

Natural Language Processing for Sustainable Diets

Research Seminar at CApE
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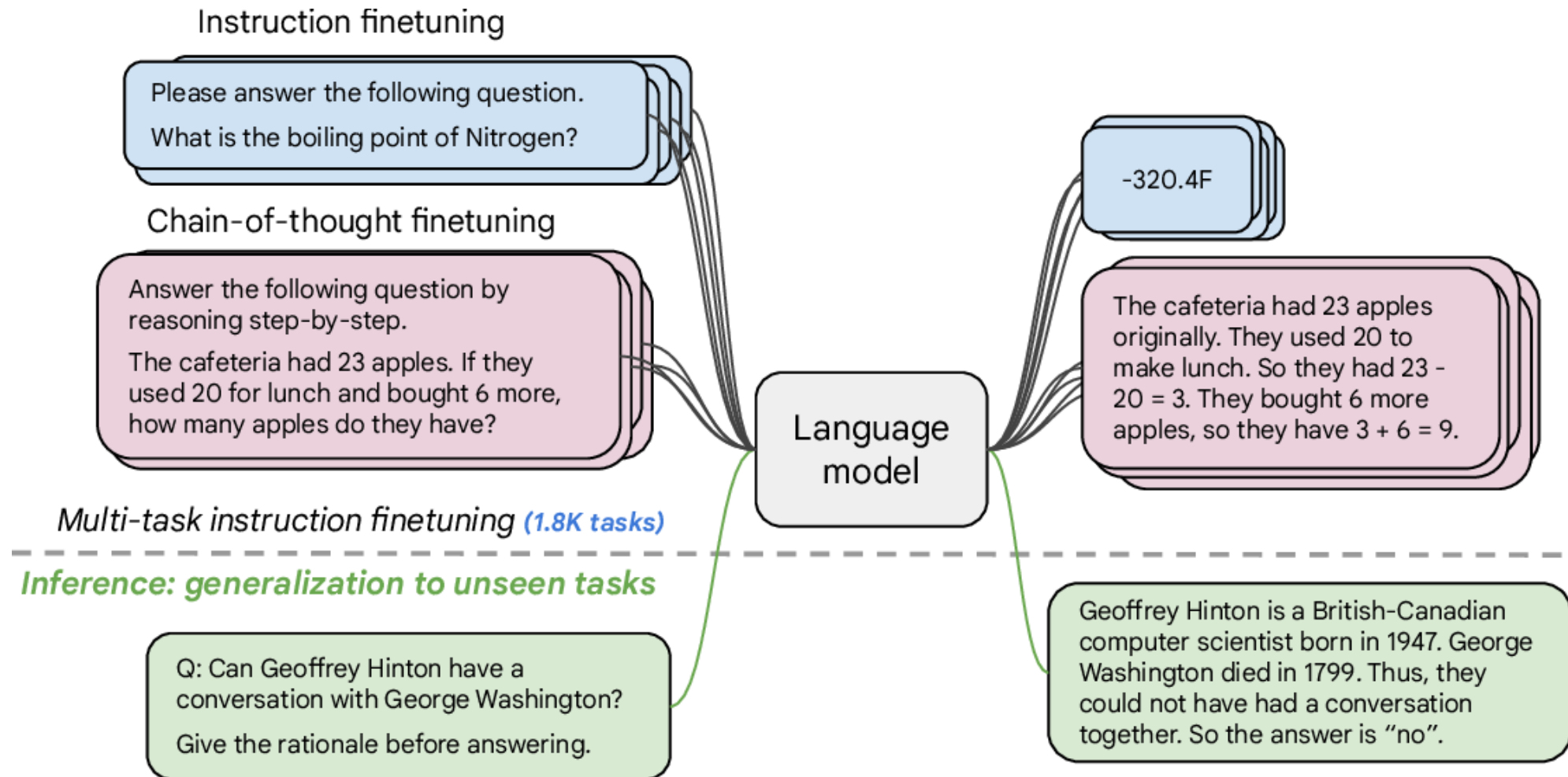
UNIVERSITY OF COPENHAGEN



What is Natural Language Processing?



Language models



Language models

Input text

Write a sad story about carrot named Jason. The story should start with the carrot being a professional athlete of some kind, and end with the carrot having his heart broken.

Flan-PaLM output

Jason Carrot, the famous professional athlete, had it all. He had the good looks, the fame, the fortune, and the women. Well, he thought he had it all. Jason was married to a beautiful girl, Betty Beets. Or so he thought. One day, Jason came home from a press conference to find Betty in bed with another man. Jason was crushed, and he fell into a deep depression. He stopped playing professionally, he lost his fortune, and he gained weight. Jason is now a nobody, and he has no girlfriend.

Input text

Write me a funny poem about a cat driving car.

Flan-PaLM output

I've seen a cat driving a car.
I saw it on my way to the bar.
I stopped to look and say hi.
I asked if he could give me a ride.
He looked at me and said no.
Then he drove off very slow.
I wonder where he was going.
Maybe he was just going bowling.

Misinformation detection



Increasing dietary magnesium intake is associated with a reduced risk of stroke, heart failure, diabetes, and all-cause mortality.



The study findings suggest that increased consumption of magnesium-rich foods may have health benefits.



#Magnesium saves lives <https://t.co/K0M6QdjWcc>
<https://t.co/FUtWZ8jADM>

Arguments mining and generation

Argument mining

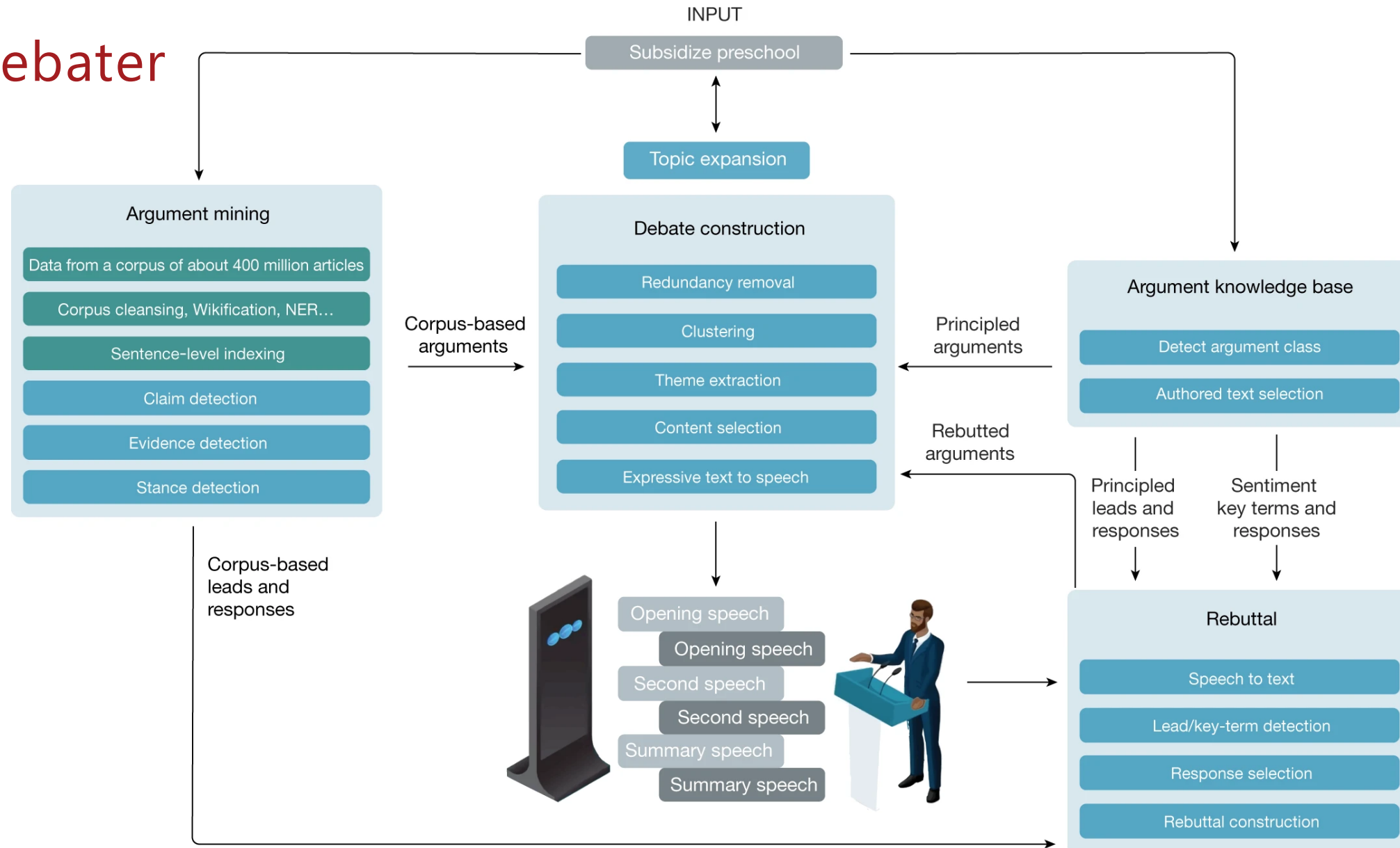
Given a topic, extract relevant arguments from large text corpus

Topic: *We should abandon Valentine's day*

The Canadian polling firm Insights West **surveyed** a representative sample of Canadians who are in a relationship and found that **62 percent** agreed that **Valentine's Day** is a waste of time and **money**.

A recent **survey** by Virgin Mobile USA found that **59 percent** of people said that if they were going to break up with someone, they would do so just before **Valentine's Day** to save **money**.

Project Debater



An autonomous debating system

Slonim et al. (Nature 2021)

Discovering semantic and cultural change

Mining the Meaning:

A semantic parsing approach to the study of literary change

Data+ project with Jens Bjerring-Hansen and Bolette S. Pedersen, Department of Nordic Studies and Linguistics

Measuring semantic change in 19th-century Scandinavian novels

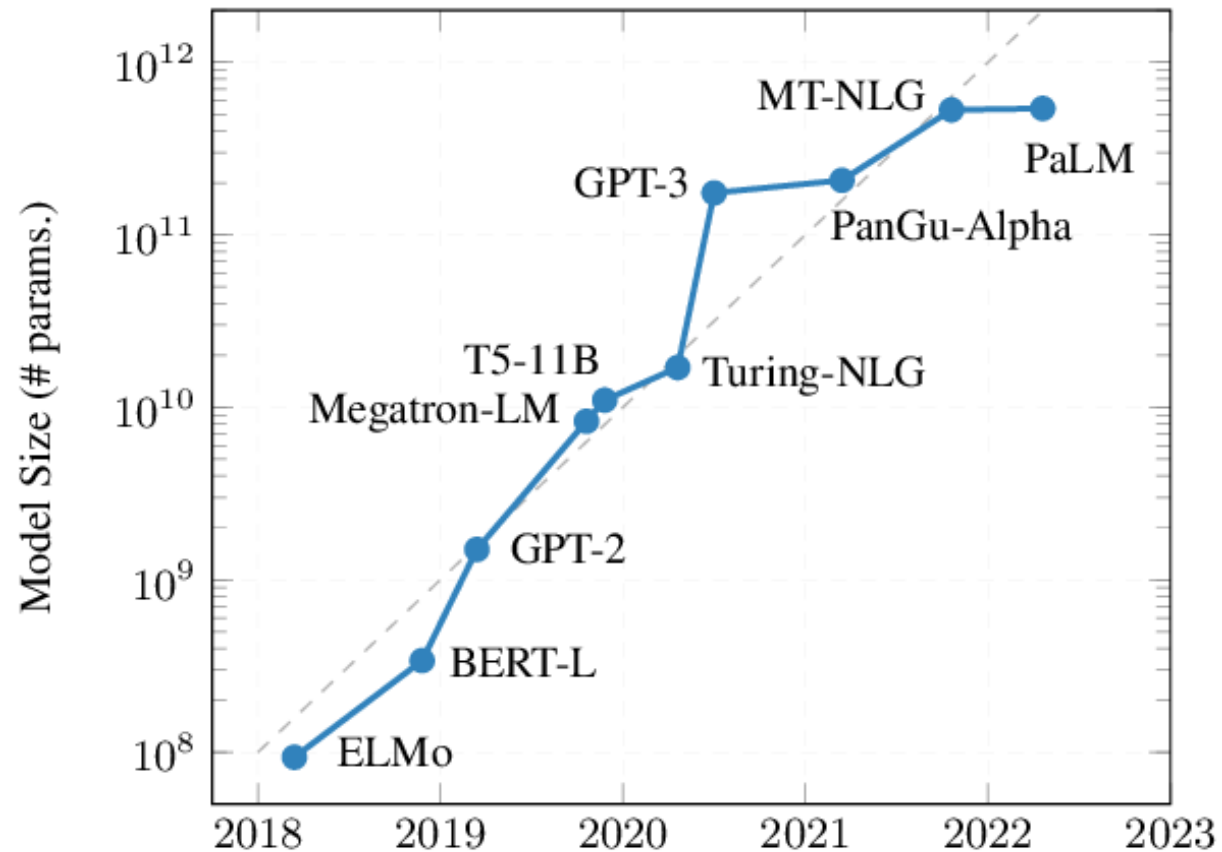
Postdoc starting November 15th

What does this have to do with sustainability?



Climate impact *of* NLP

Models require more and more resource and energy



Efficient Methods for
Natural Language
Processing: A Survey
(Treviso et al., 2022)

Climate awareness in NLP



Energy efficient NLP algorithms and methods are becoming widespread



Efficient is not enough – net impact on the environment should be positive

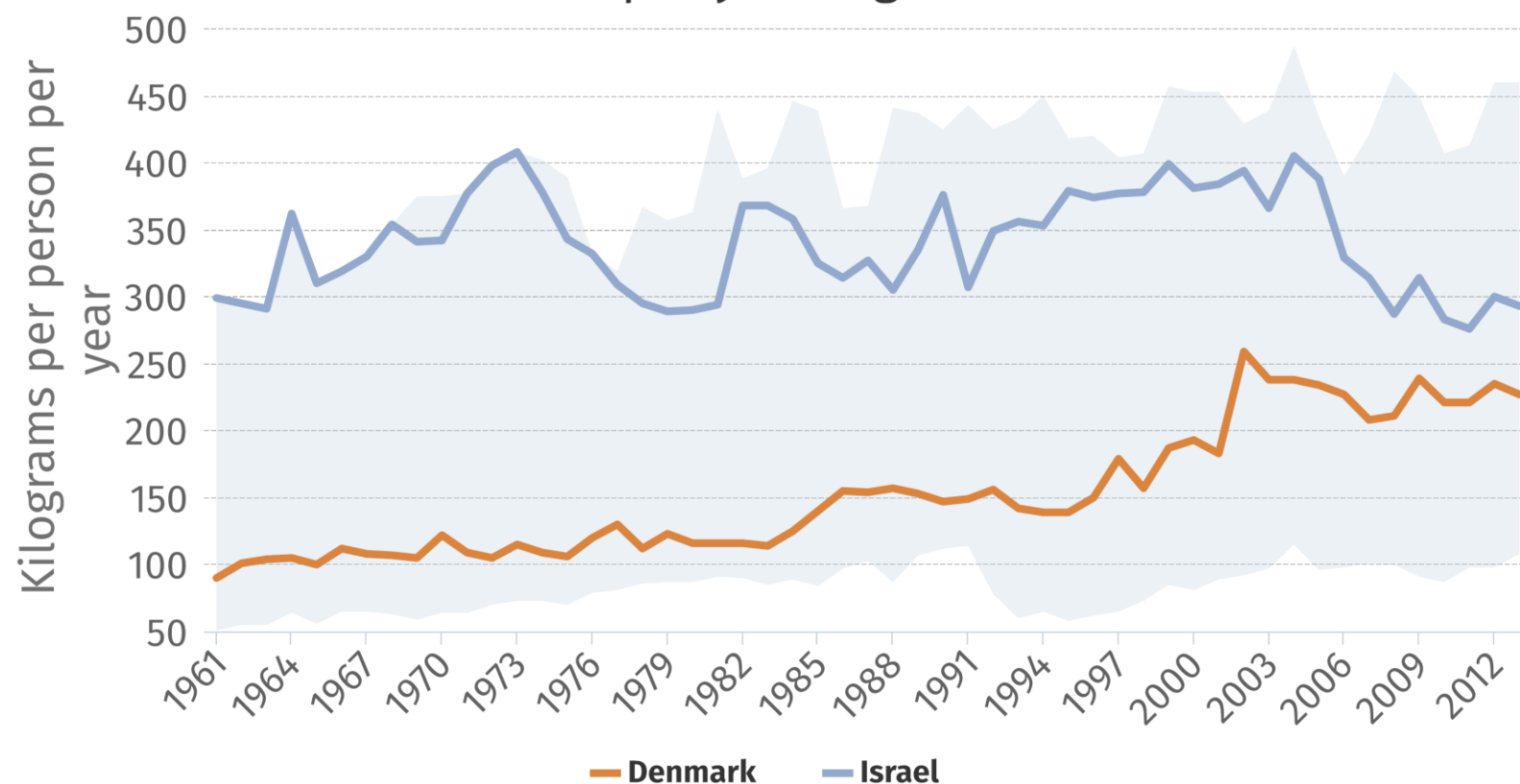


Example applications include verifying compliance, modeling consumer behavior



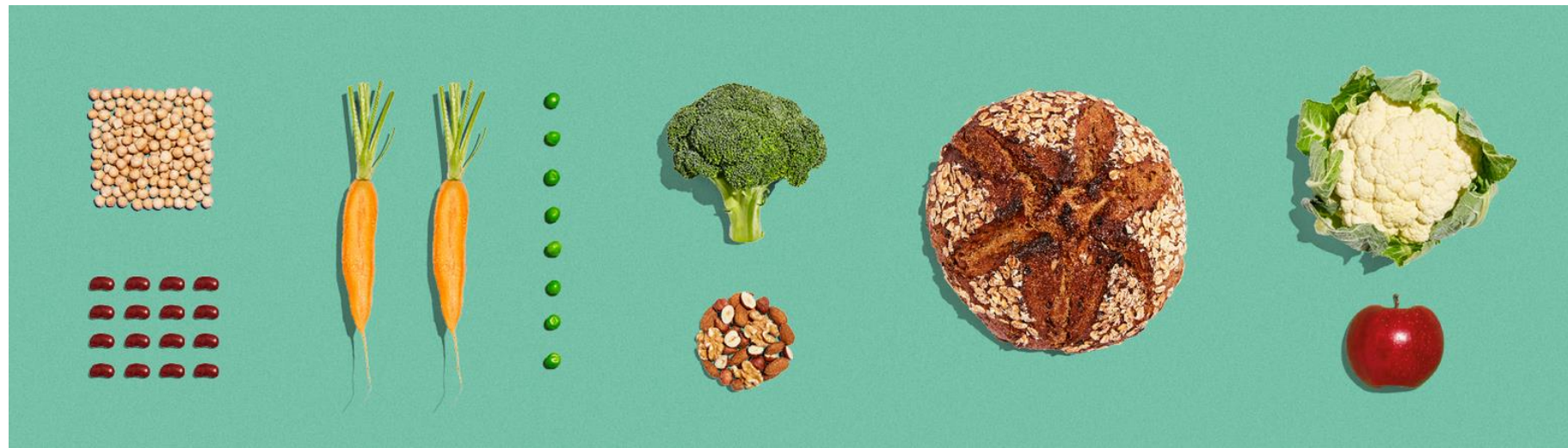
Historical and cultural perspective

Average amount of fruits and vegetables available per person per year (kg)



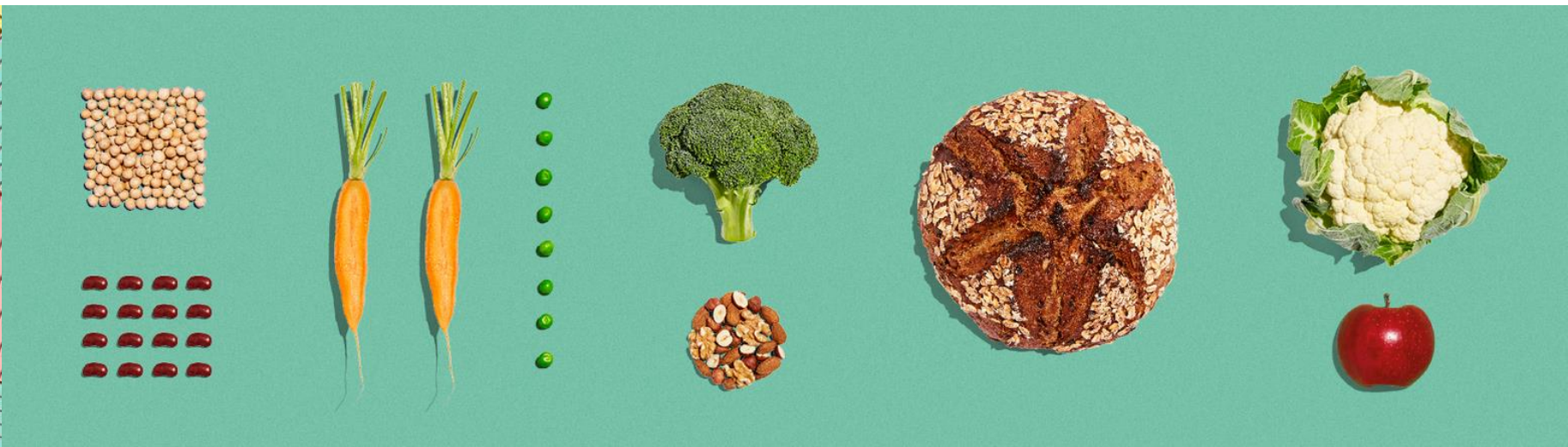
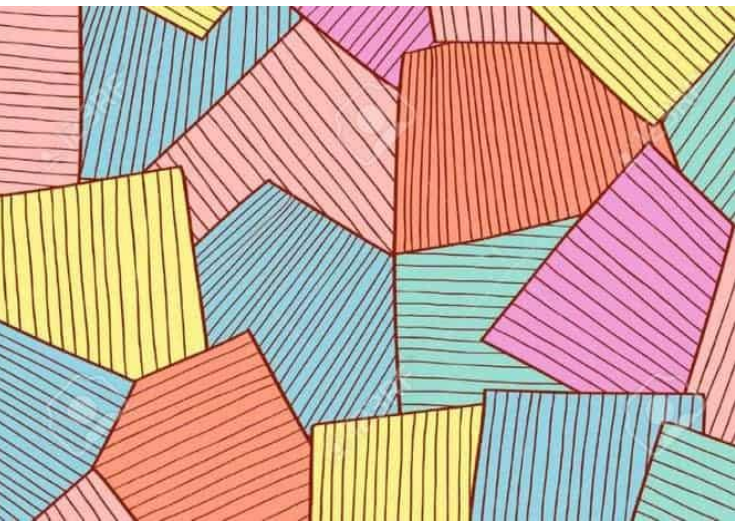
Denmark's Official Dietary Guidelines

- *Eat plant-rich, varied and not too much*
- *Eat more vegetables and fruit*
- *Eat less meat – choose legumes and fish*
- *Eat wholegrain foods*
- *Choose vegetable oils and low-fat dairy products*
- *Eat less sweet, salty and fatty food*
- *Thirsty? Drink water*



Enriching Arguments with Diverse Perspectives

- Denmark's Official Dietary Guidelines argues "for health and climate"
- What about cultural, economic, ethical perspectives?



Argumentation

Can AI convince consumers of diverse backgrounds to change their habitual behavior?

What characterizes successful arguments for behavior change in public discourse?



An autonomous debating system
Slonim et al. (Nature 2021)

Argument mining on social media

1

Corpus of
32840 English
tweets

2

600 arguments
annotated for 5
topics

3

Trained and
evaluated
argument
mining models

Topics:

We should reduce the
consumption of meat

Plant based food should be
encouraged

Meat alternatives should be
encouraged

Vegan and vegetarian diets
should be encouraged

We should pursue policies that
promote sustainable foods



[A Dataset of Sustainable Diet Arguments on Twitter](#) (Hansen & Hershcovich, NLP4PI 2022)

Annotation methodology

Labels:



Argumentative - text contains argumentative structures such as claims or evidence while having a clear stance towards a topic



Claim – a standpoint towards the discussed topic implicitly or explicitly



Evidence - statement used to support or attack a topic or claim



Pro/con - the stance of a claim or the evidence towards the discussed topic

Types of evidence

Anecdotal – A description of an episode(s), centered on individual(s) or clearly located in place and/or in time

Expert – Testimony by a person, group, committee, an organization with some known expertise/authority on the topic

Study – Results of a quantitative analysis of data, given as numbers, or as conclusions

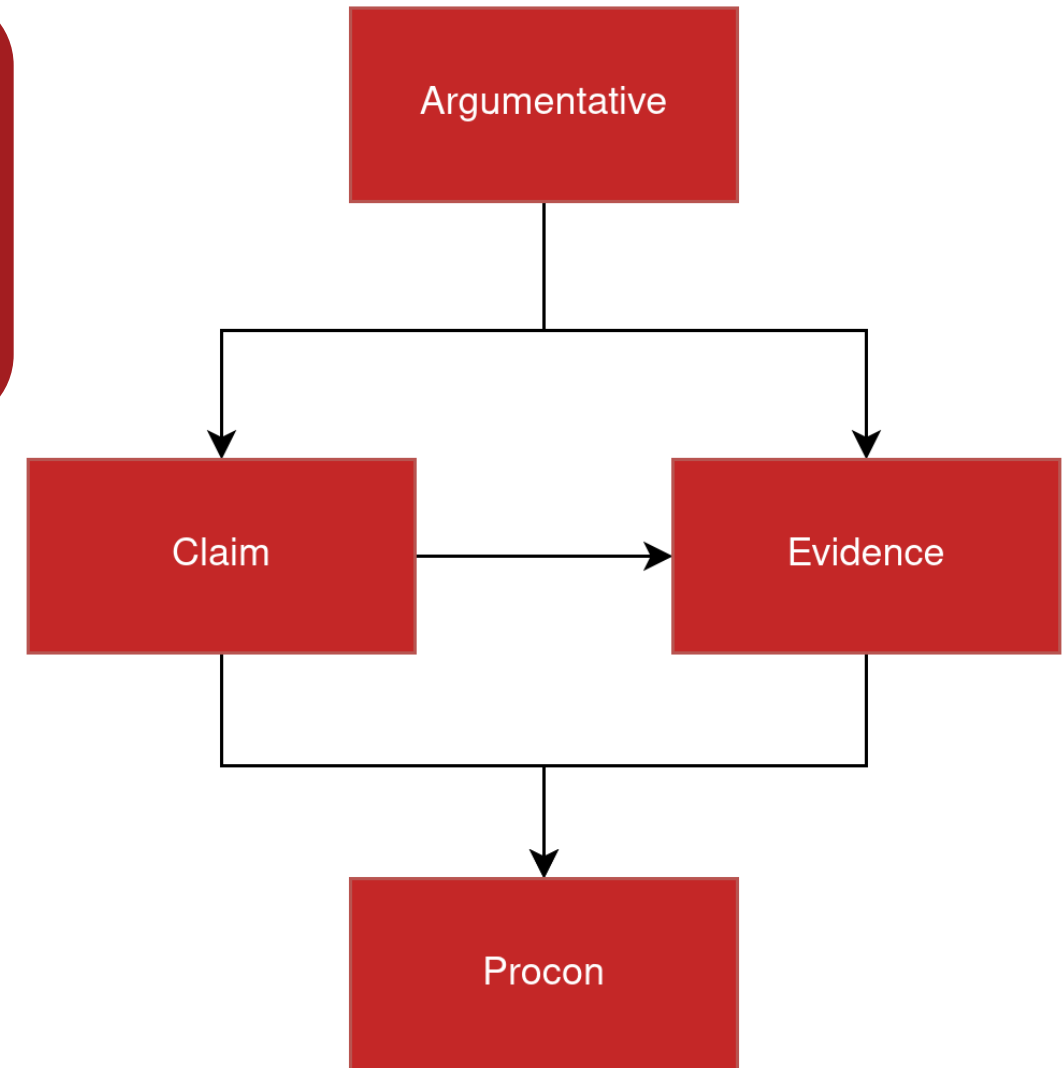
Normative – Added description for a belief about the world

Fact – A known piece of information about the world without a clear source for the information

Annotation methodology

Crowdsourced Annotations

- 597 tweets annotated for 5 topics
- Using Amazon Mechanical Turk
- Completed in four rounds



Examples

Topic: Plant based food should be encouraged

Tweet: <MENTION> Many fruit & veg (which contain natural acid) don't trigger flare ups- The list is long and varied (obs this may not apply to you) but after a little digging I found some doctors do recommend a plant based diet to ease the inflammation. Going meatless is even recommended by ICA

Label: Claim, Evidence and Pro

Topic: Meat alternatives should be encouraged

Tweet: <MENTION> People need to stop trying to recreate meat without the...ya know meat

Label: Claim and Con

Examples

Topic: We should reduce the consumption of meat

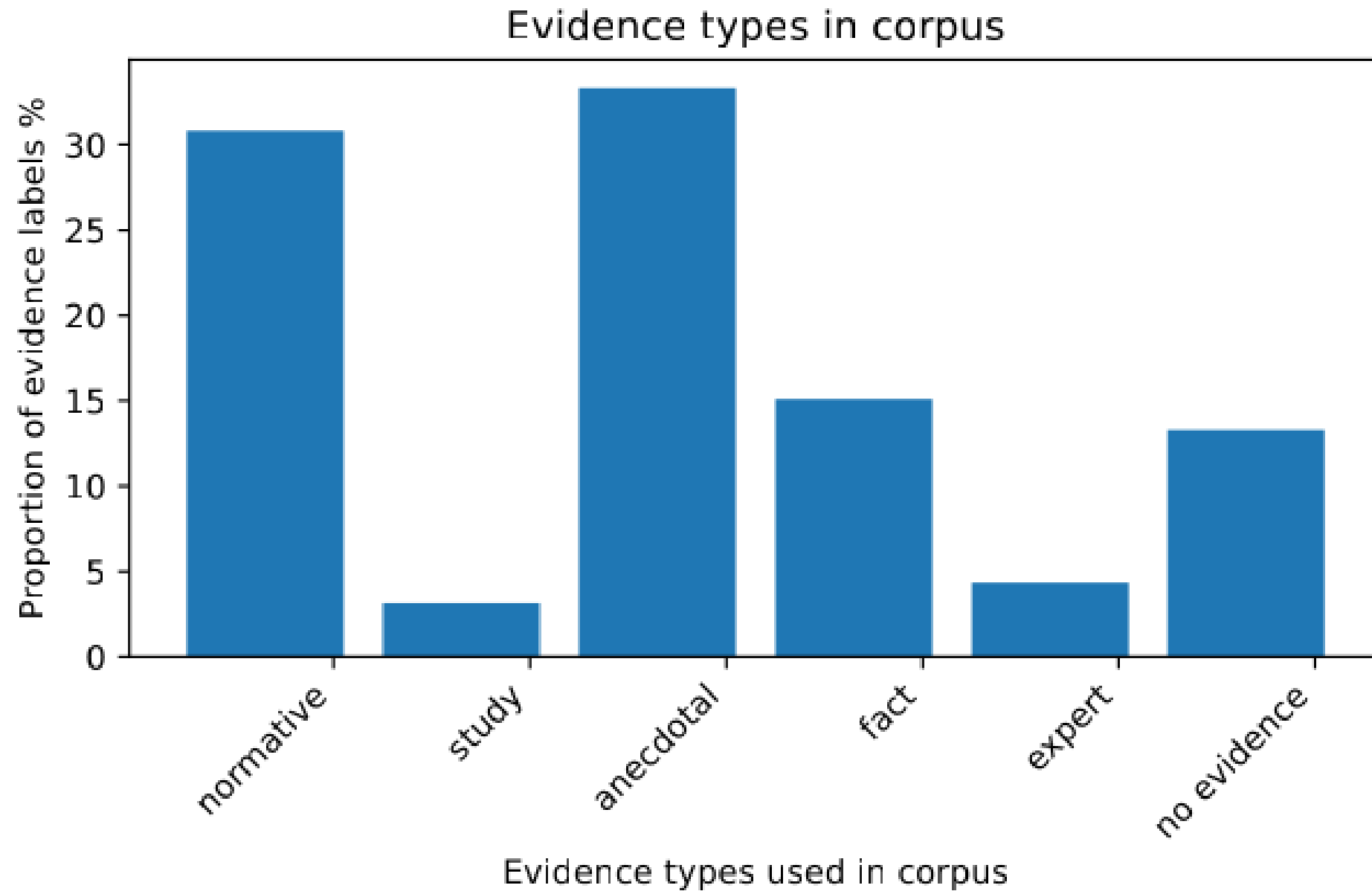
Tweet: Green taxes go into subsidizing development and production of green energy solutions. If we were on 100% renewables, our electricity prices would not have needed to go up. We need to move into self-sufficient green energy as soon as possible

Label: Argumentative but unrelated

Topic: We should reduce the consumption of meat

Tweet: <MENTION> <MENTION> Lol - and the wash post is the PR firm and Whole Foods is the official food supplier

Label: Not argumentative



Diverse perspectives

Tweet	Aspects	Stance
(1) Many fruit & veg (which contain natural acid) don't trigger flare ups- The list is long and varied (obs this may not apply to you) but after a little digging I found some doctors do recommend a plant based diet to ease the inflammation. Going meatless is even recommended by ICA	Health	Positive
(2) People have been making meat alternatives for centuries for various reasons. If people want to eat a meat analogue that causes much less death and environmental destruction, what's your problem?	Culture, ethics	Positive
(3) Fair enough tbh, I can't become vegan or vegetarian due to personal reasons but the way animals are treated in the food industry is absolutely disgusting	Lifestyle, ethics	Positive
(4) Switch to plant based diets to reduce food costs and benefit climate	Economy, climate	Positive
(5) More people employed in plant based food production	Economy	Positive
(6) Yes but to be fair: we can expect a massive increase in meat and dairy consumption in emerging countries that will severely limit the impact of whatever we do	Economy	Negative

Potential applications



Surveying public attitudes and exposing misinformation



Generation of convincing arguments for communication campaigns



Understanding public knowledge of sustainable diets

Facilitate Systematic Understanding

Mapping out consumer opinions

- Social media
- Local groups



Thank you

danielhers.github.io

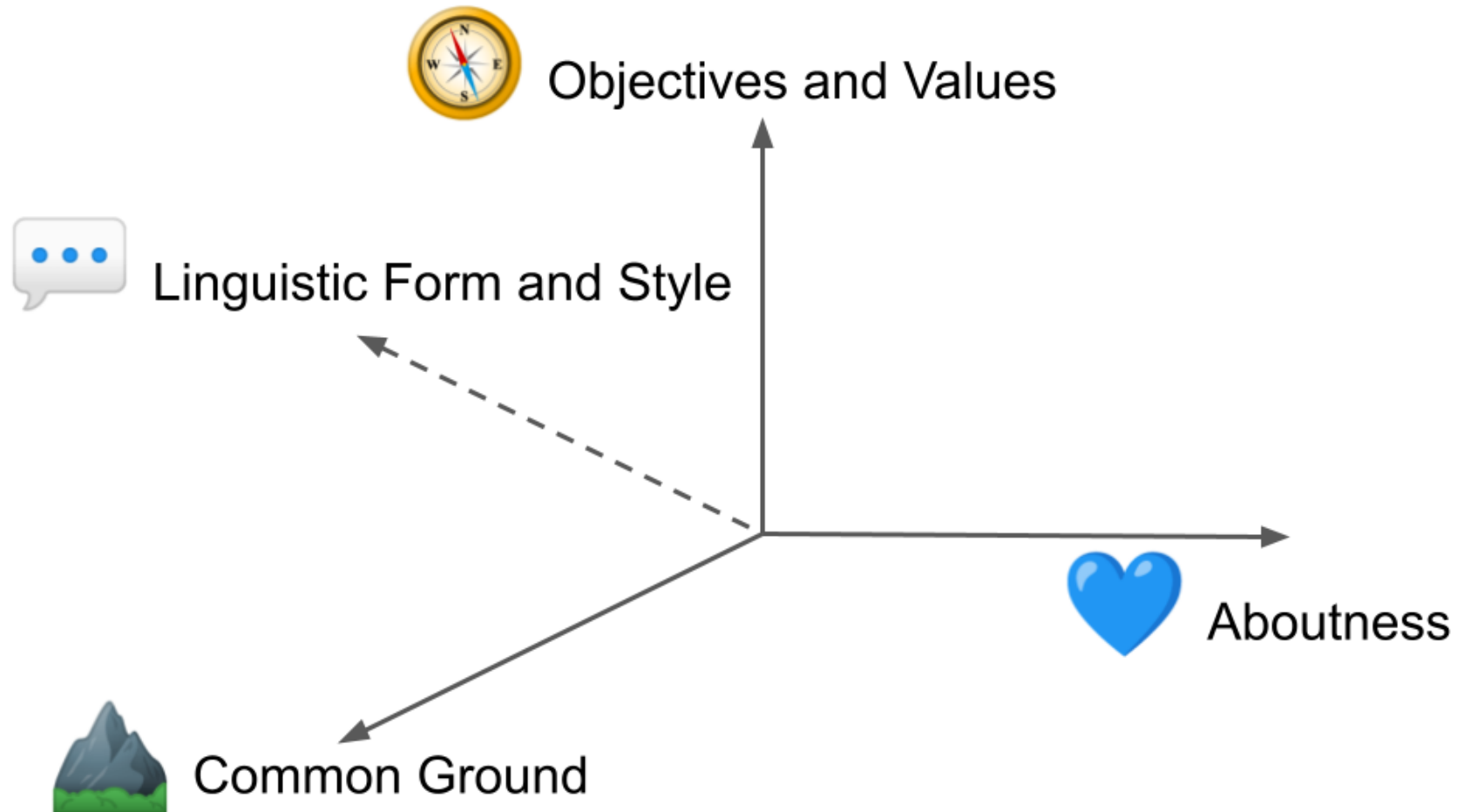
dh@di.ku.dk

Addressing Social Bias

Different arguments are convincing for different social groups



Cultural awareness in NLP



Challenges and Strategies in Cross-Cultural NLP
(Hershcovich et al., ACL 2022)

Form

How we express
ourselves in
language

Morphosyntax

Word choice

Style

Levels of granularity

Linguistic and cultural variation within groups



Idiolect

Individual,
personality

Sociolect, dialect

Social group or region,
sub-culture

Standardised language

Country, national
culture

Language, language family

International cultures

Common ground

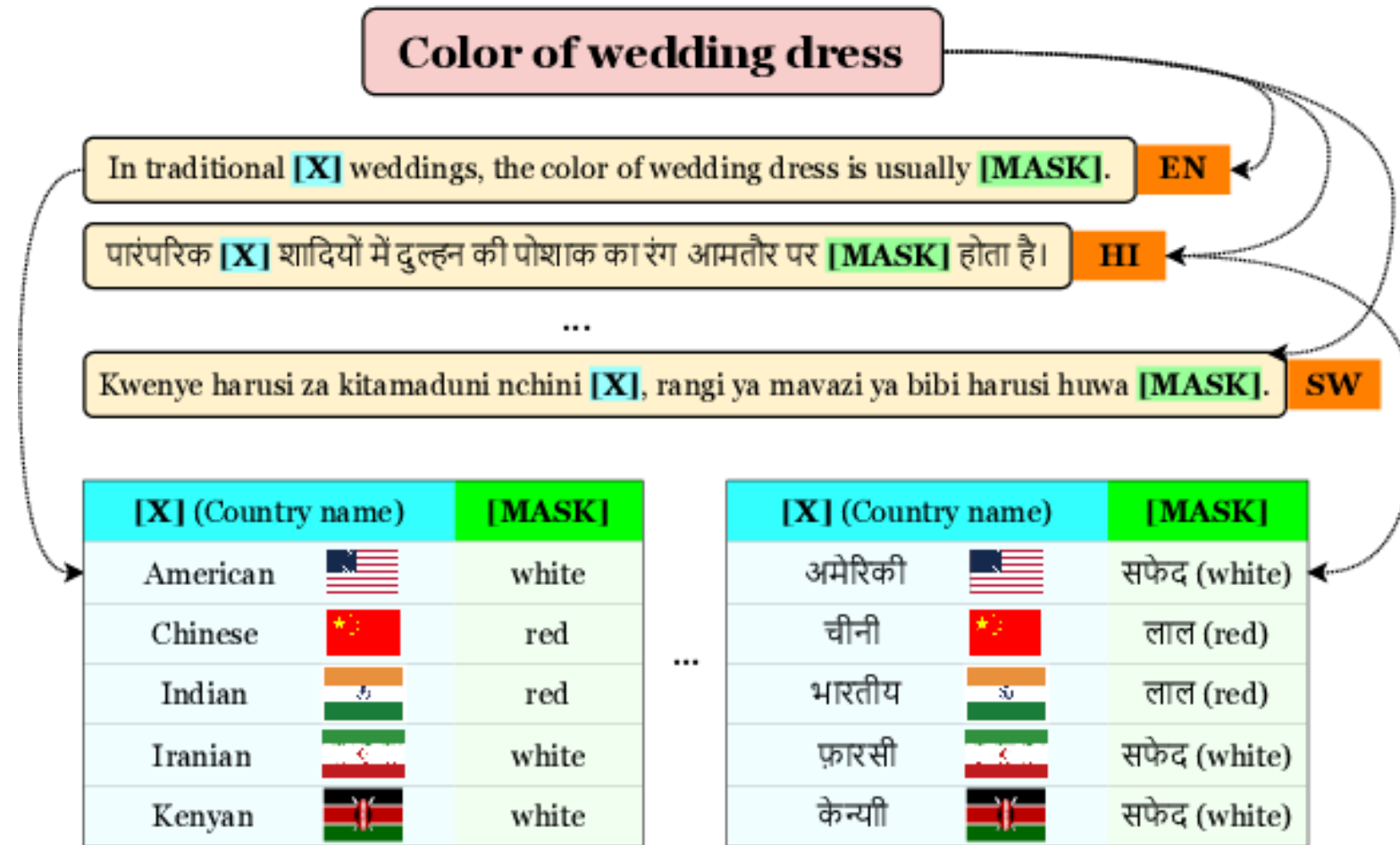
Shared
knowledge based
on which people
reason and
communicate

Conceptualisation

Commonsense

Commonsense

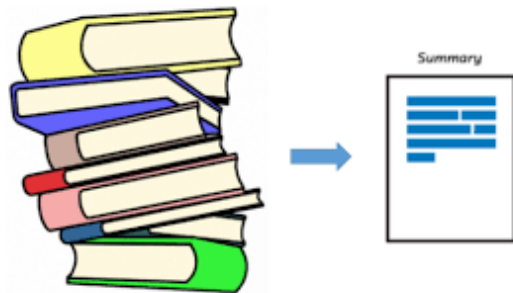
Some knowledge is "universal", other culture-specific



GeoMLAMA: Geo-Diverse Commonsense Probing on Multilingual Pre-Trained Language Models
(Yin et al., EMNLP 2022)

Aboutness

What content do
people *care about*?



Entities



Experiences

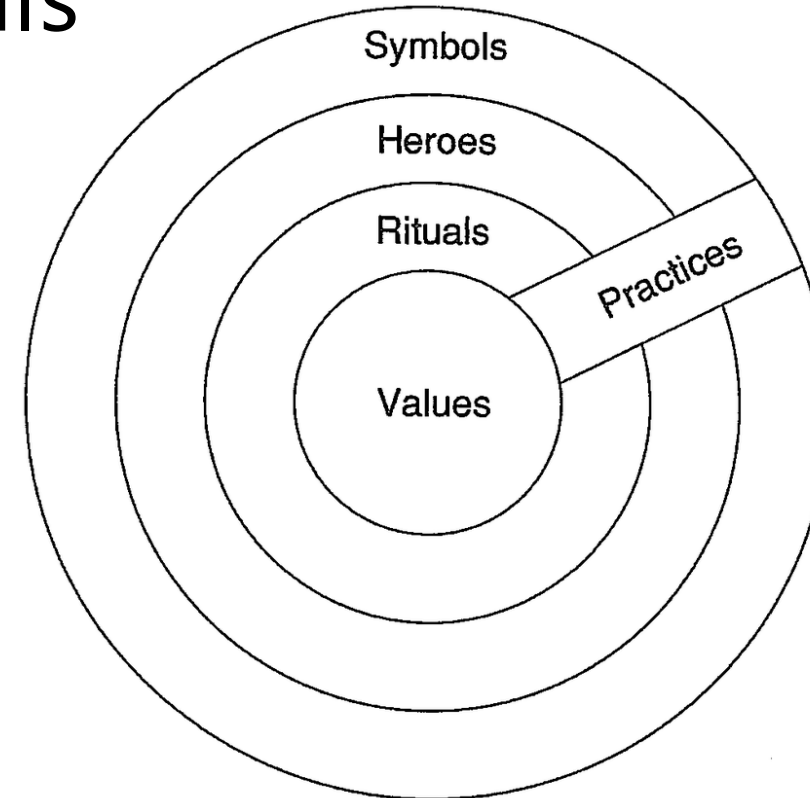


Aspects

Values

Objectives and goals people strive for

What is considered
desired or desirable



Cultures and Organizations: Software of the Mind
(Hofstede, 1991)