Radim Řehůřek: “LSI topics are not supposed to make sense; since LSI allows negative numbers, it boils down to delicate cancellations between topics and there’s no straightforward way to interpret a topic.”

LDA can be more easily interpreted, but is slower than LSI. HDP has many parameters - the parameter that corresponds to the number of topics is *Top level truncation level (T)*. The smallest number of topics that one can retrieve is 10.
1. Topic modelling algorithm:
   - **Latent Semantic Indexing**. Returns both negative and positive words and topic weights.
   - **Latent Dirichlet Allocation**
   - **Hierarchical Dirichlet Process**

2. Parameters for the algorithm. LSI and LDA accept only the number of topics modelled, with the default set to 10. HDP, however, has more parameters. As this algorithm is computationally very demanding, we recommend you to try it on a subset or set all the required parameters in advance and only then run the algorithm (connect the input to the widget).
   - First level concentration ($\gamma$): distribution at the first (corpus) level of Dirichlet Process
   - Second level concentration ($\alpha$): distribution at the second (document) level of Dirichlet Process
   - The topic Dirichlet ($\alpha$): concentration parameter used for the topic draws
   - Top level truncation (T): corpus-level truncation (no of topics)
   - Second level truncation (K): document-level truncation (no of topics)
   - Learning rate ($\kappa$): step size
   - Slow down parameter ($\tau$)

3. Produce a report.

4. If *Commit Automatically* is on, changes are communicated automatically. Alternatively press *Commit*.

### 1.13.1 Examples

**Exploring Individual Topics**

In the first example, we present a simple use of the **Topic Modelling** widget. First we load *grimm-tales-selected.tab* data set and use **Preprocess Text** to tokenize by words only and remove stopwords. Then we connect **Preprocess Text** to **Topic Modelling**, where we use a simple **Latent Semantic Indexing** to find 10 topics in the text.
LSI provides both positive and negative weights per topic. A positive weight means the word is highly representative of a topic, while a negative weight means the word is highly unrepresentative of a topic (the less it occurs in a text, the more likely the topic). Positive words are colored green and negative words are colored red.

We then select the first topic and display the most frequent words in the topic in Word Cloud. We also connected Preprocess Text to Word Cloud in order to be able to output selected documents. Now we can select a specific word in the word cloud, say little. It will be colored red and also highlighted in the word list on the left.

Now we can observe all the documents containing the word little in Corpus Viewer.

### Topic Visualization

In the second example, we will look at the correlation between topics and words/documents. We are still using the grimm-tales-selected.tab corpus. In Preprocess Text we are using the default preprocessing, with an additional filter by document frequency (0.1 - 0.9). In Topic Modelling we are using LDA model with 5 topics.

Connect Topic Modelling to MDS. Ensure the link is set to All Topics - Data. Topic Modelling will output a matrix of word weights by topic.

In MDS, the points are now topics. We have set the size of the points to Marginal topic probability, which is an additional columns of All Topics - it reports on the marginal probability of the topic in the corpus (how strongly represented is the topic in the corpus).
We can now explore which words are representative for the topic. Select, say, Topic 5 from the plot and connect MDS to Box Plot. Make sure the output is set to Data - Data (not Selected Data - Data).

In Box Plot, set the subgroup to Selected and check the Order by relevance to subgroups box. This option will sort the variables by how well they separate between the selected subgroup values. In our case, this means which words are the most representative for the topic we have selected in the plot (subgroup Yes means selected).

We can see that little, children and kings are the most representative words for Topic 5, with good separation between the word frequency for this topic and all the others. Select other topics in MDS and see how the Box Plot changes.
1.14 Corpus Viewer

Displays corpus content.

Inputs

- Corpus: A collection of documents.

Outputs

- Corpus: Documents containing the queried word.

Corpus Viewer is meant for viewing text files (instances of Corpus). It will always output an instance of corpus. If RegExp filtering is used, the widget will output only matching documents.

1. Information:

- Documents: number of documents on the input
- Preprocessed: if preprocessor is used, the result is True, else False. Reports also on the number of tokens and types (unique tokens).
- POS tagged: if POS tags are on the input, the result is True, else False.
- N-grams range: if N-grams are set in Preprocess Text, results are reported, default is 1-1 (one-grams).
- Matching: number of documents matching the RegExp Filter. All documents are output by default.

2. RegExp Filter: Python regular expression for filtering documents. By default no documents are filtered (entire corpus is on the output).

3. Search Features: features by which the RegExp Filter is filtering. Use Ctrl (Cmd) to select multiple features.

4. Display Features: features that are displayed in the viewer. Use Ctrl (Cmd) to select multiple features.

5. Show Tokens & Tags: if tokens and POS tag are present on the input, you can check this box to display them.
6. If Auto commit is on, changes are communicated automatically. Alternatively press Commit.

### 1.14.1 Example

*Corpus Viewer* can be used for displaying all or some documents in corpus. In this example, we will first load *book-excerpts.tab*, that already comes with the add-on, into *Corpus* widget. Then we will preprocess the text into words, filter out the stopwords, create bi-grams and add POS tags (more on preprocessing in Preprocess Text). Now we want to see the results of preprocessing. In *Corpus Viewer* we can see, how many unique tokens we got and what they are (tick *Show Tokens & Tags*). Since we used also POS tagger to show part-of-speech labels, they will be displayed alongside tokens underneath the text.

Now we will filter out just the documents talking about a character Bill. We use regular expression `\bBill\b` to find the documents containing only the word Bill. You can output matching or non-matching documents, view them in another *Corpus Viewer* or further analyse them.

![Example Image](image.png)

### 1.15 Word Cloud

Generates a word cloud from corpus.

**Inputs**

- **Topic**: Selected topic.
- **Corpus**: A collection of documents.

**Outputs**
• Corpus: Documents that match the selection.
• Selected Word: Selected word that can be used as query in Concordance.
• Word Counts: Words and their weights.

Word Cloud displays tokens in the corpus, their size denoting the frequency of the word in corpus or an average bag of words count, when bag of words features are at the input of the widget. Words are listed by their frequency (weight) in the widget. The widget outputs documents, containing selected tokens from the word cloud.

1. Information on the input.
   • number of words (tokens) in a topic
   • number of documents and tokens in the corpus

2. Adjust the plot.
   • If Color words is ticked, words will be assigned a random color. If unchecked, the words will be black.
   • Word tilt adjust the tilt of words. The current state of tilt is displayed next to the slider (‘no’ is the default).
   • Regenerate word cloud plot the cloud anew.

3. Words & weights displays a sorted list of words (tokens) by their frequency in the corpus or topic. Clicking on a word will select that same word in the cloud and output matching documents. Use Ctrl to select more than one word. Documents matching ANY of the selected words will be on the output (logical OR).

4. Save Image saves the image to your computer in a .svg or .png format.
1.15.1 Example

Word Cloud is an excellent widget for displaying the current state of the corpus and for monitoring the effects of preprocessing.

Use Corpus to load the data. Connect Preprocess Text to it and set your parameters. We’ve used defaults here, just to see the difference between the default preprocessing in the Word Cloud widget and the Preprocess Text widget.

We can see from the two widgets, that Preprocess Text displays only words, while default preprocessing in the Word Cloud tokenizes by word and punctuation.

1.16 Concordance

Display the context of the word.

Inputs
- Corpus: A collection of documents.

Outputs
- Selected Documents: Documents containing the queried word.
- Concordances: A table of concordances.

Concordance finds the queried word in a text and displays the context in which this word is used. Results in a single color come from the same document. The widget can output selected documents for further analysis or a table of concordances for the queried word. Note that the widget finds only exact matches of a word, which means that if you query the word ‘do’, the word ‘doctor’ won’t appear in the results.
1. **Information**:
   - **Documents**: number of documents on the input.
   - **Tokens**: number of tokens on the input.
   - **Types**: number of unique tokens on the input.
   - **Matching**: number of documents containing the queried word.

2. **Number of words**: the number of words displayed on each side of the queried word.

3. Queried word.

4. If **Auto commit is on**, selected documents are communicated automatically. Alternatively press **Commit**.

### 1.16.1 Examples

*Concordance* can be used for displaying word contexts in a corpus. First, we load *book-excerpts.tab* in **Corpus**. Then we connect **Corpus** to **Concordance** and search for concordances of a word ‘doctor’. The widget displays all documents containing the word ‘doctor’ together with their surrounding (contextual) words.

Now we can select those documents that contain interesting contexts and output them to **Corpus Viewer** to inspect them further.
In the second example, we will output concordances instead. We will keep the `book-excerpts.tab` in Corpus and the connection to **Concordance**. Our queried word remains ‘doctor’.

This time, we will connect **Data Table** to **Concordance** and select Concordances output instead. In the **Data Table**, we get a list of concordances for the queried word and the corresponding documents. Now, we will save this table with **Save Data** widget, so we can use it in other projects or for further analysis.

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### 1.17 Document Map

Displays geographic locations mentioned in the text.

**Inputs**
- Data: Data set.

**Outputs**
• Corpus: Documents containing mentions of selected geographical regions.

**Document Map** widget shows geolocations from textual (string) data. It finds mentions of geographic names (countries and capitals) and displays distributions (frequency of mentions) of these names on a map. It works with any Orange widget that outputs a data table and that contains at least one string attribute. The widget outputs selected data instances, that is all documents containing mentions of a selected country (or countries).

![Document Map Widget](image)

1. Select the meta attribute you want to search geolocations by. The widget will find all mentions of geolocations in a text and display distributions on a map.

2. Select the type of map you wish to display. The options are World, Europe and USA. You can zoom in and out of the map by pressing + and - buttons on a map or by mouse scroll.

3. The legend for the geographic distribution of data. Countries with the boldest color are most often mentioned in the selected region attribute (highest frequency).

To select documents mentioning a specific country, click on a country and the widget will output matching documents. To select more than one country hold Ctrl/Cmd upon selection.

### 1.17.1 Example

**Document Map** widget can be used for simply visualizing distributions of geolocations or for a more complex interactive data analysis. Here, we’ve queried **NY Times** for articles on Slovenia for the time period of the last year (2015-2016). First we checked the results with **Corpus Viewer**.
Then we sent the data to Document Map to see distributions of geolocations by country attribute. The attribute already contains country tags for each article, which is why NY Times is great in combinations with Document Map. We selected Germany, which sends all the documents tagged with Germany to the output. Remember, we queried NY Times for articles on Slovenia.

We can again inspect the output with Corpus Viewer. But there’s a more interesting way of visualizing the data. We’ve sent selected documents to Preprocess Text, where we’ve tokenized text to words and removed stopwords.

Finally, we can inspect the top words appearing in last year’s documents on Slovenia and mentioning also Germany with Word Cloud.

### 1.18 Word Enrichment

Word enrichment analysis for selected documents.

**Inputs**

- Corpus: A collection of documents.
- Selected Data: Selected instances from corpus.

**Outputs**

- None

Word Enrichment displays a list of words with lower p-values (higher significance) for a selected subset compared to the entire corpus. Lower p-value indicates a higher likelihood that the word is significant for the selected subset (not...
randomly occurring in a text). FDR (False Discovery Rate) is linked to p-value and reports on the expected percent of false predictions in the set of predictions, meaning it account for false positives in list of low p-values.

1. Information on the input.
   - Cluster words are all the tokens from the corpus.
   - Selected words are all the tokens from the selected subset.
   - After filtering reports on the enriched words found in the subset.

2. Filter enables you to filter by:
   - p-value
   - false discovery rate (FDR)

1.18.1 Example

In the example below, we’re retrieved recent tweets from the 2016 presidential candidates, Donald Trump and Hillary Clinton. Then we’ve preprocessed the tweets to get only words as tokens and to remove the stopwords. We’ve connected the preprocessed corpus to Bag of Words to get a table with word counts for our corpus.
Then we’ve connected Corpus Viewer to Bag of Words and selected only those tweets that were published by Donald Trump. See how we marked only the Author as our Search feature to retrieve those tweets.

**Word Enrichment** accepts two inputs - the entire corpus to serve as a reference and a selected subset from the corpus to do the enrichment on. First connect Corpus Viewer to Word Enrichment (input Matching Docs → Selected Data) and then connect Bag of Words to it (input Corpus → Data). In the Word Enrichment widget we can see the list of words that are more significant for Donald Trump than they are for Hillary Clinton.

### 1.19 Duplicate Detection

Detect & remove duplicates from a corpus.

**Inputs**

- Distances: A distance matrix.

**Outputs**

- Corpus Without Duplicated: Corpus with duplicates removed.
- Duplicates Cluster: Documents belonging to selected cluster.
- Corpus: Corpus with appended cluster labels.

**Duplicate Detection** uses clustering to find duplicates in the corpus. It is great with the Twitter widget for removing retweets and other similar documents.
To set the level of similarity, drag the line vertical line left or right in the visualization. The further left the line, the more similar the documents have to be in order to be considered duplicates. You can also set the threshold manually in the control area.

1. Information on unique and duplicate documents.
2. Linkage used for clustering (Single, Average, Complete, Weighted and Ward).
3. Distance threshold sets the similarity cutoff. The lower the value, the more similar the data instances have to be to belong to the same cluster. You can also set the cutoff by dragging the vertical line in the plot.
4. Cluster labels can be appended as attributes, class or metas.
5. List of clusters at the selected threshold. They are sorted by size by default. Click on the cluster to observe its content on the output.

1.19.1 Example

This simple example uses iris data to find identical data instances. Load iris with the File widget and pass it to Distances. In Distances, use Euclidean distance for computing the distance matrix. Pass distances to Duplicate Detection.

It looks like cluster C147 contain three duplicate entries. Let us select it in the widget and observe it in a Data Table. Remember to set the output to Duplicates Cluster. The three data instances are identical. To use the data set without duplicates, use the first output, Corpus Without Duplicates.

The same procedure can be used also for corpora. Remember to use the Bag of Words between Corpus and Distances.
1.19. Duplicate Detection
CHAPTER 2

Scripting

2.1 Corpus
2.2 Preprocessor
2.3 Twitter
2.4 New York Times
2.5 The Guardian
2.6 Wikipedia
2.7 Bag of Words
2.8 Topic Modeling
2.9 Tag
CHAPTER 3

Indices and tables

- genindex
- modindex
- search