Text Plots

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Abstract

The textplot R package allows one to visualise complex relations in texts. This is done by providing functionalities for displaying text co-occurrence networks, text correlation networks, dependency relationships as well as text clustering. In this vignette, some example visualisations of these are shown.

Keywords: Text, network, co-occurrence, correlation, text clustering, dependency parsing, visualisation.

1. General

1.1. Overview

The package allows you to visualise

- Text frequencies
- Text correlations
- Text cooccurrences
- Text clusters
- Text embeddings
- Dependency parsing results

Source code repository

The source code of the package is on github at `https://github.com/bnosac/textplot`.
The R package is distributed under the GPL-2 license.

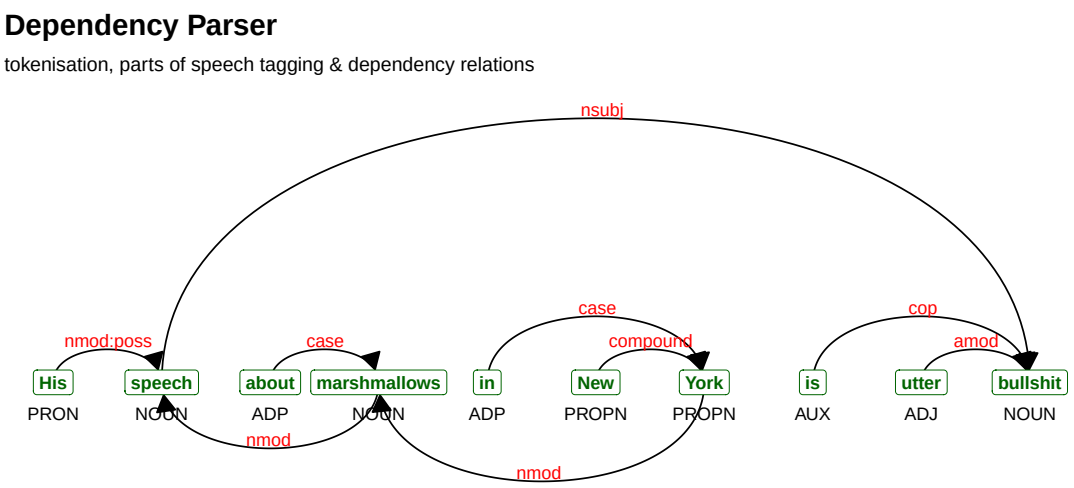
2. Example visualisations

2.1. Dependency Parser

Example 1

This example visualises the result of a text annotation which provides parts of speech tags and dependency relationships.

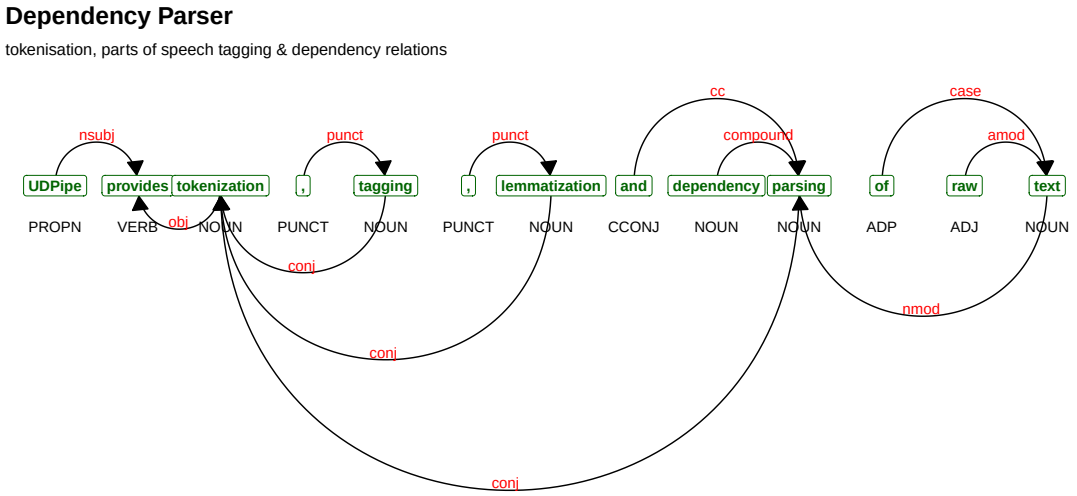
```
library(textplot)
library(udpipe)
library(ggraph)
library(ggplot2)
library(igraph)
x <- udpipe("His speech about marshmallows in New York is utter bullshit",
            "english")
plt <- textplot_dependencyparser(x, size = 4)
plt
```



Example 2

The following visualisation displays the dependency parser results on some larger sentence. Note that this function works only on 1 sentence.

```
x <- udpipe("UDPipe provides tokenization, tagging, lemmatization and
             dependency parsing of raw text", "english")
plt <- textplot_dependencyparser(x, size = 4)
plt
```



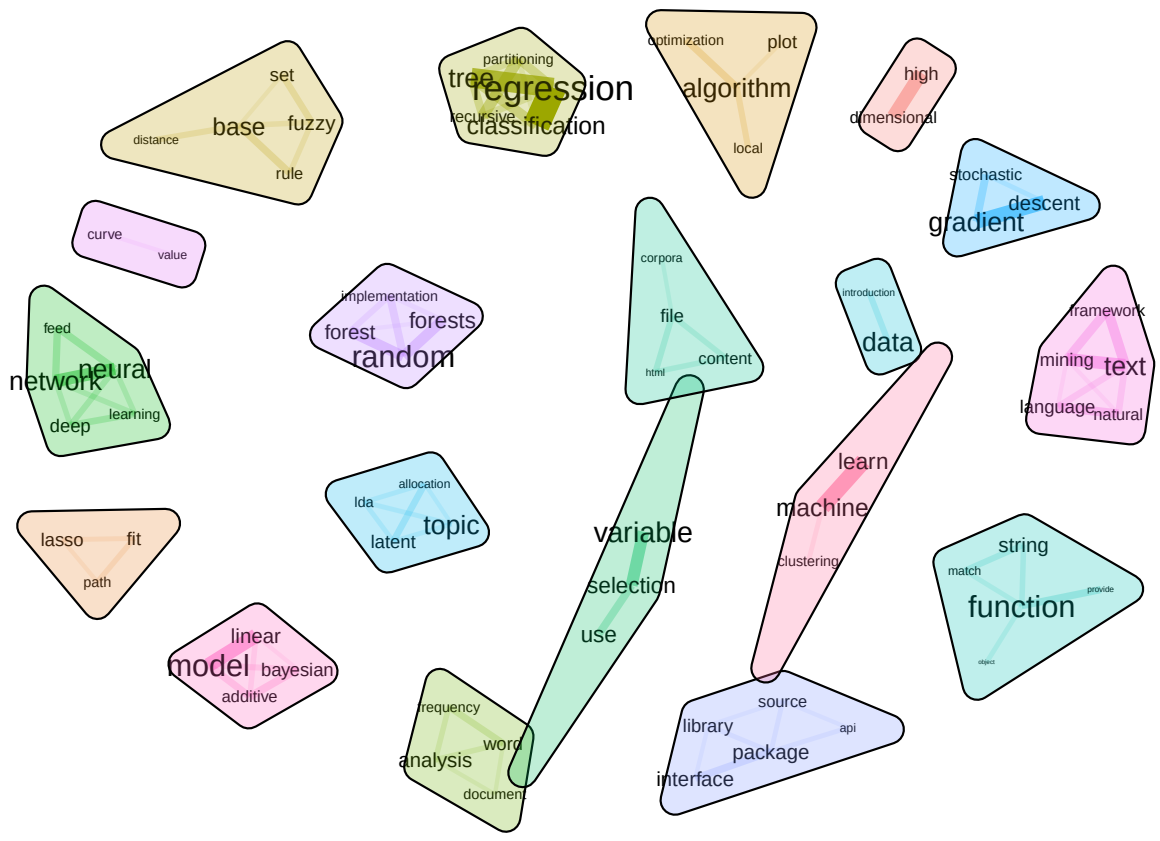
2.2. Biterm Topic Model plots

Example 1

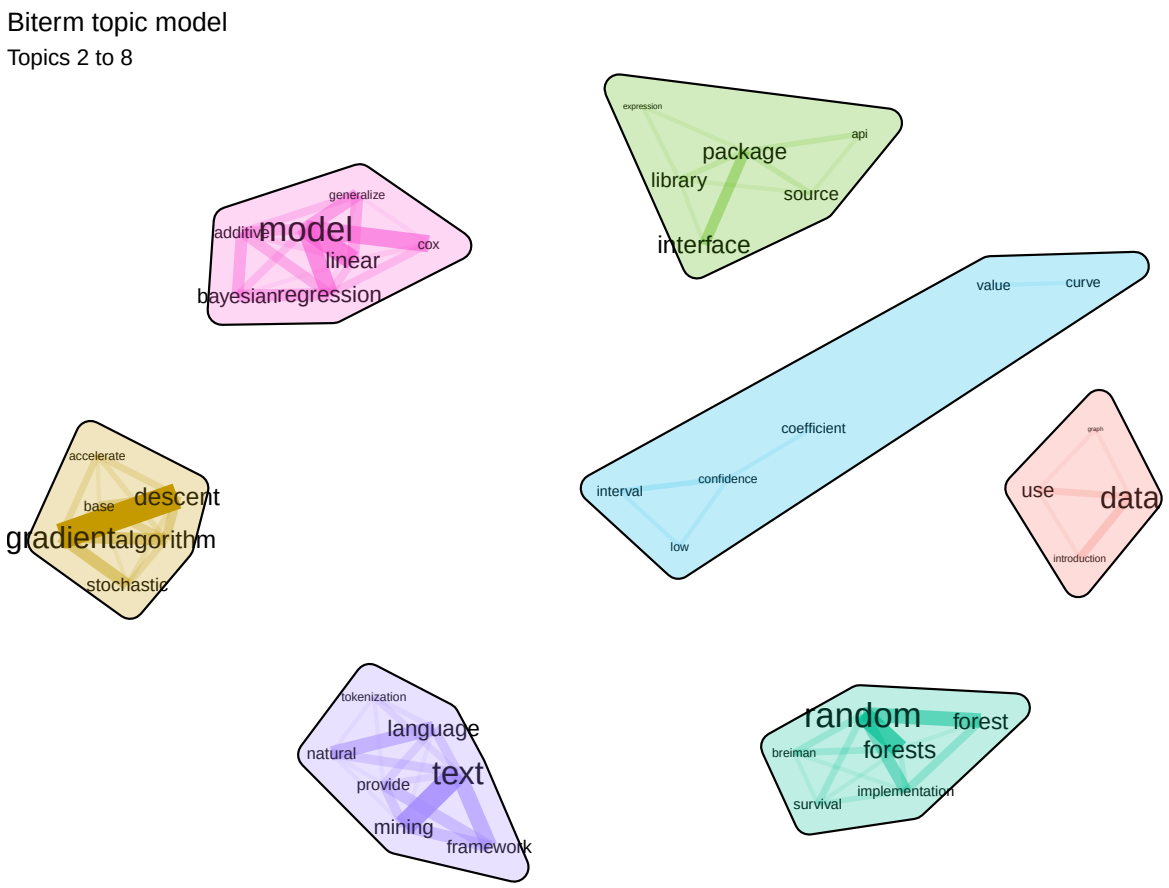
This example shows plotting a biterm topic model which was pretrained and put in the package as an example.

```
library(BTM)
library(ggplot2)
library(ggraph)
library(ggforce)
library(concaveman)
library(igraph)
data(example_btm, package = 'textplot')
model <- example_btm
plt <- plot(model, title = "BTM model", top_n = 5)
plt
```

BTM model



```
plt <- plot(model, title = "Biterm topic model", subtitle = "Topics 2 to 8",
            which = 2:8, top_n = 7)
plt
```



Example 2

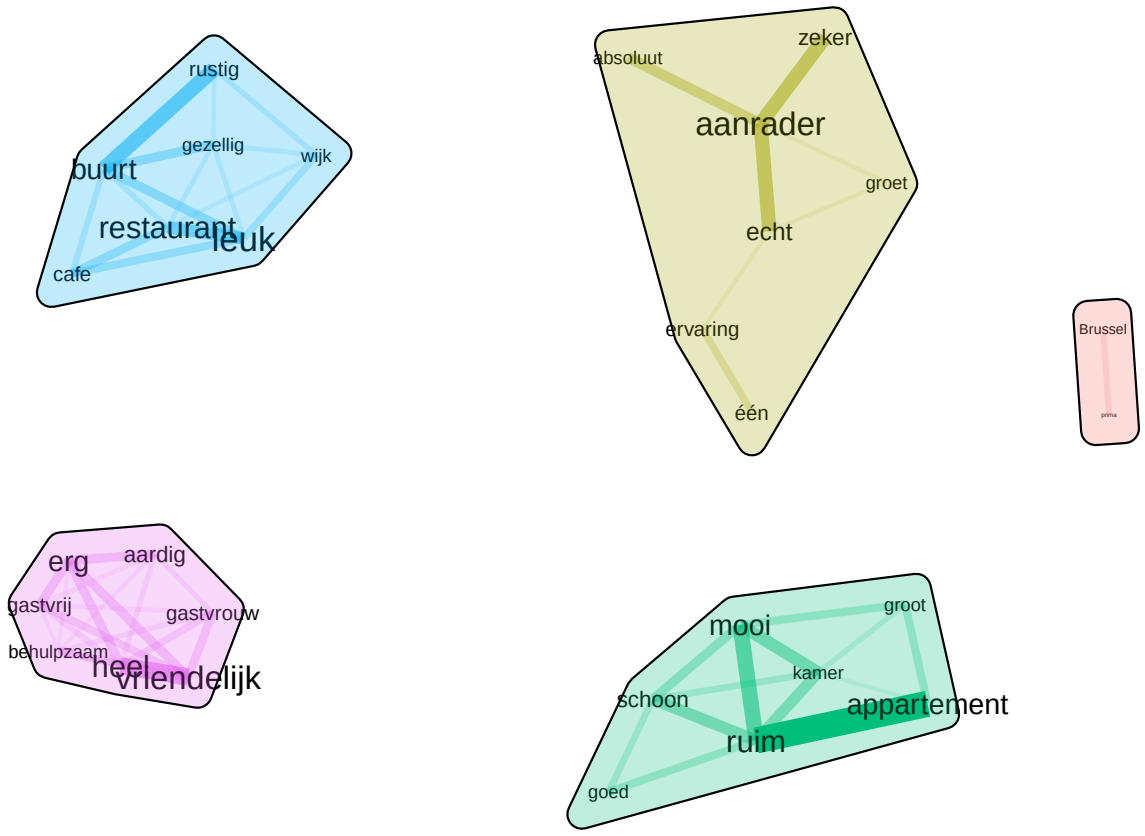
This example shows building a biterm topic model on nouns, adjectives and proper nouns occurring in the neighbourhood of one another and next plotting this model.

```
library(data.table)
library(udpipe)
## Annotate text with parts of speech tags
data("brussels_reviews", package = "udpipe")
anno <- subset(brussels_reviews, language %in% "nl")
anno <- data.frame(doc_id = anno$id, text = anno$feedback, stringsAsFactors = FALSE)
anno <- udpipe(anno, "dutch", trace = 10)
## Get cooccurrences of nouns / adjectives and proper nouns
biterms <- as.data.table(anno)
biterms <- biterms[, cooccurrence(x = lemma,
                                  relevant = upos %in% c("NOUN", "PROPN", "ADJ"),
                                  skipgram = 2),
```

```
                    by = list(doc_id)]
```

```
library(BTM)
library(ggplot2)
library(ggraph)
library(ggforce)
library(concaveman)
library(igraph)
## Build the BTM model
set.seed(123456)
x <- subset(anno, upos %in% c("NOUN", "PROPN", "ADJ"))
x <- x[, c("doc_id", "lemma")]
model <- BTM(x, k = 5, beta = 0.01, iter = 2000, background = TRUE,
             biterms = biterms, trace = 100)
plt <- plot(model)
plt
```

Biterm topic model

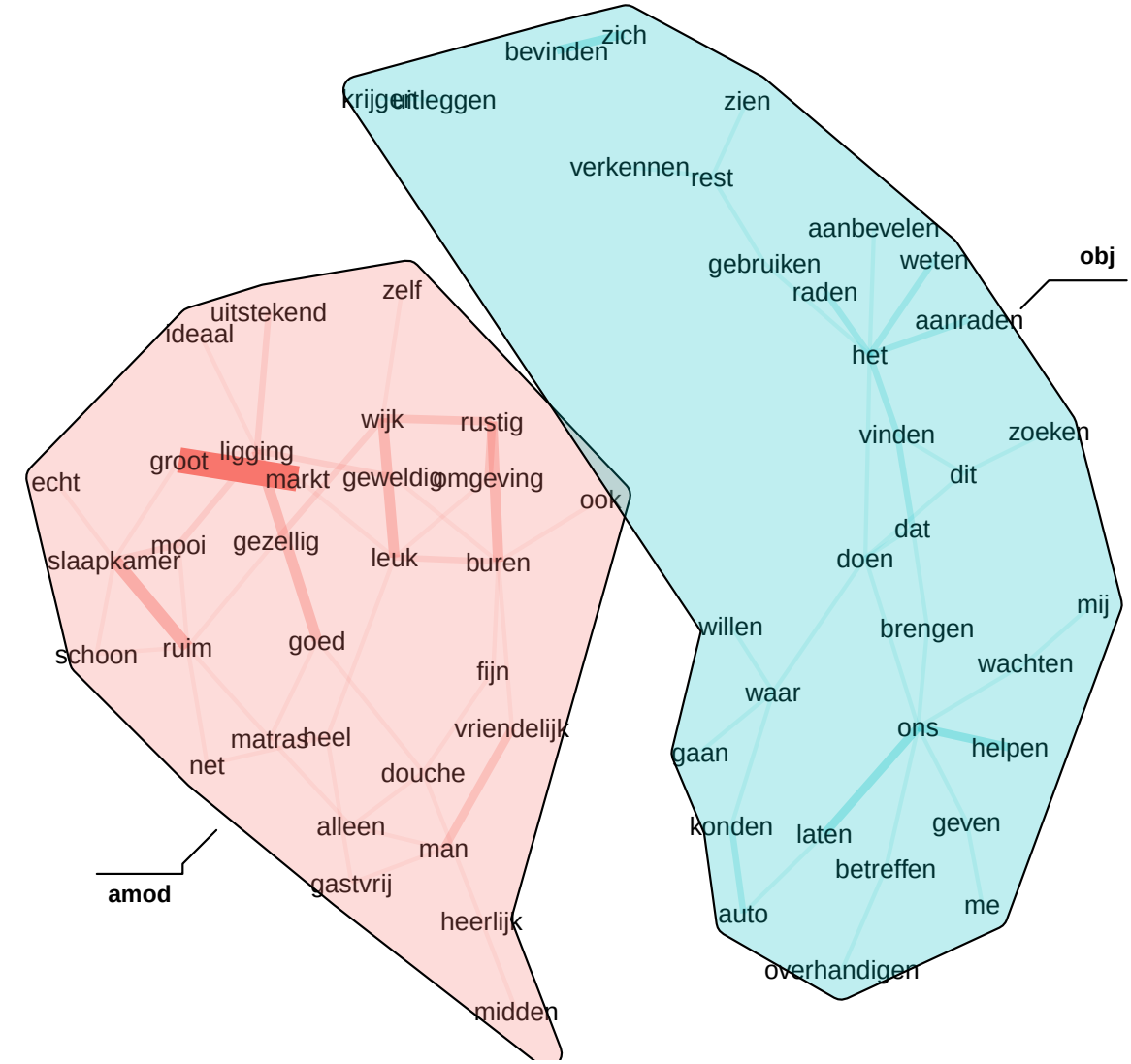


2.3. Biterm relationships

Example showing objects of verbs and adjectives modifying nouns

The below example shows the objects of verbs as well as which adjectives modify nouns. These are displayed as 2 clusters. We start from the annotation of the AirBnB data shown in the previous section 2.2.2.

```
library(BTM)
library(ggplot2)
library(ggraph)
library(ggforce)
library(concaveman)
library(igraph)
library(data.table)
library(udpipe)
x <- merge(anno, anno,
           by.x = c("doc_id", "paragraph_id", "sentence_id", "head_token_id"),
           by.y = c("doc_id", "paragraph_id", "sentence_id", "token_id"),
           all.x = TRUE, all.y = FALSE, suffixes = c("", "_parent"), sort = FALSE)
x <- subset(x, dep_rel %in% c("obj", "amod"))
x$topic <- factor(x$dep_rel)
topiclabels <- levels(x$topic)
x$topic <- as.integer(x$topic)
## Construct biterms/terminology inputs to the plot
biterms <- data.frame(term1 = x$lemma, term2 = x$lemma_parent,
                      topic = x$topic, stringsAsFactors = FALSE)
terminology <- document_term_frequencies(x, document = "topic",
                                         term = c("lemma", "lemma_parent"))
terminology <- document_term_frequencies_statistics(terminology)
terminology <- terminology[order(terminology$tf_idf, decreasing = TRUE), ]
terminology <- terminology[, head(.SD, 50), by = list(topic = doc_id)]
terminology <- data.frame(topic = terminology$topic,
                          token = terminology$term,
                          probability = 1, stringsAsFactors = FALSE)
plt <- textplot_bitermclusters(terminology, biterms,
                               labels = topiclabels,
                               title = "Objects of verbs and adjectives-nouns",
                               subtitle = "Top 50 by group")
plt
```

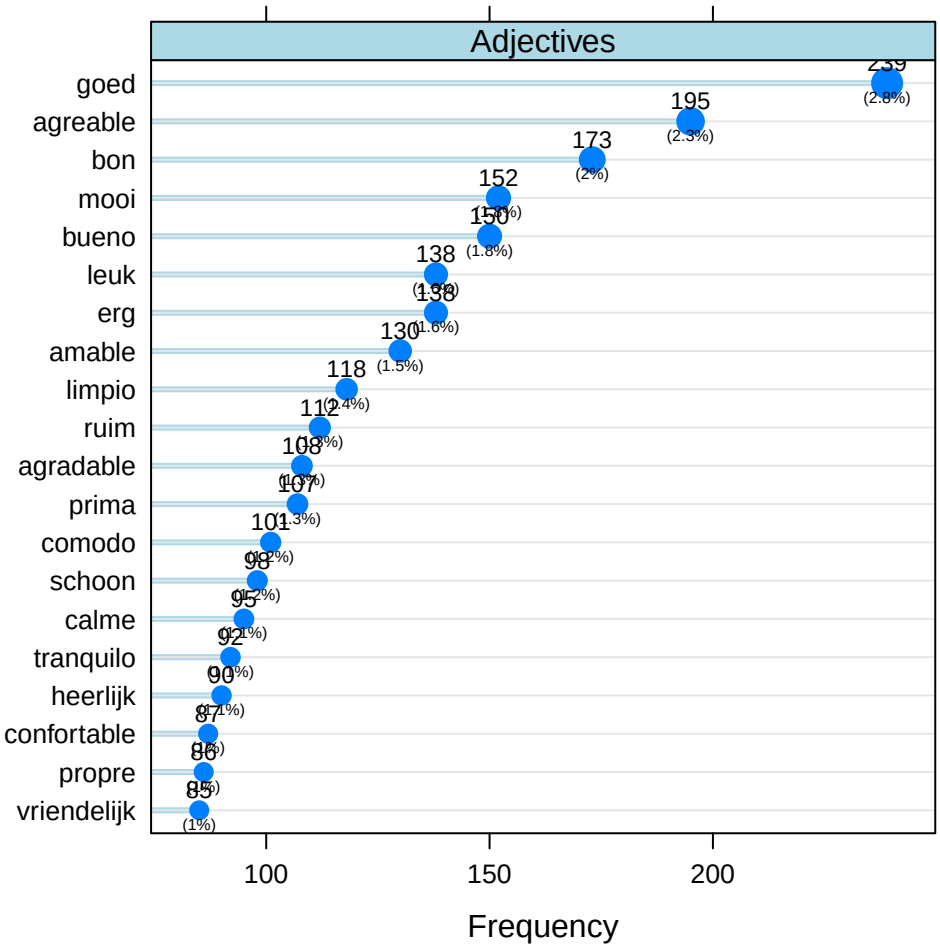

Objects of verbs and adjectives−nouns
Top 50 by group
zich
bevinden
krijgen
uitleggen
zien
verkennen
rest
aanbevelen
gebruiken
weten
raden
aanraden
het
obj
zelf
uitstekend
ideaal
wijk
rustig
vinden
zoeken
groot
ligging
echt
markt
gewelddig
omgeving
dit
ook
dat
doen
slaapkamer
mooi
gezellig
leuk
buren
mij
willen
brengen
schoon
ruim
goed
wachten
fijn
waar
vriendelijk
ons
matras
heel
gaan
helpen
net
douche
konden
laten
geven
alleen
man
betreffen
gastvrij
auto
me
amod
heerlijk
overhandigen
midden

2.4. Bar plots

Example showing frequency of adjectives

The plot below shows a simple barplot which works on the output of table.

```
library(udpipe)
data("brussels_reviews_anno", package = "udpipe")
x   <- subset(brussels_reviews_anno, xpos %in% "JJ")
x   <- sort(table(x$lemma))
plt <- textplot_bar(x, top = 20,
                    panel = "Adjectives", xlab = "Frequency",
                    col.panel = "lightblue", cextext = 0.75,
                    addpct = TRUE, cexpct = 0.5)
plt
```

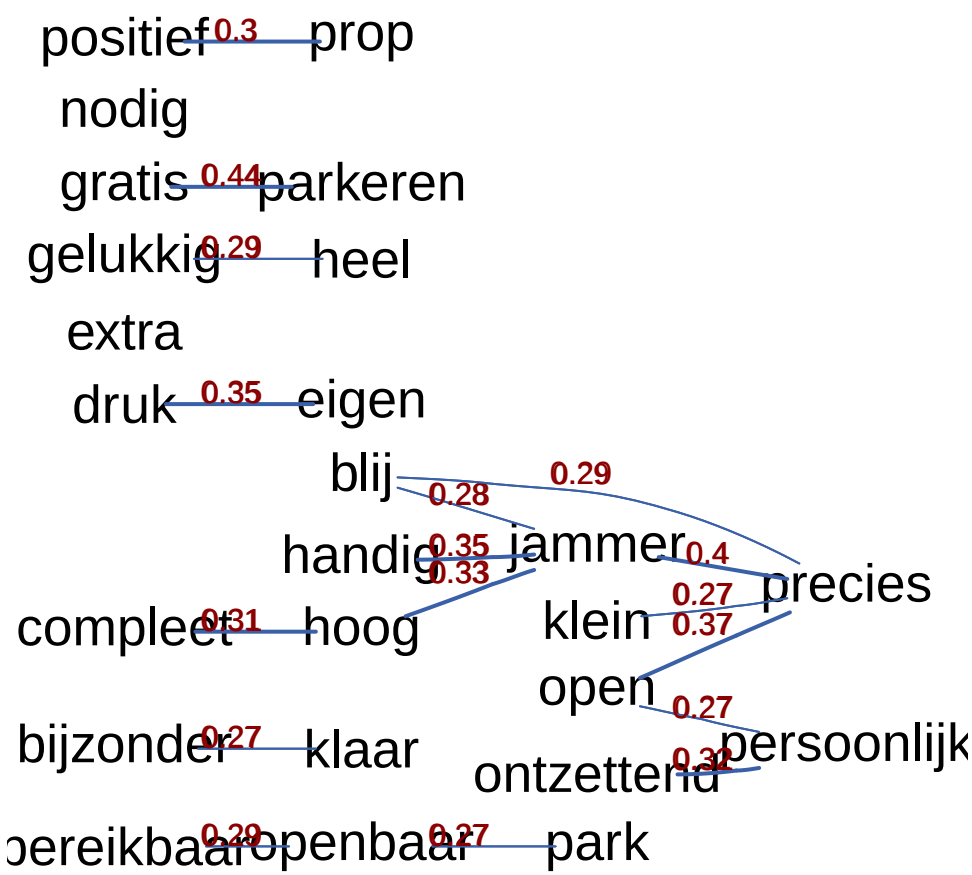


2.5. Correlation of texts

Top correlations above a certain threshold

Text correlcations are interesting to see, but as there are many, the below function allows one to visualise a subset of these, the ones with the highest correlations above a certain threshold.

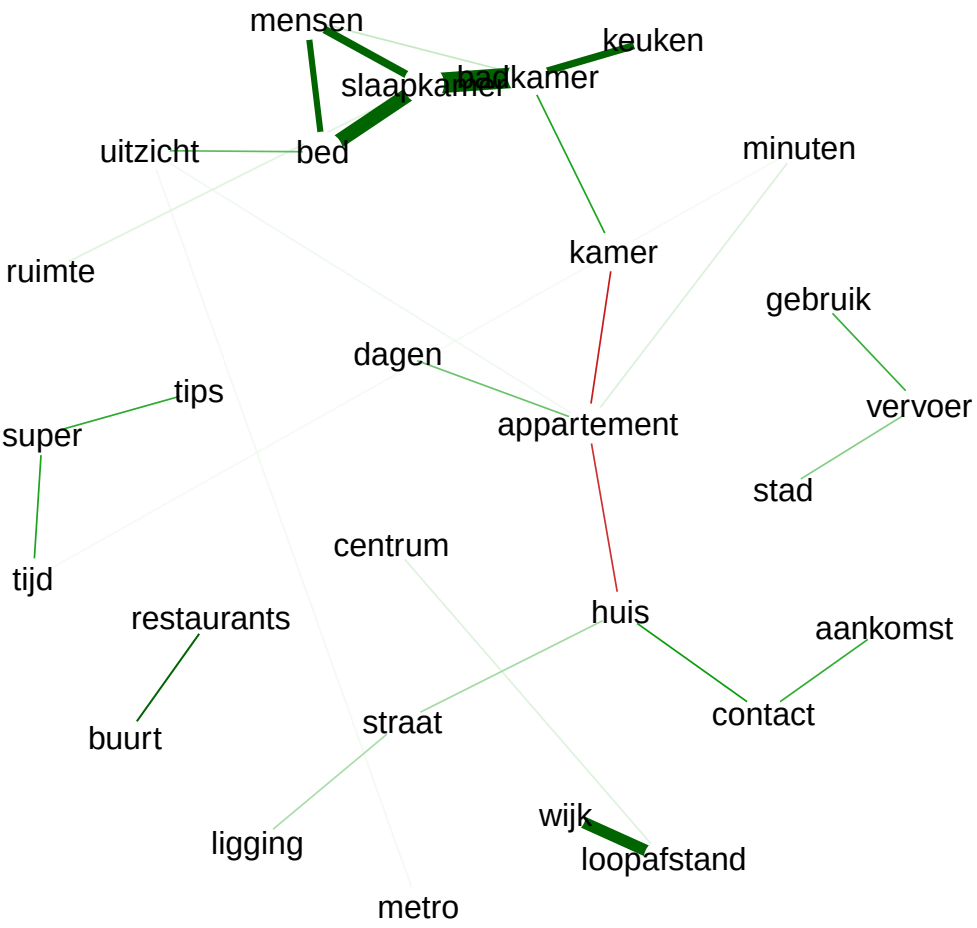
```
library(graph)
library(Rgraphviz)
library(udpipe)
dtm <- subset(anno, upos %in% "ADJ")
dtm <- document_term_frequencies(dtm, document = "doc_id", term = "lemma")
dtm <- document_term_matrix(dtm)
dtm <- dtm_remove_lowfreq(dtm, minfreq = 5)
textplot_correlation_lines(dtm, top_n = 25, threshold = 0.01, lwd = 5, label = TRUE)
```



Correlations which are non-zero after fitting a glasso model

If you have text correlations, you can also fit a glasso model on it. This puts non-relevant correlations to zero, allowing one to plot the correlations in a straightforward way.

```
library(glasso)
library(qgraph)
library(udpipe)
dtm <- subset(anno, upos %in% "NOUN")
dtm <- document_term_frequencies(dtm, document = "doc_id", term = "token")
dtm <- document_term_matrix(dtm)
dtm <- dtm_remove_lowfreq(dtm, minfreq = 20)
dtm <- dtm_remove_tfidf(dtm, top = 100)
term_correlations <- dtm_cor(dtm)
textplot_correlation_glasso(term_correlations, exclude_zero = TRUE)
```

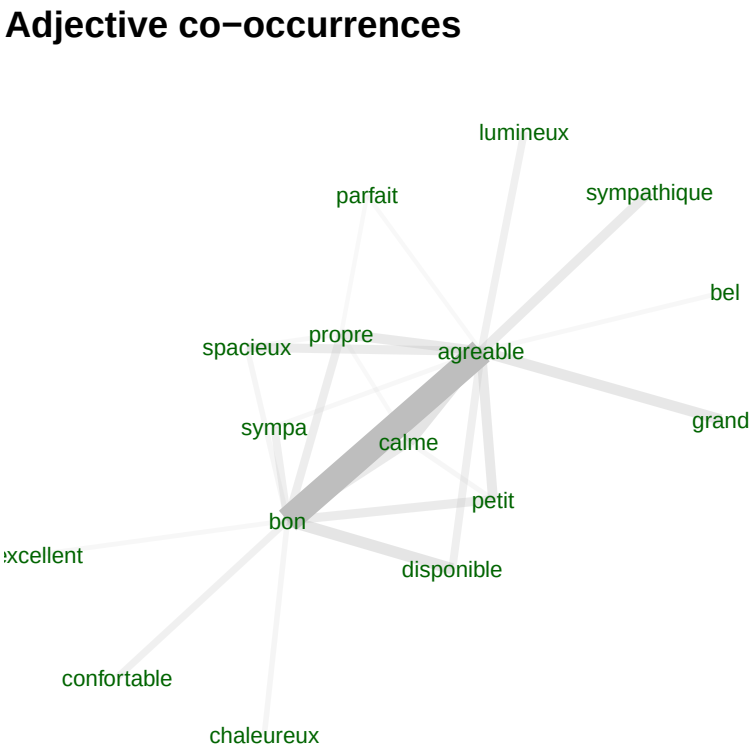


2.6. Co-occurrence of texts

Example showing adjectives occurring in the same document

The following graph shows how frequently adjectives co-occur across all the documents.

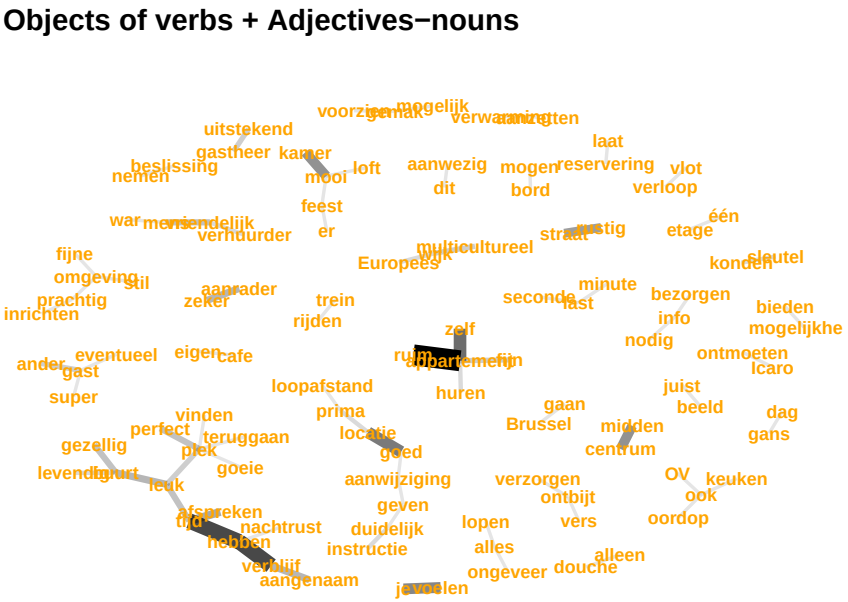
```
library(udpipe)
library(igraph)
library(ggraph)
library(ggplot2)
data(brussels_reviews_anno, package = 'udpipe')
x <- subset(brussels_reviews_anno, xpos %in% "JJ" & language %in% "fr")
x <- cooccurrence(x, group = "doc_id", term = "lemma")

plt <- textplot_cooccurrence(x,
                             title = "Adjective co-occurrences", top_n = 25)
plt
```



Example showing objects of verbs / adjectives modifying nouns on our annotated dataset

The following graph shows a similar visualisation, but instead focussing on the frequency of objects of verbs and adjectives modifying a noun. For this, we start again from the annotation of the AirBnB data shown in the section 2.2.2.

```
library(udpipe)
library(igraph)
library(ggraph)
library(ggplot2)
library(data.table)
biterms <- merge(anno, anno,
            by.x = c("doc_id", "paragraph_id", "sentence_id", "head_token_id"),
            by.y = c("doc_id", "paragraph_id", "sentence_id", "token_id"),
            all.x = TRUE, all.y = FALSE, suffixes = c("", "_parent"), sort = FALSE)
biterms <- setDT(biterms)
biterms <- subset(biterms, dep_rel %in% c("obj", "amod"))
biterms <- biterms[, list(cooc = .N), by = list(term1 = lemma, term2 = lemma_parent)]
plt <- textplot_cooccurrence(biterms,
                             title = "Objects of verbs + Adjectives-nouns",
                             top_n = 75,
                             vertex_color = "orange", edge_color = "black",
                             fontface = "bold")
plt
```



2.7. Text embeddings

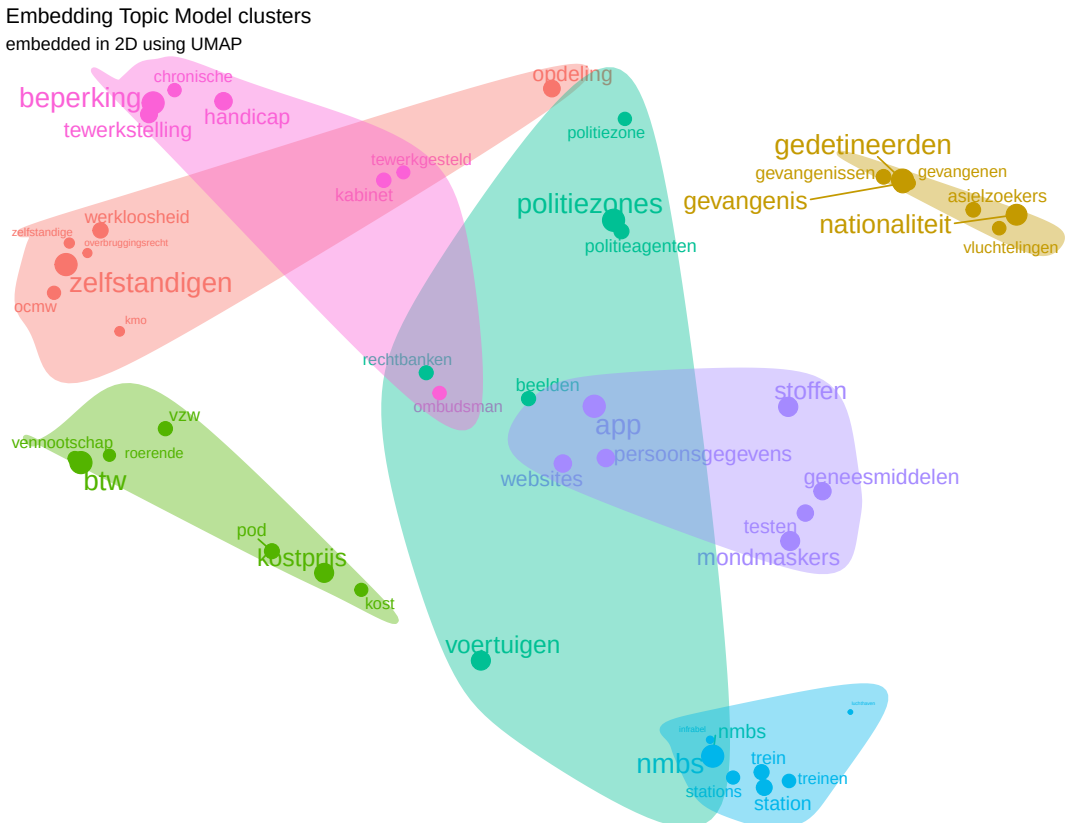
Example showing clustered text embeddings

The following graph shows the embeddings of the top 7 words emitted by a sample of topics extracted with the Embedding Topic Modelling clustering algorithm (https://github.com/bnosac/ETM).

The embeddings are mapped onto a 2-dimensional space using UMAP.

```
library(uwot)
set.seed(1234)

## Put embeddings in lower-dimensional space (2D)
data(example_embedding, package = "textplot")
embed.2d <- umap(example_embedding,
                 n_components = 2, metric = "cosine", n_neighbors = 15,
                 fast_sgd = TRUE, n_threads = 2, verbose = FALSE)
embed.2d <- data.frame(term = rownames(example_embedding),
                       x = embed.2d[, 1], y = embed.2d[, 2],
                       stringsAsFactors = FALSE)
head(embed.2d, n = 5)

##                    term          x           y
## tribunal       tribunal  3.1130461 -1.10688872
## noodnummers noodnummers  0.1152078  1.14229887
## acs                 acs  0.6113940 -0.34884149
## spi                 spi -3.1142190  1.33092278
## alert             alert -0.2639856  0.05224233

## Get a dataset with words assigned to each cluster with a certain probability weight
data(example_embedding_clusters, package = "textplot")
terminology <- merge(example_embedding_clusters, embed.2d, by = "term", sort = FALSE)
terminology <- subset(terminology, rank <= 7 & cluster %in% c(1, 3, 4, 10, 15, 19, 17))
head(terminology, n = 10)

##                   term cluster rank    weight          x          y
## 1         zelfstandigen       1    1 1.0000000 -3.1776576  1.2664826
## 5              opdeling       1    2 0.5390060 -0.2617004  2.8378106
## 13         werkloosheid       1    3 0.4511878 -2.9709151  1.5714561
## 16                 ocmw       1    4 0.3379358 -3.2498267  1.0142700
## 19         zelfstandige       1    5 0.2172686 -3.1579392  1.4583661
## 21                  kmo       1    6 0.2013531 -2.8559004  0.6703747
## 23  overbruggingsrecht       1    7 0.1851361 -3.0492878  1.3696247
## 54                  vzw       4    4 0.3867166 -2.5812951 -0.1985606
## 68                  pod       4    3 0.4328151 -1.9421130 -1.2924225
## 211                 btw       4    1 1.0000000 -3.0884663 -0.5015447
```

```
## Plot the relevant embeddings
library(ggplot2)
library(ggrepel)
library(ggalt)
plt <- textplot_embedding_2d(terminology, encircle = TRUE, points = TRUE,
                             title = "Embedding Topic Model clusters",
                             subtitle = "embedded in 2D using UMAP")
plt
```



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