

The ABC of Computational Text Analysis

#8 ETHICS AND THE EVOLUTION OF NLP

Alex Flückiger

Faculty of Humanities and Social Sciences
University of Lucerne

20 April 2023

Recap last Lecture

- **an abundance of data sources**
Swissdox, JSTOR, few datasets
- **creating your own dataset**
convert any data to **.txt**, incl. OCR
- **processing a batch of files**
perform tasks in for-loop

Feedback Assignment 2

- many neat solutions 
- level of sophistication sometimes beyond expectations 
 - highly detailed explanations
 - powerful regex, yet inconsistent



Do not use ChatGPT naively



1. Copy full assignment into ChatGPT
2. Get nicely structured, more or less unique output
3. However, especially for task 1.3, the answers are plain wrong

Parsing name in Von BRUNO VANONI, BERN.



ChatGPT's Answers (3 attempts, no cherrypicks):

```
egrep -ho "^[A-Z]+((\s[A-Z]+)*(\s[a-z]+))?,(\s[A-Z]+)+\." r  
egrep -o '^([A-Z][a-z]+ ([A-Z]\.?)?[A-Z][a-z]+ )+' newspap  
egrep -o "^[A-Z][a-z]+ ([A-Z][a-z]+ ?)+," newspaper_article
```

ChatGPT is a tool...

... learn how to use it 

- use ChatGPT as interactive partner
- don't trust; try, refine and develop understanding
- speed up tasks, automation of project not feasible

Example Usage of ChatGPT

“How do I parse two uppercased words at the beginning of a line after the word ‘Von’?”

```
^Von [A-Z]+ [A-Z]+
```

“How would it work in Python?”

```
pattern = r'^Von [A-Z]+ [A-Z]+'
matches = [line for line in lines if re.match(pattern, line
```

Outline

- ethics is everywhere  ... and your responsibility
- understand the development of modern NLP  ... or how to put words into computers

Ethics is more than philosophy.
It **is everywhere.**

An Example

Results-driven and motivated Software Engineer with a demonstrated experience in improving software performance, testing and updating existing software, and developing new software functionalities. Offers proven track record of extraordinary achievements, strong attention to detail, and ability to finish projects on schedule and within budget.



Work experience

06/2017 – 03/2019 STUTTGART, GERMANY

Software Engineer Critical Alert, Inc.

- Developed and implemented tools which increased the level of automation and efficiency of installing and configuring servers.
- Tested and updated existing software and using own knowledge and expertise made improvement suggestions.
- Redesigned company's web-based application and provided beneficial IT support to colleagues and clients.
- Awarded Employee of the Month twice for performing great work.

06/2015 – 06/2017 STUTTGART, GERMANY

Software Engineer Experian, Inc.

- Worked on the multiple software projects simultaneously and participated in the whole

09/2014 – 05/2015 OXFORD, UNITED KINGDOM

Software Engineering University of Oxford

First Class Honours

09/2011 – 05/2014 STUTTGART, GERMANY

Computer Science University of Stuttgart

Top 5% of the Programme

Clubs and Societies: Engineering Society, Math Society, Volleyball Club

09/2009 – 07/2011 LEVERKUSEN, GERMANY

Gymnasium Max-Planck-Gymnasium

Graduated with Distinction (Grade 1 - A/excellent equivalent in all subjects)

Activities: Math Society, Physics Society, Tennis Club



Skills

- LANGUAGES

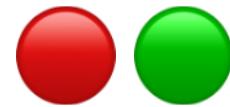
German	Native
English	Full
French	Limited
Chinese	Limited

- COMPUTER SKILLS

Microsoft Office	<div style="width: 100%; background-color: #0072bc; height: 10px;"></div>
Frameworks, DevOps	<div style="width: 100%; background-color: #0072bc; height: 10px;"></div>

You are applying for a job at a big company

Does your CV pass the automatic pre-filtering?



Your interview is recorded.



What personal traits are inferred from that?

trustworthy



smart



Face impressions as perceived by a model by (Peterson et al. 2022)

Don't worry about the future...

... worry about the present.

- AI is persuasive in everyday's life
 - assessing risks and performances (credits, job, crimes, terrorism etc.)
- AI is extremely capable
- AI is smart within limits only and often poorly evaluated



What is going on behind the scene?

An (R)evolution of NLP

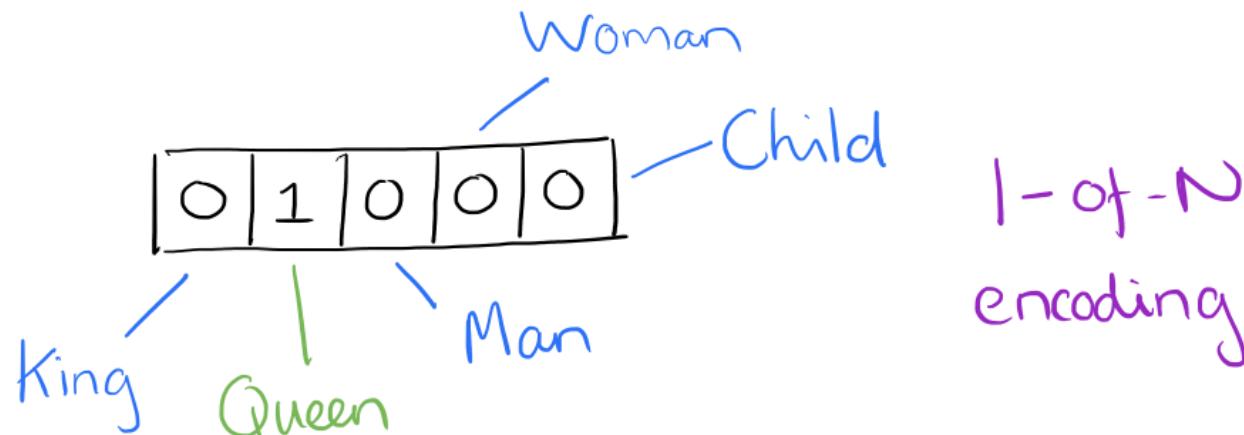
From Bag of Words to Embeddings

Putting Words into Computers (Smith 2020; Church and Liberman 2021; Manning 2022)

- from **coarse+static** to **fine+contextual** meaning
- how to measure similarity of words and documents?
- from counting to learning representations

Bag of Words

- word as arbitrary, discrete numbers
 $\text{King} = 1, \text{ Queen} = 2, \text{ Man} = 3, \text{ Woman} = 4$
- intrinsic meaning
- how are these words similar?



Vector-representations of words as discrete symbols (Colyer 2016)

Representing a Corpus

Collection of Documents

1. NLP is great. I love NLP.
2. I understand NLP.
3. NLP, NLP, NLP.

Document Term Matrix

	NLP	I	is	<i>term</i>	
Doc1	2	1	1	...	
Doc2	1	1	0	...	
Doc3	3	0	0	...	
DocID	<i>term frequency</i>	

"I eat a hot _____ for lunch."

«You shall know a word by the company it keeps!»

Firth (1957)

Word Embeddings

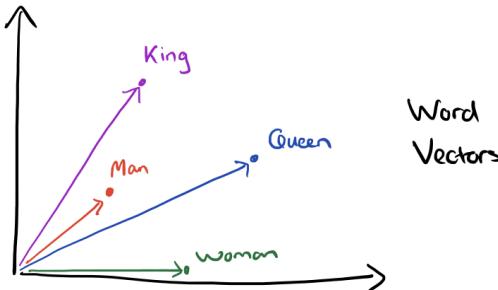
word2vec (Mikolov et al. 2013)

- words as continuous vectors
 - accounting for similarity between words
- semantic similarity

$$\text{King} - \text{Man} + \text{Woman} = \text{Queen}$$

$$\text{France} / \text{Paris} = \text{Switzerland} / \text{Bern}$$

King	Queen	Woman	Princess
0.99	0.99	0.02	0.98
0.99	0.05	0.01	0.02
0.05	0.93	0.999	0.94
0.7	0.6	0.5	0.1
:			

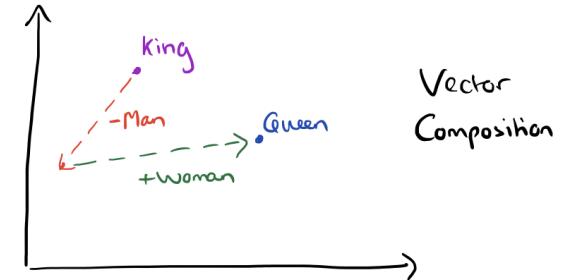


Single continuous vector per word

(Colyer 2016)

Words as points in a semantic space

(Colyer 2016)



Doing arithmetics with words

(Colyer 2016)

Contextualized Word Embeddings

BERT (Devlin et al. 2019)

- recontextualize static word embedding
 - different embeddings in different contexts
 - accounting for ambiguity (e.g., **bank**)
- acquire linguistic knowledge from language models (LM)
 - LM predict next/missing word
 - pre-trained on loads of data



embeddings are the cornerstone of modern NLP

Large Language Models (LLM)

ChatGPT (OpenAI 2023)

- **scale up attempts of previous models**
more model parameters (>175B) and train data (>300B words)
- **optimize for conversations**
instruction-tuning (summarize, translate, reason)
Reinforcement Learning from Human Feedback (RLHF)



There are dozens other models than ChatGPT.

Modern NLP is propelled by Data

Associations in Data

« becomes a doctor.»

Learning Patterns from Data

[] becomes a doctor .

23.931% he	12.105% she	0.543% michael
0.535% jack	0.446% peter	0.435% tom
0.418% i	0.408% jake	0.407% sam
0.365% john	0.352% alex	0.350% max
0.330% david	0.316% paul	0.303% bill

BERT's predictions for what should fill in the hidden word

Gender bias of the commonly used language model BERT (Devlin et al. 2019)

Cultural Associations in Training Data

Her hobby is _.

His hobby is _.

Number of Tokens ⓘ

30 200 1000 5000 All

Chart Type ⓘ

Likelihoods

Differences

Update



_ likelihood, His sentence →

Gender bias of the commonly used language model **BERT** (Devlin et al. 2019)

Word Embeddings are biased ...

... because ~~our data is~~ we are biased. (Bender et al. 2021)

In-class: Exercises I

1. Open the following website in your browser:

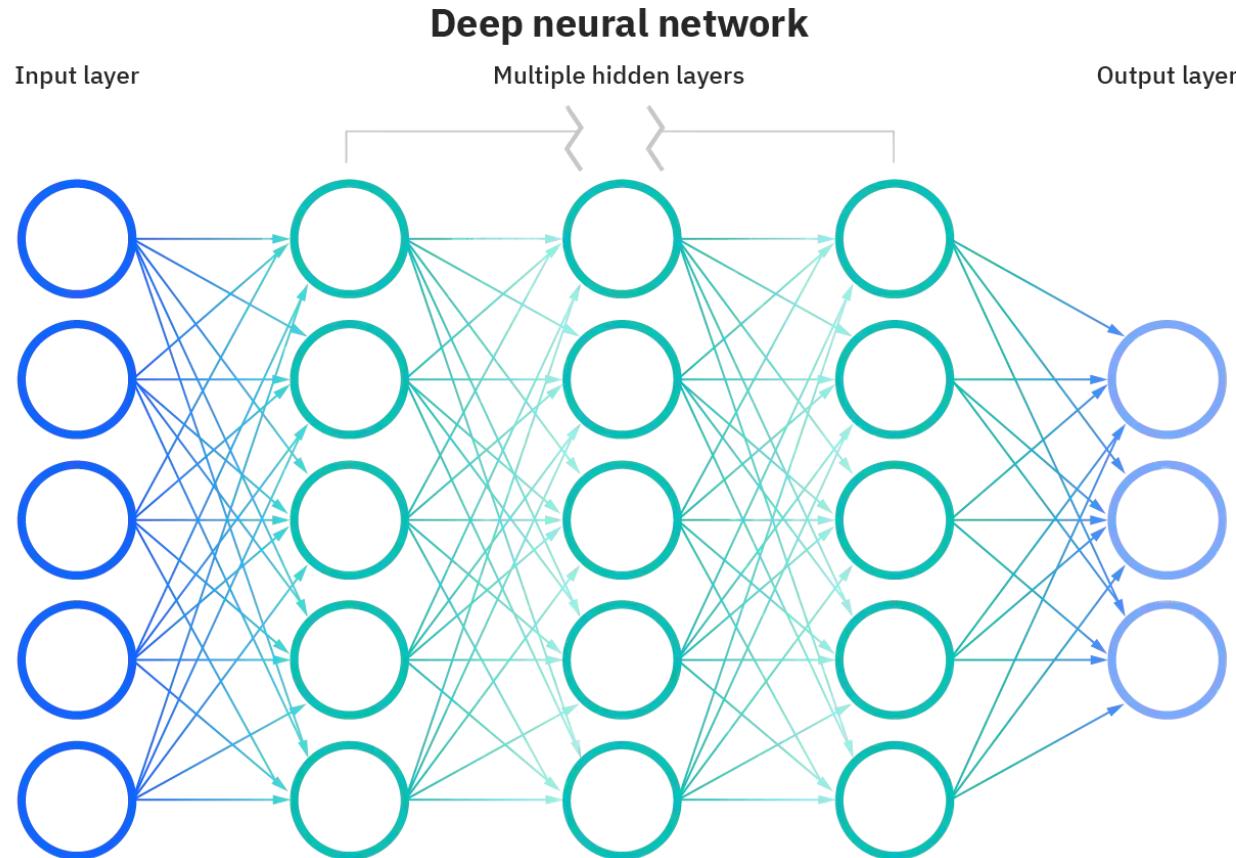
<https://pair.withgoogle.com/explorables/fill-in-the-blank/>

2. Read the article and play around with the interactive demo.

3. What works surprisingly well? What looks flawed by societal bias? Where do you see limits of large language models?

Modern AI = DL

How does Deep Learning look like?



Simplified illustration of a Neural Network. Arrows are weights.

How does Deep Learning work?

Deep Learning **works** like a huge bureaucracy

1. **start** with **random** prediction
2. **blame** units for contributing to **wrong predictions**
3. **adjust** units based on the accounted blame
4. **repeat** the cycle



train with **gradient descent**, a series of **small steps** taken **to minimize an error function**

Current State of Deep Learning

Extremely powerful but ... (Bengio, Lecun, and Hinton 2021)

- great at **learning patterns**, yet reasoning in its infancy
- requires tons of data due to inefficient learning
- generalizes poorly

Limitations of data-driven Deep Learning

„This sentence contains 37 characters.“

„Dieser Satz enthält 32 Buchstaben.“

AL

Translate this sentence into German: „This sentence contains 37 characters.“



„Dieser Satz enthält 37 Zeichen.“

AL

Sind es immer noch 37 Zeichen?



Ja, es sind immer noch 37 Zeichen. Die Übersetzung des Satzes hat keine Auswirkung auf die Anzahl der Zeichen im Originalsatz.

Doubts about practical implications?

The screenshot shows the Google Translate interface comparing English and German translations of several sentences. The English input includes statements about flatmates being smart and beautiful, an engineer getting a promotion, and a child carer going to the zoo and getting a promotion. The German output shows a clear gender bias, where female gender is consistently applied to both the flatmate and the child carer, while the male engineer is the only one not gendered.

Text input (English):

- Your flatmate is smart.
- Your flatmate is beautiful.
- The engineer gets a promotion.
- The child carer goes to the zoo with the kids.
- The child carer gets a promotion.

Text output (German):

- Dein Mitbewohner ist schlau.
- Deine Mitbewohnerin ist wunderschön.
- Der Ingenieur wird befördert.
- Die Kinderbetreuerin geht mit den Kindern in den Zoo.
- Der Kinderbetreuer bekommt eine Beförderung.

Feedback options: [Send feedback](#)

Gender bias in Google Translate

Biased Data and beyond

«Raw data is an oxymoron.»

Gitelman (2013)

Three Sides of the AI Coin

Explaining vs Solving vs Tracking

- conduct research to **understand**
- **automate** tedious tasks
- **track** people for profit or political reasons

Fair is a Fad

- companies also engage in fair AI to avoid regulation
- **Fair and good – but to whom?** (Kalluri 2020)
- lacking democratic legitimacy

«Don't ask if artificial intelligence is good or fair, ask how it shifts power.»

Kalluri (2020)

Data represents real life.

Don't be a fool. Be wise, think twice.

Algorithmic Management of Labour Force

AI Composing an email announcing a 9% reduction in headcount. Include a quote of Martin Luther King to ensure ongoing spirit of the stuff.

 Subject: Important Announcement Regarding Our Workforce Like Dislike

Dear Team,

As you are aware, our company has been facing challenges in the current economic climate. As a result, we have had to make difficult decisions in order to ensure the long-term stability and success of our organization.

It is with a heavy heart that I must inform you that we will be reducing our workforce by 9%. This decision was not made lightly and was done in the best interest of the company. We understand the impact this will have on our team and we will do everything we can to support those affected during this transition.

But even in the darkest of times, hope remains. As Martin Luther King Jr. said, "The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands at times of challenge and controversy." We must remember that we are all in this together and that we will come out stronger on the other side.

We value each and every one of you and we are committed to continuing to provide opportunities for growth and development within our organization. We will be providing more information in the coming days about the specific details of the reduction and how it will be implemented.

Thank you for your dedication and hard work.

Best,
[Your Name] ⟳ Regenerate response

Text generation may be used to communicate difficult decisions strategically



Questions?

References

- Bender, Emily M., Timnit Gebru, Angelina McMillan-Major, and Shmargaret Shmitchell. 2021. "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? " In *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, 610–23. Virtual Event Canada: ACM. <https://doi.org/10.1145/3442188.3445922>.
- Bengio, Yoshua, Yann Lecun, and Geoffrey Hinton. 2021. "Deep Learning for AI." *Communications of the ACM* 64 (7): 58–65. <https://doi.org/10.1145/3448250>.
- Church, Kenneth, and Mark Liberman. 2021. "The Future of Computational Linguistics: On Beyond Alchemy." *Frontiers in Artificial Intelligence* 4. <https://doi.org/10.3389/frai.2021.625341>.
- Colyer, Adrian. 2016. "The Amazing Power of Word Vectors." *the morning paper*. 2016. <https://blog.acolyer.org/2016/04/21/the-amazing-power-of-word-vectors/>.
- Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova. 2019. "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." <http://arxiv.org/abs/1810.04805>.
- Firth, John R. 1957. "A Synopsis of Linguistic Theory, 1930-1955." In *Studies in Linguistic Analysis: Special Volume of the Philological Society*, edited by John R. Firth, 1–32. Oxford: Blackwell. <http://ci.nii.ac.jp/naid/10020680394/>.
- Gitelman, Lisa. 2013. *Raw Data Is an Oxymoron*. Cambridge: MIT.
- Kalluri, Pratyusha. 2020. "Don't Ask If Artificial Intelligence Is Good or Fair, Ask How It Shifts Power." *Nature* 583 (7815, 7815): 169–69. <https://doi.org/10.1038/d41586-020-02003-2>.
- Manning, Christopher D. 2022. "Human Language Understanding & Reasoning." *Daedalus* 151 (2): 127–38. https://doi.org/10.1162/daed_a_01905.
- Mikolov, Tomas, Ilya Sutskever, Kai Chen, Greg S. Corrado, and Jeff Dean. 2013. "Distributed Representations of Words and Phrases and Their Compositionality." In *Advances in Neural Information Processing Systems*, 3111–19.
- OpenAI. 2023. "GPT-4 Technical Report." March 27, 2023. <http://arxiv.org/abs/2303.08774>.
- Peterson, Joshua C., Stefan Uddenberg, Thomas L. Griffiths, Alexander Todorov, and Jordan W. Suchow. 2022. "Deep Models of Superficial Face Judgments." *Proceedings of the National*