ML4CC: Lecture 8

Sit with your discussion groups (same as last time)!

Assignments reminder

Keep doing your PMIRO+Q

Your third coding assignment is due Friday, March 20th by 8am.

Your project plan assignment is due April 1st by 11:59pm.

Climate Change in the News

The climate blow from Trump's Canadian tariff war

By **ARIANNA SKIBELL** | 03/11/2025 06:00 PM EDT

In response to Trump imposing a 25 percent tariff on the nation's northern neighbor last week, Ontario had implemented a levy on power exports to some U.S. states, and threatened to withhold electricity altogether if Trump didn't back down.

Trump shot back this morning, announcing plans to double tariffs on Canadian steel and aluminum imports to 50 percent. Those levies would have taken effect tomorrow, Trump said on his social media platform Truth Social.

Ontario Premier Doug Ford then told MSNBC he had no plans to reverse course. "We will not back down," Ford said. "We will be relentless."

If the momentary truce ends and Quebec follows Ontario's lead, it could be bad news for New England, potentially costing $66 million to $165 million in annual import duties, according to an estimate from the New England's grid operator.

Phillip Barlett, Maine's top utility regulator, called the situation "destabilizing."

"If we end up subject to significant export tariffs from Canada, or they're unwilling to send energy, that certainly impacts the reliability of the grid here," he told Ben.

As the once-friendly neighboring countries continue to one-up each other with the threat of increasingly higher tariffs, electric grid operators are concerned about the U.S. supply of hydropower and other electricity imported from Canada, writes Benjamin Storrow. The bulk of that imported electricity goes to Northeastern states in the form of hydropower. Other imports include power sources such as nuclear, wind and natural gas.

Imports have helped the U.S. region cut costs and shore up the grid by moving away from natural gas, which is more vulnerable to market spikes and winter shortages. Carbon-free hydropower is also key for helping New England meet its goal of reducing planet-warming pollution at least 80 percent below 1990 levels by midcentury. New York's target is an 85 percent reduction.

That's why Massachusetts and New York City spent years working to secure massive power lines through New England to carry hydropower from Quebec. The lines, which are both under construction, are slated to increase the amount of energy that can be transported from Canada by 36 percent.

But that power could be massively expensive or unavailable entirely if tensions escalate. The two countries have (for now) reached a mini-détente after a heated round of threats, agreeing late this afternoon to suspend existing and planned tariffs, write Ari Hawkins and Doug Palmer.

Climate Change in the News

NYU'S INDEPENDENT STUDENT NEWSPAPER | EST. 1973

WASHINGTON SQUARE NEWS

News Opinion Sports Culture Arts Multimedia Magazine Sponsored

Opinion: Turning climate anxiety into action

Climate change is perhaps the greatest existential threat to humanity, yet the pressure to solve this crisis can paralyze us before we find a solution.

Antonia Ang, Contributing Writer

March 7, 2025

LATEST

Hundreds protest ICE detainment of Mahmoud Khalil in Washington Square Park

Alex Woodworth and Amelia Hernandez Gioia • March 12, 2025

"Instead of only focusing on inevitable destruction, we need to **talk about progress**, resilience efforts, small wins and potential solutions — all of which encourage hope and action rather than avoidance. It's equally as important to openly talk about climate anxiety. Facing these issues as a community rather than alone, whether that be **through academic coursework**, local initiatives or campus-wide discussions, can be one of the most influential steps in addressing our collective distress."

Paper 6 Discussion

Tackling Climate Change with Machine Learning: workshop at ICLR 2023.

MINING EFFECTIVE STRATEGIES FOR CLIMATE CHANGE COMMUNICATION

Aswin Suresh EPFL
Lazar Milikic EPFL
Francis Murray EPFL
Yurui Zhu EPFL
Matthias Grossglauser EPFL

ABSTRACT

With the goal of understanding effective strategies to communicate about climate change, we build interpretable models to rank tweets related to climate change with respect to the engagement they generate. Our models are based on the Bradley-Terry model of pairwise comparison outcomes and use a combination of the tweets' topic and metadata features to do the ranking. To remove confounding factors related to author popularity and minimise noise, they are trained on pairs of tweets that are from the same author and around the same time period and have a sufficiently large difference in engagement. The models achieve good accuracy on a held-out set of pairs. We show that we can interpret the parameters of the trained model to identify the topic and metadata features that contribute to high engagement. Among other observations, we see that topics related to climate projections, human cost and deaths tend to have low engagement while those related to mitigation and adaptation strategies have high engagement. We hope the insights gained from this study will help craft effective climate communication to promote engagement, thereby lending strength to efforts to tackle climate change.

Attendance

Select one person from the group to go to fill out the attendance form (link in Brightspace)

Discussion Question 1

How precisely is tweet “engagement” defined? Do you think this is a good way to measure how effective communication is?

Sum of likes, retweets, and replies

and obtain pairs of tweets that were created within 7 days of each other and have a difference in engagement (sum of likes, retweets and replies) of 100 units or 10%, whichever is higher. This

People can engage with a tweet for many reasons, including to support it but also argue against it. This method collapses over different styles of engagement and has no means of measuring positive vs negative engagement.

Discussion Question 2

Why do the authors focus on the pairwise comparison of two tweets? What are the constraints they use to pick pairs? Do these constraints significantly impact the amount of data they can train on?

By comparing similar tweets with different content, they can isolate the impact of content

However, a significant challenge in building such models is the presence of confounding factors such as author popularity. A tweet might generate strong engagement because its author is popular rather than because of its engaging content. Another potential confounder is the change in public interest in climate change over time. For instance, tweets about climate change made around the time of extreme weather or a major climate change conference might receive greater attention than tweets at other times. We minimise the effect of such confounders by defining the task as comparing the engagement within a pair of tweets rather than predicting the engagement for a given tweet. The pair of tweets are chosen to be from the same author and from the same window in time.

A model trained to predict a single tweet's engagement would probably do well simply by guessing based on author popularity. By forcing the model to predict which of two tweets by the same author in the same time period gets more engagement, the model needs to learn the impact of tweet content

We use the Twitter API to obtain 8,041,921 tweets related to climate change created between January 1st 2021 and November 4th 2022. To decide whether a tweet is related to climate change, we check if it contains one of the keywords in the 'General' topic category of UN Global Pulse (2014), a taxonomy for studying climate change tweets. We keep only the tweets in English (94.28% of the dataset). For each tweet, we keep its full text, author and information about whether it contains URLs, hashtags, animated GIFS, images or videos. We also keep the public engagement metrics about the tweet, i.e. the number of likes, retweets and replies that it obtained.

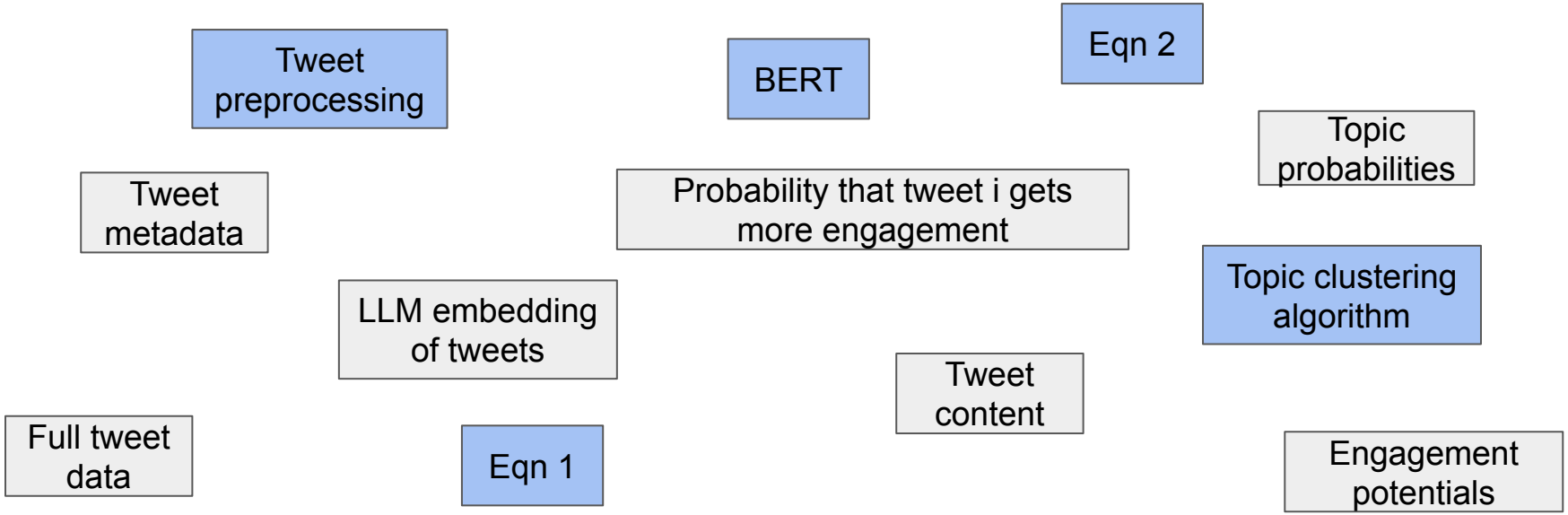
We then construct the pairs of tweets to compare. For each author, we go through their history and obtain pairs of tweets that were created within 7 days of each other and have a difference in engagement (sum of likes, retweets and replies) of 100 units or 10%, whichever is higher. This method of creating pairs ensures that we avoid confounding factors related to the author and time and minimise the noise in the comparison. We finally end up with 774,507 pairs of tweets which we use for training our engagement prediction model.

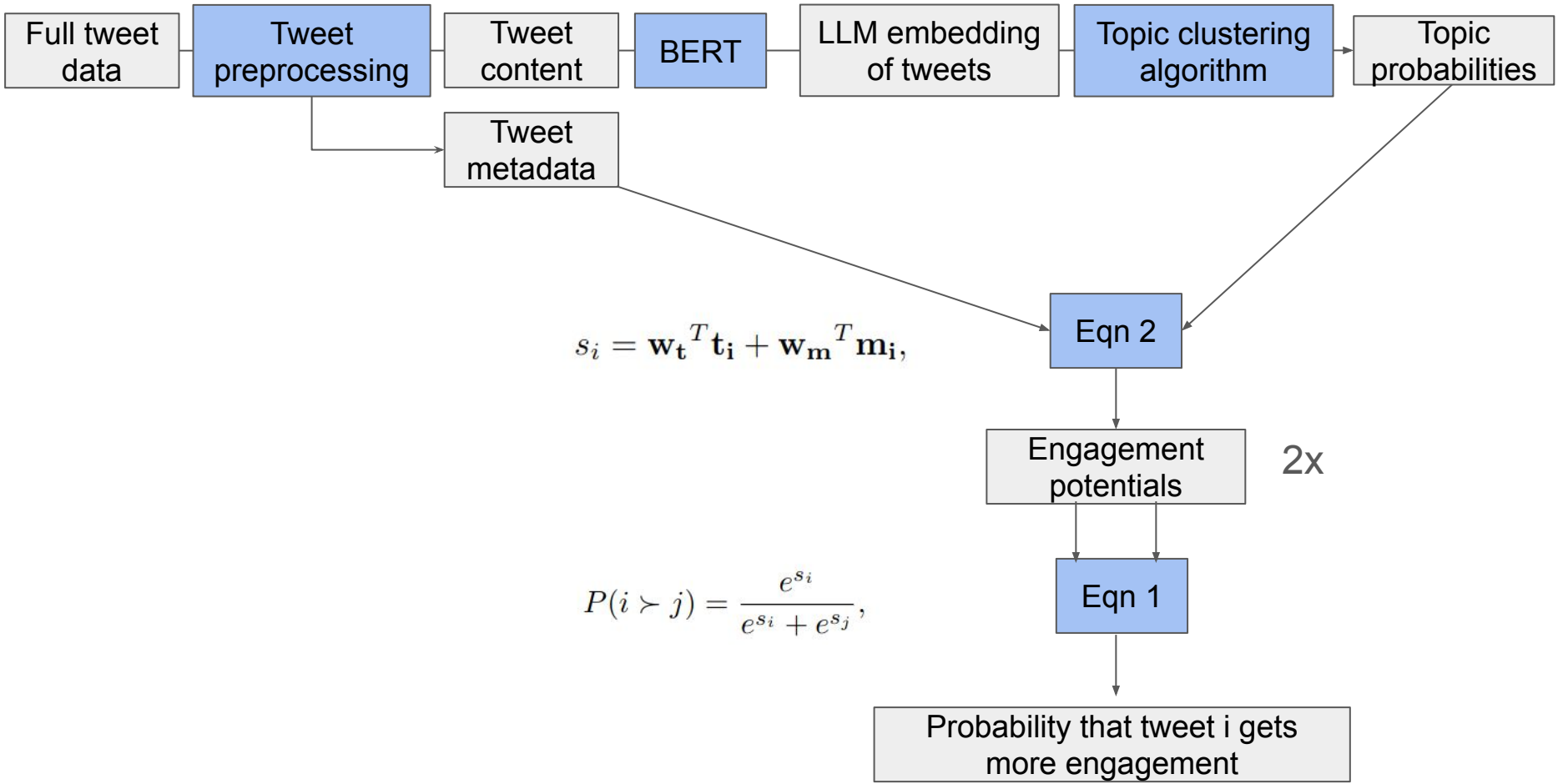
774,507 pairs is a lot less than the ~8,041,921^2 possible pairs.

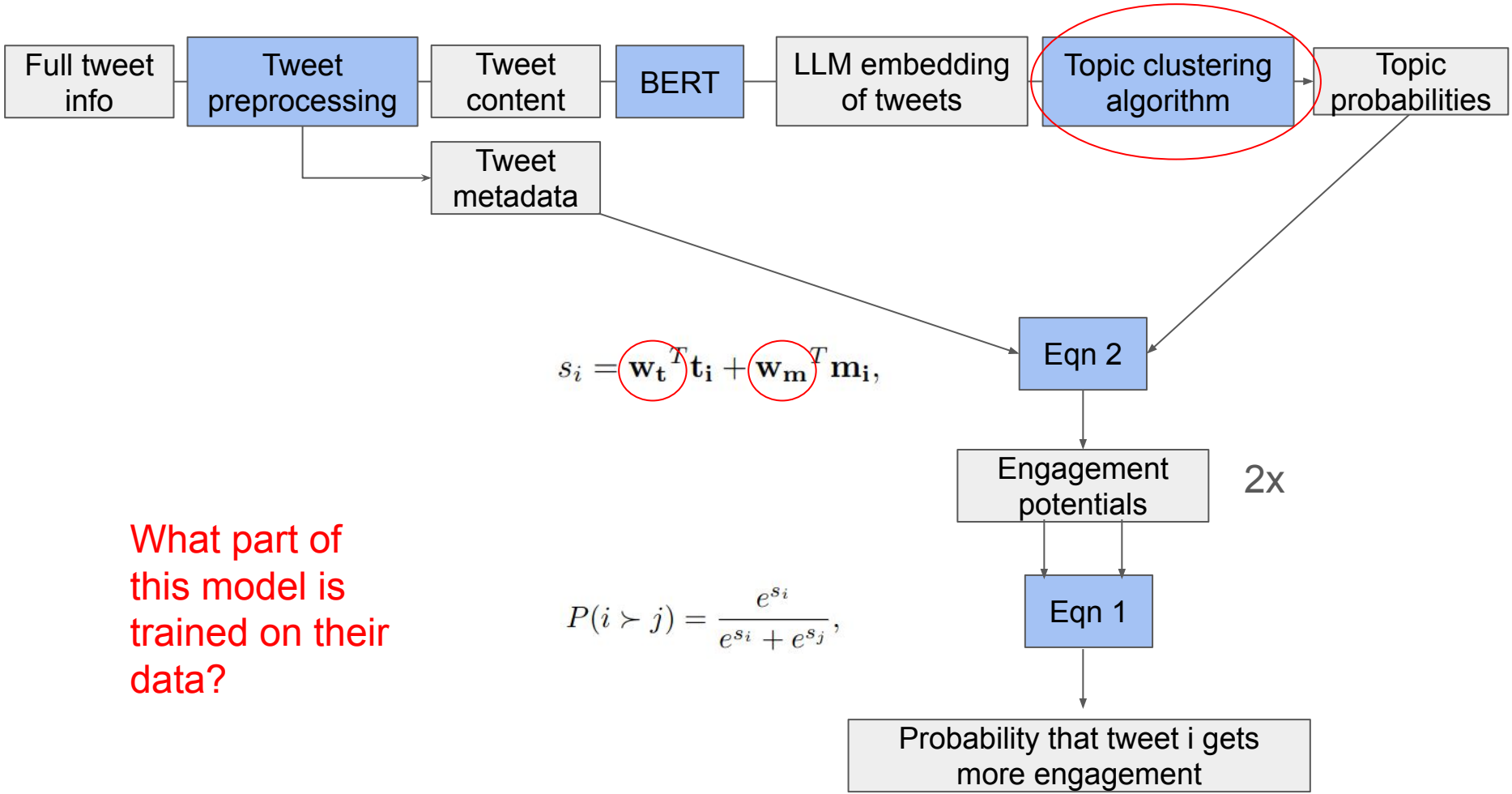
(but still a good amount of pairs)

Discussion Question 3

Draw a box and arrow diagram that explains the conceptual architecture of the model built in the paper. Make sure it includes the following boxes. Blue boxes represent functions/models and gray boxes represent data objects.




Full tweet data
Tweet preprocessing
Tweet content
BERT
LLM embedding of tweets
Topic clustering algorithm
Topic probabilities
Tweet metadata
$s_i = \mathbf{w_t}^T \mathbf{t_i} + \mathbf{w_m}^T \mathbf{m_i},$
Eqn 2
Engagement potentials
2x
$P(i \succ j) = \frac{e^{s_i}}{e^{s_i} + e^{s_j}},$
Eqn 1
Probability that tweet i gets more engagement


Full tweet info
Tweet preprocessing
Tweet content
BERT
LLM embedding of tweets
Topic clustering algorithm
Topic probabilities
Tweet metadata
$s_i = \mathbf{w_t}^T \mathbf{t_i} + \mathbf{w_m}^T \mathbf{m_i},$
Eqn 2
Engagement potentials
2x
What part of this model is trained on their data?
$P(i \succ j) = \frac{e^{s_i}}{e^{s_i} + e^{s_j}},$
Eqn 1
Probability that tweet i gets more engagement

Discussion Question 4

The authors describe their model as “interpretable”. What about the design makes the model easy to interpret/learn from?

Understandable features + linear model

The output of the topic clustering algorithm is a vector of probabilities associated with each topic. The metadata features are also easily interpretable. The weights assigned to these features by the linear model directly indicate how important each feature is for tweet engagement.

$$s_i = \mathbf{w_t}^T \mathbf{t_i} + \mathbf{w_m}^T \mathbf{m_i},$$

Table 2: Feature coefficients with 96% confidence intervals, computed from 300 bootstrap samples

Feature	Coeff.	Feature	Coeff.	Feature	Coeff.
President	7.71 ± 0.78	Geology	0.79 ± 0.77	Investment	-6.70 ± 0.81
Clean Energy	4.25 ± 0.82	Mixed	0.00 ± 0.10	Human cost	-8.41 ± 0.90
Drought-resistant	4.00 ± 1.12	Low Water	-0.38 ± 0.90	Projections	-10.68 ± 0.85
Africa	2.79 ± 0.90	Conference	-1.65 ± 0.99	Links/Promo	-13.71 ± 1.26
Planet	2.77 ± 0.84	Research	-2.12 ± 0.84	Meta:URL	-1.54 ± 0.13
Fossil fuels	1.56 ± 0.82	Youth	-2.70 ± 1.12	Meta:Hashtag	-0.12 ± 0.12
Politics	1.51 ± 0.79	Health	-3.58 ± 0.94	Meta:GIF	0.47 ± 0.28
Global warming	1.18 ± 0.84	Rain	-3.62 ± 1.03	Meta:Video	0.76 ± 0.13
Geopolitics	1.09 ± 0.77	News	-5.07 ± 0.93	Meta:Image	0.58 ± 0.10
Anger	0.79 ± 0.90	Deaths	-5.43 ± 0.89	Meta:WorkHr	-0.24 ± 0.10

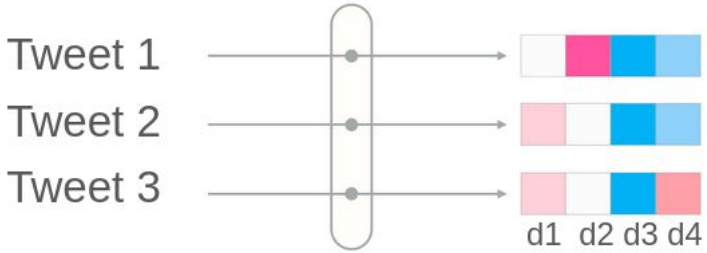
Discussion Question 5

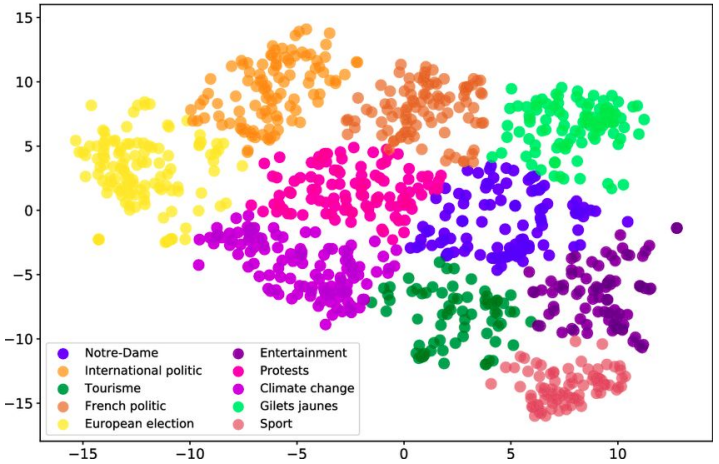
How were the topic labels determined?

Topic labels determined by hand

variable model to cluster these representations into topics in an unsupervised fashion. The learned topics can be interpreted by looking at the tweets whose representations are closest to the centre of the clusters. Once the model is trained on a set of tweets, it can be used to infer the probability that

features. The names of the topics were manually assigned by examining the top 500 tweets with the highest probability for the topic. A random sample of 10 tweets from this set for each of the topics in the table is given in the Appendix for a more detailed interpretation.





Discussion Question 6

Which source of information is more responsible for good model performance: tweet topic or metadata? How do you know?

Topic contributes more to performance

Table 1: Test accuracies of different models with 95% confidence intervals

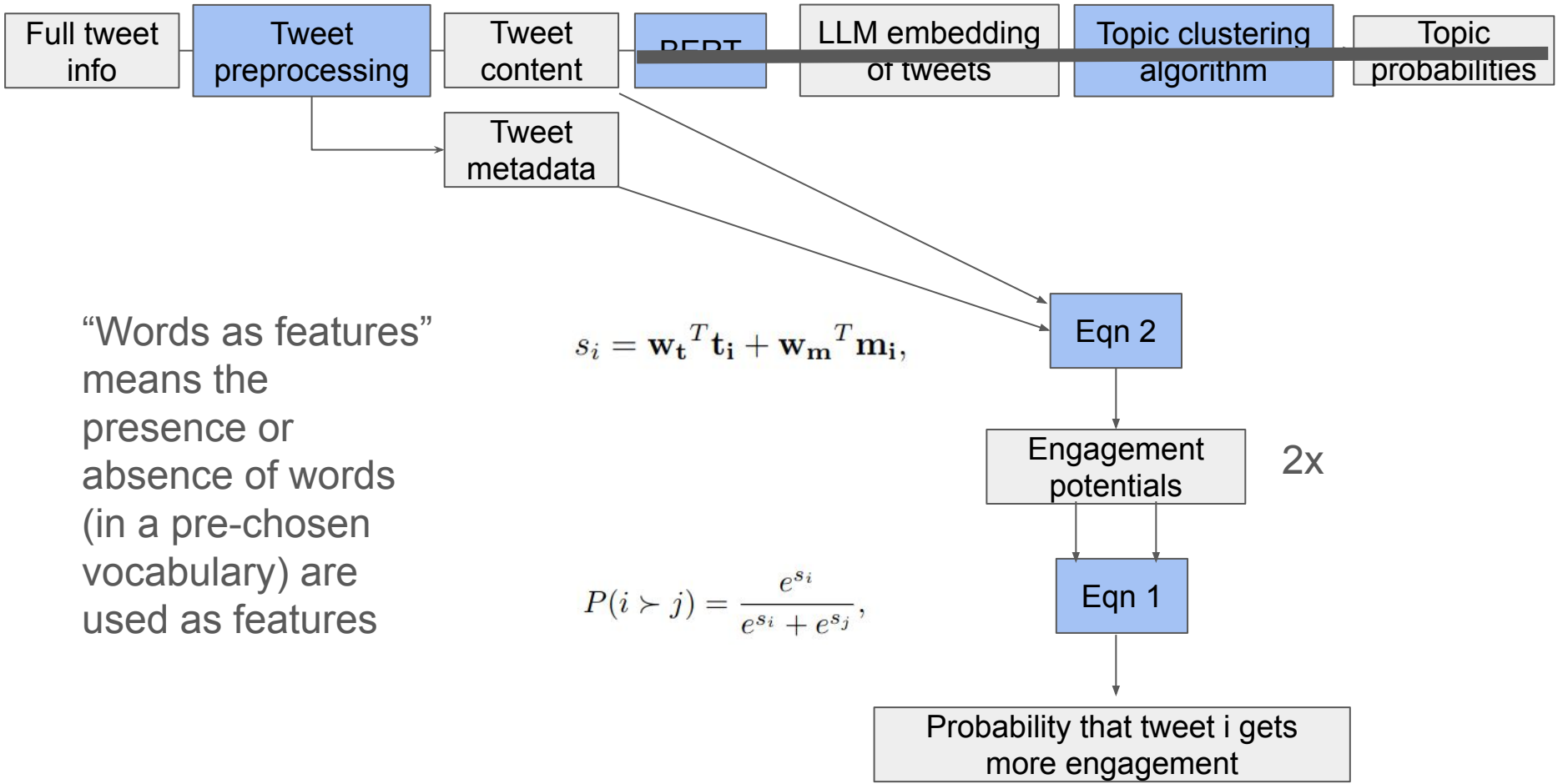
Random	**Meta**	**Topic**	**Topic+Meta**	**Human**
50.17 ± 0.50	58.90 ± 0.49	64.54 ± 0.48	$\mathbf{66.53 \pm 0.47}$	65.00 ± 6.61

But metadata contains extra information such that the union of both inputs performs best.

Discussion Question 7

What are the authors describing here?

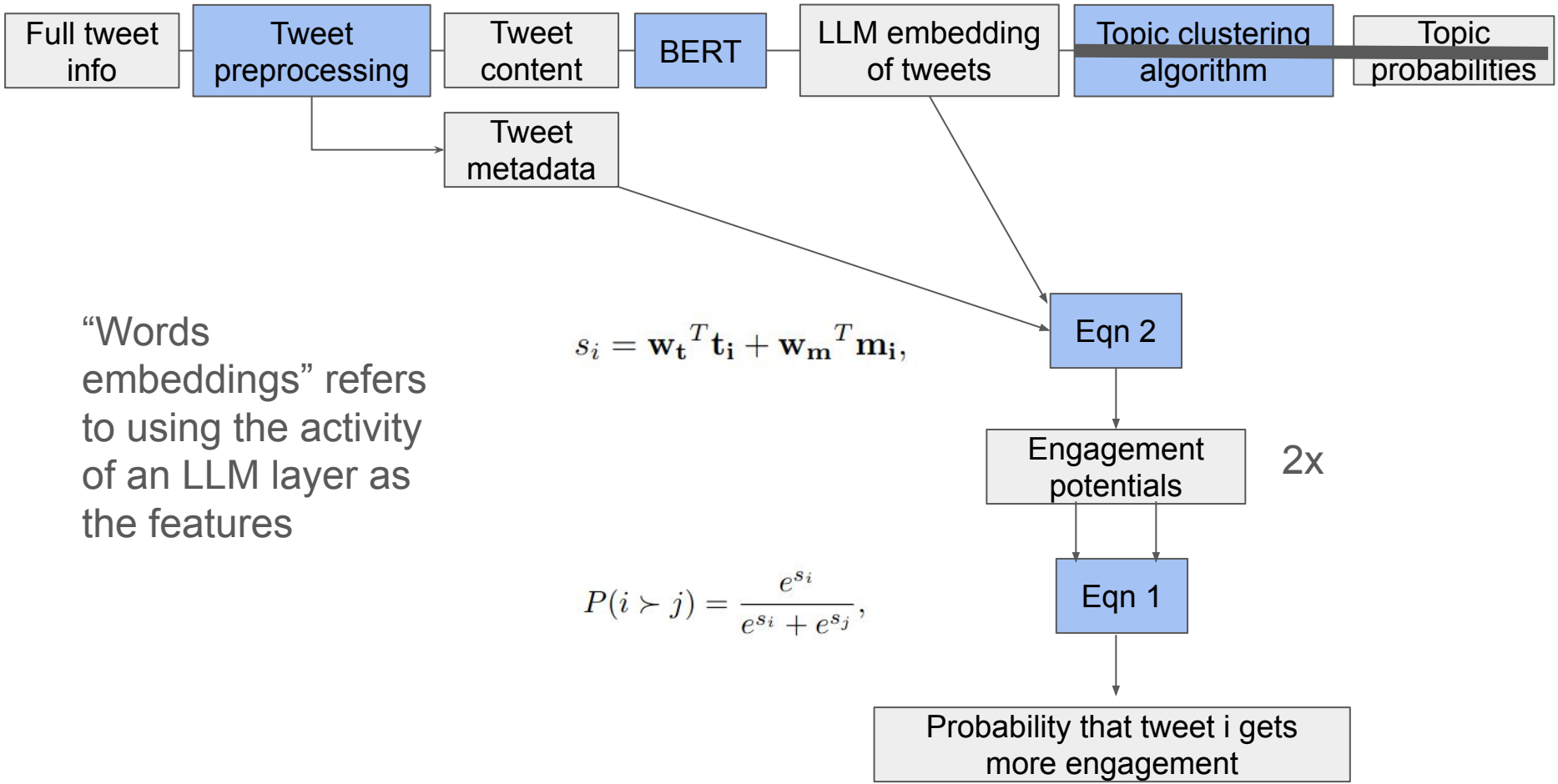
engagement of tweets containing the same URL. We also tried models using the words as features, instead of topics. However the accuracy was slightly lower, and the interpretation was more difficult for those models as a clear pattern couldn't be seen among the most predictive words. The accuracy for word-based models could possibly be increased by using contextual word embeddings and state-of-the-art sequence models like Transformers (Vaswani et al. (2017)), but their interpretation is likely to still be difficult.



"Words as features" means the presence or absence of words (in a pre-chosen vocabulary) are used as features

$$s_i = \mathbf{w_t}^T \mathbf{t_i} + \mathbf{w_m}^T \mathbf{m_i},$$

$$P(i \succ j) = \frac{e^{s_i}}{e^{s_i} + e^{s_j}},$$



"Words embeddings" refers to using the activity of an LLM layer as the features

$$s_i = \mathbf{w_t}^T \mathbf{t_i} + \mathbf{w_m}^T \mathbf{m_i},$$

$$P(i \succ j) = \frac{e^{s_i}}{e^{s_i} + e^{s_j}},$$

Discussion Question 8

Share what questions you wrote in your PMIRO+Q and decide as a group what you'd like to ask.

Update your PMIRO+Q

Submit a second file to the Brightspace assignment (don’t overwrite the original):

It should:

Update your PMIRO as needed

Answer your own Q

You can be talking with your group during this!

15 min break

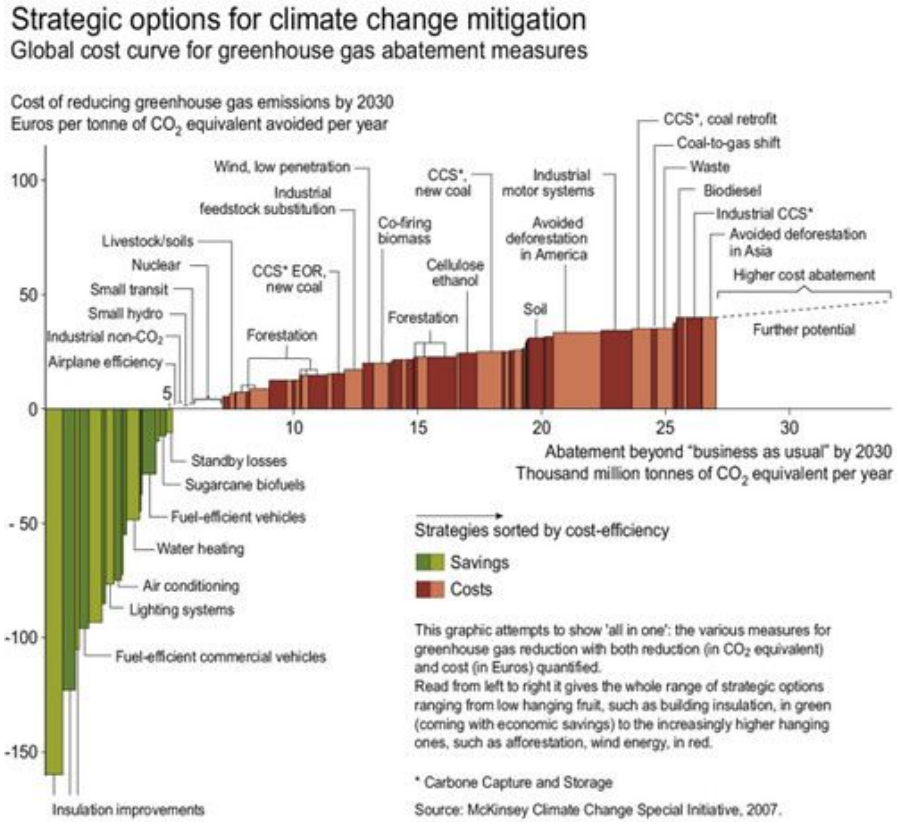
Lecture

Climate Change content: finances

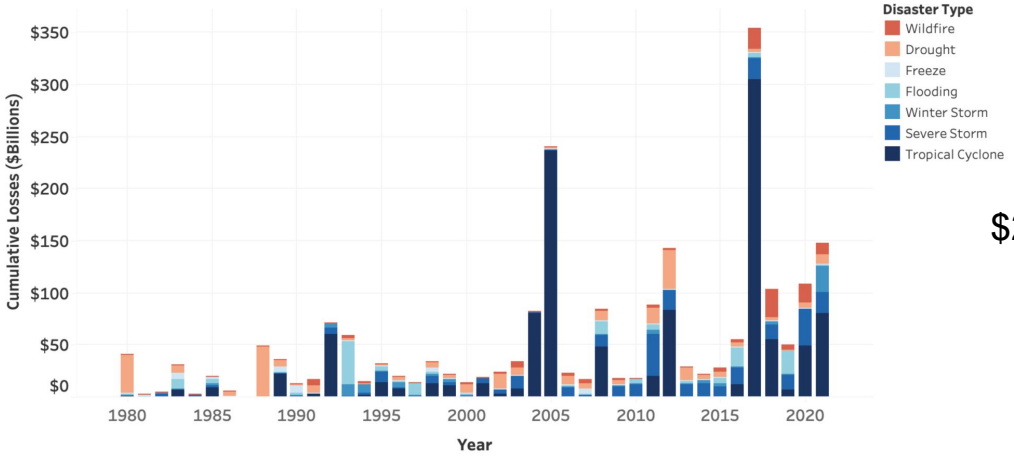
Machine learning content: recommender systems, genetic algorithms

Addressing climate change takes money

Some methods of reducing GHGs are actually financially beneficial immediately (such as increasing energy efficiency), but others will cost a significant amount of money upfront.



But the effects of climate change are even more expensive



$2.2 trillion in losses from 1980-2022 for the US

https://e2.org/reports/cost-of-climate-change/

Press releases

Deloitte Report: Inaction on Climate Change Could Cost the US Economy $14.5 Trillion by 2070

The U.S. economy could gain $3 trillion over the next 50 years if it accelerates towards a path of low-emissions growth

And over the next 50 years, nearly 900,000 jobs could disappear each year due to climate damage

Where should that money come from?

Free Market

Corporations

Carbon Tax

Carbon Credits/Offsets

Free Market

Consumers “vote with their wallet” and choose to buy sustainable options rather than products associated with high emissions

Will consumers make sustainable choices?

Some research suggests they might

Exhibit 1

Products that make environmental, social, and governance-related claims have achieved disproportionate growth.

Retail sales growth, US, CAGR 2018–22, %

[1]Environmental, social, and governance.
Source: NielsenIQ

McKinsey & Company

Searches for Sustainable Goods Have Increased Rapidly

There is growing interest in researching and buying sustainable products online.

- Global Google searches for topics related to sustainable products increased by around **130%** between 2017 and 2022.
- Searches made in the US followed a similar trend, increasing by **117%** over the same time period.

Sales of Carbon Labeled Products Doubled in One Year

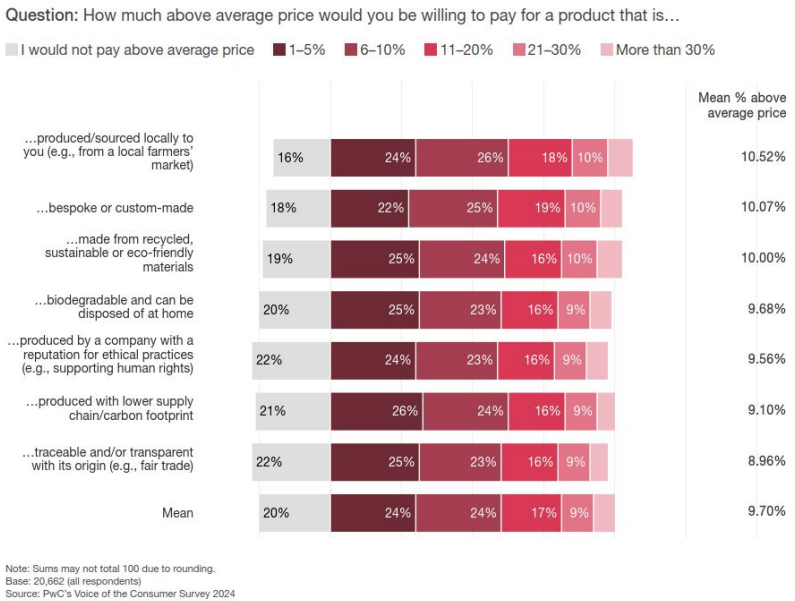
Many consumers are looking to reduce their carbon footprint and they appear to have identified the emissions associated with the goods that they buy as a key factor in achieving this.

- Carbon Labeled products (such as those with 1% For the Planet or Climate Neutral Certification) enjoyed more than **$3.4 Billion** worth of sales in 2021 - double that of the previous year.

https://theroundup.org/environmentally-conscious-consumer-statistics/

Will consumers make sustainable choices?

- One-third (31%) of consumers cite inflation as the number-one risk to their country or territory, with 62% expecting groceries to represent their most significant expenditure increase
- But while cost-of-living pressures weigh, some consumers say they are willing to spend 9.7% more, on average, for sustainably produced or sourced goods, as almost nine-in-ten (85%) report experiencing first-hand the disruptive effects of climate change in their daily lives
- Digital experience remains key: 46% of consumers purchased products directly through social media - up from 21% in 2019 - even as data protection concerns are high



Note: Sums may not total 100 due to rounding.
Base: 20,662 (all respondents)
Source: PwC's Voice of the Consumer Survey 2024

This may even continue under economic uncertainty

Can we leave it to the consumer to fund our climate change response?

Probably not, due to....

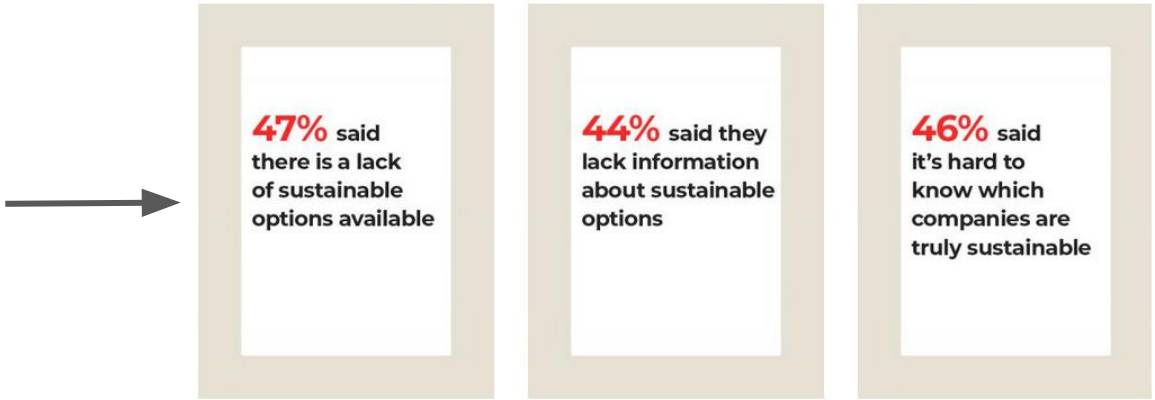
Can we leave it to the consumer to fund our climate change response?

Probably not, due to....

Sustainable travel a key priority for Australian travellers

Sustainability and responsibility are no longer nice-to-haves, they're non-negotiables for travellers. **A massive 89% of respondents** said they were likely to choose sustainable travel options for their next trip and want to know their holidays aren't just good for them but good for local communities and the planet, too.

However, our research shows that operators still have work to do when it comes to communicating sustainability messages to customers, with almost half of respondents identifying three primary barriers to travelling sustainably.



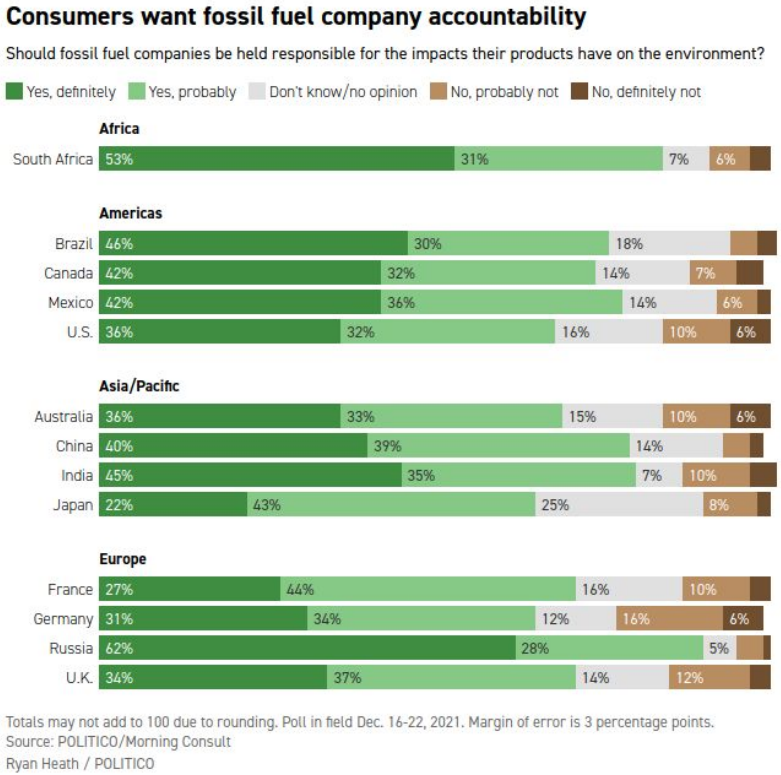
Can we leave it to the consumer to fund our climate change response?

Probably not, due to....

The need to fund collective infrastructure projects

People believe fossil fuel companies should pay

Respondents in every country surveyed were united **against increasing costs to taxpayers or consumers**. In the U.S., 15 percent of adults said climate change costs should be borne by consumers through higher prices. Eighteen percent said taxpayers should pay a lot of the cost.



https://www.politico.com/news/2022/02/09/climate-change-expensive-who-should-pay-00005198

Taking oil companies to court to pay for climate change

It's been six years since cities in California started the trend of taking Big Oil to court for deceiving the public about the consequences of burning fossil fuels. The move followed investigations showing that Exxon and other companies had known about the dangers of skyrocketing carbon emissions for decades, but publicly downplayed the threat. Today, around 30 lawsuits have been filed around the country as cities, states, and Indigenous tribes seek to make the industry pay for the costs of climate change.

Last September, the state of California demanded that oil companies fund efforts to recover from extreme weather. In December, the Makah and Shoalwater Bay tribes along the coast of Washington state became the first Native American tribes to take oil companies to court over the costs of responding to climate-related risks from rising seas, flooding, and ocean acidification. Meanwhile, Hoboken, New Jersey, and a collection of cities in Puerto Rico have added racketeering lawsuits to the mix, alleging that oil companies engaged in a conspiracy of deception.

Climate ‘Superfunds’

Collect money from fossil fuel companies for disaster recovery and climate change adaptation.

Governor Signs Climate Change Superfund Act

LIZ KRUEGER | December 26, 2024 | ISSUE: CLIMATE CHANGE, AFFORDABILITY, COST OF LIVING

Nation-Leading Bill Would Charge The Largest Multinational Oil & Gas Companies For New York's Climate Adaptation Costs While Insulating Consumers

Albany – Today, Governor Kathy Hochul signed the Climate Change Superfund Act (S.2129/A.3351), nation-leading legislation that will use the polluter-pays model exemplified by existing federal and state superfund laws to collect $75 billion over twenty-five years for climate change adaptation from the parties most responsible for causing the climate crisis - big oil and gas companies. The bill was carried in the Senate by Senator Liz Krueger, and in the Assembly by Assembly Member Jeffrey Dinowitz.

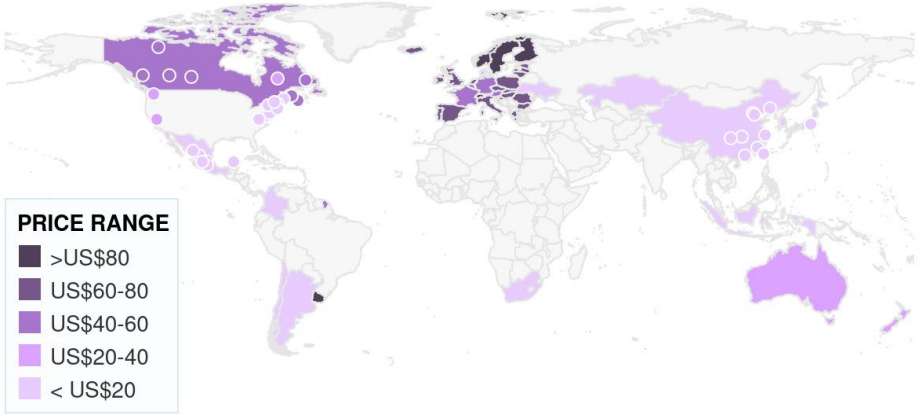
Carbon tax

According to the EPA, tax-based regulatory systems provide incentives for polluters to find cost-effective solutions to emissions control.

Firms will either pay the tax or, if it is cheaper, they will reduce emissions to avoid the tax.

Price of carbon around the world, 2024

Heat map shows the level of the main price set by emissions trading sytems or Carbon taxes in each jurisdiction (US$/tCO2e), subject to any filters applied. The year can be adjusted using the slider below the map.



Offsets and carbon credits

Blockchain-based carbon credit tracking

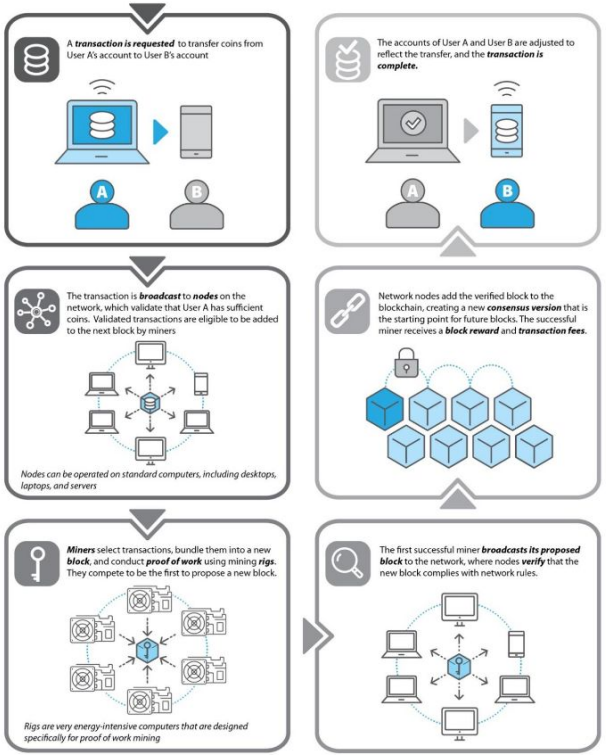


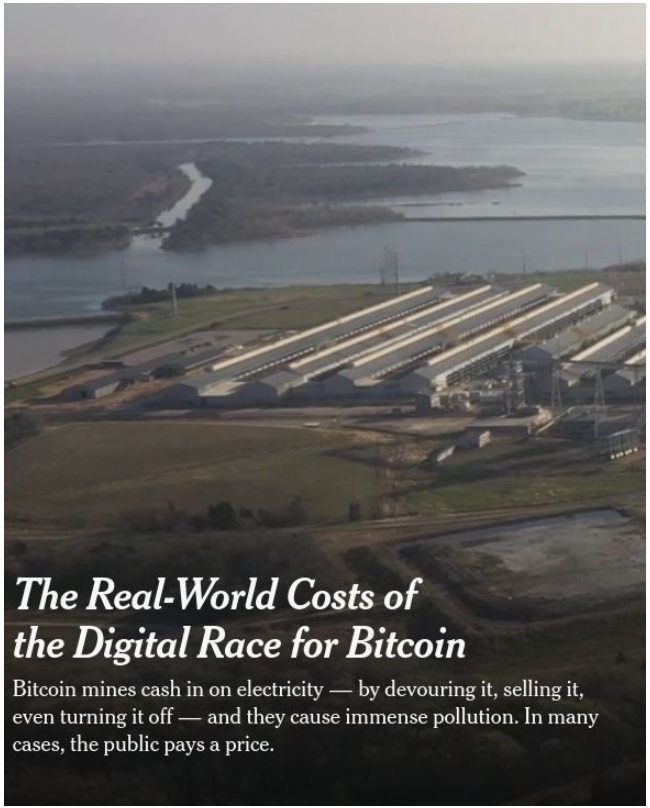
Figure 1.1: Understanding Proof of Work Blockchain in Crypto-Asset Mining. Adapted from Kilroy Blockchain.[33]

The blockchain creates a public ledger that can be used to verify that an entity has bought or sold carbon credits.

Most blockchains run on “proof of work”

This is a problem because...

Proof of Work is a huge waste of energy



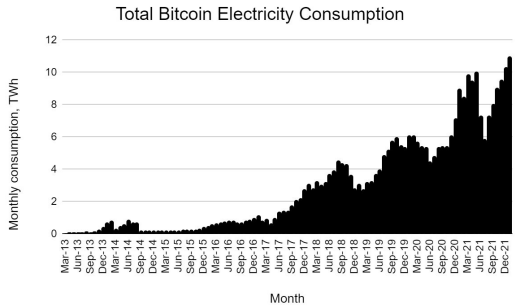
Texas was gasping for electricity. Winter Storm Uri had knocked out power plants across the state, leaving tens of thousands of homes in icy darkness. By the end of Feb. 14, 2021, nearly 40 people had died, some from the freezing cold.

Meanwhile, in the husk of a onetime aluminum smelting plant an hour outside of Austin, row upon row of computers were using enough electricity to power about 6,500 homes as they raced to earn Bitcoin, the world's largest cryptocurrency.

The computers were performing trillions of calculations per second, hunting for an elusive combination of numbers that Bitcoin's algorithm would accept. About every 10 minutes, a computer somewhere guesses correctly and wins a small number of Bitcoins worth, in recent weeks, about $170,000. Anyone can try, but to make a business of it can require as much electricity as a small city.

Crypto mining requires way too much energy

Any one proposing a blockchain-based carbon credit system or crypto-funded climate company will need to address energy issues



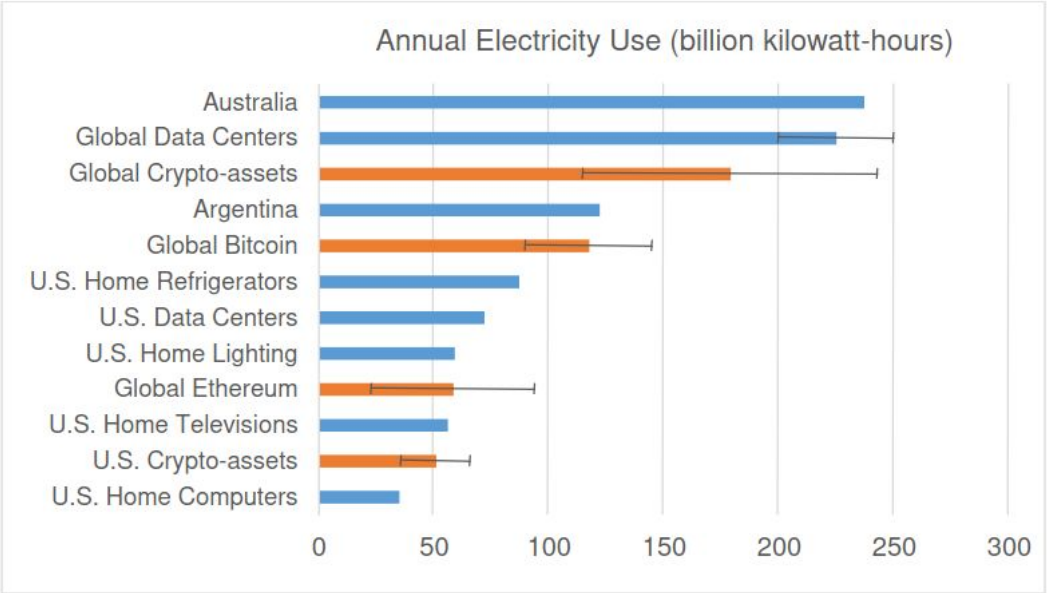


Figure 2.1: Comparison of Annual Electricity Use of Several Examples and the Best Estimates for Crypto-assets, as of August 2022, with error bars representing the best range of values.[80,81]

https://www.whitehouse.gov/wp-content/uploads/2022/09/09-2022-Crypto-Assets-and-Climate-Report.pdf

Crypto mining and the popularization of AI are driving up energy use in unprecedented ways

The Washington Post
Democracy Dies in Darkness

BUSINESS

Amid explosive demand, America is running out of power

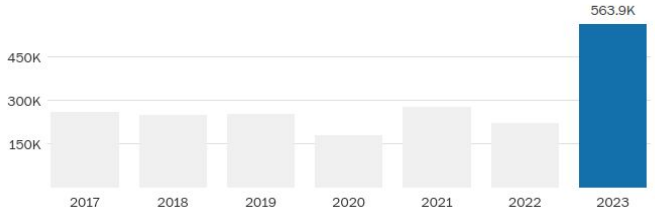
AI and the boom in clean-tech manufacturing are pushing America's power grid to the brink. Utilities can't keep up.

By Evan Halper

March 7, 2024 at 6:05 a.m. EST

Projected new energy demand in North America doubles

9-year growth forecast of demand for new electricity, in gigawatt hours



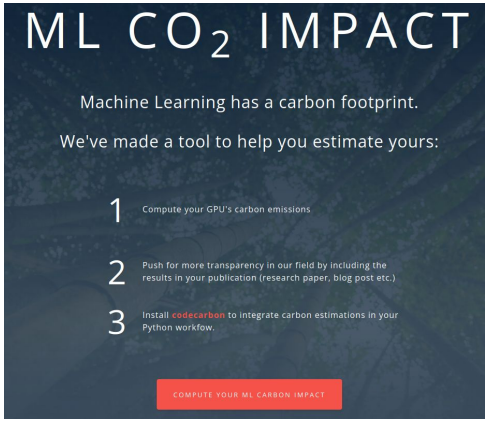
Data covers U.S., Canada and part of Baja California, Mexico.

Source: North American Electric Reliability Corp. Long Term Reliability Assessment

A major factor behind the skyrocketing demand is the rapid innovation in artificial intelligence, which is driving the construction of large warehouses of computing infrastructure that require exponentially more power than traditional data centers. AI is also part of a huge scale-up of cloud computing. Tech firms like Amazon, Apple, Google, Meta and Microsoft are scouring the nation for sites for new data centers, and many lesser-known firms are also on the hunt.

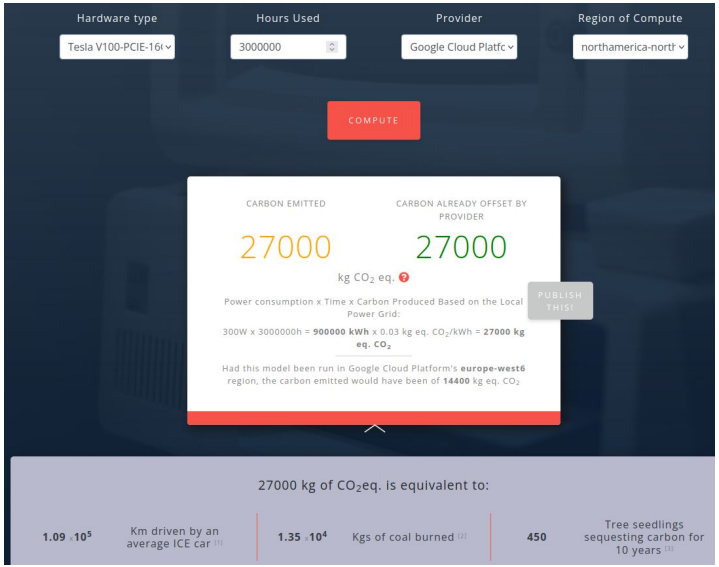
The proliferation of crypto-mining, in which currencies like bitcoin are transacted and minted, is also driving data center growth. It is all putting new pressures on an overtaxed grid — the network of transmission lines and power

Machine Learning requires energy



https://mlco2.github.io/impact/

~$5 mil to train an early version of ChatGPT



Very large models (like ChatGPT) can use an enormous amount of energy for training.

**This week's paper explicitly measures their compute-related emissions*

How can we get people to switch to better products?

Build a recommender system

A system or algorithm that recommends products or posts to a user based on knowledge of that user. These algorithms can be built in many different ways

A good recommender system might help people switch to more eco-friendly products

Recommendation problems can be complex

We don’t want to recommend just *any* eco-friendly products. We want to recommend products that:

Aren’t too expensive

Are similar to what a person normally wants

Lower emissions without other side effects like increased water use

Etc.

One way to say this: we have *multiple objectives*

How can we write a loss function when we have multiple objectives?

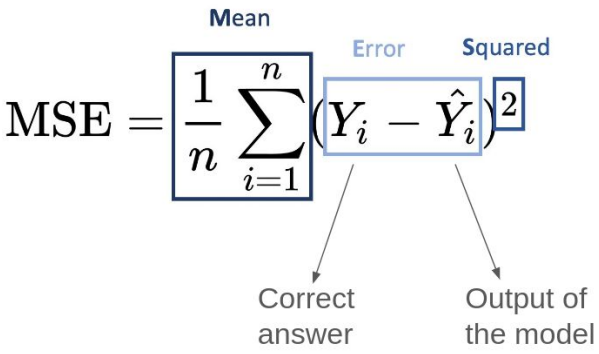
Lecture 2:

The loss function tells the network what we want it to do

If we want to train a model on a regression problem, for example, we may use Mean Squared Error as the loss function.

Also known as “cost” or “objective” function. Higher values mean the model is performing poorly.

When we have the “correct answer” that we can train the network with, this is known as “supervised learning”



Haltakov

How can we write a loss function when we have multiple objectives?

One option: “scalarization”

I.e., turn the multiple objectives into a single scalar value by computing a weighted sum of them.

E.g.,

Total Loss = a*CO2_term + b*Cost_term + ...

Pros: can treat it like a normal loss/optimization function

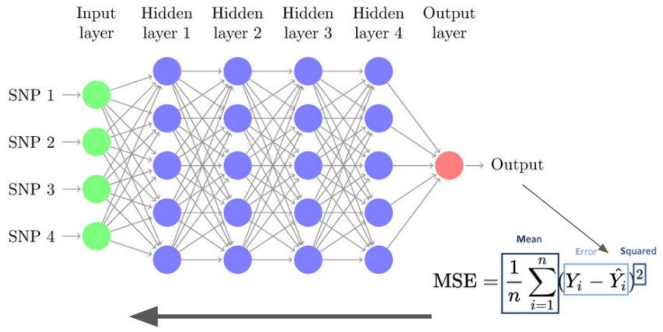
Cons: need to decide on the weights

How can we write a loss function when we have multiple objectives?

But why does the loss function need to be a single function anyway?

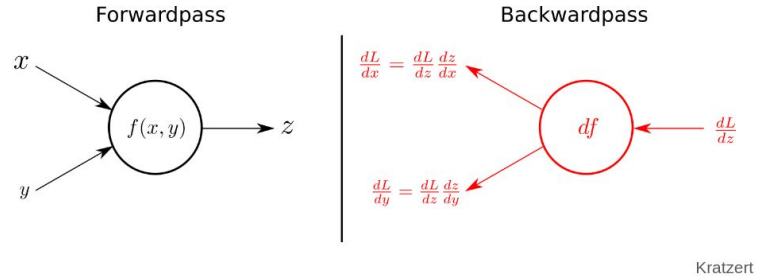
Lecture 2:

How do we use the loss function to learn the right weights?



"Backpropagate the error"

Backpropagation algorithm

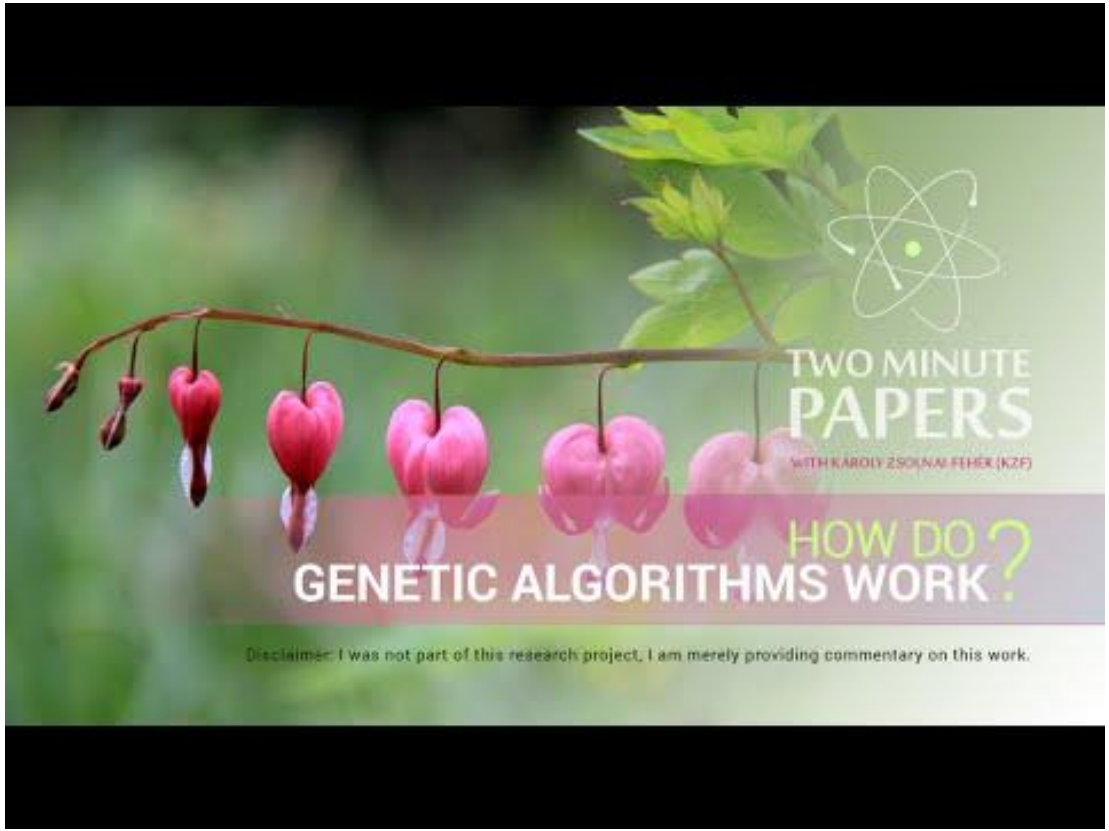


Kratzert

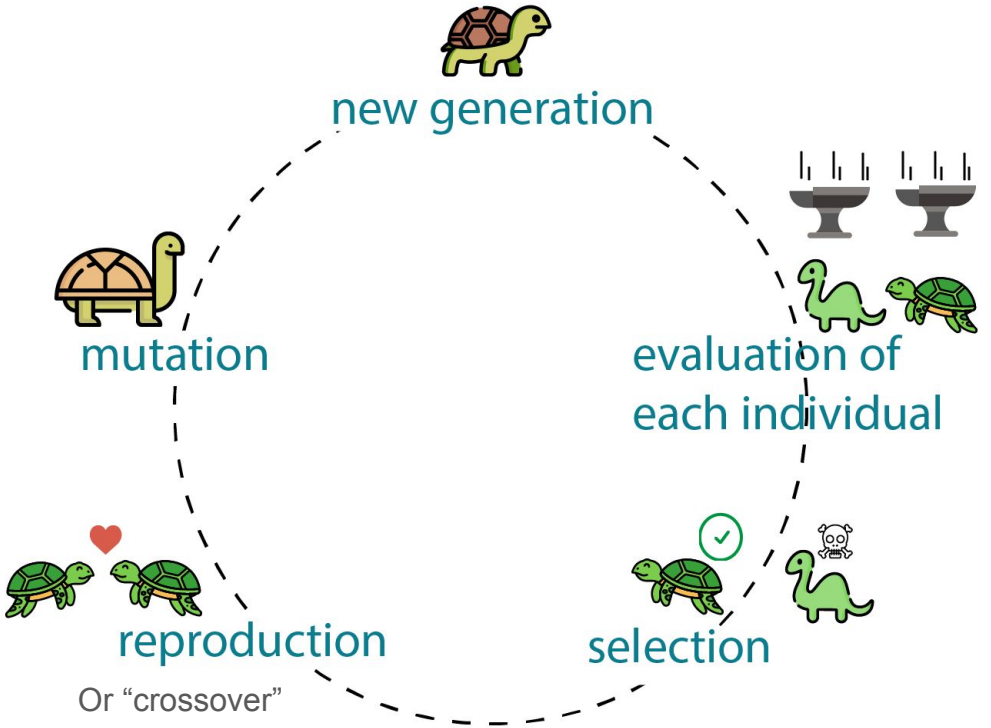
By applying the chain rule for derivatives, we can calculate exactly in which direction a weight should change in order to make the loss function decrease

For backpropagation, we need a single differentiable function

Evolutionary/Genetic Algorithms



Evolutionary/Genetic Algorithms



Where does something like a loss function go?

In evolutionary algorithms, each individual needs to be evaluated according to a “fitness” function, and those that fall below a fitness threshold don’t get to be part of the next generation (‘selection’).

This fitness function can be anything we like!

https://www.generativedesign.org

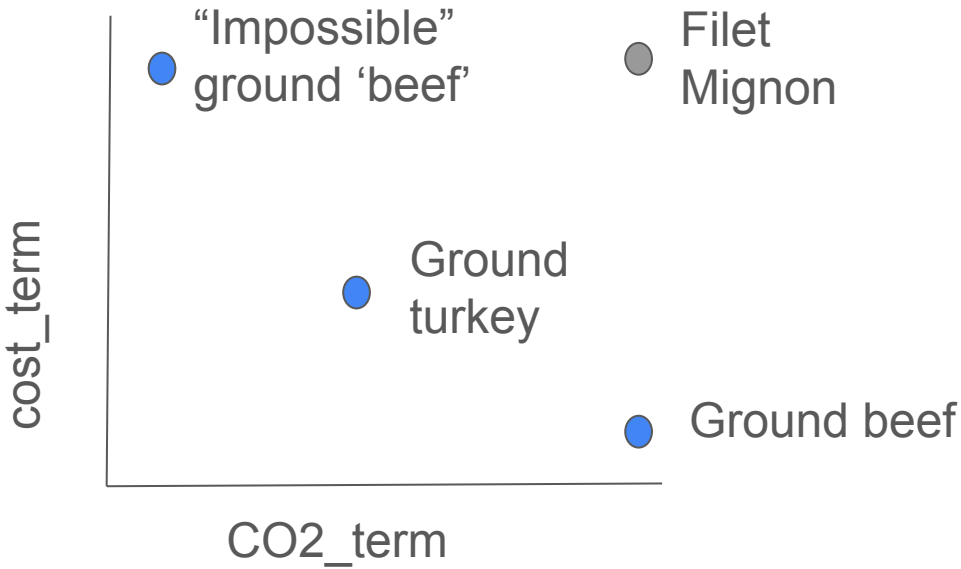
What kind of fitness function and selection problem can we use for multi-objective problems?

1. Represent fitness as an objective *vector* (e.g. [CO2_term, cost_term, ...]
2. Apply “non-dominated sorting”
3. Select the solutions on the “Pareto Front”

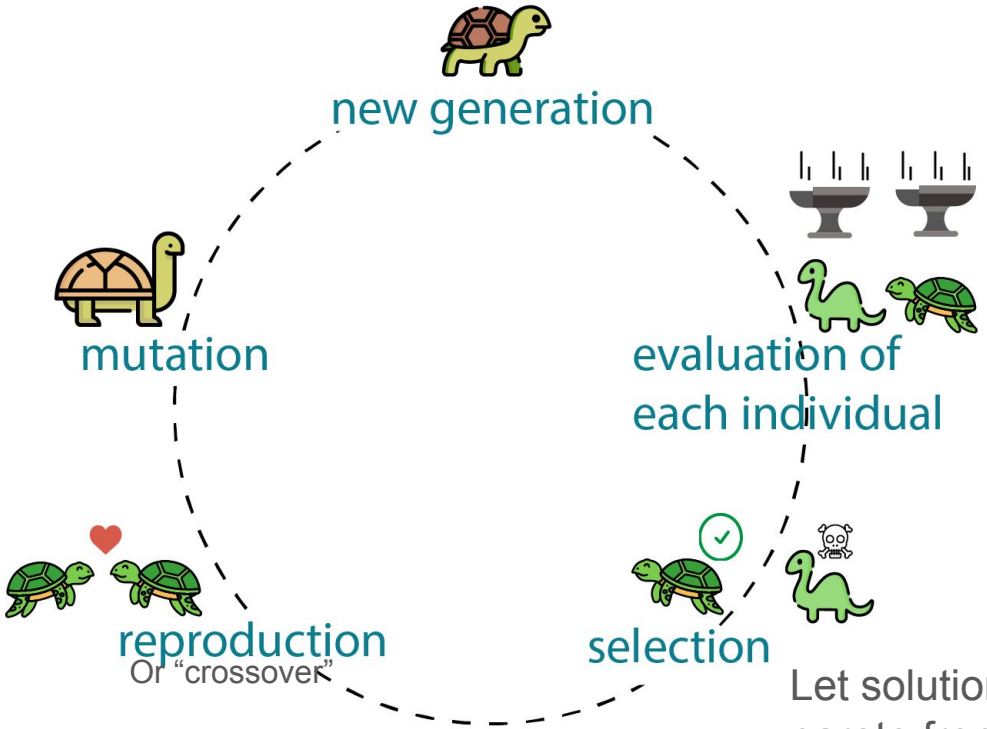
I.e., get the solutions that are the best you can do for one term without sacrificing the others

The pareto front is the result of trade-offs in the various objective terms

Trying to minimize:



NSGA-II

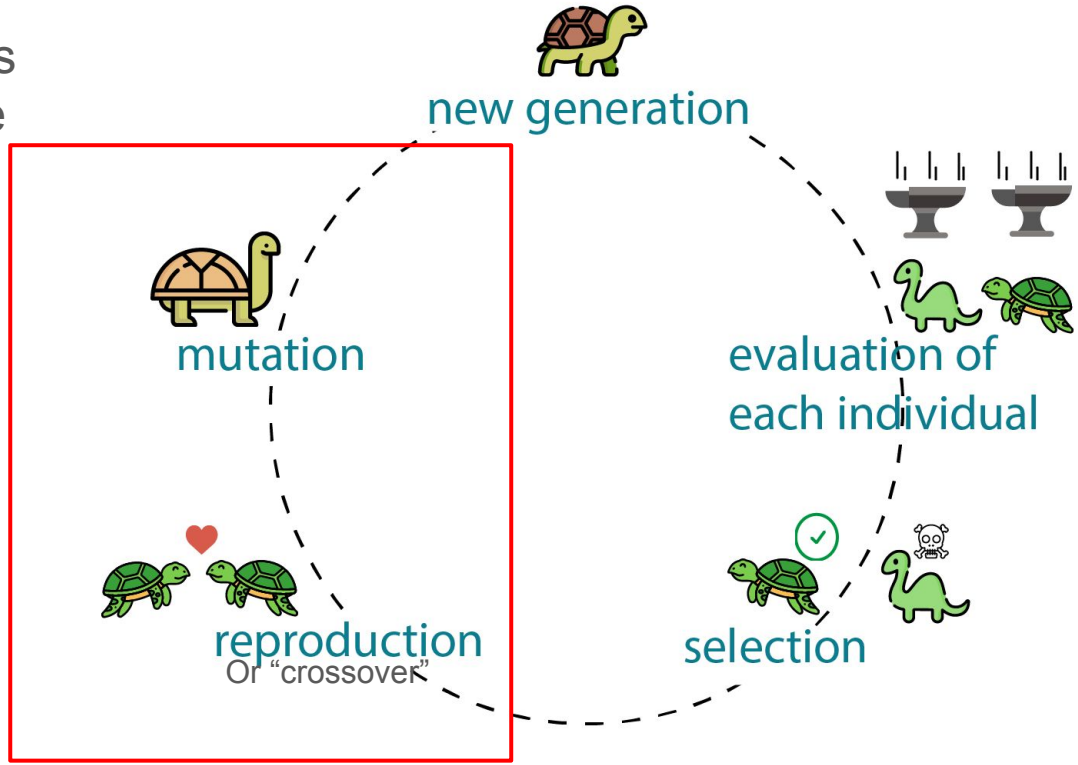


Calculate performance according to each of the multiple objective terms. Identify solutions on the pareto front.

Let solutions on or near the pareto front move on to the next generation

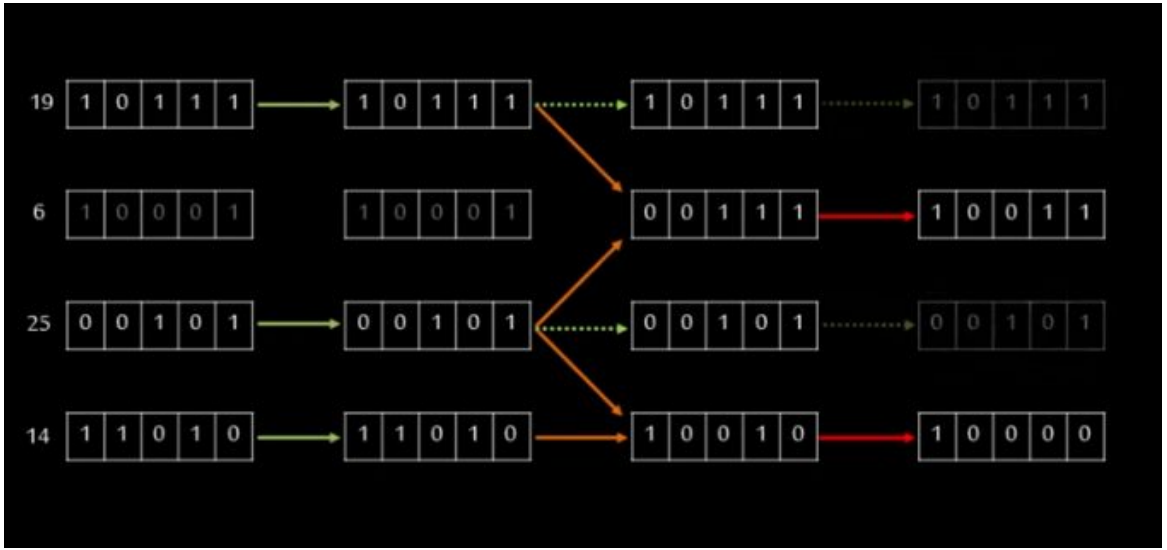
https://www.generativedesign.org

These things can be done randomly



https://www.generativedesign.org

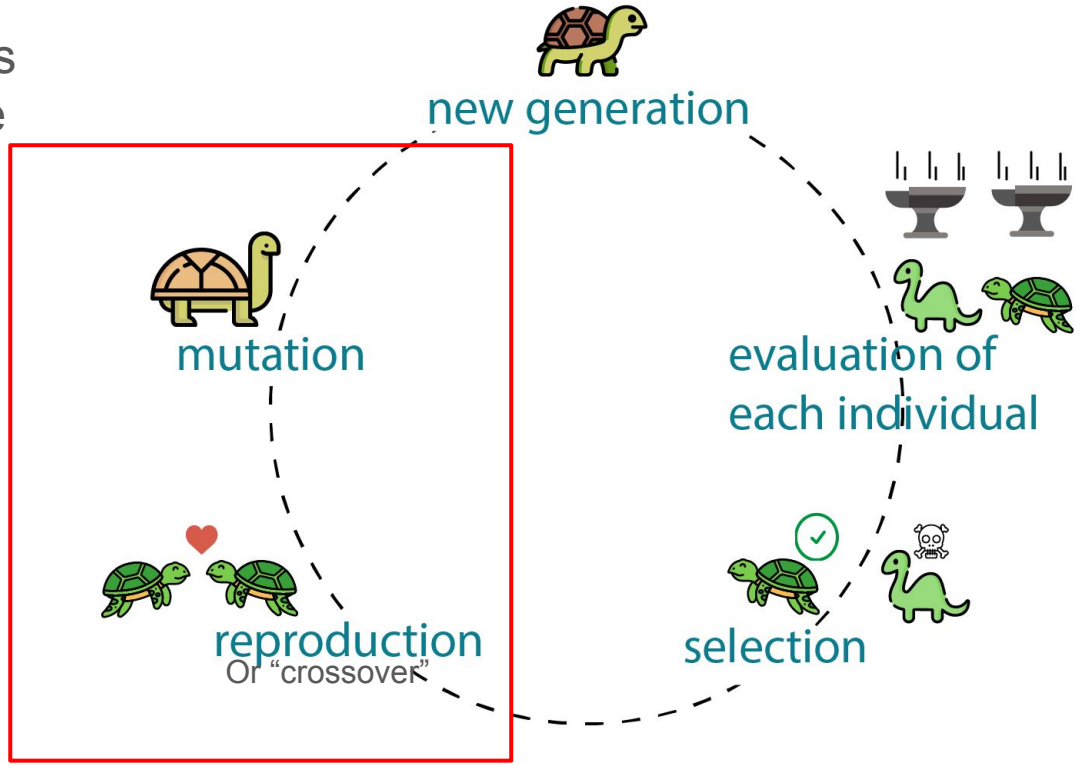
Random pairing and mutation



Randomly pair two solutions that survived the selection phase. Take some of the features from one and some from the other - this makes a new individual (crossover/reproduction). Randomly change some of the features of this individual (mutation) before evaluating it

These things can be done randomly

...or we can get fancy about it

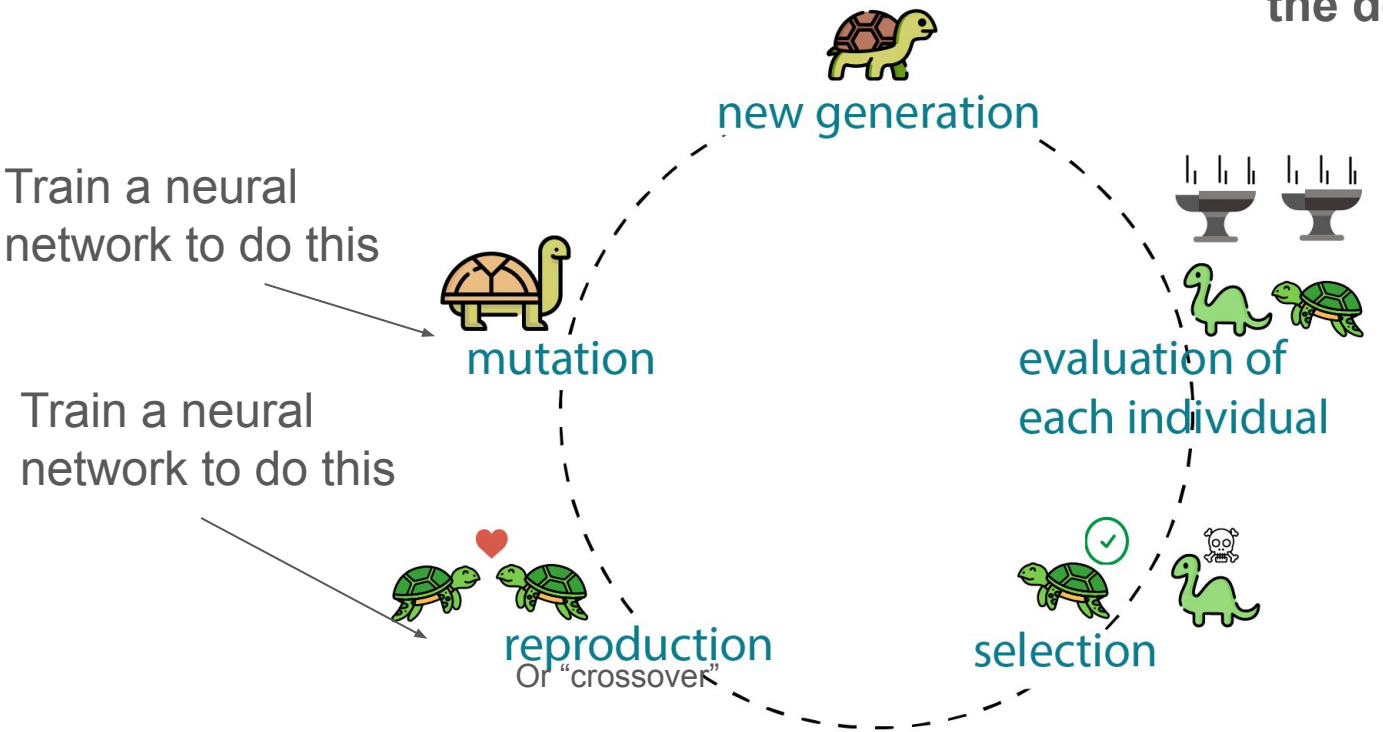


https://www.generativedesign.org

G3A: Gradient Guided Genetic Algorithms

Don’t worry about the details of this!

(it’s mostly just a bunch of tricks to be able to do backpropagation here)



https://www.generativedesign.org

For your reading:

MO-NES is another modified evolutionary algorithm, don’t worry about how it works.

In this work, we are trying to find the best ‘basket’ - which is the set of all items a household buys in a week (so solutions are evaluated based on everything in the basket)

There are more details that may be helpful in the appendix

Exam recap

If you want to review your specific exam, speak to Rijul