Data

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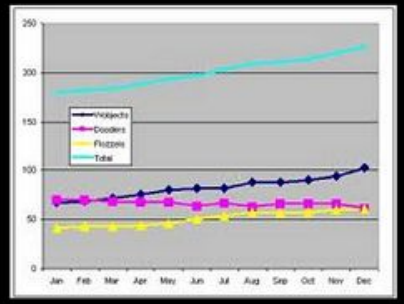
Contents

Data Scientist

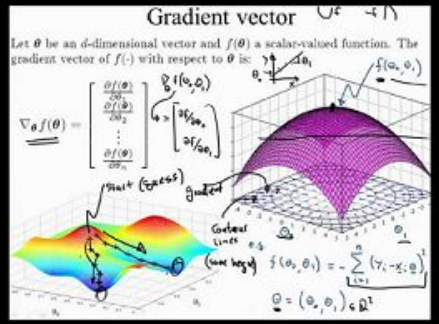
What my friends think I do

What my mom thinks I do

What society thinks I do



What my boss thinks I do



What I think I do

What I actually do

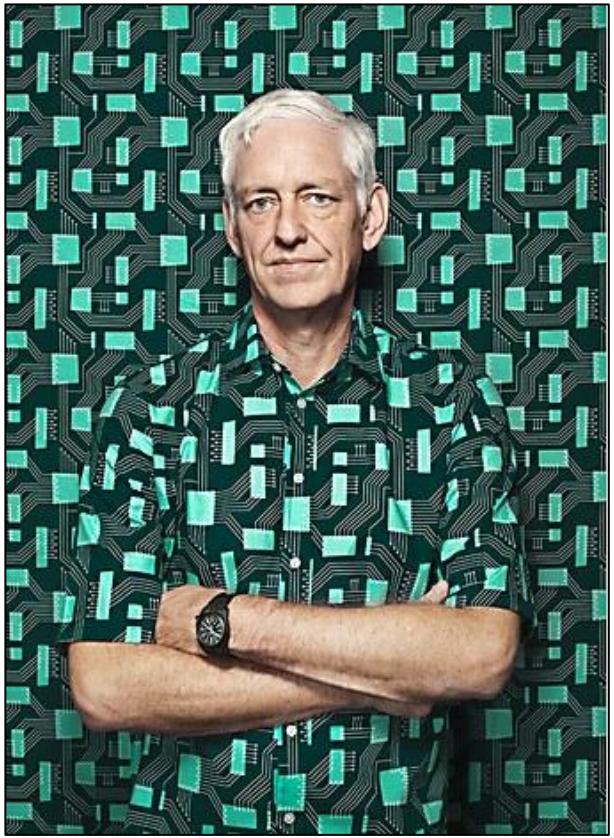
Motivation

“Data is ten times more powerful than algorithms.”

— Peter Norvig

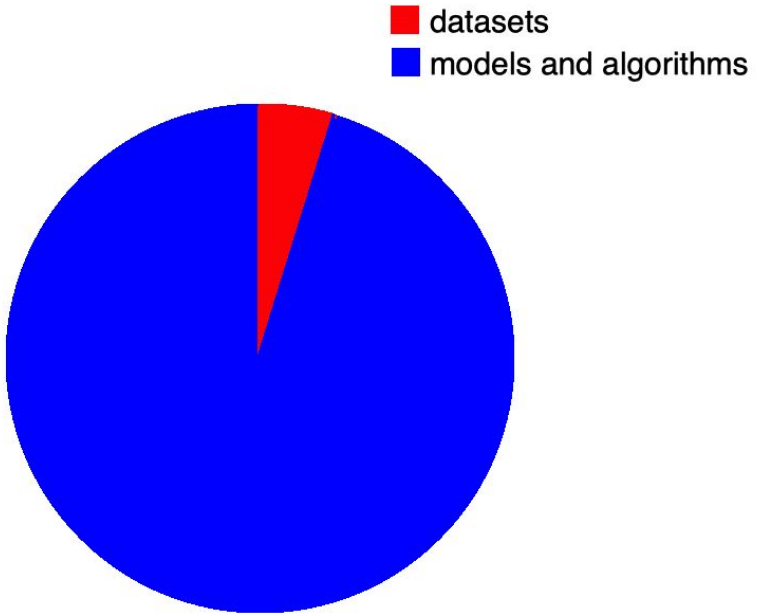
The Unreasonable Effectiveness of Data

http://youtu.be/yvDCzhbjYWs

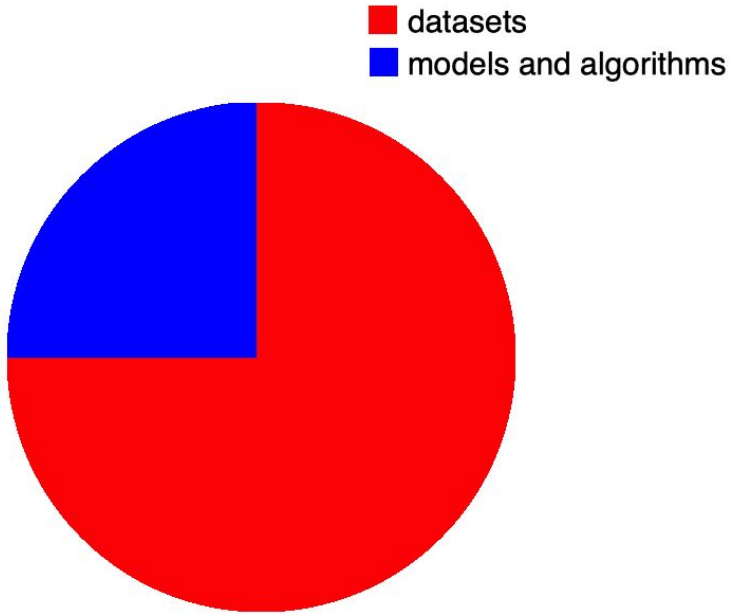


Amount of lost sleep over...

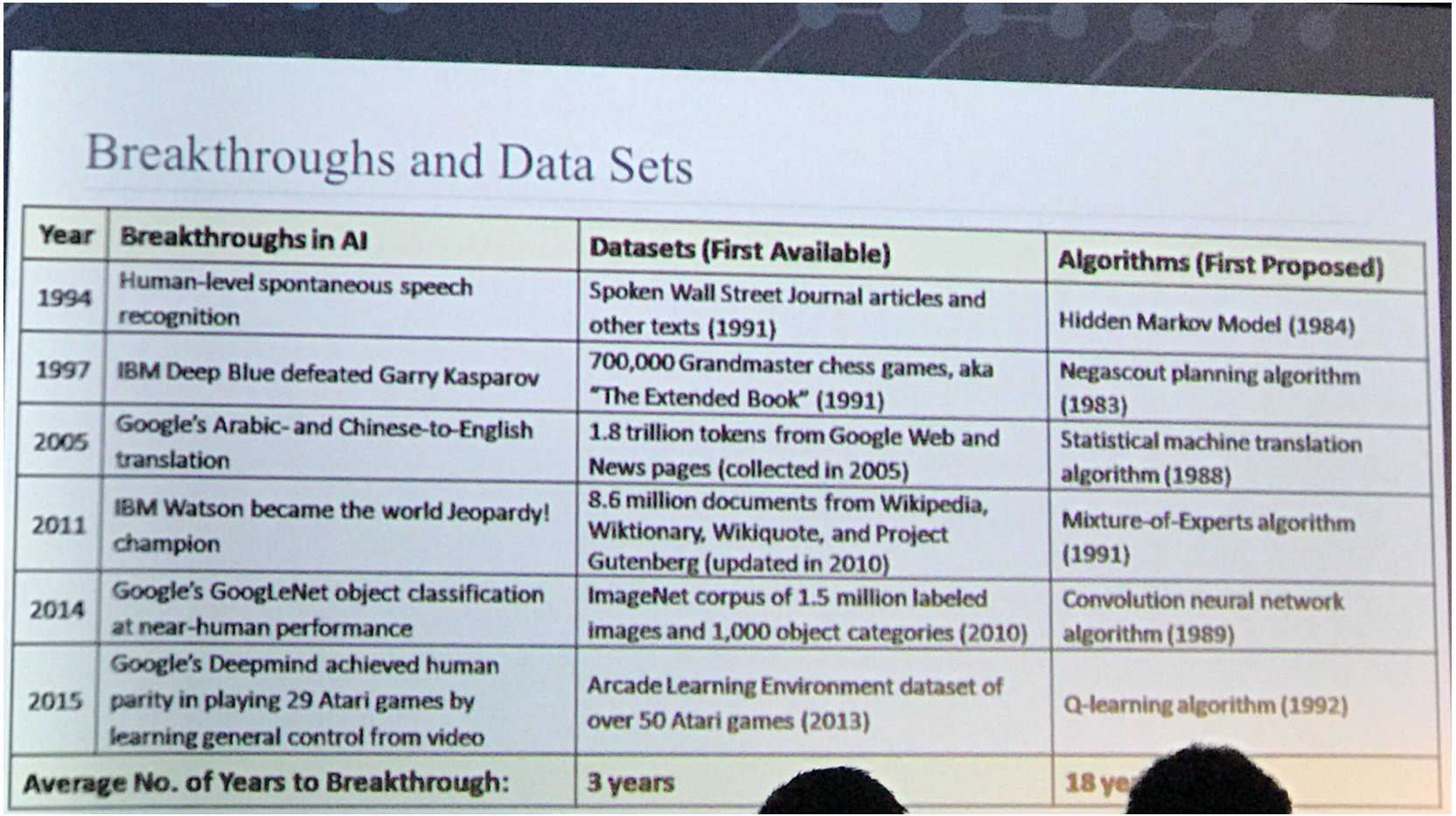
PhD



Tesla



https://d1p17r2m4rzlbo.cloudfront.net/wp-content/uploads/2018/06/TRAIN_AI_2018_Andrej_Karpathy_Tesla.pdf



Breakthroughs and Data Sets

Year	Breakthroughs in AI	Datasets (First Available)	Algorithms (First Proposed)
1994	Human-level spontaneous speech recognition	Spoken Wall Street Journal articles and other texts (1991)	Hidden Markov Model (1984)
1997	IBM Deep Blue defeated Garry Kasparov	700,000 Grandmaster chess games, aka "The Extended Book" (1991)	Negascout planning algorithm (1983)
2005	Google's Arabic- and Chinese-to-English translation	1.8 trillion tokens from Google Web and News pages (collected in 2005)	Statistical machine translation algorithm (1988)
2011	IBM Watson became the world Jeopardy! champion	8.6 million documents from Wikipedia, Wiktionary, Wikiquote, and Project Gutenberg (updated in 2010)	Mixture-of-Experts algorithm (1991)
2014	Google's GoogLeNet object classification at near-human performance	ImageNet corpus of 1.5 million labeled images and 1,000 object categories (2010)	Convolution neural network algorithm (1989)
2015	Google's Deepmind achieved human parity in playing 29 Atari games by learning general control from video	Arcade Learning Environment dataset of over 50 Atari games (2013)	Q-learning algorithm (1992)
Average No. of Years to Breakthrough:		**3 years**	**18 ye**

https://twitter.com/shivon/status/864889085697024000

Role of Data

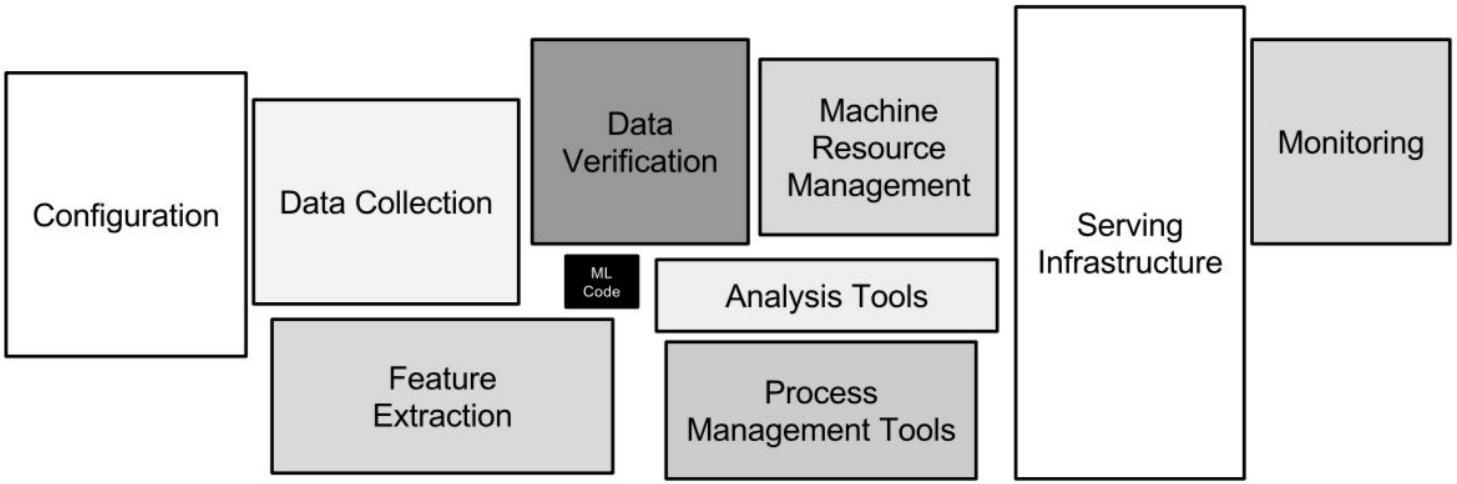


Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.

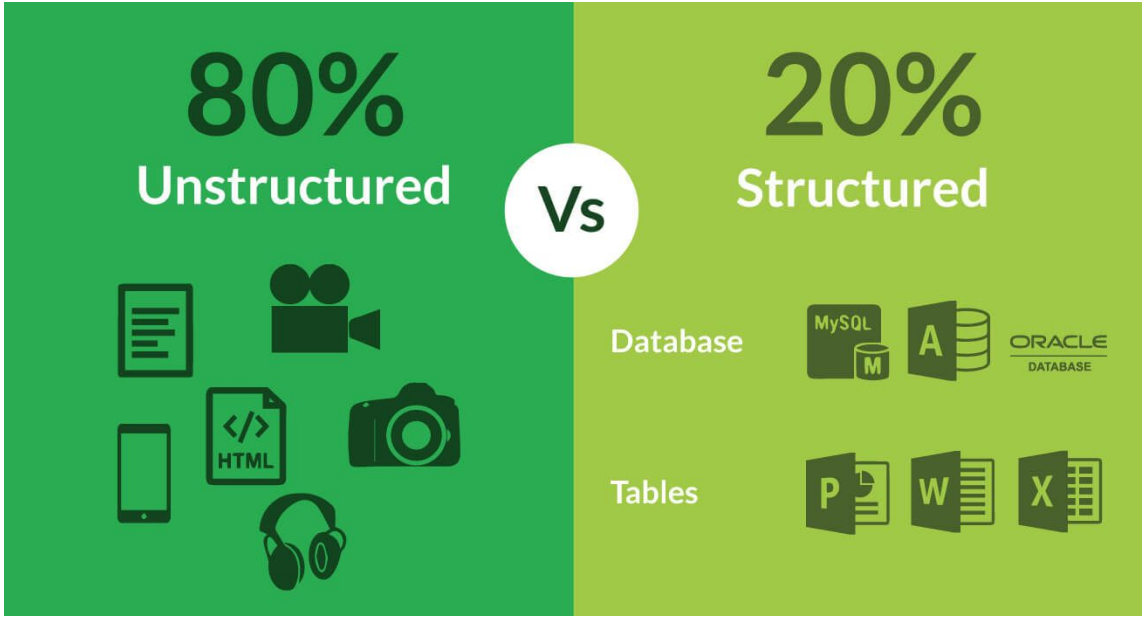
https://medium.com/@neal_lathia/five-lessons-from-building-machine-learning-systems-d703162846ad

Uses of Data in NLP

- understanding the problem
- statistical analysis
- connecting separate domains
- evaluation data set
- training data set
- real-time feedback
- marketing/PR
- external competitions

Types of Data

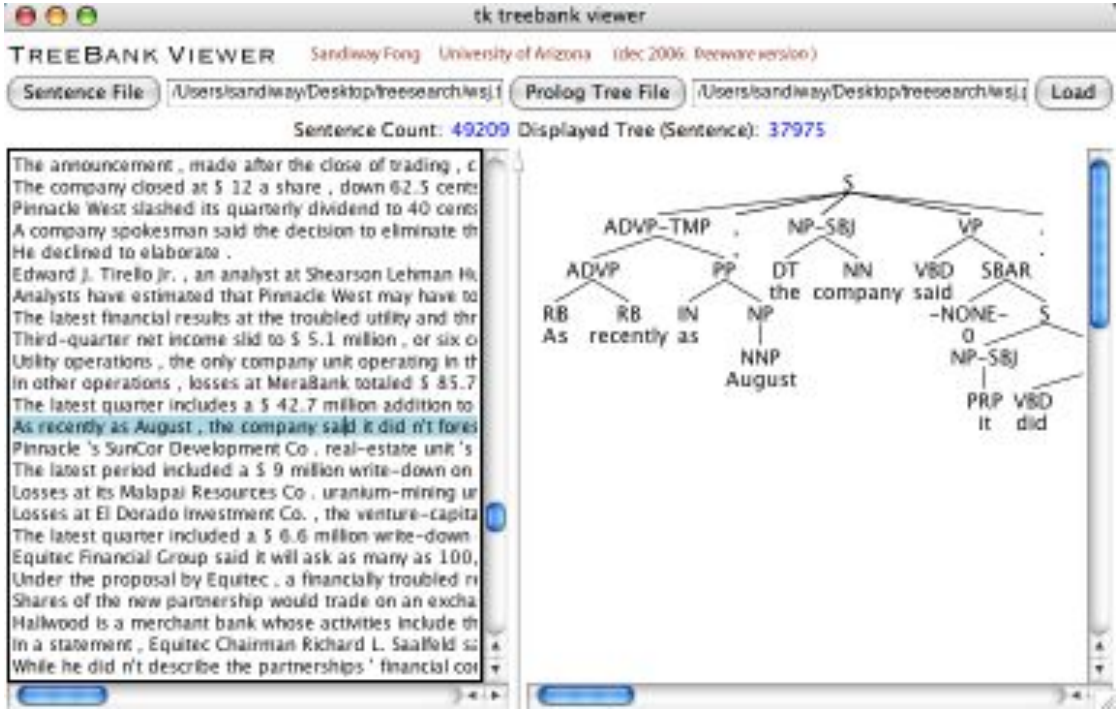
- Structured
- Semi-structured
- Unstructured



Existing Data Sources

- Annotated corpora
- DBs & KBs
- Dictionaries, lexicons, thesauri
- Raw texts

Corpora


tk treebank viewer
TREEBANK VIEWER
Sandiway Fong
University of Arizona
(dec 2006: freeware version)
Sentence File
Prolog Tree File
Load
Sentence Count: 49209
Displayed Tree (Sentence): 37975
The announcement , made after the close of trading , c
The company closed at $ 12 a share , down 62.5 cent
Pinnacle West slashed its quarterly dividend to 40 cent
A company spokesman said the decision to eliminate th
He declined to elaborate .
Edward J. Tirello Jr. , an analyst at Shearson Lehman Hu
Analysts have estimated that Pinnacle West may have to
The latest financial results at the troubled utility and thr
Third-quarter net income slid to $ 5.1 million , or six c
Utility operations , the only company unit operating in th
In other operations , losses at MeraBank totaled $ 85.7
The latest quarter includes a $ 42.7 million addition to
As recently as August , the company said it did n't fores
Pinnacle 's SunCor Development Co . real-estate unit 's
The latest period included a $ 9 million write-down on
Losses at its Malapai Resources Co . uranium-mining ur
Losses at El Dorado Investment Co. , the venture-capita
The latest quarter included a $ 6.6 million write-down
Equitec Financial Group said it will ask as many as 100,
Under the proposal by Equitec , a financially troubled r
Shares of the new partnership would trade on an excha
Hallwood is a merchant bank whose activities include th
In a statement , Equitec Chairman Richard L. Saalfeld sa
While he did n't describe the partnerships ' financial co
S
ADVP-TMP
,
NP-SBJ
VP
.
ADVP
PP
DT
NN
VBD
SBAR
RB
As
RB
recently
IN
as
NP
the
company
said
-NONE-
0
S
NNP
August
NP-SBJ
PRP
it
VBD
did

Corpus

- Structured collection of documents
- Usually, with some annotation

Corpora by Size

- Small **~10k-10M** tokens
  - manually annotated for specific tasks: Brown, OntoNotes
- Big **~1G** tokens
  - automatically annotated: GigaWord
- Huge **>100G** tokens
  - not annotated, but may be cleaned up: WebText-2, Stories

Prominent Corpora

- National: OANC/MASC, British (non-free)
- LDC (non-free): Penn Treebank, OntoNotes, Web Treebank
- Books: Gutenberg, GoogleBooks
- Corporate: Reuters, Enron
- Research: SNLI, SQuAD
- Multilang: UDeps, Europarl

Corpus Formats

- Simple formats: Brown, BSF, ...
- Linguistics specific: PTB, CONNL, ...
- Custom XML or JSON (also, CSV, etc.)
- Weird/exciting 🤪

Brown Corpus

The/at Fulton/np-tl County/nn-tl Grand/jj-tl Jury/nn-tl said/vbd Friday/nr an/at investigation/nn of/in Atlanta's/np$ recent/jj primary/nn election/nn produced/vbd ``/`` no/at evidence/nn "/" that/cs any/dti irregularities/nns took/vbd place/nn ./.

The/at jury/nn further/rbr said/vbd in/in term-end/nn presentments/nns that/cs the/at City/nn-tl Executive/jj-tl Committee/nn-tl ,/, which/wdt had/hvd over-all/jj charge/nn of/in the/at election/nn ,/, ``/`` deserves/vbz the/at praise/nn and/cc thanks/nns of/in the/at City/nn-tl of/in-tl Atlanta/np-tl "/" for/in the/at manner/nn in/in which/wdt the/at election/nn was/bedz conducted/vbn ./.

The/at September-October/np term/nn jury/nn had/hvd been/ben charged/vbn by/in Fulton/np-tl Superior/jj-tl Court/nn-tl Judge/nn-tl Durwood/np Pye/np to/to investigate/vb reports/nns of/in possible/jj ``/`` irregularities/nns "/" in/in the/at hard-fought/jj primary/nn which/wdt was/bedz won/vbn by/in Mayor-nominate/nn-tl Ivan/np Allen/np Jr./np ./.

Brat Standalone Format (ner-uk corpus)

T1	ОРГ 53 64	Океан Ельзи
T2	ОРГ 137 157	Інституту ім. Глієра
T3	РІЗН 190 195	Ягуар
T4	ОРГ 283 290	Океанів
T5	ПЕРС 292 303	Денис Дудко
T6	ПЕРС 342 358	Олексій Саранчин
T7	ОРГ 416 420	ТНМК
T8	ОРГ 441 457	Інституті музики
T9	ЛОК 767 774	Харкові
T10	ОРГ 928 936	СхідSide
T11	ОРГ 981 985	ТНМК
T12	ПЕРС 1000 1026	Дмитро «Бобін» Александров
T13	ПЕРС 1037 1055	Володимир Шабалтас
T14	ПЕРС 1122 1141	Олександр Лебеденко
T15	ПЕРС 1156 1161	Дудко
T16	ПЕРС 1172 1180	Саранчин
T17	ПЕРС 1275 1280	Дудко
T18	ПЕРС 1335 1354	Давідом Голо

PTB+JSONL (SNLI corpus)

{"annotator_labels": ["neutral", "entailment", "neutral", "neutral", "neutral"], "captionID": "4705552913.jpg#2", "gold_label": "neutral", "pairID": "4705552913.jpg#2r1n", "sentence1": "Two women are embracing while holding to go packages.", "sentence1_binary_parse": "((Two women) ((are (embracing (while (holding (to (go packages)))))) .))", "sentence1_parse": "(ROOT (S (NP (CD Two) (NNS women)) (VP (VBP are) (VP (VBG embracing) (SBAR (IN while) (S (NP (VBG holding)) (VP (TO to) (VP (VB go) (NP (NNS packages)))))))) (. .)))", "sentence2": "The sisters are hugging goodbye while holding to go packages after just eating lunch.", "sentence2_binary_parse": "((The sisters) ((are ((hugging goodbye) (while (holding (to ((go packages) (after (just (eating lunch))))))))) .))", "sentence2_parse": "(ROOT (S (NP (DT The) (NNS sisters)) (VP (VBP are) (VP (VBG hugging) (NP (UH goodbye)) (PP (IN while) (S (VP (VBG holding) (S (VP (TO to) (VP (VB go) (NP (NNS packages)) (PP (IN after) (S (ADVP (RB just)) (VP (VBG eating) (NP (NN lunch))))))))))) (. .)))"}

XML (FCE corpus)

```
<?xml version="1.0" encoding="UTF-8"?>
<learner><head sortkey="TR3*0100*2000*02">
<candidate><personnel><language>Catalan</language><age>16-20</age></personnel><score>28.0
0</score></candidate>
  <text>
    <answer1>
      <question_number>1</question_number>
      <exam_score>2.3</exam_score>
        <coded_answer>
         <p>DECEMBER 12TH</p>
         <p>PRINCIPAL MR. ROBERTSON</p>
         <p>DEAR SIR,</p>
         <p>I WANT TO <NS type="S"><i>THAK</i><c>THANK</c></NS> YOU FOR PREPARING SUCH A
GOOD PROGRAMME FOR US AND ESPECIALLY FOR TAKING US <NS
type="RT"><i>TO</i><c>ON</c></NS> THE RIVER TRIP TO GREENWICH. I WOULD LIKE TO KNOW IF
THERE IS ANY CHANCE OF CHANGING THE PROGRAMME BECAUSE WE HAVE FOUND A VERY
INTERESTING ACTIVITY TO DO ON TUESDAY 14 MARCH. IT <NS type="RV"><i>CONSISTS <NS
type="RT"><i>ON</i><c>IN</c></NS></i><c>INVOLVES</c></NS> VISITING THE LONDON FASHION
AND LEISURE SHOW <NS type="RT"><i>IN</i><c>AT</c></NS> THE CENTRAL EXHIBITION HALL. I
THINK IT'S A GREAT OPPORTUNITY TO MAKE GREATER USE OF OUR KNOWLEDGE OF <NS
type="MD"><c>THE</c></NS> ENGLISH LANGUAGE. <NS type="ID"><i>ON THE OTHER
HAND</i><c>ALSO</c></NS>, WE COULD LEARN THE DIFFERENT WAYS TO GET TO THE CENTRAL
EXHIBITION HALL.</p>
```

CONNLU (UD_Ukrainian corpus)

```
# doc_title = Сад Гетсиманський
# newdoc id = 028g
# newpar id = 02tb
# sent_id = 02to
# text = Дідусь, той що атестував, посміхнувся й спитав:
1	Дідусь	дідусь	NOUN	Ncmsny	Animacy=Anim|Case=Nom|Gender=Masc|Number=Sing	7	nsubj	_	Id=02tp|SpaceAfter=No
2	,	,	PUNCT	U	_	3	punct	_	Id=02tq
3	той	той	DET	Pd--m-sna	Case=Nom|Gender=Masc|Number=Sing|PronType=Dem	7	dislocated	_	Id=02tr
4	що	що	SCONJ	Css	_	5	mark	_	Id=02ts
5	атестував	атестувати	VERB	Vmpis-sm	Aspect=Imp|Gender=Masc|Mood=Ind|Number=Sing|Tense=Past|VerbForm=Fin	3	acl	_	Id=02tt|SpaceAfter=No
6	,	,	PUNCT	U	_	5	punct	_	Id=02tu
7	посміхнувся	посміхнутися	VERB	Vmeis-sm	Aspect=Perf|Gender=Masc|Mood=Ind|Number=Sing|Tense=Past|VerbForm=Fin	0	root	_	Id=02tv
8	й	й	CCONJ	Ccs	_	9	cc	_	Id=02tw
9	спитав	спитати	VERB	Vmeis-sm	Aspect=Perf|Gender=Masc|Mood=Ind|Number=Sing|Tense=Past|VerbForm=Fin	7	conj	_	Id=02tx|SpaceAfter=No
10	:	:	PUNCT	U	_	7	punct	_	Id=02ty
```

wdiff (WikEd corpus)

- spelling error corrections:

  `You can use rsync to [-donload-] {+download+} the database .`

- grammatical error corrections:

  `There [-is-] {+are+} also [-a-] two computer games based on the movie .`

- sentence rewordings and paraphrases:

  `These anarchists [-argue against-] {+oppose the+} regulation of corporations .`

Custom format similar to PTB (AMRBank corpus)

```
# AMR release (generated on Mon Jan 27, 2014 at 20:44:26)

# ::id nw.wsj_0001.1 ::date 2012-04-25T16:31:34 ::annotator ISI-AMR-01 ::preferred
# ::snt Pierre Vinken , 61 years old , will join the board as a nonexecutive director Nov. 29 .
# ::save-date Tue Sep 17, 2013 ::file nw_wsj_0001_1.txt
(j / join-01
      :ARG0 (p / person :name (p2 / name :op1 "Pierre" :op2 "Vinken")
            :age (t / temporal-quantity :quant 61
                  :unit (y / year)))
      :ARG1 (b / board
            :ARG1-of (h / have-org-role-91
                  :ARG0 p
                  :ARG2 (d2 / director
                        :mod (e / executive :polarity -))))
      :time (d / date-entity :month 11 :day 29))
```

Ad-hoc format (Paraphrases corpus)

Sentences file:
<s snum=146> bank of holland , wuhan office , was also officially established just recently . </s>
<s snum=425> in a similar poll made about half a year after the return of hong kong to china , 35.9% called themselves " hongkongnese " , and 18% called themselves chinese . </s>
<s snum=556> experts disclosed at the land reclamation conference held in xiaoshan , zhejiang province that the government hopes to reclaim 1 million hectares of land from the sea along its 18,000 kilometers of coastline within 40 to 50 years . </s>
<s snum=161> at the beginning , teachers of the orphanage accompanied him to school and picked him up , but from the second year , he became a resident student and went back to the orphanage only for weekends . he never missed a class , rain or shine . </s>

Alignment file:
146 1 1 S
146 2 2 S
146 3 3 S
146 4 4 S
146 5 5 S

Corpus Processing Example: NPS Chats

```
<Post class="Emotion" user="10-19-30sUser2">
    10-19-30sUser11 lol
    <terminals>
        <t pos="NNP" word="10-19-30sUser11"/>
        <t pos="UH" word="lol"/>
    </terminals>
</Post>
```

http://lisp-univ-etc.blogspot.com/2013/06/nltk-21-working-with-text-corpora.html

SAX Parsing

```
(defmethod read-corpus-file ((type (eql :nps-chat)) source)
  (cxml:parse source (make 'nps-chat-sax)))

(defclass nps-chat-sax (sax:sax-parser-mixin)
  ((texts :initform nil)
   (tokens :initform nil)
   (classes :initform nil)
   (users :initform nil)
   (cur-tag :initform nil)
   (cur-tokens :initform nil)))
```

```
(defmethod sax:start-element ((sax nps-chat-sax) namespace-uri local-name qname attributes)
  (with-slots (classes users cur-tokens cur-tag) sax
    (case cur-tag
      (:post (push (attr "class" attributes) classes)
             (push (attr "user" attributes) users))
      (:t (push (make-token
                 :word (attr "word" attributes)
                 :tag (attr "pos" attributes))
                cur-tokens)))))
```

```
(defmethod sax:characters ((sax nps-chat-sax) data)
  (with-slots (cur-tag texts) sax
    (when (eql :terminals cur-tag)
      (push data texts))))
```

```
(defmethod sax:end-element ((sax nps-chat-sax) namespace-uri local-name qname)
  (when (eql :terminals (mkeyw local-name))
    (with-slots (tokens cur-tokens) sax
      (push (reverse cur-tokens) tokens)
      (setf cur-tokens nil))))
```

```
(defmethod sax:end-document ((sax nps-chat-sax))
  (with-slots (texts tokens users classes) sax
    (values (reverse texts)
            (reverse tokens)
            (reverse classes)
            (reverse users))))
```

Corpora Pitfalls

- Tied to a domain
- Annotation quality

Technical:

- Require licensing
- Require processing of custom formats

Data Licensing

From data owners: universities/companies/individuals

Issues:

- data owners have no idea about cost and/or license
- legislation is different in different countries
- be ready to spend about 3 months
- and sometimes...


JOEY DOESN'T SHARE FOOD!
ROFLBOT

Sometimes you win, sometimes you learn

- The Story of a Missing Licence from Creators
- The Story of a Lost Electronic Copy
- The Story of a Never-Ending Divorce
- The Story of the Corpus of Ukrainian

Structured Data

Dictionaries

- Wordlists, lexicons
- Dictionaries
- Wiktionary
- Thesauri

DBs & KBs

- Wikimedia (DBPedia, Wikidb)
- RDF knowledge bases (Freebase, OpenCYC)
- KBPedia
- WordNet, ConceptNet, BabelNet
- Private or public data sources (*gov)

KBPedia Use Cases

http://kbpedia.org/use-cases

Knowledge Graph (KG) Use Cases

- Browse the Knowledge Graph
- Search the Knowledge Graph
- Expand Queries Using Semsets
- Uses and Control of Inferencing
- Leverage KBpedia's Aspects

Machine Learning (KBAI) Use Cases

- Create Supervised Learning Training Sets
- Create Word Embedding Corpuses
- Create Graph Embedding Corpuses
- Classify Text
- Create 'Gold Standards' for Tuning Learners
- Disambiguate KG Concepts
- Dynamic Machine Learning Using the KG

Mapping Use Cases

- Map Concepts
- Map Entities
- Extend KBpedia for Domains
- General Use of the Mapper

Creating Your Own Data ¯_(ツ)_/¯

Ways to Create Data

- Scraping
- Annotation
- Crowdsourcing
- Generating
- Getting from users

Sources of Raw Data

- Internet
- CommonCrawl (also, NewsCrawl)
- UMBC, ClueWeb, WikiText
- Wikipedia
- Social media: Reddit, Twitter

Raw Data Pros & Cons

+ Can collect stats => build LMs, word vectors...

+ Can have a variety of domains

– But hard to control the distribution of domains

– Web artifacts

– Web noise/social media noise

– Huge processing effort

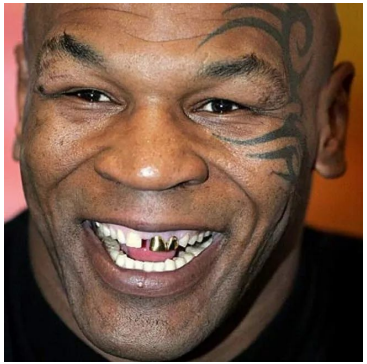
– Rate limits

More Specific Sources

- Media websites
- Libraries
- Registries & online DBs
- Thematic forums
- Specific APIs (Twitter, Wordnik, NewsAPI/Webhose, ...)
- Custom search API

Use Case: getting tweets about #lisp

- Getting access to twitter API nowadays is a huge PITA
- Using twitter/search API to retrieve all the tweets with the word “lisp”
- Mind the API limitations (limit of tweets, limit on date)
- Overlap in the API calls
- Retweets are a headache
- Using https://publish.twitter.com/oembed?url=




WHAT IF I TOLD YOU
THERE'S AN API FOR EVERY WEBSITE

Web Scraping Rules of Thumb

- Creativity FTW
- Readability FTW
- But respect copyright!
- Don’t overload websites, respect robots.txt
- AWS can also be FTW

Use Case: debates corpus

- Scraping Debatabase
  http://idebate.org/debatabase/index.php
- Using crawlik

Annotation vs Crowdsourcing

Data Annotation: who?

- Own annotators
- Volunteers
- Crowdsourcing platforms
  - *Amazon Mechanical Turk, kotyky.org.ua*
- Expert linguists
  - *Appen, Leapforce, iSoftStone*

Data Annotation: who?

Crowdsourcing	Expert Linguists
+ cheap and fast	- expensive and time-consuming
- little control over quality	+ easier to control quality

Data Annotation: who?

Crowdsourcing	Expert Linguists
+ cheap and fast	- expensive and time-consuming
- little control over quality	+ easier to control quality

There will always be *errors* in your data!

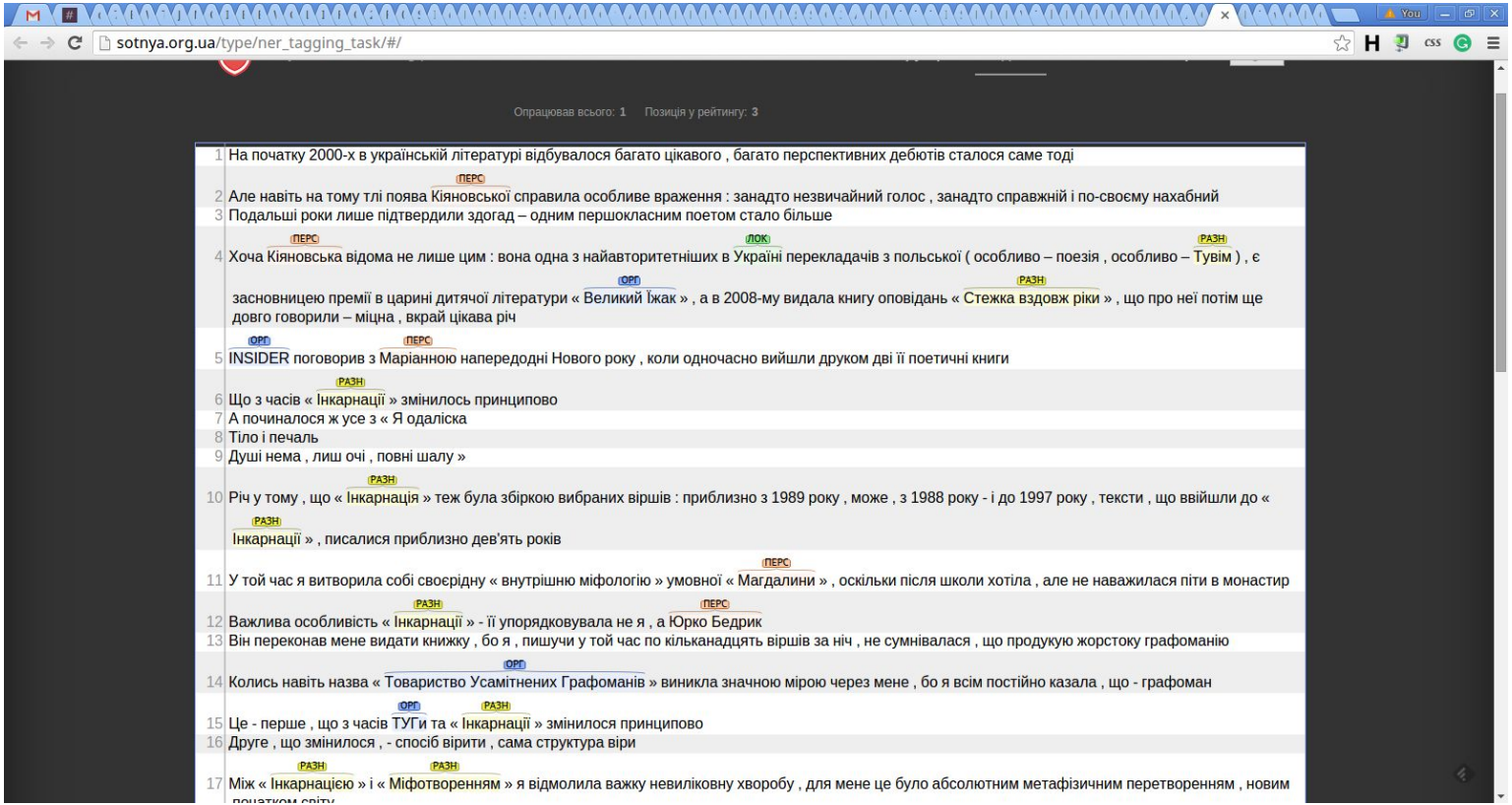
Crowdsourcing: Volunteers

- Friends
- Co-workers, fellow students
- Internet volunteers
- Paid volunteers :)

Use Case: ner-uk corpus

- 264 texts
- 238,927 tokens
- 6,751 NER entities
- Vulyk
- 3 volunteer annotators
- 1 volunteer editor (Seva)
- ~20k HRN
- 1-2 months

Use Case: ner-uk corpus



https://github.com/lang-uk/ner-uk/tree/master/doc

Crowdsourcing: Amazon Mechanical Turk

- mturk.com - a platform for work that requires human intelligence
- Requesters vs. Workers
- Tasks are organized in HITs (human intelligence tasks)
- Provides a sandbox: requestersandbox.mturk.com

amazonmechanical turk beta | REQUESTER

Home | Create | Manage | Developer | Help

New Project | New Batch with an Existing Project | Create HITs individually

Start a New Project

- Categorization
- Data Collection
- Moderation of an Image
- Sentiment
- Survey
- Survey Link
- Tagging of an Image
- Transcription from A/V
- Transcription from an Image
- Writing
- Other

Example of Categorization

Choose the best category for this image

View Instructions

Select the room location in home for this picture. Seating areas outside are outside not living. Offices or dens are living not bedrooms. Bedrooms should contain a bed in the picture.

- kitchen
- living
- bath
- bed
- outside

You must ACCEPT the HIT before you can submit the results.

Create Project »

Leave feedback for this page.

AMT Prices

1. The Worker reward ($0.01 minimum)
2. The AMT fee (20–40%)
3. Additional 5% if you want your Workers to be Masters
4. Extra per HIT if you choose a predefined qualification (e.g., age, gender, native language)

Expert Linguists: Appen

- appen.com - development of high-quality, human annotated datasets for ML
- 180 languages
- 1 mln annotators

Use case: mobile spelling corrections

- What we need?
  - Spelling error annotations in mobile phone messages.

Use case: mobile spelling corrections

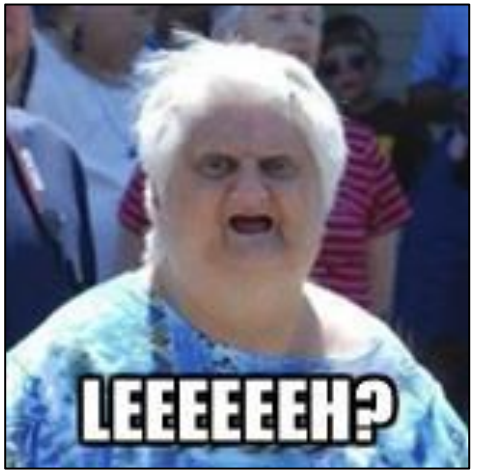
- What's available?
  - *NUS SMS Corpus*
    - *55,000 messages*
  - *Mobile Forensics corpus*
    - *4,934 messages*
  - *The Enron Mobile Email Dataset*
    - *2,600 messages*
  - *SMS Spam Collection v. 1*
    - *425 spam messages + NUS SMS*

NUS SMS Corpus: Singlish

Waiting in a car 4 my mum lor. U leh? Reach home already?

Lor - expresses general agreeability

Leh - expresses negativity



The data says we need more data.

someecards
user card

Attack plan

- Collect data
  - Scrape Twitter
  - Use Amazon Mechanical Turk
- Annotate data
  - Automatic annotation
  - Annotation with expert linguists

Twitter

- Twython
- A few thousand tweets from 2011–2013
- “source” in [“IPhone”, “Android”, “Mobile”]
- Data quality:
  - language filter
  - profanities
  - too short or just hashtags
  - average word length < 3, etc.

AMT data collection: idea 1

- What if we ask the turkers to ***retype*** some short messages?
  - How to set up AMT on the phone?
  - What messages to retype?
  - How do we know...
    - they are not copy-pasting?
    - they are not typing some other text instead?
    - they are using a mobile phone?
    - they are not using autocorrect?

Results

- 10,000 sentences
- 2 days
- $0.05 per HIT
- 33,000 misspellings

Instructions (Click to expand)

Important: You must use your smartphone to complete this task. Open this task from a browser on your smartphone using the following link: www.goo.gl/ShortLink. Type the answers using your mobile keyboard. Turn off your spell checker and autocorrect for this task. Submissions which do not use a mobile device will be rejected.

Short link to task for smartphones: rebrand.ly/d7eb

If you need help turning off the spell checker, use the instructions below:
- for Android: http://www.wikihow.com/Turn-Off-Auto-Correct-on-an-Android
- for iOS: http://www.howtoisolve.com/how-to-turn-off-spell-check-on-iphone-6-6-plus-ios-8-1/

In this task, you'll be presented with 5 sentences and asked to retype the sentences as quickly as you can. Do not worry about any errors in your writing.

You will need to do the following:

- Use a mobile keyboard on your smartphone to perform the task
- Disable spellcheck / autocorrect on your phone
- Type as quickly as you can
- Do **not** go back to correct any spelling errors

Example

Pack my box with five dozen liquor jugs.

Pack my box with five dozen liquor jugs.

Pack my box with five dozen liquour jugs.

Pack my box with five dozen liquir jugs.

Paxk my box with guve dozen liquorr jugs.

Pack my box with five dozen liquor jugs.

AMT data collection: idea 2

- What if we ask the turkers to ***give short answers***?
  - How to set up AMT on the phone?
  - What questions to ask?
  - How do we know...
    - they are not copy-pasting random text?
    - they are using a mobile phone?
    - they are not using autocorrect?

Results

- 2,000 answers to 200 questions
- 4 days
- $0.15 per HIT

Issues:

- Misspellings cannot be extracted
- Some data bias

Bias

Saree. Attried in saree looks gorgeous. Its neet beautiful and sexy dress.

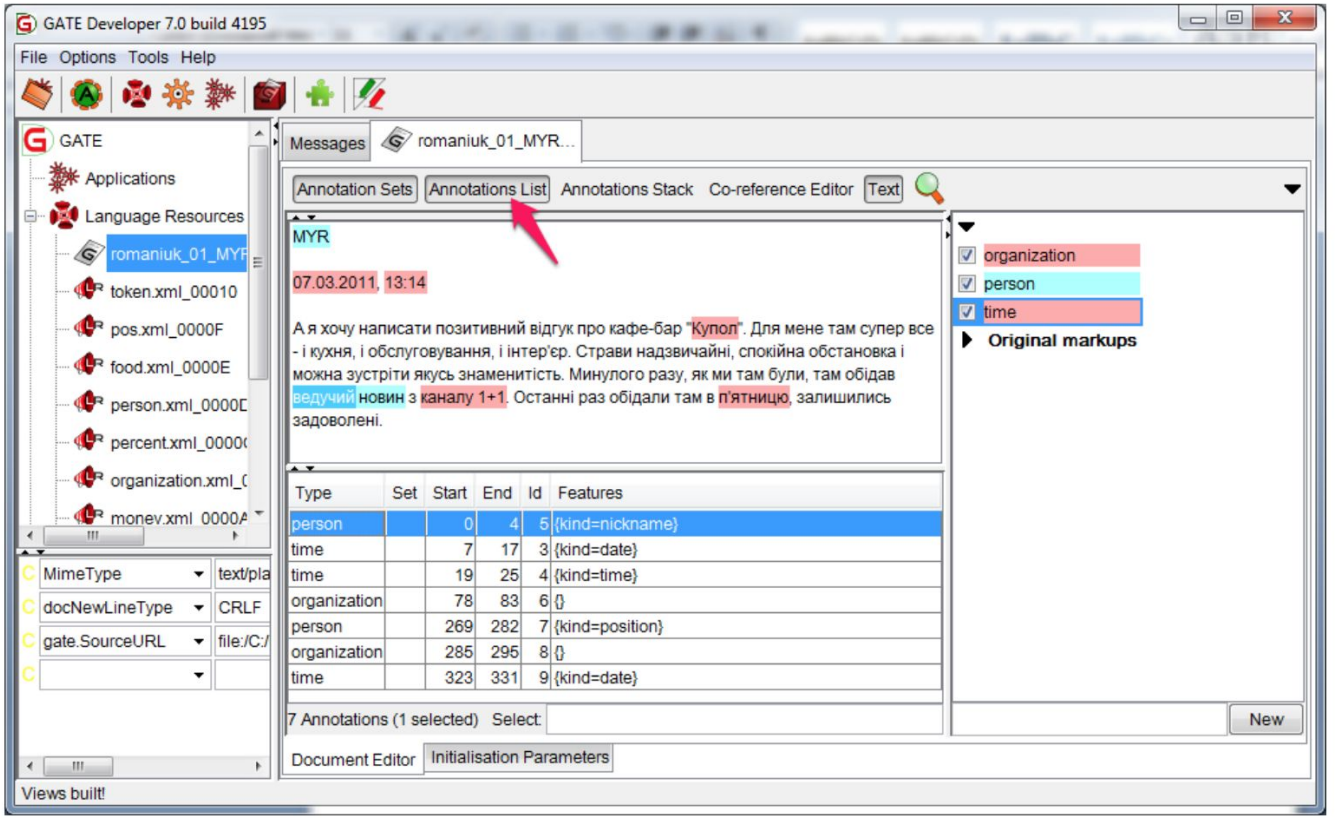
My favourite place is Guruvayur temple. I love Guruvayurappan and i feel relaxed there.

I live in mumbai, maharashtra, india. In mumbai there are many spots where we can enjoy...

Annotation Tools

Classic:

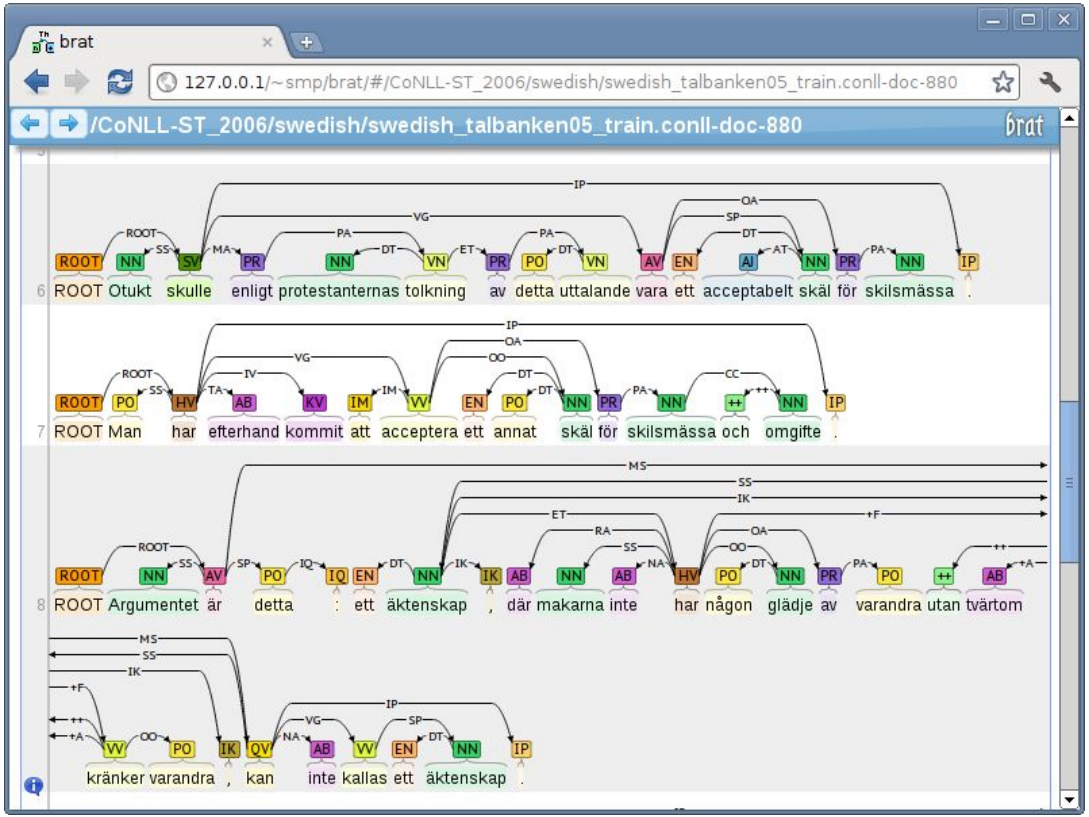
- GATE
- INCEpTION



Annotation Tools

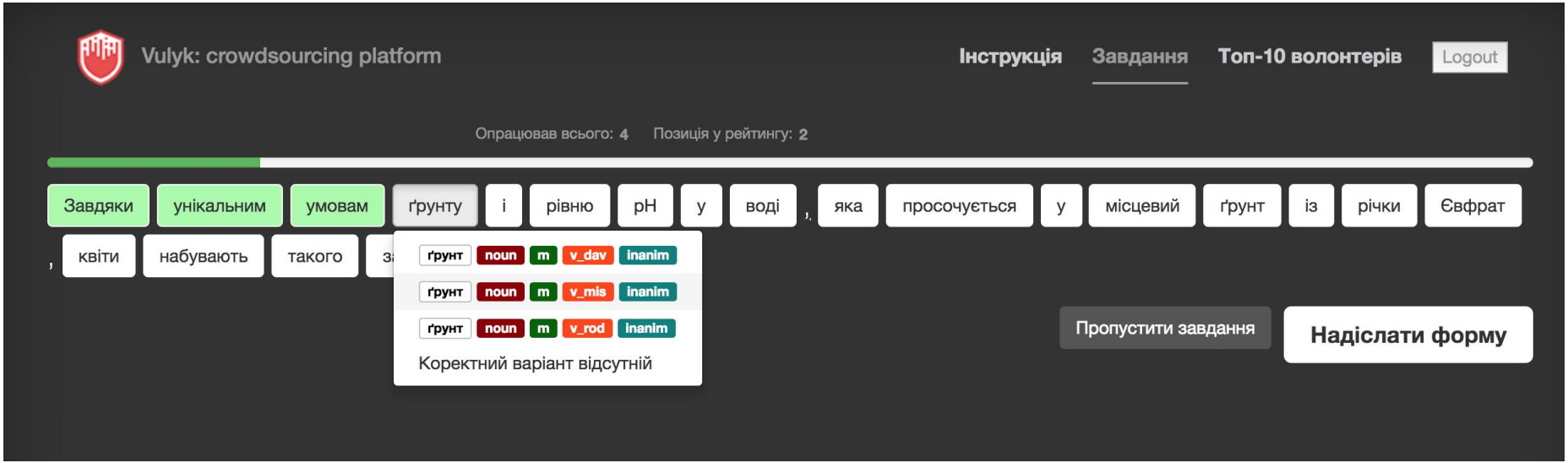
Modern:

- Brat
- Anafora



Annotation Tools

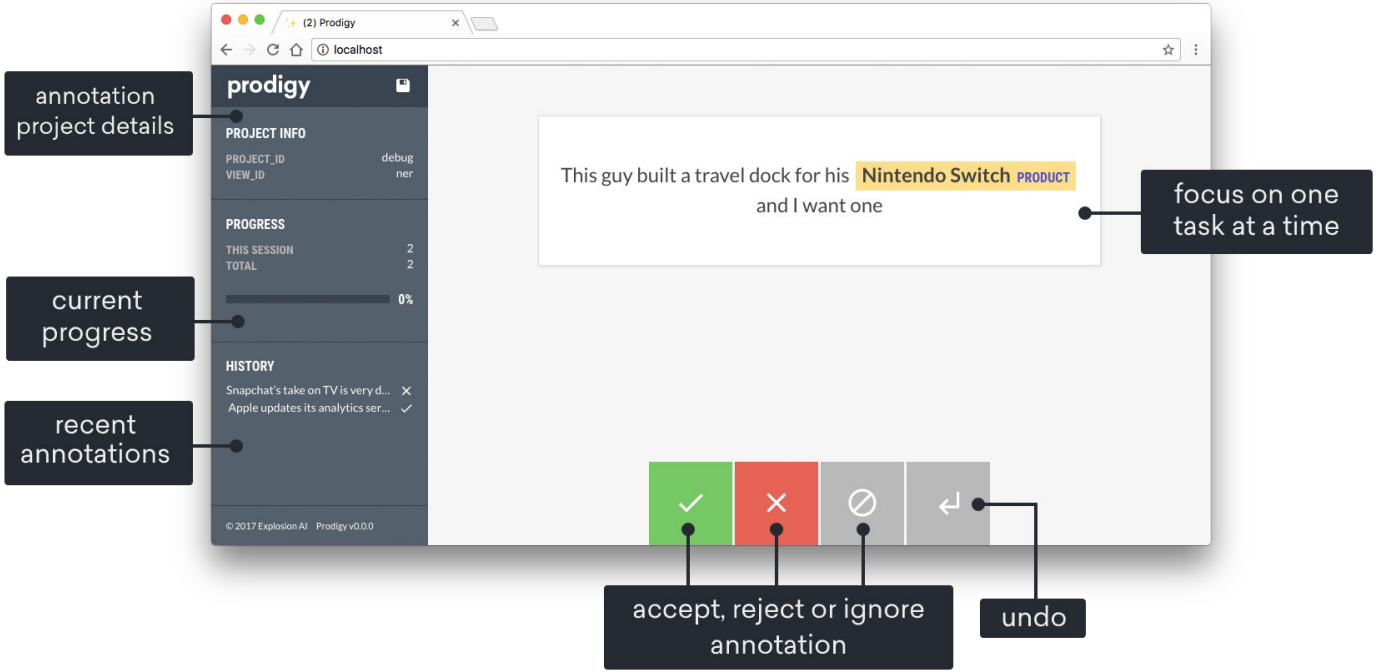
Modern: Brat, Anafora



Annotation Tools

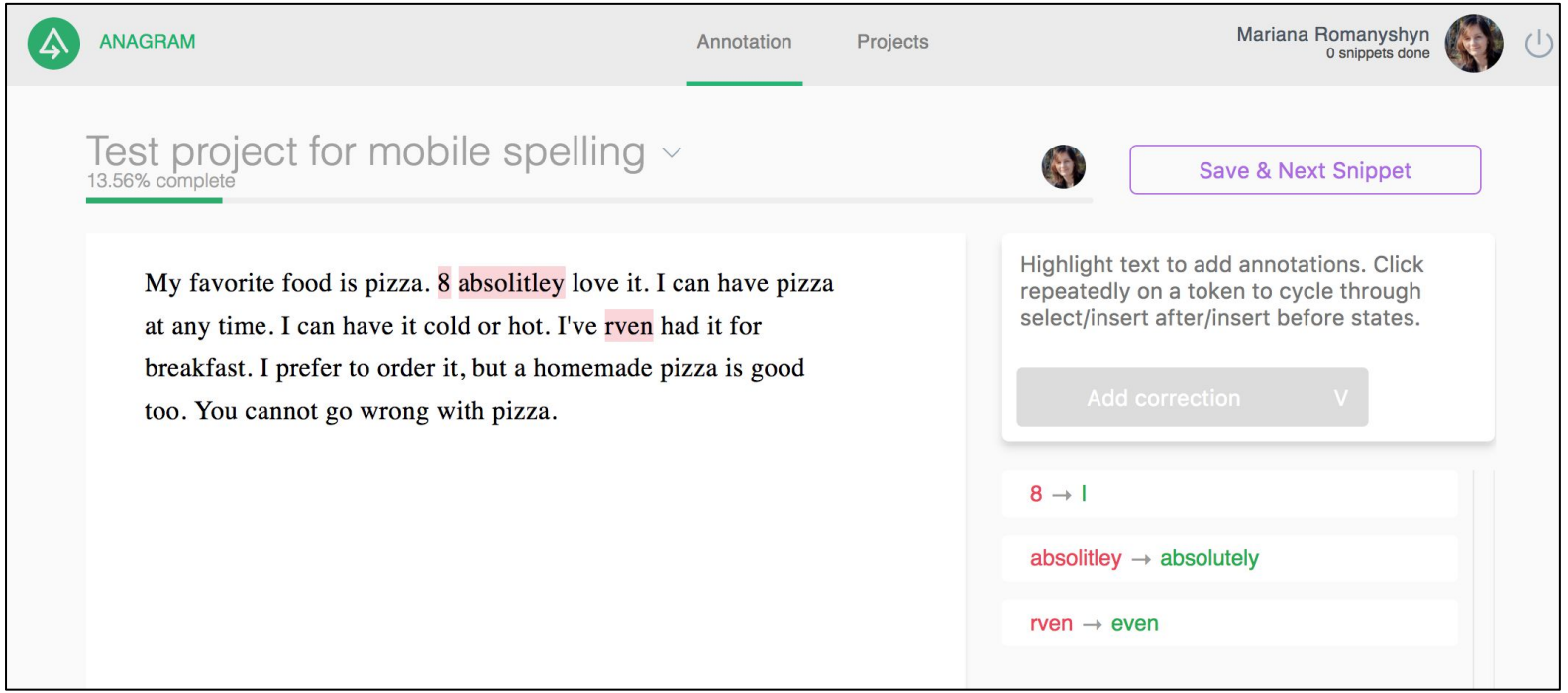
“AI-Powered”:

- Prodigy
- Snorkel



Annotation Tools

Custom :)



Annotation

- Data: *SMS + Twitter + AMT project*
- Who: *expert linguists*
- Tool: *Anagram*

The main issue

cud u tell ppl im gona b a bit l8 cos 2 buses hav gon past cos they were full & im still waitin 4 1. Pete x

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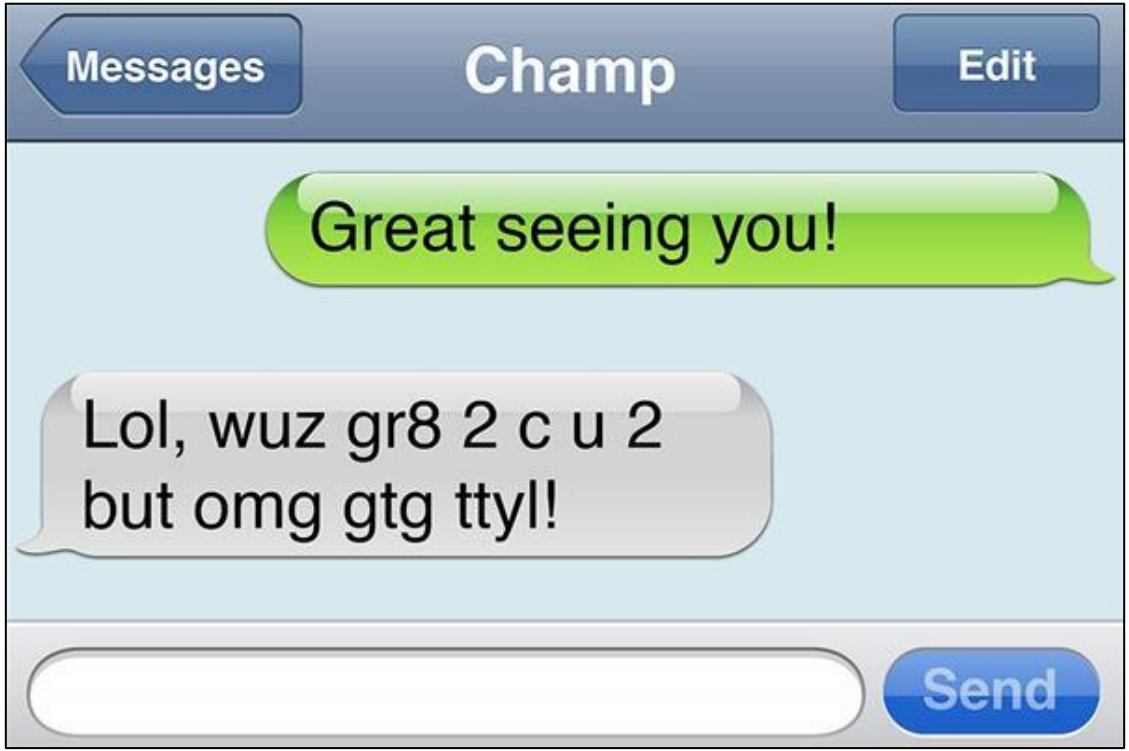

Annotation Process

- Guidelines
- Training
- Calibration
- Annotation
- Disagreement resolution

Learnings

1. Guidelines
    a. short, covering one task only
    b. non-contradicting
    c. with a fall-back option
    d. with as many examples as possible

Learnings

2. Quality control
    a. annotate the first batch yourself
    b. set up qualification tests (training)
    c. check annotators' qualifications
    d. do cross-annotation
    e. set up automatic acceptance/rejection of the work

Learnings

3. Automatically annotated data saves time...

(and teach the annotators)

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4. Saving time and money
   a. extract 100% agreement from crowdsourcing
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5. Pay quickly and be responsive to emails

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   a. extract 100% agreement from crowdsourcing
   b. use experts to reannotate the rest
5. Pay quickly and be responsive to emails
6. Gamification
7. Annotation bias

Inter-annotator agreement

How much do annotators agree?

- in general
- for each class

Basic metric: Cohen’s Kappa

$$K = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)}$$

, where

Pr(a) — actual agreement

Pr(e) — expected agreement

Cohen’s Kappa. Example

		B	B	B	
		pos	neut	neg	TOT
A	pos	54	28	3	85
A	neut	31	18	23	72
A	neg	0	21	72	93
	TOT	85	67	98	250

Cohen's Kappa. Example

		B	B	B	
		pos	neut	neg	TOT
A	pos	54	28	3	85
A	neut	31	18	23	72
A	neg	0	21	72	93
	TOT	85	67	98	250

$$K = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)}$$

$$Pr(a) = (54 + 18 + 72) / 250 = \mathbf{.576}\ (57.6\%)$$

Cohen’s Kappa. Example

		B	B	B	
		pos	neut	neg	TOT
A	pos	54	28	3	85
A	neut	31	18	23	72
A	neg	0	21	72	93
	TOT	85	67	98	250

$$K = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)}$$

A used the label **“positive”** 85 times (54 + 28 + 3), or .425%

B used the **“positive”** label 85 times (54 + 31), or .425%

Pr(e) = .425 × .425 = .180

Cohen's Kappa. Example

		B	B	B	
		pos	neut	neg	TOT
A	pos	54	28	3	85
A	neut	31	18	23	72
A	neg	0	21	72	93
	TOT	85	67	98	250

$$K = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)}$$

$$Pr(e) = .180 + .077 + .146 = \mathbf{.403}$$

Cohen's Kappa. Example

		B	B	B	
		pos	neut	neg	TOT
A	pos	54	28	3	85
A	neut	31	18	23	72
A	neg	0	21	72	93
	TOT	85	67	98	250

$$K = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)}$$

$$K = \frac{.576 - .403}{1 - .403} = \frac{.173}{.597} = .29$$

Cohen’s Kappa

What value is good?

- it depends
- ideally, > 0.8
- in real life, > 0.4 may be good enough

Data Generation

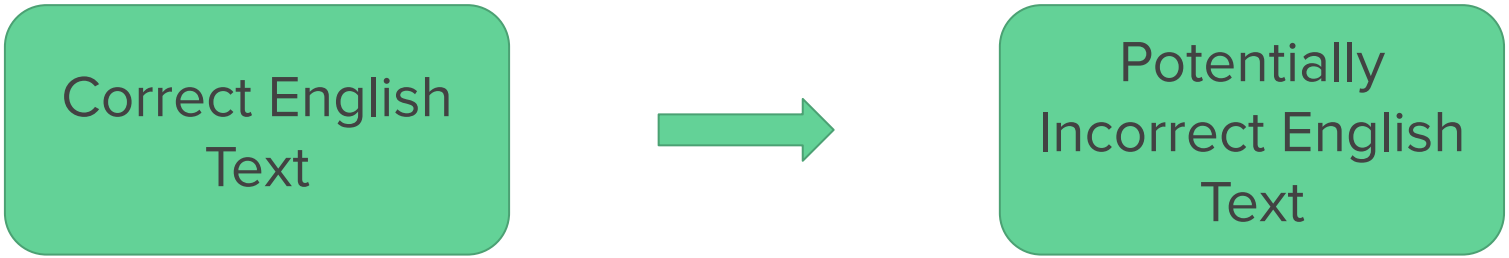
Use case: collocation correction

Today I did a very silly mistake.

Use case: collocation correction

Today I {did=>made} a very silly mistake.

The Idea

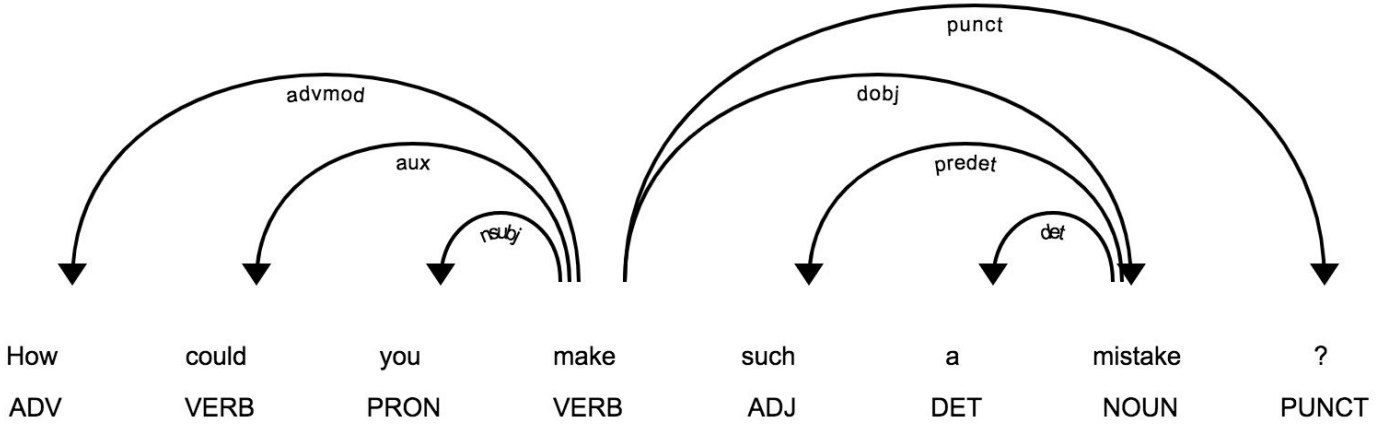


Collocation types

Categories	*Examples*
noun + verb	*the results suggest, the research shows*
verb + noun	*provides an explanation, discuss the problem*
adjective + noun	*concrete example, potential problem*
verb + particle	*point out, carry out*
adverb + verb	*clearly differs, thoroughly examine*

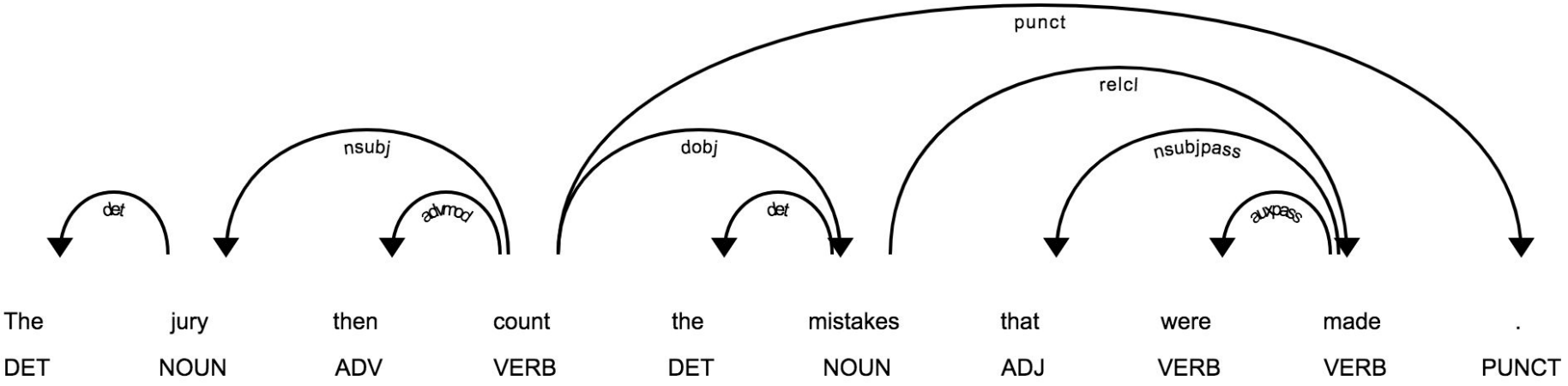
Use case: collocation correction

- Extract collocations from good texts



Use case: collocation correction

- Extract collocations from good texts



Use case: collocation correction

- Extract collocations from good texts
- Get synonyms from a thesaurus

How could you make such a mistake?

do

commit

perform

execute

...

Use case: collocation correction

- Extract collocations from good texts
- Get synonyms from a thesaurus
- Filter out if:
  - the replacement is a good collocation
  - the combination is frequent in good texts

Use case: collocation correction

- Extract collocations from good texts
- Get synonyms from a thesaurus
- Filter out good replacements

How could you make such a mistake?

do

commit

perform

execute

...

Use case: collocation correction

- Extract collocations from good texts
- Get synonyms from a thesaurus
- Filter out good replacements
- Replace the good word with a synonym

How could you do such a mistake?

How could you perform such a mistake?

How could you execute such a mistake?

Results

- True positives
  - *I thought you did a {full => comprehensive} research...*
  - *...the most {beautiful => good-looking} men in the world.*
- Problems
  - Not all confusions are synonymous:
    - *{crowded => heavy} traffic*
  - Rare combinations can be treated as a mistake
    - *{Subversive=>Underground} lines characterize...*

Data Generation Pros & Cons

+ Potentially unlimited volume

+ Control of the parameters

– Artificial

Acquiring Data from Users

+ Your product, your domain

+ Real-time, allows adaptation

+ Ties into customer support

− Chicken & egg problem

− Legal issues, requires anonymization

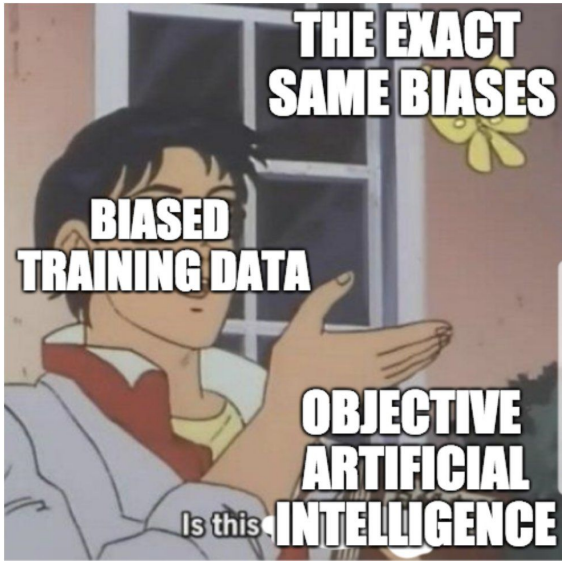
Potential approach: “lean startup”

Data Best Practices

- Proper ML dataset handling
- Domain adequacy, diversity
- Inter-annotator agreement
- Reasonable baselines
- Error analysis
- Real-time tracking

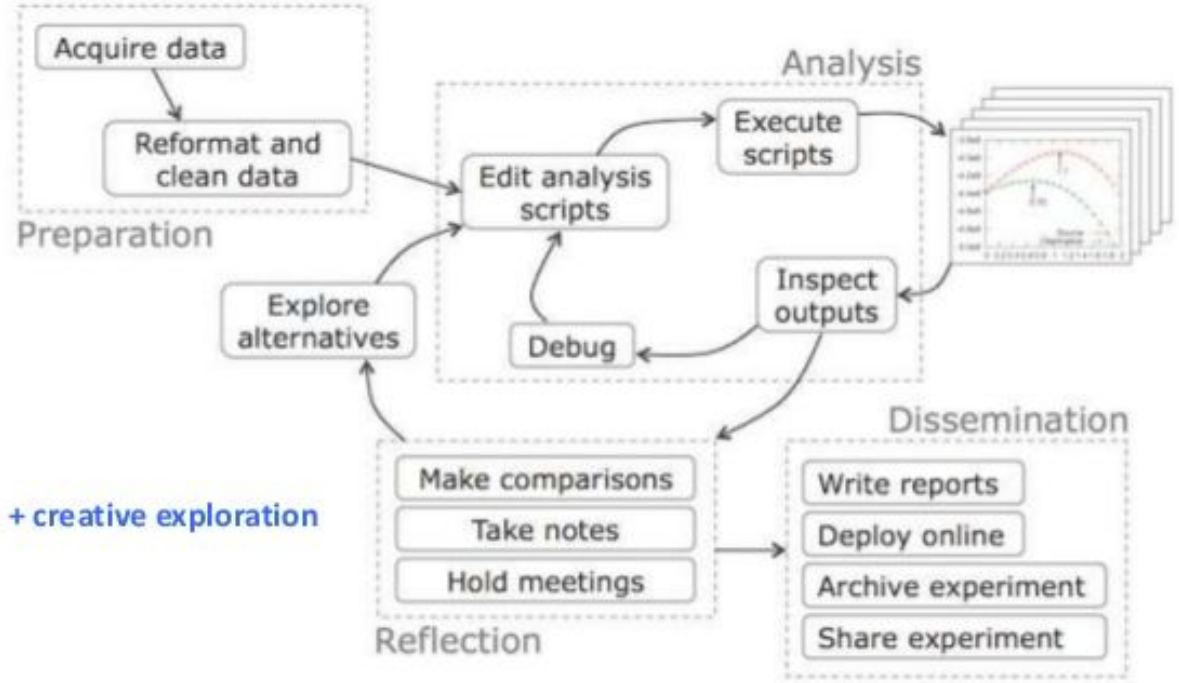
Be Aware of Bias

- Domain bias
- Dataset bias
- Model bias
- Social bias



https://www.slideshare.net/grammarly/grammarly-ainlp-club-1-domain-and-social-bias-in-nlp-case-study-in-language-identification-tim-baldwin-80252288

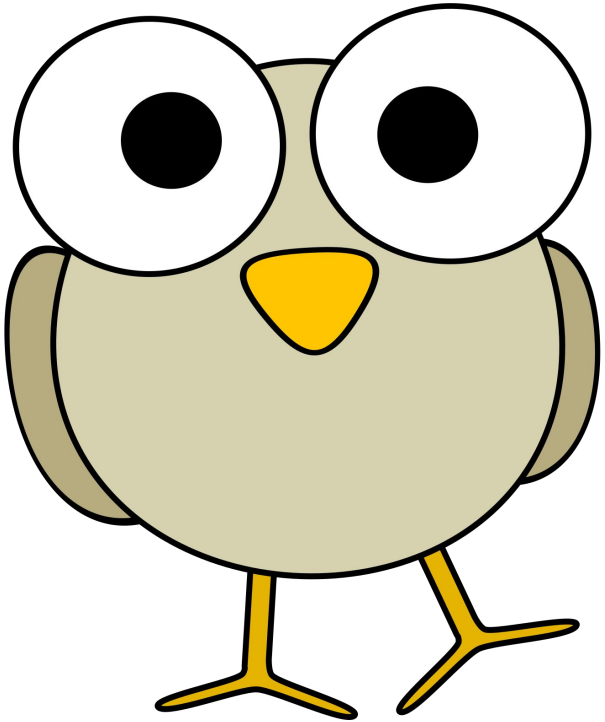
Data Workflow



Source: Josh Wills, Senior Director of Data Science, Cloudera. *"From the Lab to the Factory: Building a Production Machine Learning Infrastructure."*

Tools

- 👀 (+ grep & co)
- other Shell powertools
- statistical analysis tools + plotting
- annotation tools
- web-scraping tools
- metrics databases (Graphite)
- Hadoop, Spark



? ?