

Creating annotated corpora

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Overview

- 1 NLP and Human Annotations
- 2 Linguistic Annotation
- 3 Evaluation
- 4 Text corpora
- 5 Platforms and shared tasks

Transformers reading assignment: Questions

- How is the Adam optimizer used? What does it actually do?
 - ▶ Extension of Stochastic Gradient Descent
 - ▶ Per-parameter learning rate
- Different attention functions?
 - ▶ Masked attention in decoding to avoid peeking ahead
- Positional encoding? Sinusoidal functions?
 - ▶ https://kazemnejad.com/blog/transformer_architecture_positional_encoding/
- What are the checkpoints?
 - ▶ Partially trained models
- Can we combine attention with CNN/RNN?

Transformers reading assignment: Questions

- Could these types of attention layers be used in training a model that optimizes the responses of a virtual assistant such as Siri?
- How well does this sequence-to-sequence model performs on non-latin language. For example, in Sino-English translation. Could the model effectively turn Chinese tokens into vectors and further process those in the models?
 - ▶ Reordering problem: word order is meaningful
 - ▶ Chinese → English: difficulty due to less inflection
- “self-attention could yield more interpretable models” - That they work closer to how humans understand language? That we more easily understand how they produce results?
- In the test for model generalizability (paragraph 6.3), the author's model is outperformed by the Recurrent Neural Network Grammar, even though the introduction of the paper stresses that recurrent networks are generally worse at dealing with long sequences of data?
 - ▶ These RNNs are not generalizing
- What is constituency parsing?
- Why are the EN-FR translations slower than the EN-DE translations?

Transformers reading assignment: Questions

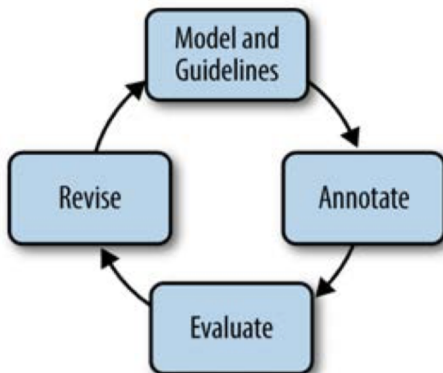
- Is there a situation where a multi-headed attention layer would not work well or simply be less useful for the model?
 - ▶ Redundant attention heads, downsize for inference
 - ▶ No recursive computation
- Does the transformer draw on the ideas of CNN since I feel the Multi-Head Attention is similar to the concept of multiple convolutional kernels in CNN?
- How else can this model be applied?
- Why does this model perform so much better than the RNN models? I thought neural networks were meant to be pretty much the strongest models available?
- Has this become the dominant approach since?
- Why weren't transformers explored earlier?
- How could these transformer models be improved upon even more?

NLP and Human Annotations

NLP and Human Annotations

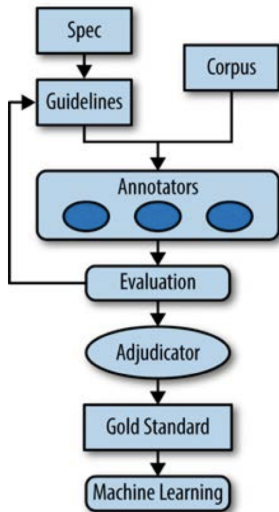
- NLP (and ML in general) is driven by human-annotated corpora.
- <http://nlpprogress.com>.
- Annotation is **difficult** and **expensive**.

Annotation pipeline



Pustejovsky and Stubbs, 2012. Natural Language Annotation for Machine Learning.

Annotation pipeline



Pustejovsky and Stubbs, 2012. Natural Language Annotation for Machine Learning.

Specs and guidelines

- Goal: given our problem, *how can we formalize our description of the annotation process for multiple annotators to provide the same judgment?*
 - ▶ What is the goal of the project?
 - ▶ How will the annotation be created? (For example, which tags or documents to annotate first, how to use the annotation tools, etc.)
 - ▶ What is each tag called and how is it used? (provide examples and discuss problematic choices.)
 - ▶ What parts of the text do you want annotated?
- Note: annotation is usually boring and time-consuming, and cannot be done for 8 hours straight. Annotators also get better over time: early annotations might be discarded.

Pustejovsky and Stubbs, 2012. Natural Language Annotation for Machine Learning.

Adjudication

- **Adjudication** is the process of deciding on a single annotation for a piece of text, using information from all independent annotators.
- Yes, it is only possible when multiple annotators independently annotate (at least some) of the corpus. *This is a very good procedure to follow, and the only one which will allow to evaluate results.*
- It can be as time-consuming (or more so) as a primary annotation.
- It does not need to be identical with a primary annotation (all annotators can be wrong by chance), but unlikely so.

Pustejovsky and Stubbs, 2012. Natural Language Annotation for Machine Learning.

Automatic annotation

- **Manual annotation:** Data is annotated by
 - ▶ Experts
 - ▶ The crowd (e.g. Amazon Mechanical Turk)
- **Based on:**
 - ▶ A (expert-created) ground truth
 - ▶ Annotation guidelines
 - ▶ Elicitation of implicit/explicit knowledge
- **Semi-automatic annotation:** A computer program is used to annotate the data, and annotators perform checks and corrections
- **Automatic annotation:** A computer program (predictive model, parser etc.) is used to annotate the data

Automatic annotation

Advantages

- Process far more data
- Study rare phenomena
- Estimate probabilities more accurately
- Flexible: work with your own type of text
- Don't need to hire a bunch of students to annotate...!

Disadvantages

- Annotation errors
- Biases of automatic system are introduced
- Cannot really be used as training data for machine learning
- Annotation may constrain what can be researched

Automatic annotation: Potential biases

- Random errors and systematic errors
- More errors for rare phenomena
- More errors when there is more ambiguity
- More errors for larger structures, longer sentences
- Multi-word units / idiomatic expressions
- More errors for out-of-domain data
- More errors when original text contains errors

Automatic annotation: Checking quality

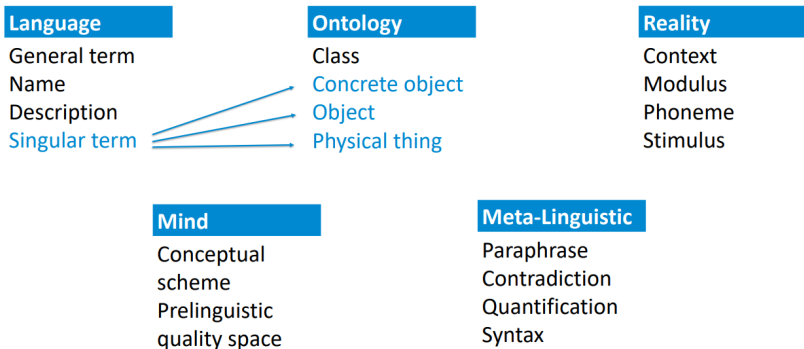
- Find existing evaluations on similar text types
- Manually check (parts of) text

When querying based on automatic annotation:

- Manually check results (precision)
- Check on the basis of a simpler layer of annotation
- Check on the basis of exemplars (recall)

Ground truth

- Quine's view of the world



Eliciting explicit knowledge

- Distributional semantic modeling of Quine

Synonym detection task

What word is most related to 'Information' ?

- | | |
|-----------------|---|
| a) Learning | b) Reductions |
| c) Collateral | d) Application |
| e) Ordered Pair | f) None of these words is even remotely related |

Coherence task

What word does not belong to the group?

- | | |
|---|-------------|
| a) Numbers | b) Pronouns |
| c) Subtraction | d) Actually |
| e) No coherent group can be formed from these words | |

FIGURE 1: Target word a), nearest neighbours b) and c), and outlier d).

Linguistic Annotation

Levels of linguistic annotation

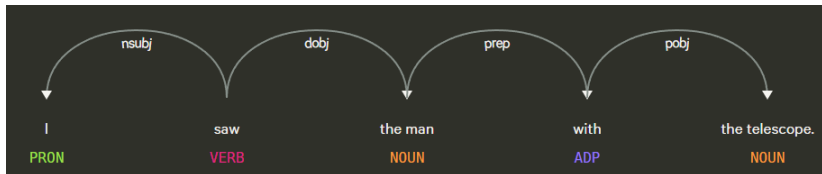
- Tokenization, lemmatization...
- Part-of-speech tagging

```
>>> text = word_tokenize("They refuse to permit us to obtain the refuse permit")
>>> nltk.pos_tag(text)
[('They', 'PRP'), ('refuse', 'VBP'), ('to', 'TO'), ('permit', 'VB'), ('us', 'PRP'),
 ('to', 'TO'), ('obtain', 'VB'), ('the', 'DT'), ('refuse', 'NN'), ('permit', 'NN')]
```

CC	Coordinating conj.	TO	infinitival <i>to</i>
CD	Cardinal number	UH	Interjection
DT	Determiner	VB	Verb, base form
EX	Existential there	VBD	Verb, past tense
FW	Foreign word	VBG	Verb, gerund/present pple
IN	Preposition	VCN	Verb, past participle
JJ	Adjective	VBP	Verb, non-3rd ps. sg. present
JJR	Adjective, comparative	VBZ	Verb, 3rd ps. sg. present
JJS	Adjective, superlative	WDT	Wh-determiner
LS	List item marker	WP	Wh-pronoun
MD	Modal	WP\$	Possessive <i>wh</i> -pronoun
NN	Noun, singular or mass	WRB	Wh-adverb
NNS	Noun, plural	#	Pound sign
NNP	Proper noun, singular	\$	Dollar sign
NNPS	Proper noun, plural	.	Sentence-final punctuation
PDT	Predeterminer	,	Comma
POS	Possessive ending	:	Colon, semi-colon
PRP	Personal pronoun	(Left bracket character
PP\$	Possessive pronoun)	Right bracket character
RB	Adverb	"	Straight double quote
RBR	Adverb, comparative	'	Left open single quote
RBS	Adverb, superlative	"	Left open double quote
RP	Particle	'	Right close single quote
SYM	Symbol	"	Right close double quote

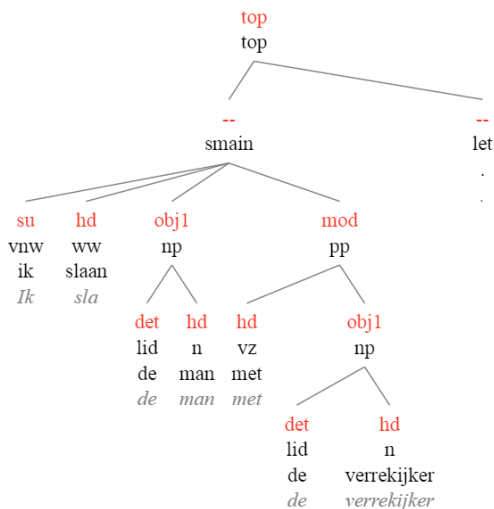
Levels of linguistic annotation

- Syntax: Dependency parsing




Levels of linguistic annotation

- Syntax: Constituency parsing
- Syntactically annotated corpora are also called treebanks



Levels of linguistic annotation

- Semantic: DBpedia (linking to ontology/knowledge base)



The logo for DBpedia Spotlight features a stylized molecular structure with orange and yellow spheres above the text 'DBpedia Spotlight' in a blue and white font. A yellow beam of light emanates from the spheres, pointing towards a document icon on the right.

Confidence: 0.5 Language:

☐ n-best candidates

Most Read

1. [Coronavirus](#): Police told to be 'consistent' with lockdown approach
2. [Coronavirus](#): [World Bank warns](#) of 'economic [pain](#)' in [Asia](#)
3. [Houseparty](#) offers \$1m reward for proof of sabotage
4. [Coronavirus](#): Millions of garden plants set to be binned
5. Woodmancote murder probe: Two adults and two children found dead
6. [Coronavirus](#): [British Airways](#) suspends all [Gatwick](#) flights
7. [Coronavirus](#): Supermarket sales in March 'busier than [Christmas](#)'
8. [Blood test](#) 'can check for more than 50 types of [cancer](#)'
9. [Coronavirus](#) briefing: [UK](#) shutdown tactics under scrutiny and global latest
10. [Coronavirus](#) in [UK](#): How many confirmed cases are there in your area?

This demo uses the statistical DBpedia Spotlight web service at <https://api.dbpedia-spotlight.org/en>.

[How to cite this work](#)

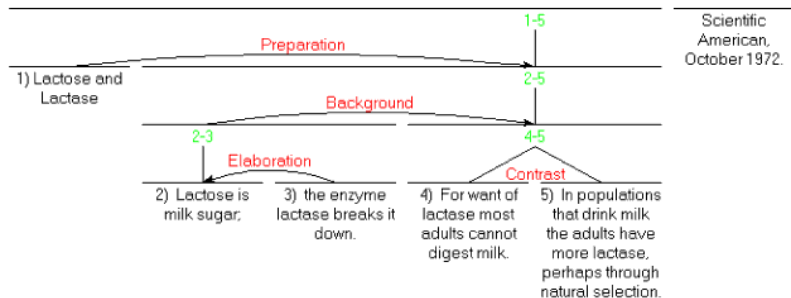
You should know:

- These demos do not support HTTPS, please switch to the [http version](#) if they don't work in your browser.
- This interface has been tested with Firefox 6.0.2 and Chromium 12.0.
- We have a cute [bookmarklet](#) that you should try out!

This demonstration uses the [DBpedia Spotlight jQuery Plugin v0.3](#).
For the latest versions, please visit: <http://spotlight.dbpedia.org>

Levels of linguistic annotation

- Discourse: Rhetorical Structure Theory



Evaluation

Interannotator agreement



annotator A

	puppy	fried chicken
annotator B		
puppy	6	3
fried chicken	2	5

observed agreement = $11/16 = 68.75\%$

Credit: David Bamman, UCBerkeley.

Cohen's kappa

- Similar idea to mutual information: observed minus expected agreement.
- Cohen's kappa is defined for two annotators over the same set of annotation tasks:

$$\kappa = \frac{p_o - p_e}{1 - p_e}$$

Where p_o is the observed correct agreement and p_e the expected correct agreement.

		annotator A	
		puppy	fried chicken
annotator B	puppy	7	4
	fried chicken	8	81

Credit: David Bamman, UC Berkeley.

Cohen's kappa example

- $p_o = 0.88$
- $p_e = P(A = \text{puppy})P(B = \text{puppy}) + P(A = \text{chicken})P(B = \text{chicken})$
-

$$\kappa = \frac{0.88 - 0.773}{1 - 0.773} = 0.471$$

annotator A

		puppy	fried chicken
annotator B	puppy	7	4
	fried chicken	8	81

Credit: David Bamman, UC Berkeley.

Cohen's kappa scores

Note: these are rules of thumb.

0.80-1.00	Very good agreement
0.60-0.80	Good agreement
0.40-0.60	Moderate agreement
0.20-0.40	Fair agreement
< 0.20	Poor agreement

Exercise: try to calculate fringe cases. E.g., 50/50 puppy/chicken all in agreement, 0/100 puppy/chicken all in agreement, 50/50 wrong puppy/chicken all in agreement.

Credit: David Bamman, UC Berkeley.

Fleiss' kappa

- Extension to multiple annotators (> 2).
- Defined as Cohen's kappa but comparing pairs of annotators:

$$\kappa = \frac{P_o - P_e}{1 - P_e}$$

annotator A

	puppy	fried chicken
annotator B		
puppy	7	4
fried chicken	8	81

Credit: David Bamman, UC Berkeley.

Fleiss' kappa

- Number of annotators who assign category j to item i : n_{ij} .
- For item i with n annotations, how many annotators agree among all $n(n-1)$ possible pairs:

$$P_i = \frac{1}{n(n-1)} \sum_{j=1}^K n_{ij}(n_{ij} - 1)$$

- Note that N is the number of items, and K the available annotation categories. Average agreement among all items:

$$P_o = \frac{1}{N} \sum_{i=1}^N P_i$$

Fleiss' kappa, continued

- Probability of category j :

$$p_j = \frac{1}{Nn} \sum_{i=1}^N n_{ij}$$

- Expected agreement by chance:

$$P_e = \sum_{j=1}^K p_j^2$$

- Back to original formula:

$$\kappa = \frac{P_o - P_e}{1 - P_e}$$

Text corpora

Corpus linguistics

- Balanced corpus
- Learner corpus
- Historical corpus
- Parallel corpus
- Spoken corpus (transcribed)
- N-gram corpus

Metadata

- Information about the texts in a corpus
- Year of publication, author, medium, register, edition, chapter, age of speaker, language, encoding, size etc.
- Particularly important for historical corpora and corpora where distinct documents matter (academic texts, movie reviews)

Corpus creation: Things to note

- Have clear selection criteria
 - ▶ Avoid subjective choices/criteria ('many errors')
- Select representative texts for the topic
- Take a balanced sample (if needed for e.g. training purposes)
- Think about copyright issues
- Consider availability and format
 - ▶ On paper
 - ▶ Images/scans
 - ▶ Proprietary format
 - ▶ Plain text
 - ▶ Annotated text





















Corpus analysis

- Keyword-in-Context

an accident **waiting to happen** - Idioms by The Free Dictionary
accident **waiting to happen** Definition from Wiktionary,
News 'This is a Ferguson **waiting to happen**:' Activists speak out again:
> Idioms > A > Accident **waiting to happen** Idiom: Accident waiting to
Trouble **Waiting to Happen** From Wikipedia, the free encyclopedia
26 April 2015. 'Nightmare **Waiting to Happen**': Quake Experts Gathered in
Start reading Accidents **Waiting to Happen** on the free Kindle Reading
Earthquake Was "Nightmare **Waiting to Happen**" Slate Sign In Sign Up Slate
ions Disasters 'Nightmare **waiting to happen**': Experts gathered in Nepal
an></div> A tragedy **waiting to happen** By Colin Stark Updated 1759
al quake was a "nightmare **waiting to happen**" Breaking News US Secretary
Nepal quake was 'nightmare **waiting to happen**' Major earthquakes hit Nepa:
umph of Life Contact Tarot **Waiting to Happen** - A Tarot Deck by Andrew Mc
nergy Solution or Accident **Waiting to Happen**: The Public and Nuclear Pow
, Angela Weight and Sanity **Waiting to Happen** don't live here anymore. Cor
of Things Is a Revolution **Waiting to Happen** The challenge of the IoT is
arquake was a 'nightmare **waiting to happen**' says lead scientist Expert:
Angela Weight Sanity **Waiting to Happen** Skip to content Home Book(s)
os Games Music En Deadman **Waiting To Happen** by nProcess Random Animation
an accident **waiting to happen** - definition in the British
[Bhuj-temblor]A catastrophe **waiting to happen**? The author has posted comm
grade Winter Meeting trade **waiting to happen** between M's, Rockies JP Mor
: Author Says Disaster Was **Waiting to Happen** Don't Miss Out - Follow us
earthquake was a disaster **waiting to happen** Sitting on one of the most
gallery 10 Sports Injuries **Waiting to Happen** of Advertisement Skip this
en Noun (plural disasters **waiting to happen**) Something potentially very
ist Classic FAILs accident **waiting to happen** Share on Facebook- Featured

Corpus analysis

- Keyword-in-Context
- Collocations

+ NOUN		NEW WORD	?
1334	3.04	job	
945	2.37	point	
870	3.73	article	
820	2.32	book	
769	4.02	example	
741	2.11	work	
632	3.33	post	
596	3.31	choice	
508	3.01	star	
455	2.99	opportunity	
406	2.76	source	
374	3.04	quality	
363	2.92	performance	
331	2.61	condition	
300	2.20	chance	
299	2.80	skill	
264	2.08	piece	
250	2.51	resource	
214	2.67	tool	
212	3.80	rating	
201	2.50	review	

Corpus analysis

- Keyword-in-Context
- Collocations
- Collostructions
 - ▶ ? waiting to happen

Prediction	Prob.	Prob. Top-K
event	0.097763	0.2703
disaster	0.064560	0.1611
accident	0.059664	0.1394
explosion	0.049361	0.1390
invasion	0.016694	0.0486
earthquake	0.016525	0.0478
action	0.016206	0.0422
emergency	0.014662	0.0417
attack	0.013799	0.0403
miracle	0.013404	0.0371
adventure	0.011491	0.0324

Querying corpora

- Nederlab with Corpus Query Language

zoeken in tekst

eenvoudig zoeken geavanceerd zoeken **expertzoeken**

Corpus Query Language

+

lemma

▼

is

▼

klinken

OR

+

⚙

+

pos

▼

is

▼

WW

OR

+

⚙

`[lemma="klinken"][pos="WW"]`

zoek reset ?

Querying corpora

- Nederlab with Corpus Query Language

Historie van mejuffrouw Sara Burgerhart

datering: 1782

auteur: **Aagje Deken** (Amstelveen (Noord-Holland), 1741-Den Haag (Zuid-Holland), 1804) **Betje Wolff** (Vlissingen (Zeeland), 1738-Den Haag (Zuid-Holland), 1804)

genre: **fictie, proza, briefroman**

collectie: **DBNL**

aantal hits: 1

dat	zy	evenwel	beter	de	klink	kan	maken	dan	Jaantje	en
dat	zy	evenwel	goed	de	klinken	kunnen	maken	dan	jaan	en

Kransje van letter-bloempjes, voor Neerlandsch jufferschap

datering: 1790

auteur: **Gerrit Manheer** (Rotterdam (Zuid-Holland), 1749-Rotterdam (Zuid-Holland), 1807)

genre: **fictie, poezie, liederen/liedjes**

collectie: **DBNL**

aantal hits: 1

Die	Gij	,	door	lachjes	klink	in	uw	'	fluweele	boeijen
die	gij	,	door	lach	klink	in	uw	'	fluweele	boeijen

Werken van het Amsteldamsch Dicht- en Letteröfenend Genootschap. Te Amsteldam by M. de Bruyn, 1790. In gr. 8 vo. , 118 bladz .

uit: **Vaderlandsche letteroefeningen. Jaargang 1791**

datering: 1791

genre: **non-fictie, periodieken, tijdschriften, jaarboeken, letterkunde (secundair)**

collectie: **DBNL**

aantal hits: 1

Dat	den	der	Barden	klaagzang	klink	'	,	Hoe	Elza's	jammer
dat	de	de	bard	klaagzang	klink	'	,	hoe	Elza	jammer

Querying corpora

- NLCOW14 (web corpus)

... NLCOW14AX01

[pos="verbpapa"%c][word="kunnen"%c][word="hebben"%c] 0

100

[Preview again](#)

[Export results](#)

[Delete](#)

Wel , it ' s a hell of a job , zou wijlen Fortuyn	gezegd kunnen hebben	.	http://www.repu...
Zij zou ook op mij	geschoten kunnen hebben	in dat restaurant .	http://home.hcc...
Uit de stukken blijkt verder dat [A] , [B] en [eiser] zelf kort na het ongeval naar het ziekenhuis zijn vervoerd en daarom niet met medeleerlingen van [B]	gecommuniceerd kunnen hebben	.	http://www.lets...
" en hij zegt dan verder , dat die andere mensen het niet	gedaan kunnen hebben	omdat zij niet gearresteerd waren .	http://www.hebr...
" Ik haal een Grieks woord om de context te verduidelijken . de laatste zin die begint met " met andere woorden " zou zich zo in Korinthe	afgespeeld kunnen hebben	.	http://forum.re...
Anders zou zich uit de intensiteit van du Perrons gevoelens een tragedie	ontwikkeld kunnen hebben	, die de Hamlet zou hebben aangevuld en in tragische kracht wellicht overtroffen .	http://www.dbnl...
Dostoevski zou het	geschreven kunnen hebben	.	http://m.nrc.nl...

Querying corpora

- Word relation search with PaQu

CORPUS:

woord **hoofdwoord**

metadata

[voorbeelden](#)

aantal:

``hlemma` = "groot" AND `rel` = "obcomp"`

1. nee 't was wel iets **groter** **dan** een uh hondenhok ggg .
- dan:vg — obcomp — groter:adj
2. maar jij hebt een iets **grotere** dan uh **dan** die ik had .
- dan:vg — obcomp — grotere:adj
3. daar is het verschil **groter** **dan** met zo'n m*a zo'n marathon vind ik lijkt me .
- dan:vg — obcomp — groter:adj
4. is de aarde **groter** **dan** de maan ?

Querying corpora

- Syntactic search with PaQu

corpus:

XPATH query (voorbeelden):

```
//node[@cat="ssub" and node[@rel="hd" and @root="heb" and @pos="verb" and number(@begin) < number(..//node[@rel="vc" and @cat="ppart"]//node[@rel="hd" and @pos="verb"]/@begin)] and node[@rel="vc" and @cat="ppart" and node[@rel="hd" and @pos="verb"]]]
```

aantal:

1. Hij werd echter reeds in januari 1931 lid van de NSDAP nadat hij in december 1930 een toespraak van Adolf Hitler had bijgewoond in de Berlijnse Hasenheide . ✚
2. Zelf schreef hij dat hij een maand had getwijfeld , maar dat hij uiteindelijk toch besloten had om lid te worden , omdat Hitler helemaal niet stereotiep was overgekomen in de toespraak . ✚
3. Van alle veroordeelde nazi-kopstukken was hij de enige die schuld had bekend . ✚
4. In werkelijkheid waren de verbeteringen van slaap- en verblijfsomstandigheden van dwangarbeiders al gepland voordat Speer de fabrieken had bezocht waar deze werkten . ✚
5. Later kwam tevens aan het licht dat hij had medegewerkt aan de uitbreidingsplannen voor Auschwitz . ✚
6. Die gevoelsarmoede , die afwezigheid van normale menselijke reacties , is de belangrijkste onbeantwoorbare vraag die Fest lang bezig heeft gehouden . ✚
7. In 1999 werd Agassi de vijfde speler in de geschiedenis van de sport die alle vier de Grand Slam toernooien had gewonnen : de Australian Open , de Open Franse Tenniskampioenschappen , Wimbledon en de US Open . ✚

Platforms and shared tasks

Annotation tools

- Brat <http://brat.nlplab.org>
- Inception <https://inception-project.github.io>
- Prodigy <https://prodi.gy>

Annotation platforms

- Supervisely <https://supervise.ly>
- Dataturks <https://dataturks.com>
- Amazon Mechanical Turk <https://www.mturk.com>
- Figure Eight <https://www.figure-eight.com>
- Alcrowd <https://www.aicrowd.com>