Statistics of collocations

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Outline

1. Collocations
   - Definitions
   - Methods for counting
2. Statistical measures
   - Notions of probability
   - Statistics of surprise
3. Implications of collocations
   - Collocations in a window
   - Word sketches

Collocations

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- Stock phrases: *the rich and powerful, by and large*

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- Skip-grams: pairs in a window of N words:
  W2: *to be* (2); *to or*; *be or*; *be not*

Counting bigrams

Bigrams		Trigrams	
of the	7211.67	i do not	522.24
in the	5167.19	there be a	401.55
it be	4050.64	it be a	372.39
to the	2617.17	one of the	356.03
be a	2366.99	it be not	348.88
do not	2230.41	there be no	292.65
on the	2181.97	be able to	241.46
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last year	107.22
prime minister	97.18
last night	84.95
first time	83.27
other hand	56.12
last week	51.27
other people	42.01
next year	40.35
soviet union	38.95
young man	38.29

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	1	2	3	4	5	6
1	.	.	.	**x**	.	.
2	.	.	.	.	.	.
3	.	.	.	.	.	.
4	.	.	.	.	.	.
5	.	.	.	.	.	.
6	.	.	.	.	.	.

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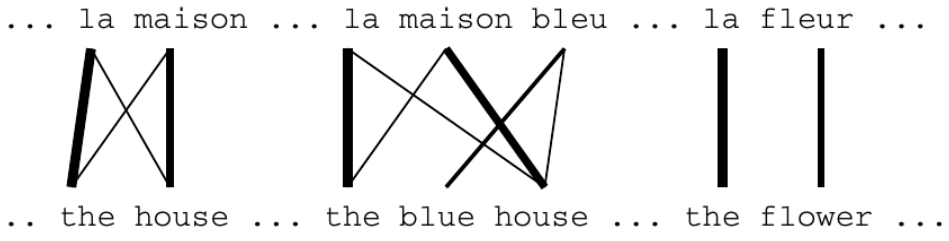

- $p(house|maison) = 0.476$
  $p(home|maison) = 0.104$
  $p(parent|maison) = 0.077$
  $p(flower|fleur) = 0.039$

Measures of collocations

- $O_{ij} = \frac{F_{ij}}{N}$ — observed probability,
- $E_{ij} = \frac{F_i}{N} \times \frac{F_j}{N}$ — expected probability,
- $MI_{ij} = \log\left(\frac{O_{ij}}{E_{ij}}\right)$ — Mutual Information score,
- $Dice_{ij} = 2 \times \frac{O_{ij}}{E_i + E_j}$ — Dice score,
- $T_{ij} = \frac{O_{ij} - E_{ij}}{\sqrt{O_{ij}}}$ — T-score
- Log-likelihood (LL) score from contingency table

	word2	¬ word2
word1	F_{ij}	$F_i - F_{ij}$
¬ word1	$F_j - F_{ij}$	$N - F_{ij}$

$loglike = 2(a \ln(\frac{F_i}{E1}) + b \ln(\frac{F_j}{E2}))$; $E1 = c\frac{a+b}{c+d}$; $E2 = d\frac{a+b}{c+d}$

Examples of predictions

- *new company*,
  $F_{ij} = 358, F_i = 105,645, F_j = 57,118, N = 100,000,000$
- *private company*,
  $F_{ij} = 423, F_i = 16,357, F_j = 57,118, N = 100,000,000$
- *post office*,
  $F_{ij} = 1,425, F_i = 10,871, F_j = 29,132, N = 100,000,000$

	MI score	Dice	T-score	LL-score
new company	6.19	2.82	15.97	761.32
private company	5.74	7.61	20.18	2,548.55
post office	8.59	9.44	25.11	6,354.51

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- Collocations for other languages
  den Vorteil *eines persönlichen Kontaktes über die Stimme* ***bietet****.*
  offer the advantage

Automation through word sketches

- Word sketches in `http://the.sketchengine.co.uk/`
- Fixed set of queries for Intellitext:
  Modifiers: ADV .. V.*
  Objects: V.* .. N.* or N.* *to be* VVN
- Sketches for other languages
  bieten

Basic points

- Collocations and collocates
- Statistics for measuring surprise
- Human judgment vs. computer model

For the seminar

Study collocation properties for words in your projects
Use their immediate left/right contexts and spans;
Try filtering collocates by their POS tags
Use word sketches

For further classes

Please either install Python and Jupyter Lab on your own laptop:
`https://jupyter.org/install`
or make sure you have access to Google Drive and Google Colab:
`https://colab.research.google.com/`