TRANSFORMERS, BERT & ex-NLP

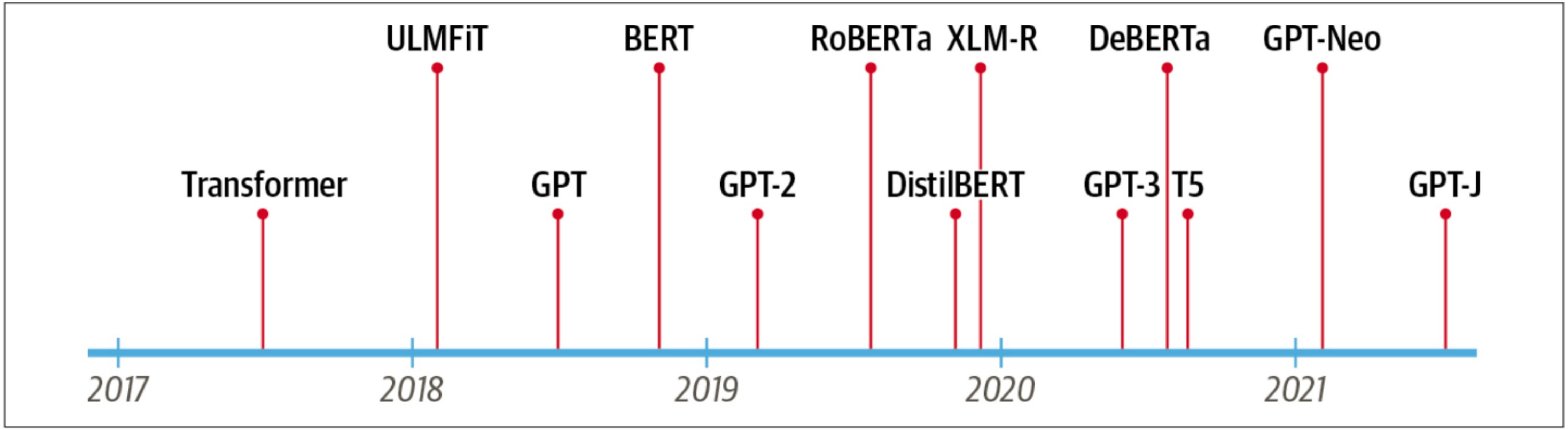
M&S RESEARCH HAY DAY

Huyen Nguyen

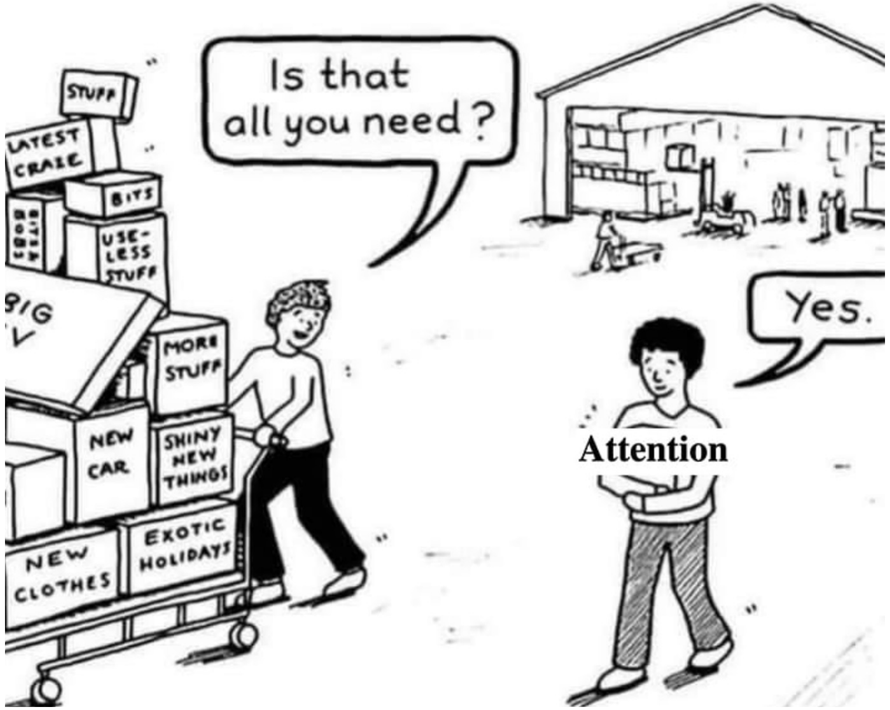
Daniel Anadria

Hadi Mohammadi

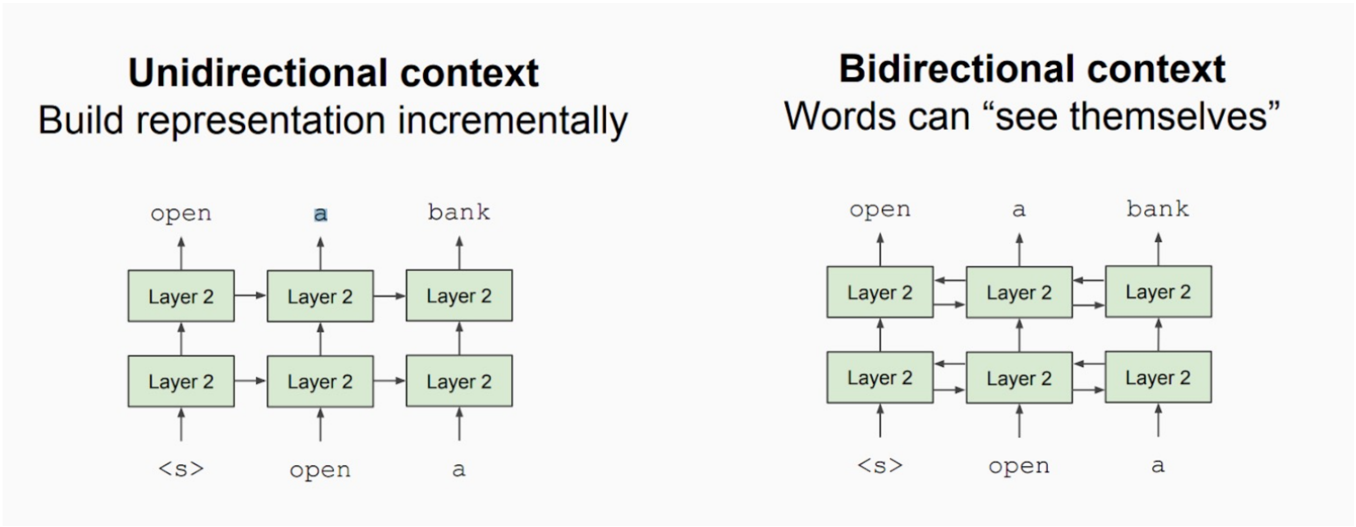
THE TRANSFORMER TIMELINE



TRANSFORMER >> RNN, LSTM for NLP

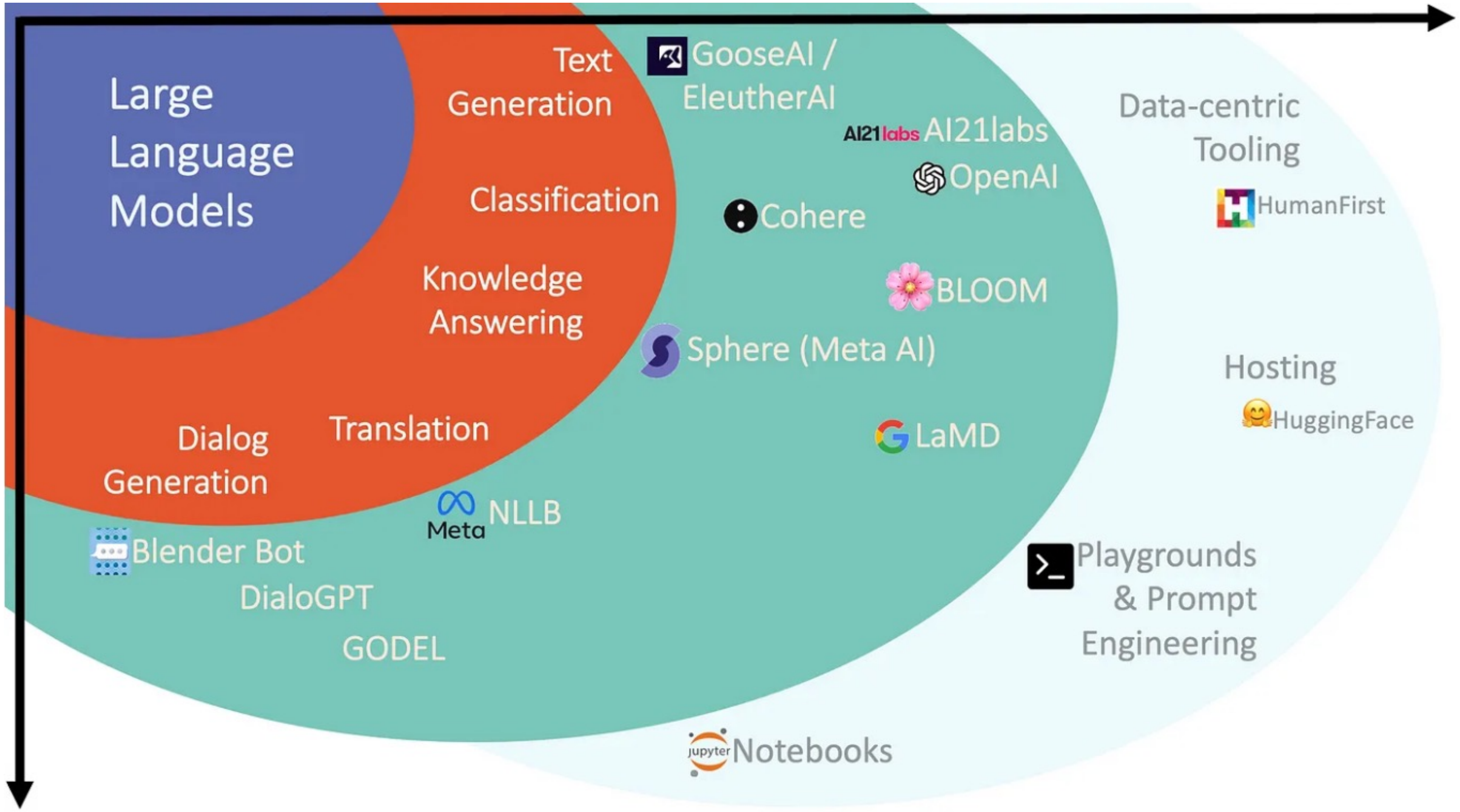


Attention is all you need.
(Vaswani et al., NeurIPS 2017)



- ✓ Parallel Processing
- ✓ Bidirectionality
- ✓ Less labelled data required

THE LARGE LANGUAGE MODEL LANDSCAPE



[Source: https://cobusgreyling.medium.com/the-large-language-model-landscape-9da7ee17710b](https://cobusgreyling.medium.com/the-large-language-model-landscape-9da7ee17710b)

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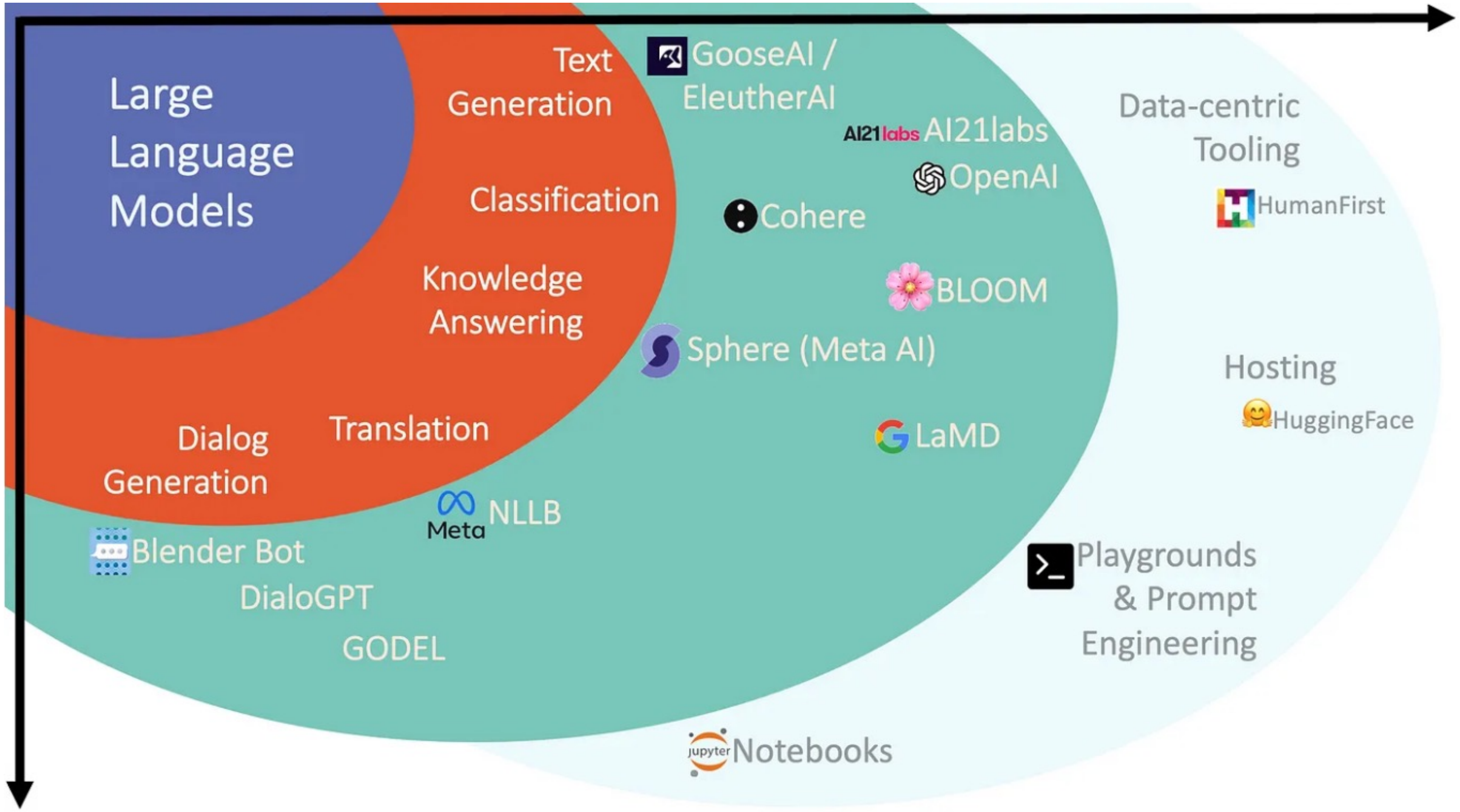

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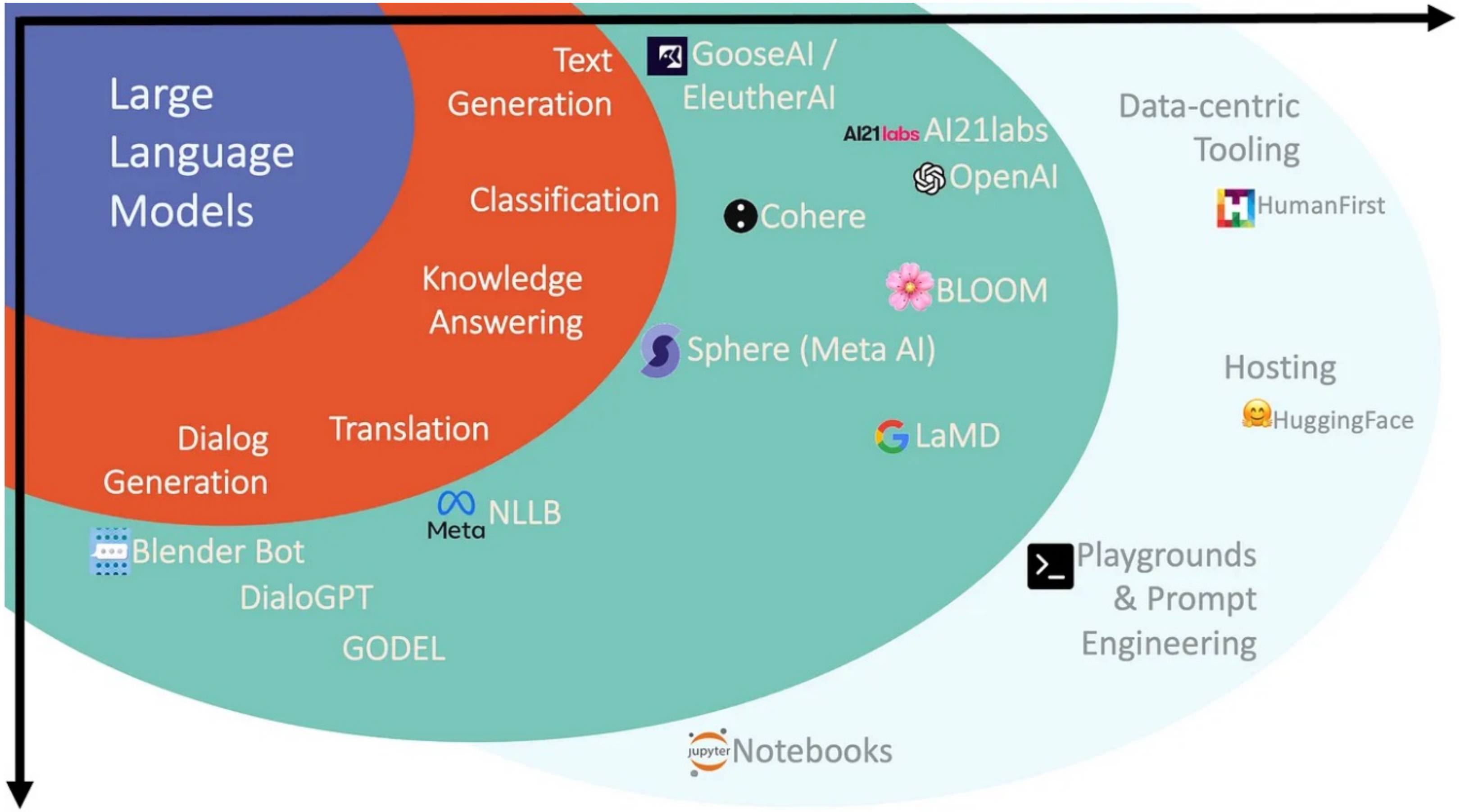

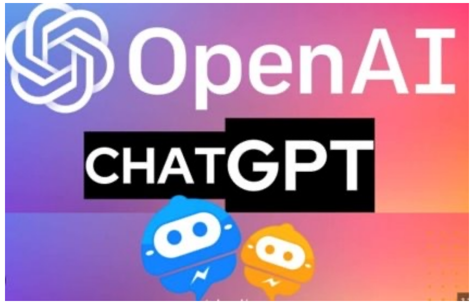

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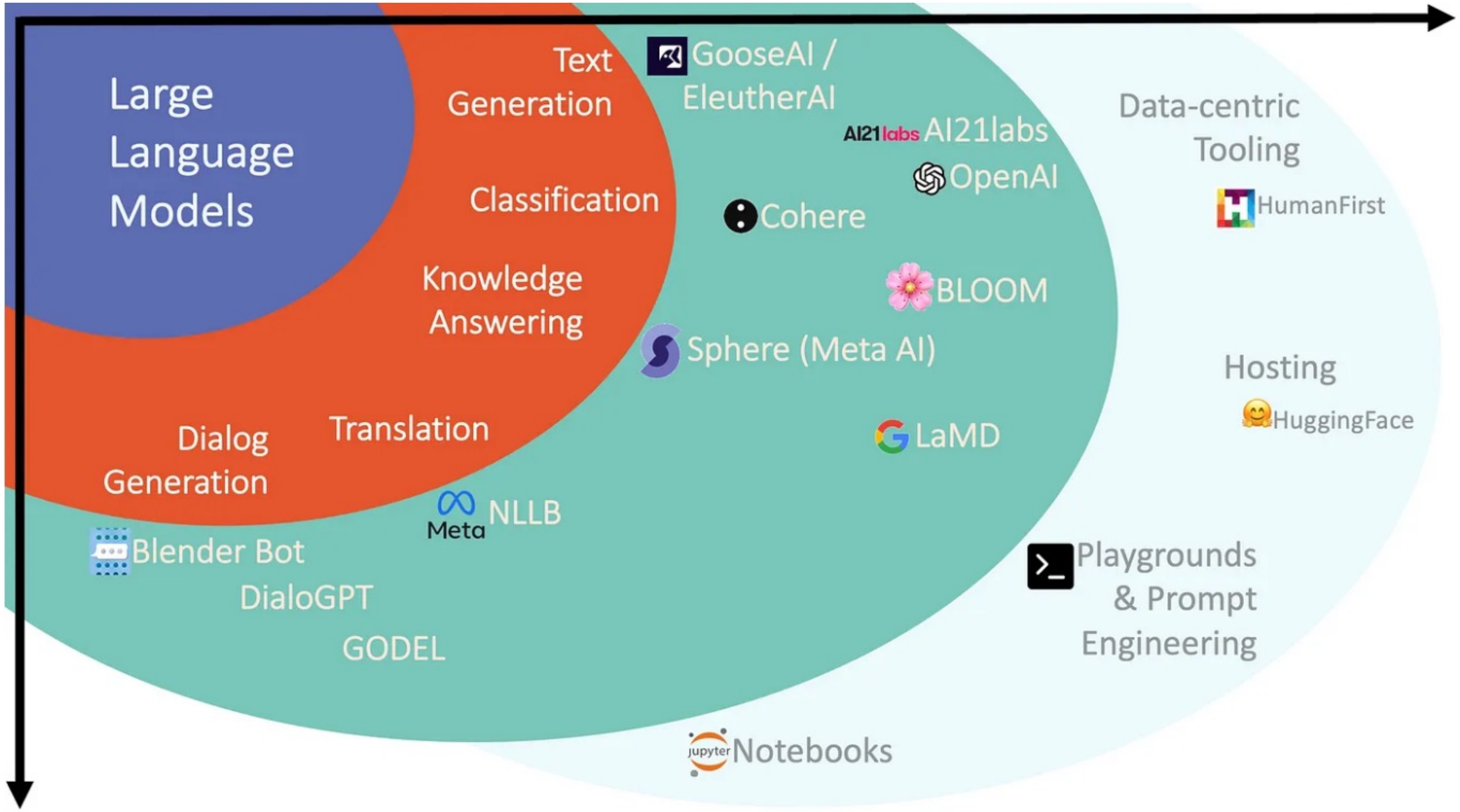

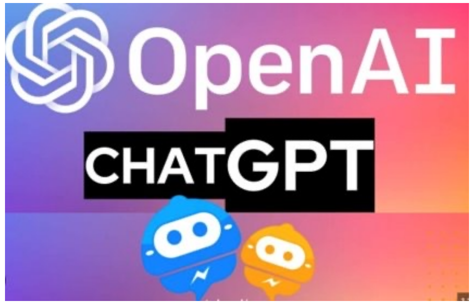

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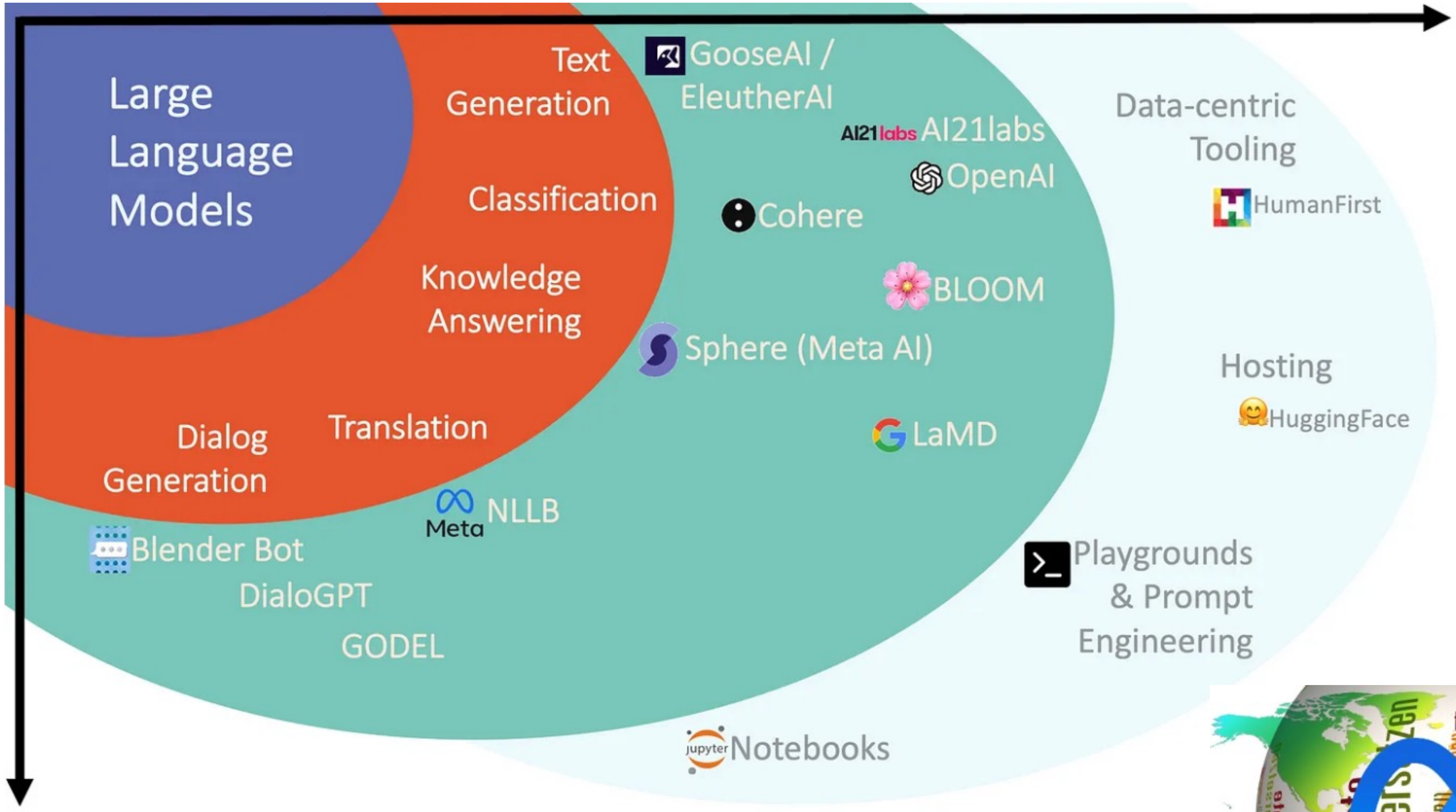

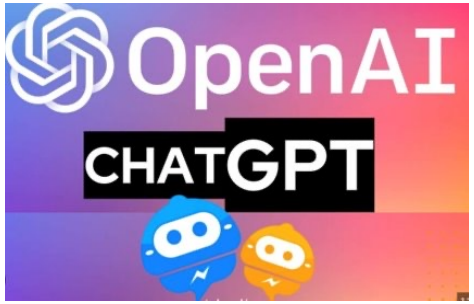

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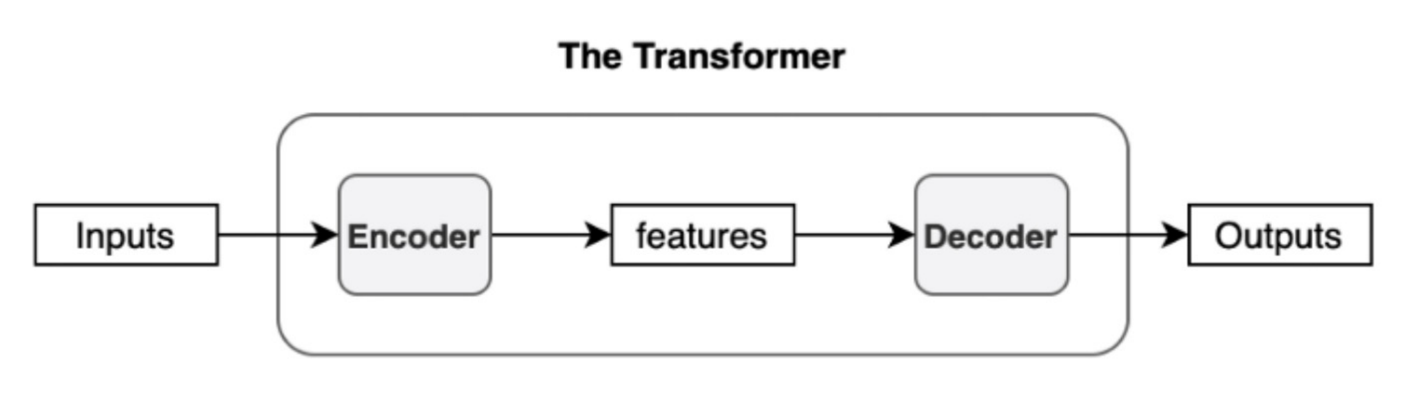
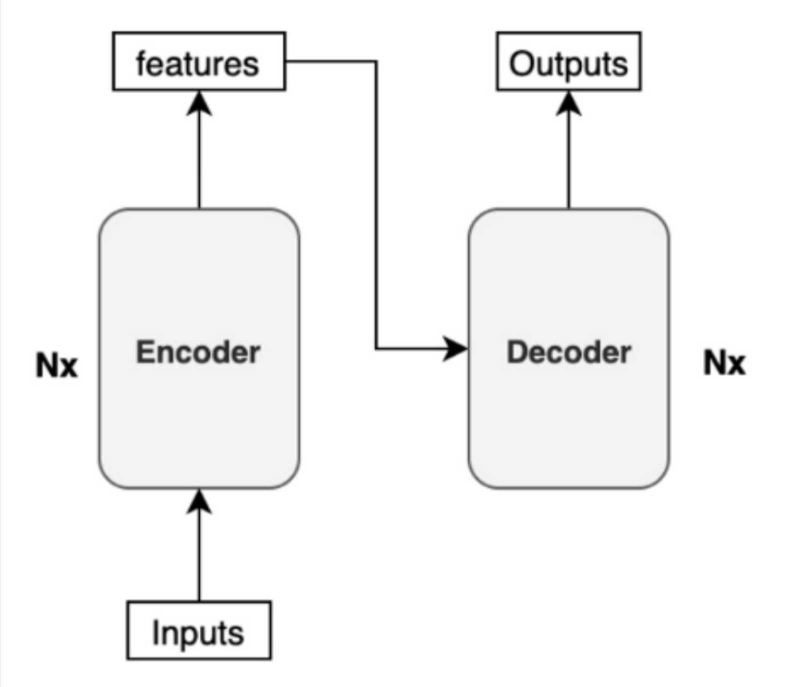
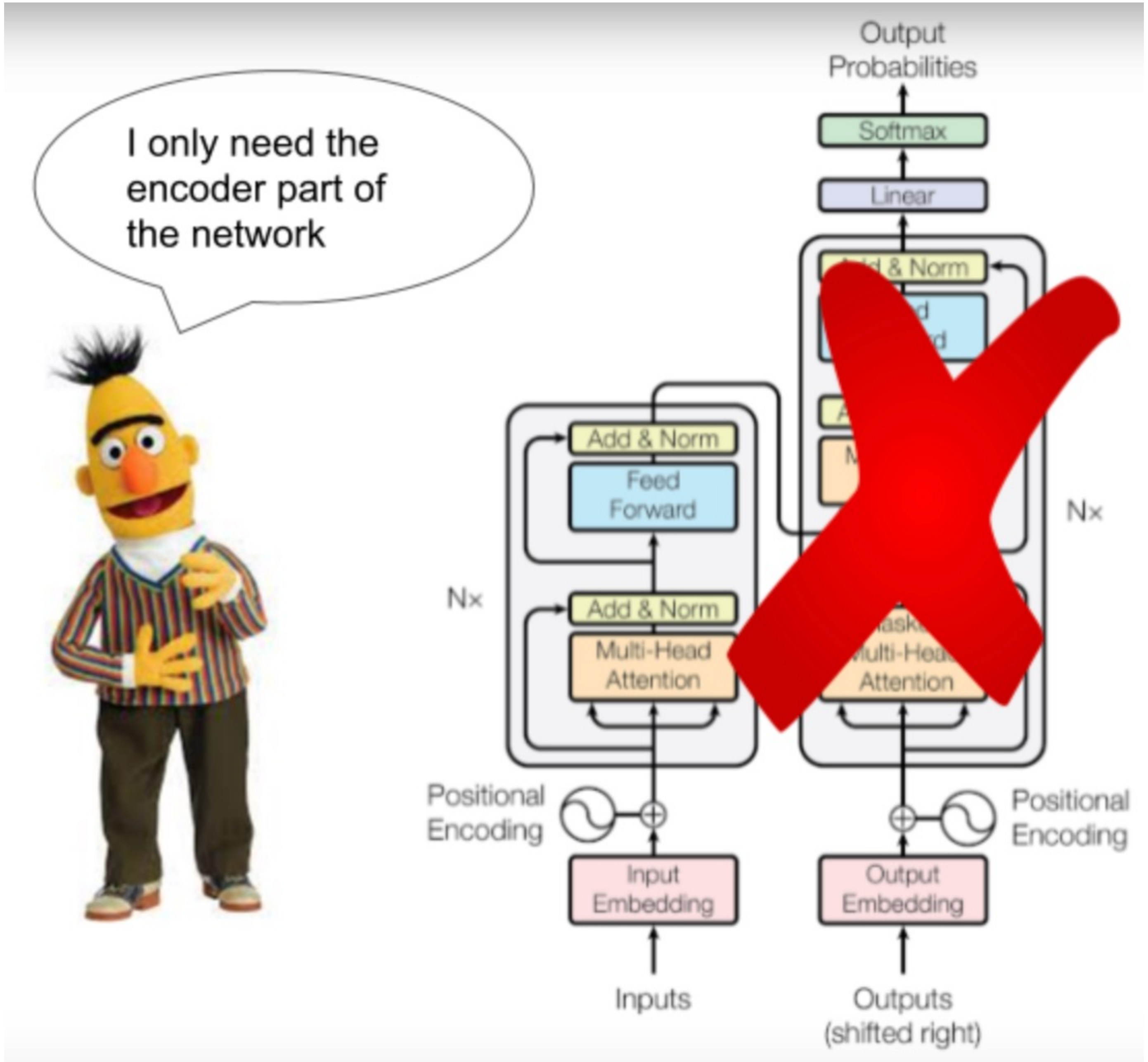
TRANSFORMER ARCHITECTURE

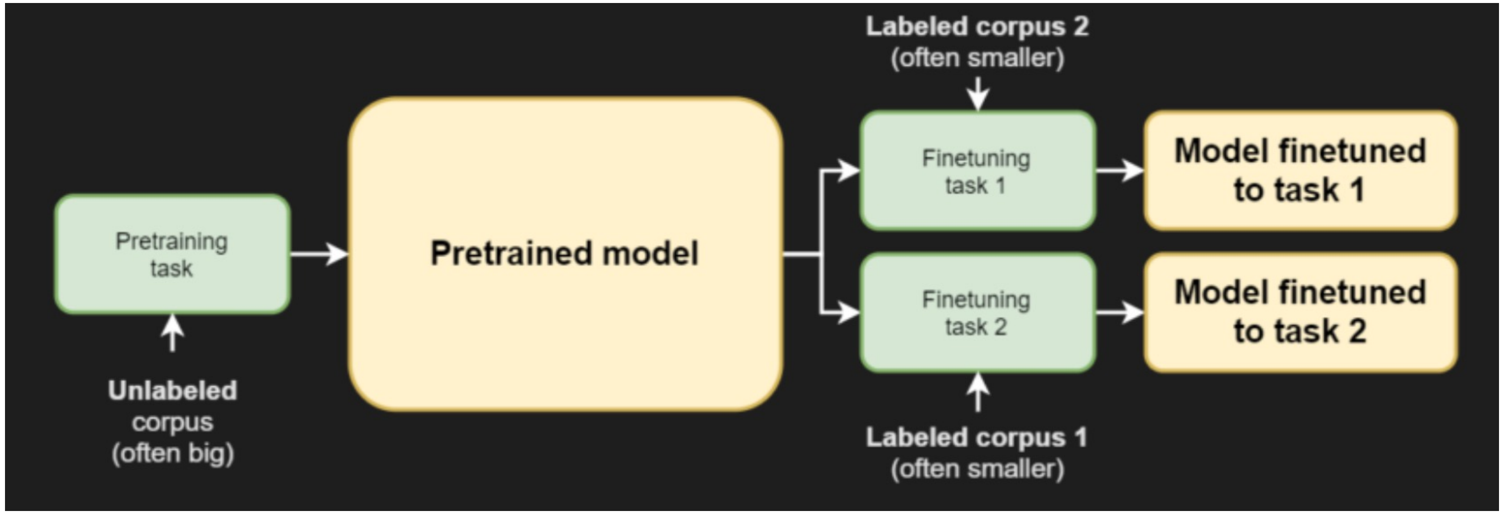




BIDIRECTIONAL
ENCODER
REPRESENTATION
for
TRANSFORMER



Bidirectional Encoder Representation for Transformer



BERT = fine-tuning & transfer learning i.e. pre-train a model on the large unlabelled corpus and finetune to a specific language task.

BERT pre-training has two objectives:

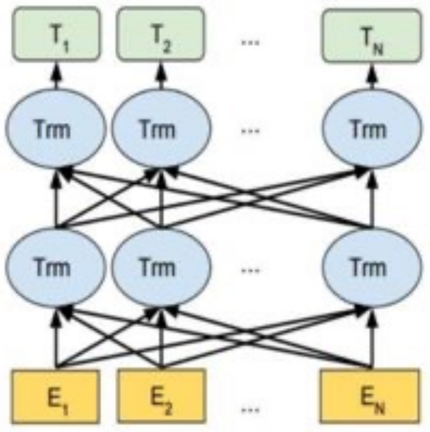
1) Predict masked tokens in texts (Masked Language Modelling)

LET'S PRETEND WE'RE BERT…

…and play a fill-in-the-blank game:

"Is _______ learning going to solve natural _______ processing and allow communication between _______ and machines?"

→ Which words do you think go in the blanks?



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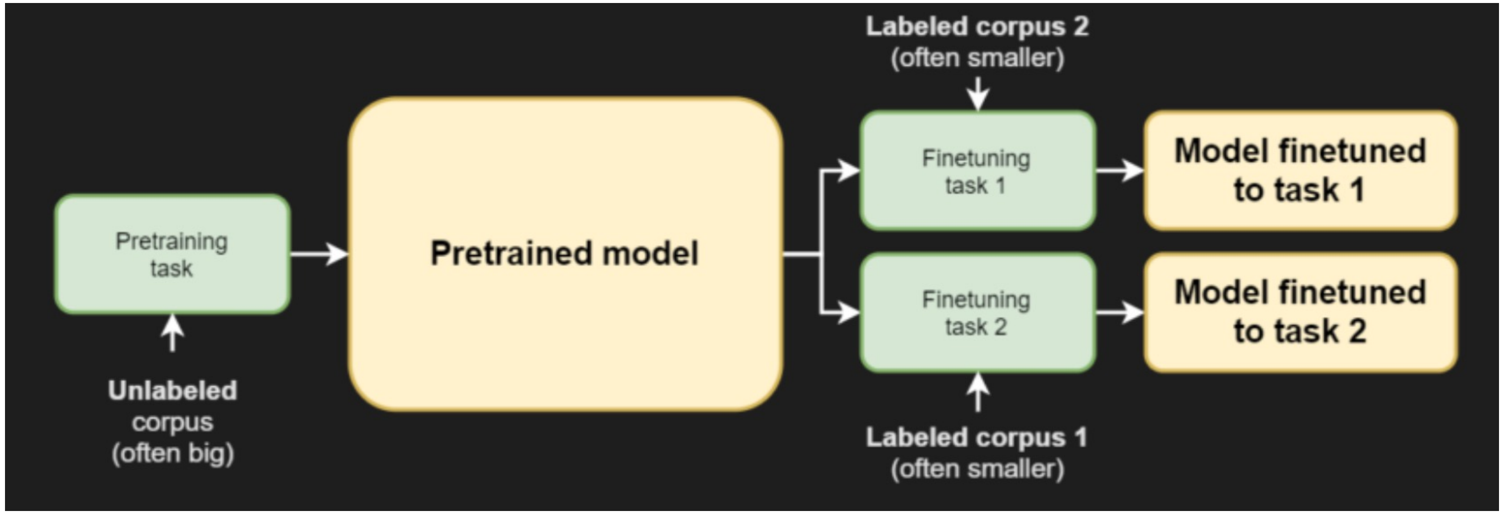


BERT pre-training has two objectives:

1) Predict masked tokens in texts (Masked Language Modelling)
2) Determine if one text passage is likely to follow another (Next Sentence Prediction)

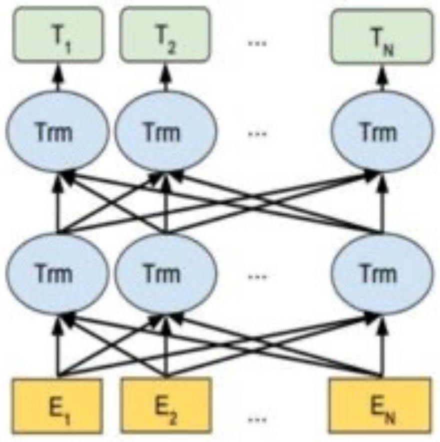
LET'S PRETEND WE'RE BERT...

...and check whether a pair of sentences are absolute nonsense or not.

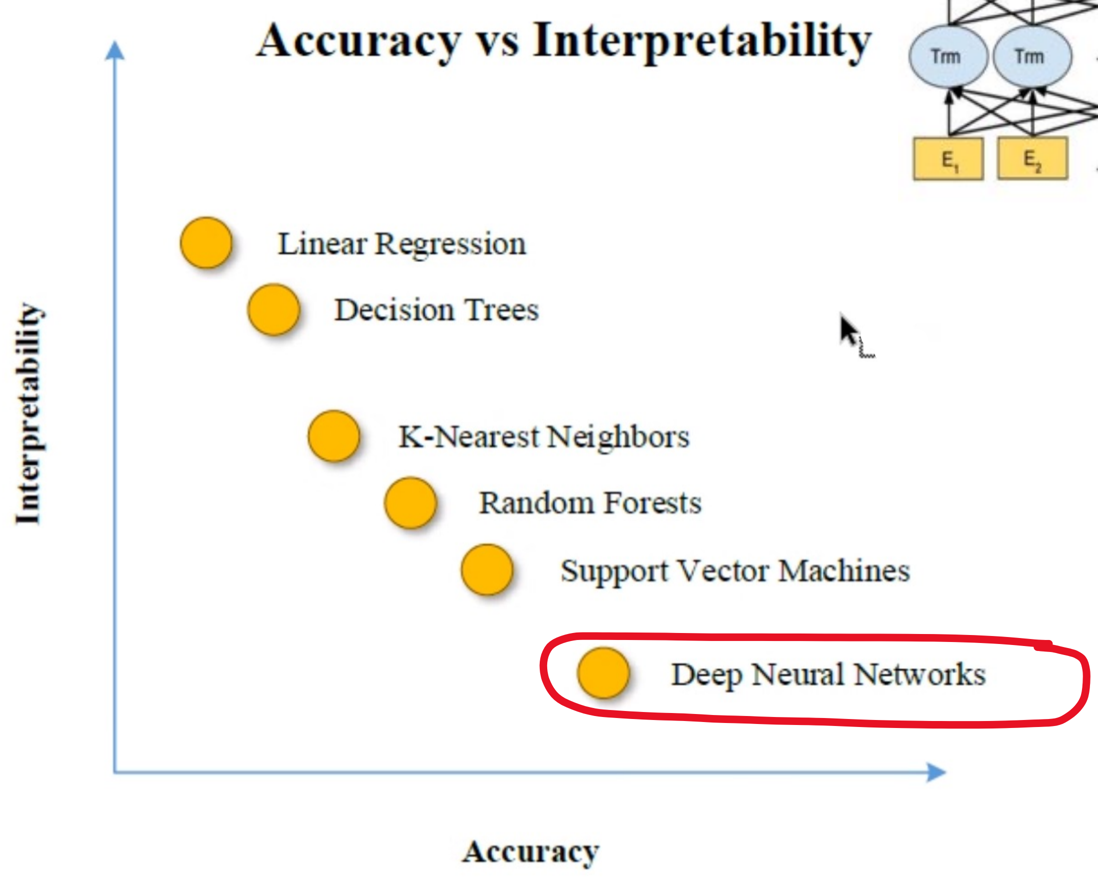
Sentence 1: *"When I was younger, I dreamt of flying to Jupyter."*

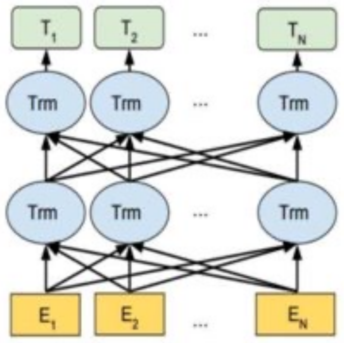
Sentence 2: *"Peking ducks taste better than spring rolls."*

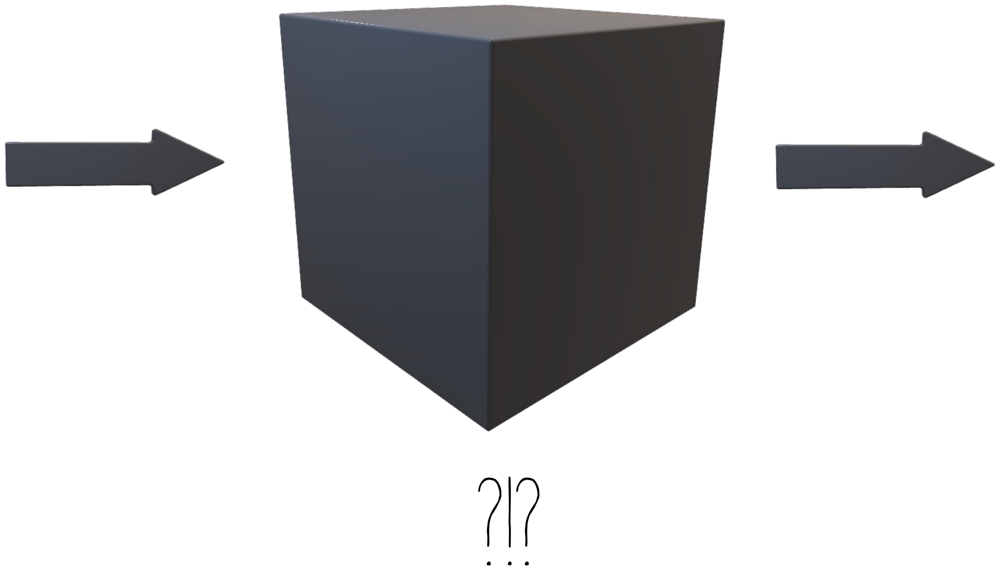
Is Sentence 2 related to Sentence 1?



HOW TO INTERPRET FINDINGS?







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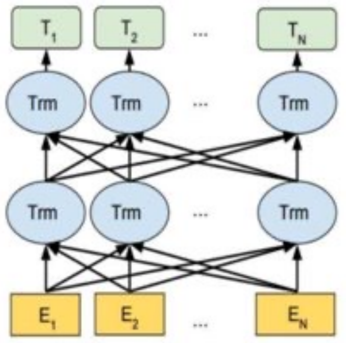
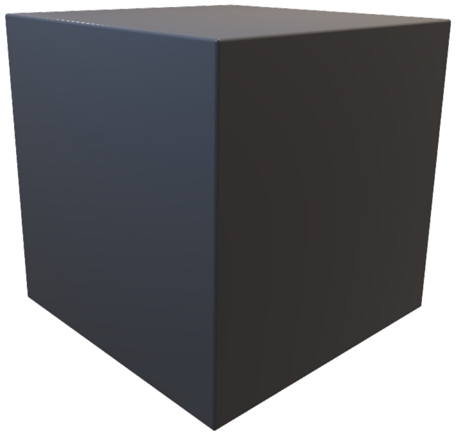
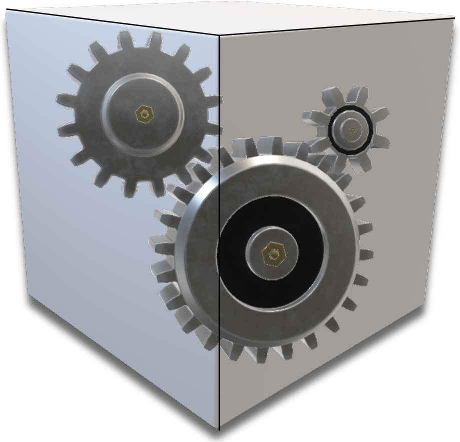


XAI

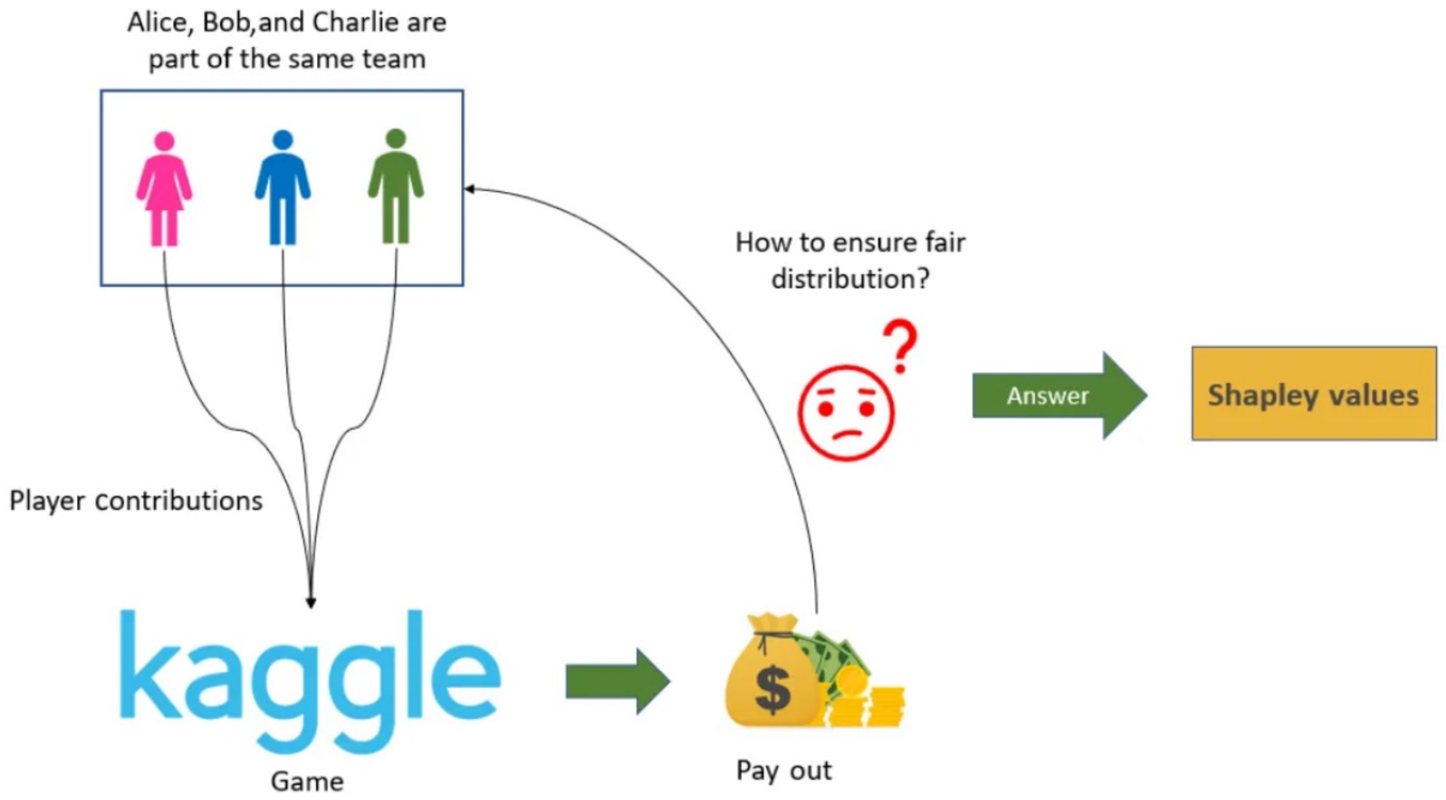




Which tokens in the input are important?

Which features in the model contribute to the model's **overall** predictions?

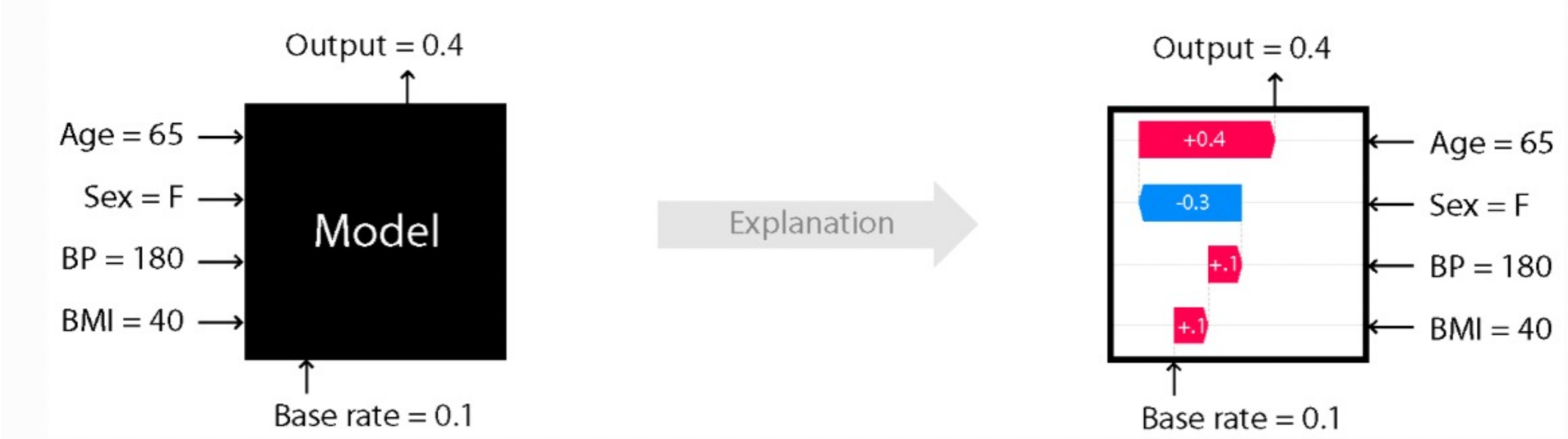
SHAP = SHapley Additive exPlanations

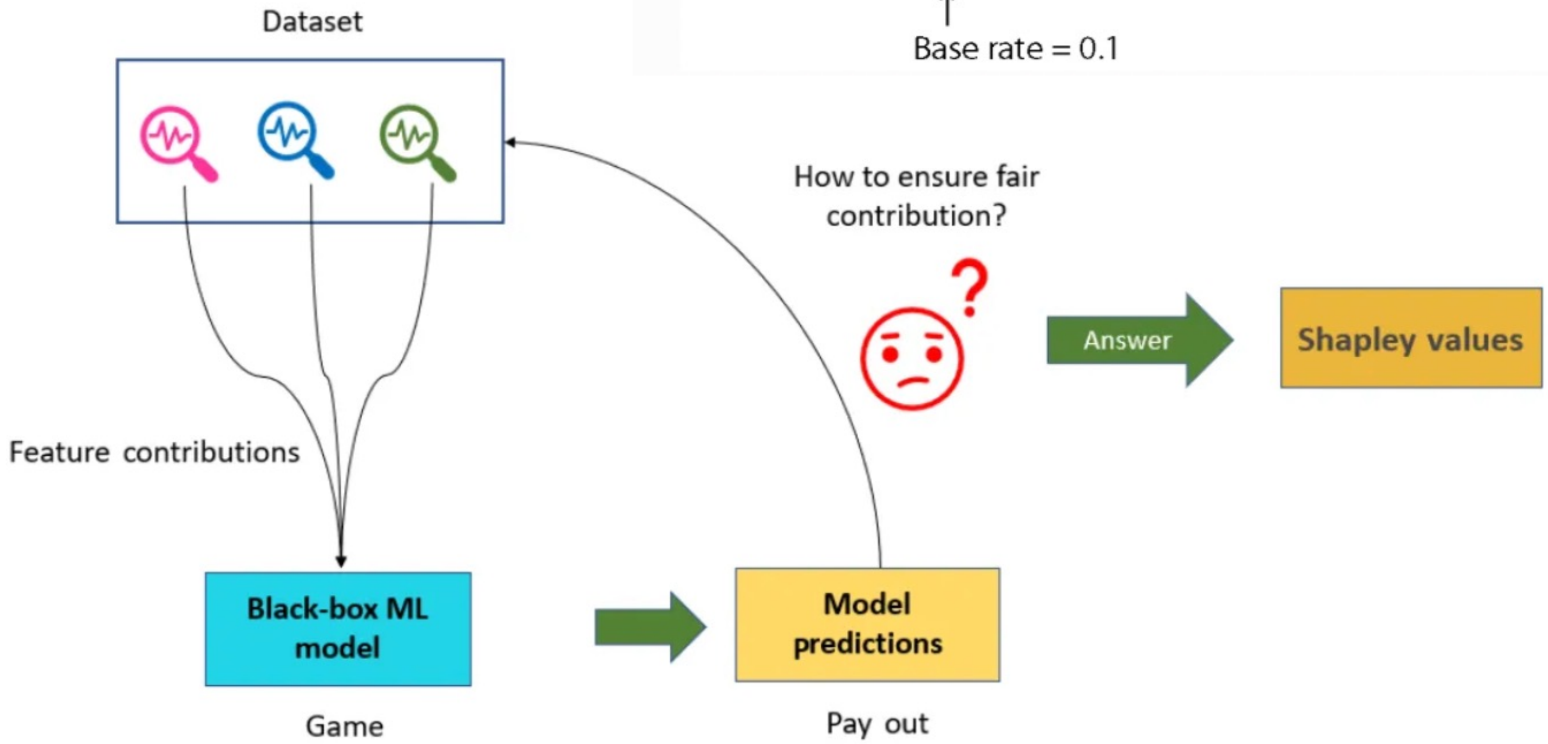


= mean ***marginal contribution*** *of each feature value across all possible values in the feature space.*

[Source: Understanding the workings of SHAP and Shapley values used in Explanale AI - Adita Bhattacharya]

SHAP





= mean *__marginal contribution__ of each feature value across all possible values in the feature space.*

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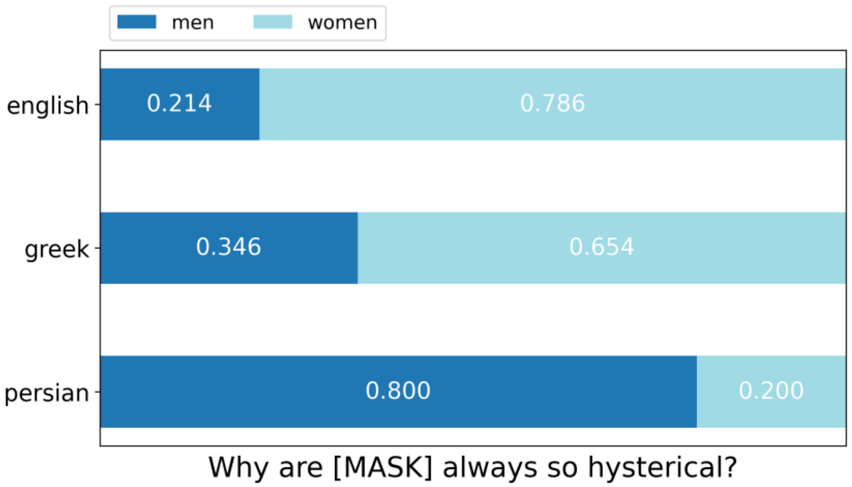
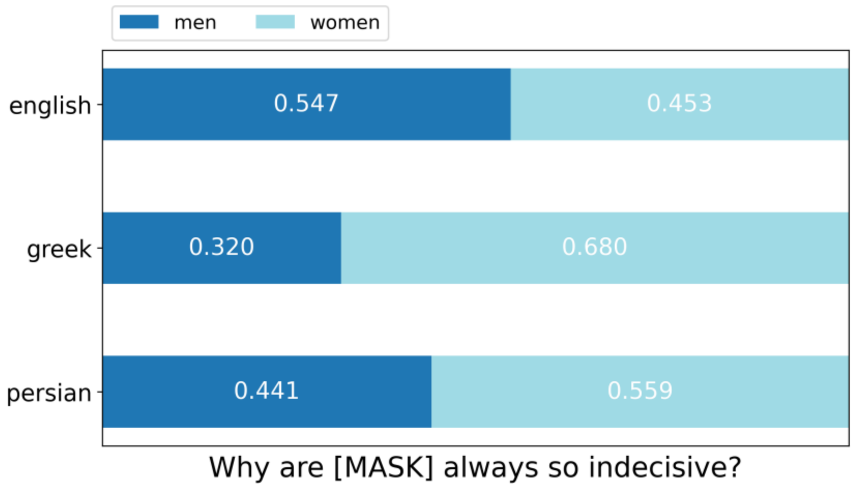
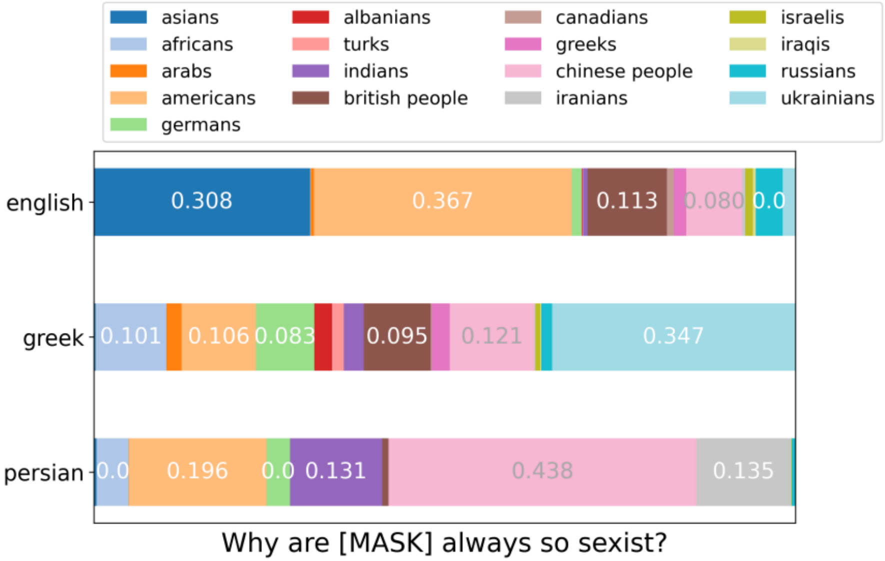
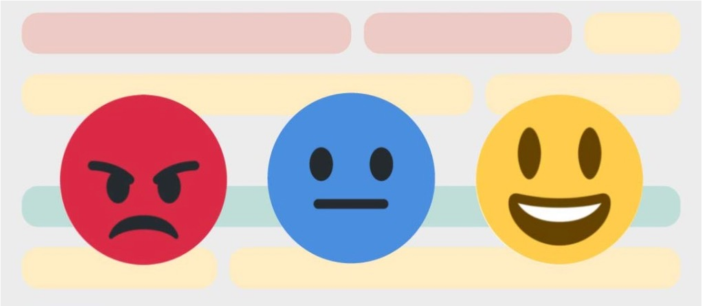
BIASES IN BERT?

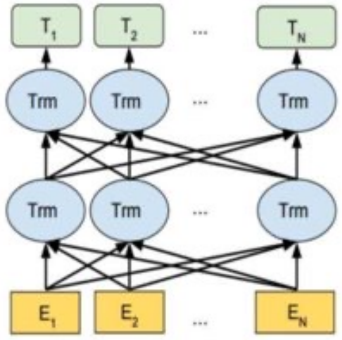






Source: BehnamGhader & Milios 2022 TSRML





CODE TIME!

REFERENCES, FURTHER READINGS & TUTORIALS

[Vaswani et al. 2017 NeurIPS Attention is all you need].

[Devlin et al.2018 arxiv BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding.]

[Kalyan et al. 2021 arxiv AMMUS: A Survey of Transformer-based Pretrained Models in Natural Language Processing.]

[Danilevsky et al.2020 arxiv A Survey of the State of Explainable AI for Natural Language Processing].

[DeepSense AI 2022 Overview of Explainable AI Methods in NLP.]

[Lundberg and Lee 2017 NeurIPS A Unified Approach to Interpreting Model Predictions.]

[BehnamGhader and Milios 2022 TSRML An Analysis of Social Biases Present in BERT variants across multiple languages.]

[Neptune.ai How to code BERT using Pytorch - Tutorial with Examples.]

[Towards Data Science: Understanding the workings of SHAP and Shapley values used in Explanale AI - Adita Bhattacharya]