

Generative AI and Social Media



Tauhid Zaman

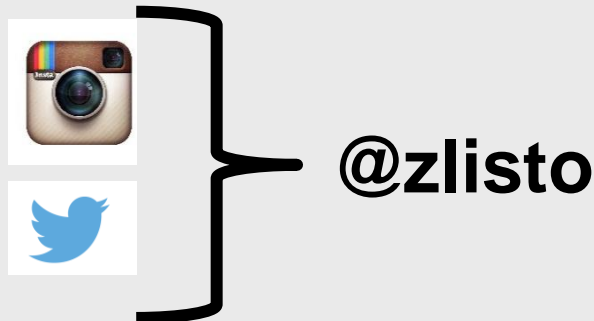
Generative AI and Social Media

- **Learn to use generative AI tools**
 - For analyzing and creating social media data
 - For building social media related web applications
- **No coding experience required**
 - AI does most of the work for us
- **Lectures**
 - 1.00-4:30
 - Room: 822



Bio - Tauhid Zaman

- Associate Professor in the Operations Management Group (OMG) at Yale SOM
- BS, MEng, PhD in Electrical Engineering and Computer Science from MIT
- Research: Social media analytics, generative AI, cryptocurrency, sports analytics
- Email: tauhid.zaman@yale.edu

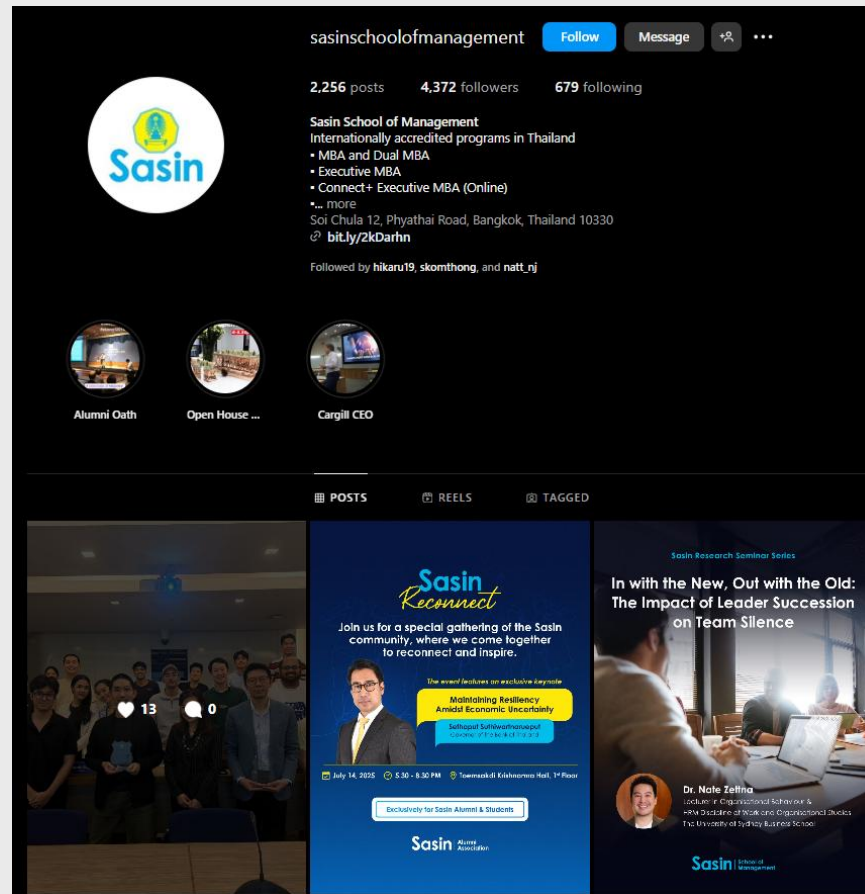


Course Info

- **Course website:**
https://zlisto.github.io/genAI_social_media/
- **Instructor**
 - Tauhid Zaman, tauhid.zaman@yale.edu
- **Teaching Assistant**
 - Lisa



What Can We Do With Generative AI + Social Media?



Learning About an Audience

Search engines



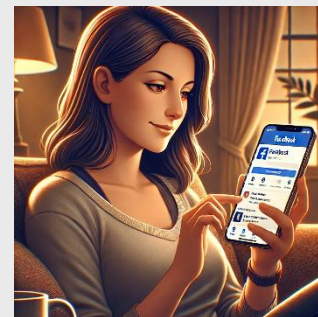
What you need



Social media



What you like



Learning About an Audience

AI Agents



What you feel



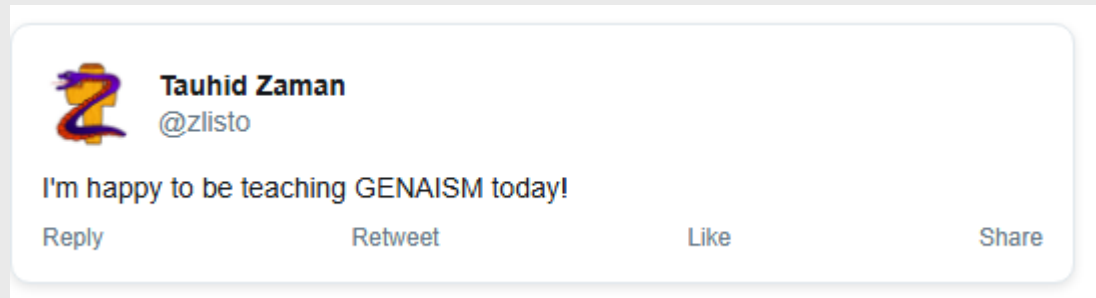
Analyzing Social Media Data with AI

- **Measure sentiment**
- **Community detection**
- **Image analysis**



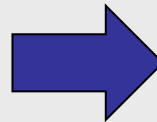
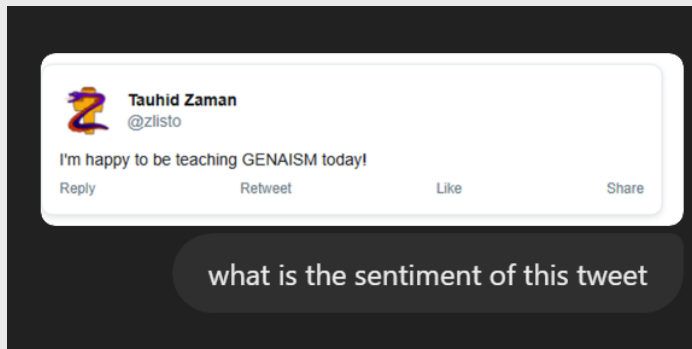
Measuring Sentiment

- Old way: train a model that looks for happy or sad words in text



Measuring Sentiment with AI

- New way: ask AI



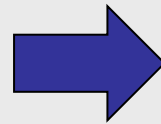
Sentiment Analysis:

- **Polarity:** 1.0 (Positive sentiment)
- **Subjectivity:** 1.0 (Completely subjective)

The sentiment is highly positive, reflecting happiness and enthusiasm. [:-]

Community Detection

- Old way: use network structure and machine learning algorithms



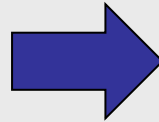
Community Detection with AI

- New way: ask AI

TwFollow Joe Biden Following

	name	username	userId
1	President Biden	POTUS	'1349149363'
2	The White House	WhiteHouse	'1323730784'

Put these people into communities based on their twitter bios

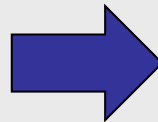
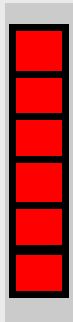
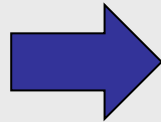


Social Network Communities

Name	Community
Alex	Friends from Work
Sophia	Friends from Work
James	College Friends
Emma	College Friends
Liam	Neighborhood
Olivia	Neighborhood
Noah	Family
Ava	Family
William	Online Friends
Isabella	Online Friends

Image Analysis

- Old way: train a classifier on labeled images



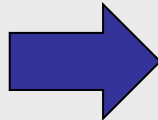
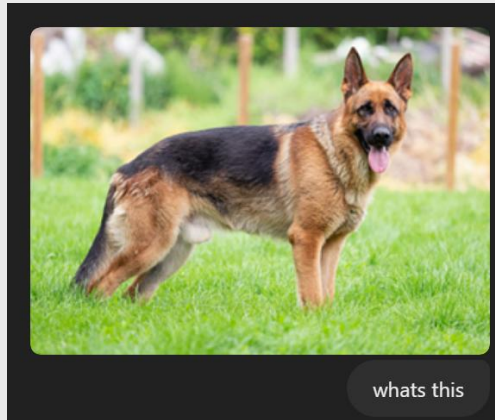
What is this a picture of?

- ☒ Dog
- ☐ Cat
- ☐ Plane



Image Analysis with AI

- New way: ask AI



This image appears to show a German Shepherd dog. Let me know if you need further details or analysis!



Creating Social Media Content with AI

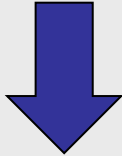
- **Text content**
- **Image content**
- **Audio content**
- **Video content**



Text Content

Tweet

write a tweet about how hyped i am to be teaching Generative AI and Social Media (GENAISM) and put in a funny joke about Elon Musk.



Tauhid Zaman
@zlisto

Super hyped to be teaching Generative AI and Social Media (GENAISM)! 🚀 If this goes well, I might just rebrand myself as 'Professor X.AI' and wait for Elon Musk to send me a cease-and-desist. 🤖 #GENAISM #AI

Reply

Retweet

Like

Share

Image Caption



write a funny tweet about this image and put in a funny joke about Elon Musk



Tauhid Zaman
@zlisto

Breaking: Elon Musk unveils the next-gen Tesla DogBot. It doesn't fetch, but it might tweet back at you. Beta testing begins in your backyard. 🐕🤖 #DogeCoin #Innovation

Reply

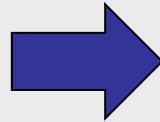
Retweet

Like

Share

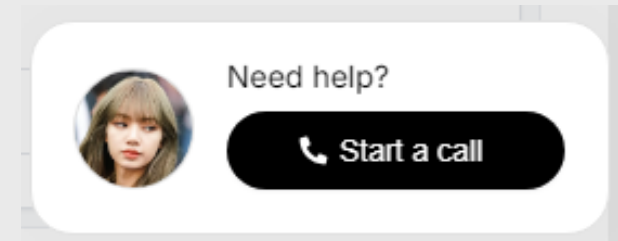
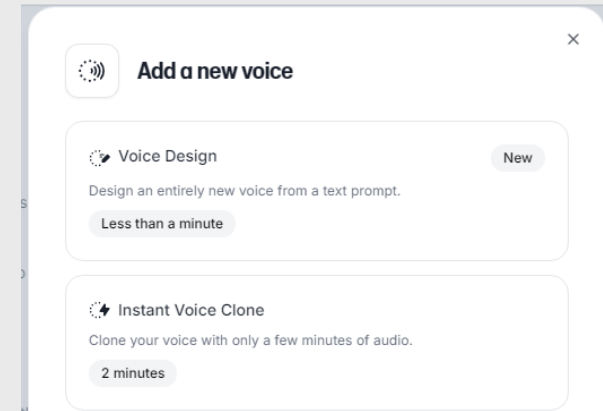
Image Content

draw a catchy Instagram image for this tweet:
Breaking: Elon Musk unveils the next-gen Tesla
DogBot. It doesn't fetch, but it might tweet
back at you. Beta testing begins in your
backyard. 🐕🤖 #DogeCoin #Innovation



Audio Content

- **AI can easily convert text to speech**
- **AI can also clone someone's voice**
 - **ElevenLabs**
- **Allows us to make narrations for videos**
- **Allows us to make human sounding, intelligent conversational agents**
 - **New thing from ElevenLabs**



Video Content

- **Convert a script into video**
 - **Google Gemini**

- Scene 1: Sasin University campus, with upbeat background music and quick cuts of students walking.
- Scene 2: Classroom filled with excited students working on laptops.
- Scene 3: Students laughing and high-fiving while showing their projects to each other.



Building Web Apps with AI

- **Course teaches you how to build web applications for social media**
- **To build a web app you need to know**
 - **HTML**
 - **JavaScript**
 - **Python**
 - **SQL**
- **In the old days you'd hire a team of software developers to build your app for you**
 - **And pay them a lot**



Building Web Apps with AI

- **With AI you build a web app by yourself with very little training**
 - Vibe coding – coding by telling the AI the vibe of what you want to make
- **Once you have the basics down, you can make some very creative and cool apps**
- **Some examples**
 - Narration generator
 - Photoblog writer
 - Video maker
 - Influencer assistant
 - And many more ...



Vibe Coding

Hello, Tauhid

Write a python script
to monitor system performance

Calculate rocket
trajectory to Mars

Create an app
for tracking tasks

Ask Gemini



Deep Research



Canvas



Video

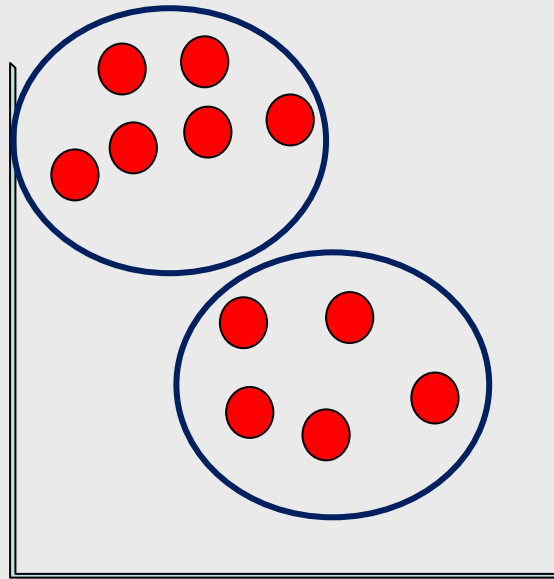


Transformers



Geometry of Data Points

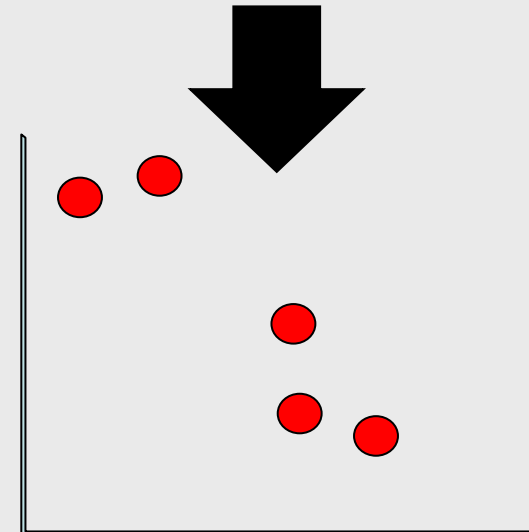
- The geometry of these data points consists of two clusters



Embeddings

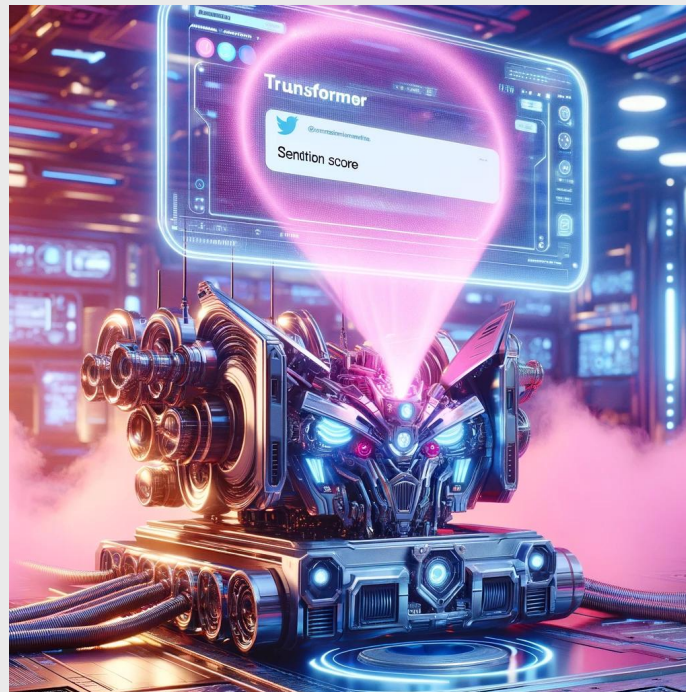
- If we embed text, we turn text into a numeric data point
- A good embedding will encode meaning of the text in the geometry of the data points
- With a good embedding, we can do a lot of useful things with text

Document
Time to tell the story of Tesla & SpaceX
Asteroid impact risk is well understood, but not comets. Those worry me.
Yesterday, I did the most important thing I can do to support @BarackObama - I voted
The President has been steady on the issues
A favorite Obama family recipe is up for a vote



Transformers

- Neural network developed in 2017 by Google
- Revolutionized natural language processing



What Can Transformers Do?

- Measure sentiment
- Translation
- Web search
- Text summarization
- Generate text
- Question answering
- Write code
- Be your friend 😊
- **ANYTHING!!!!**



Transformers

Attention Is All You Need

Ashish Vaswani*
Google Brain
avaswani@google.com

Noam Shazeer*
Google Brain
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Niki Parmar*
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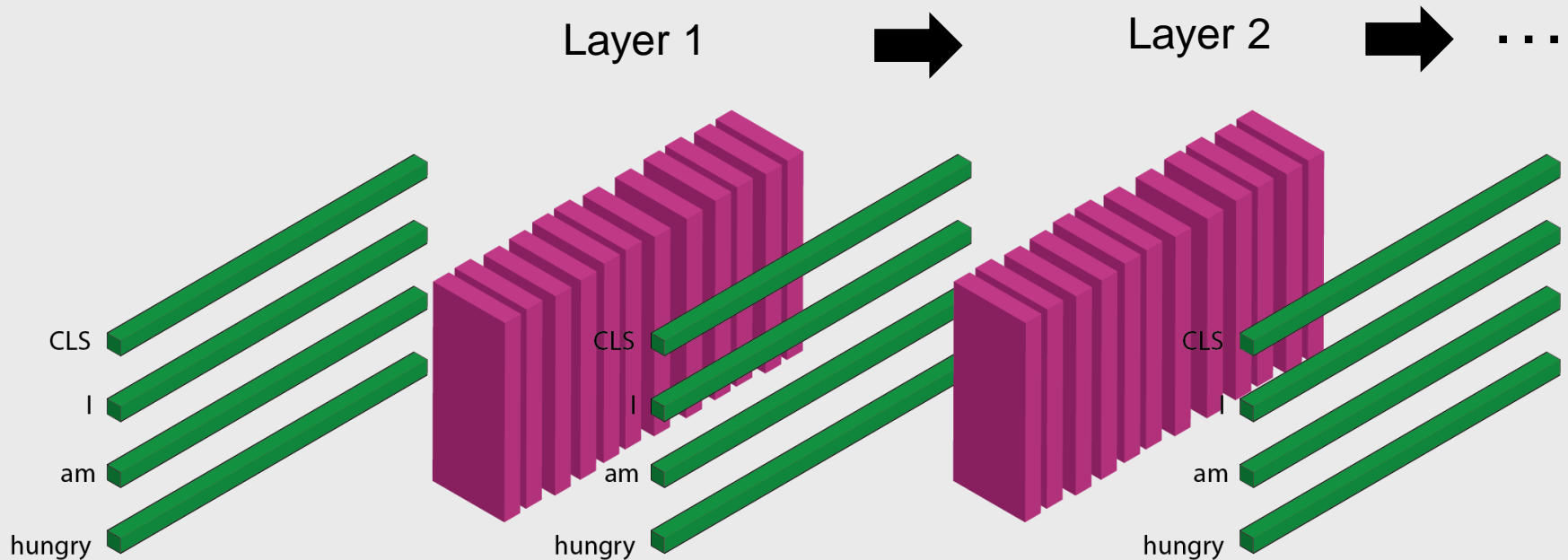
Abstract

The dominant sequence transduction models are based on complex recurrent or convolutional neural networks that include an encoder and a decoder. The best performing models also connect the encoder and decoder through an attention



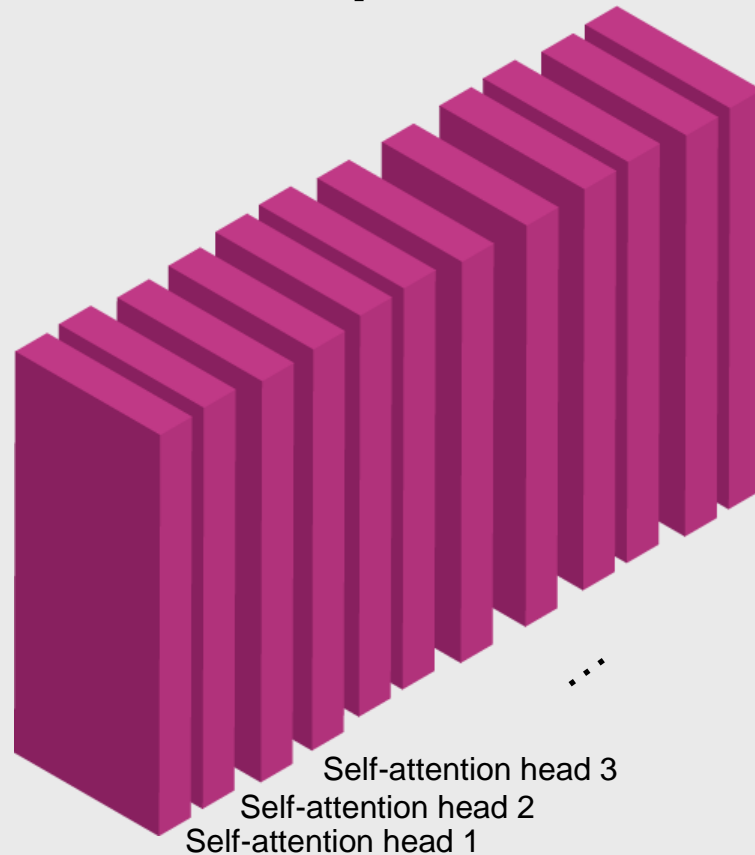
Transformer Architecture

- The transformer has many layers
- Each layer has an embedding vector for each word in the input text



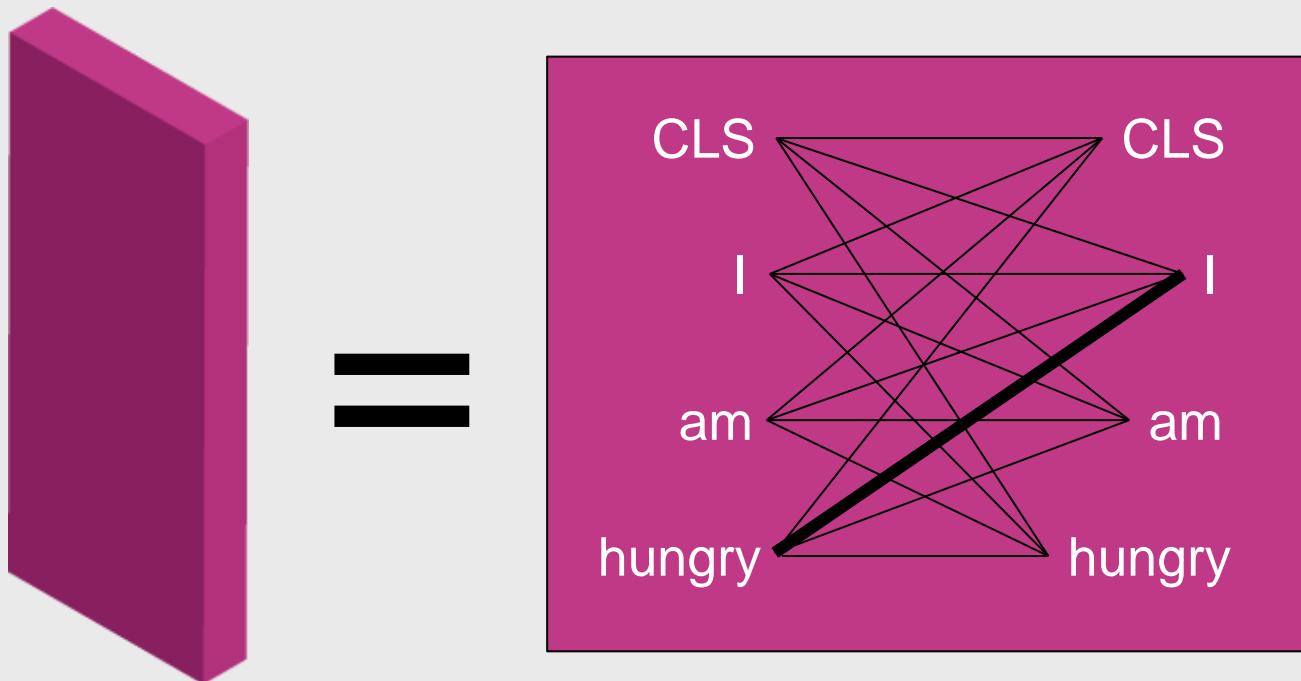
Transformer Layer

- Each layer has many **self-attention heads**
- Each attention head operates on a small chunk of the input vectors in parallel



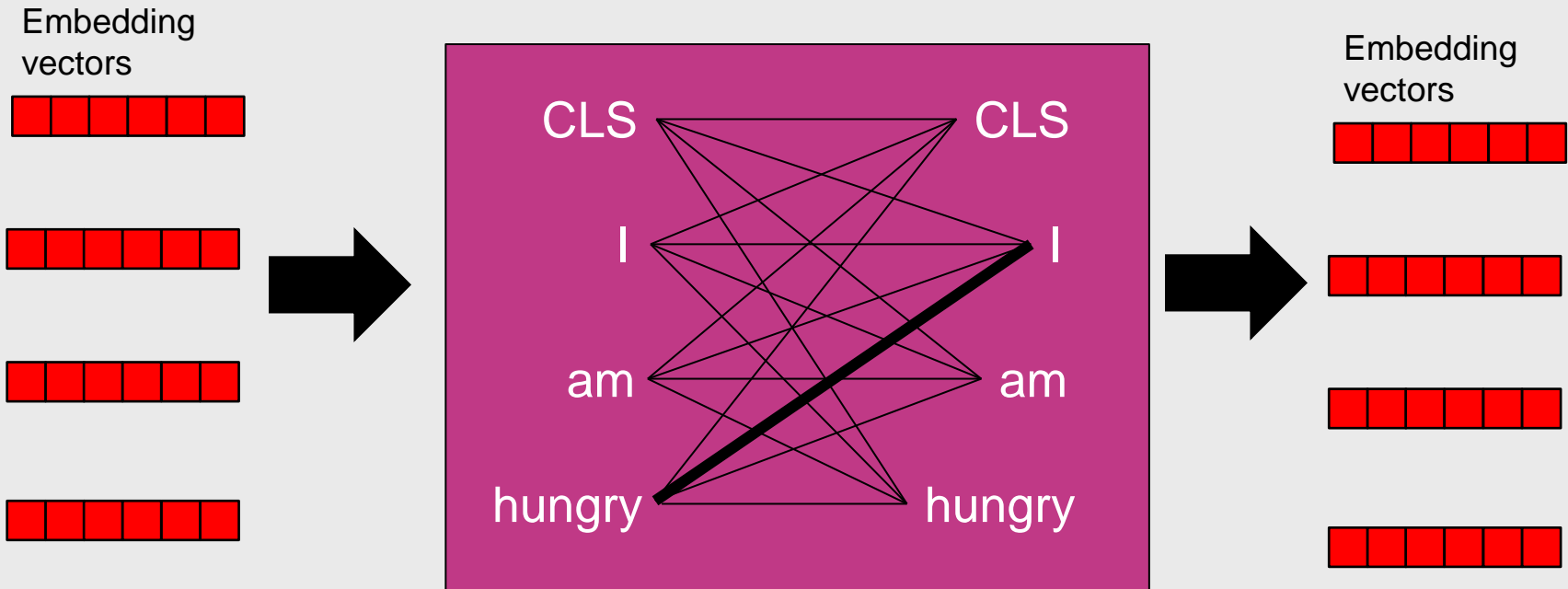
Self-Attention Head

- Each self-attention head computes weights from each word to each other word, creating an **attention pattern**
- This attention pattern represents some aspect of the language (subject, sentiment, etc)



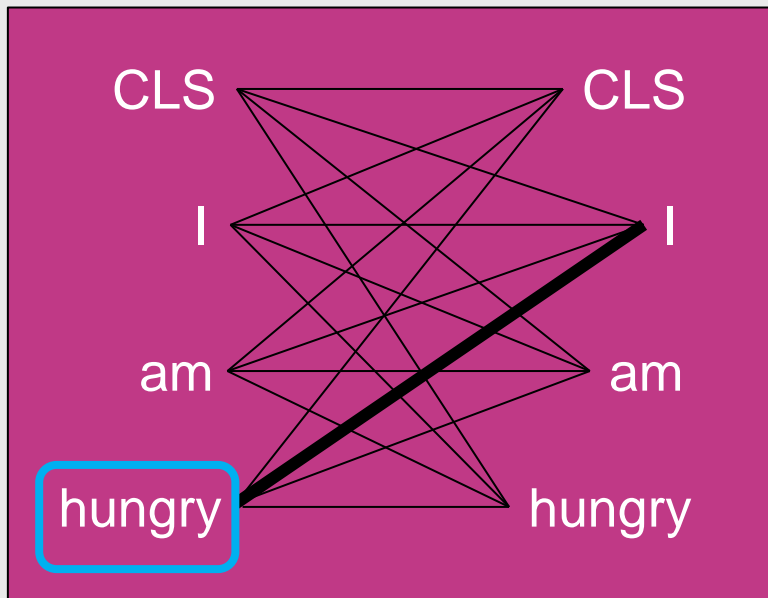
Self-Attention Head

- Each self-attention head outputs a context dependent embedding vector for each word








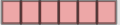



Self-Attention Head

- Output embedding vector of a word is a weighted combination of input embedding vector of all words
- Weight is given by attention pattern



hungry

Word	Vector	Weight	Weight x Vector
CLS		0.01	
I		0.9	
am		0.07	
hungry		0.02	
		Sum:	

Context Dependent Embeddings

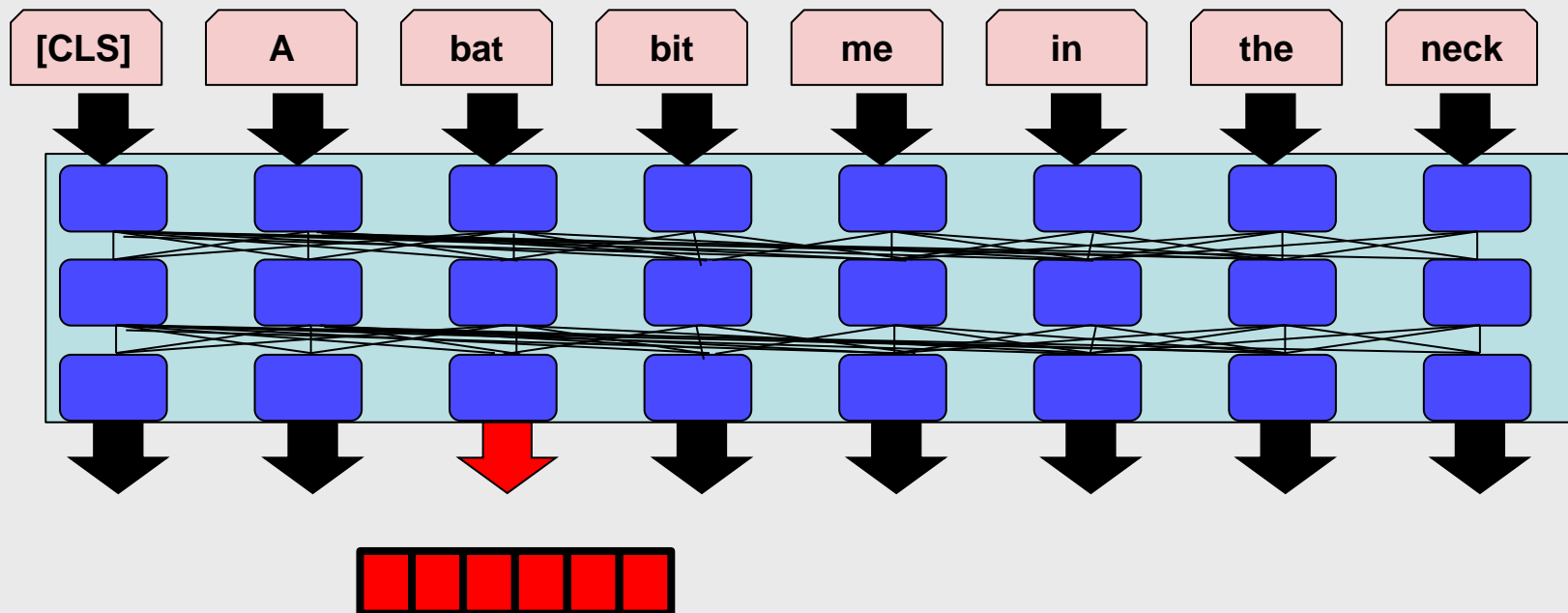
Consider these sentences that use the word **bat**

1. A **bat** flew out of the cave
2. The **bat** pooped on the ground
3. A **bat** bit me in the neck
4. Im afraid of a **bat** because it is like a rat with wings
5. A **bat** flew out of the baseball players hand
6. I hit a home run with the metal **bat**
7. No one swung a **bat** harder than Babe Ruth

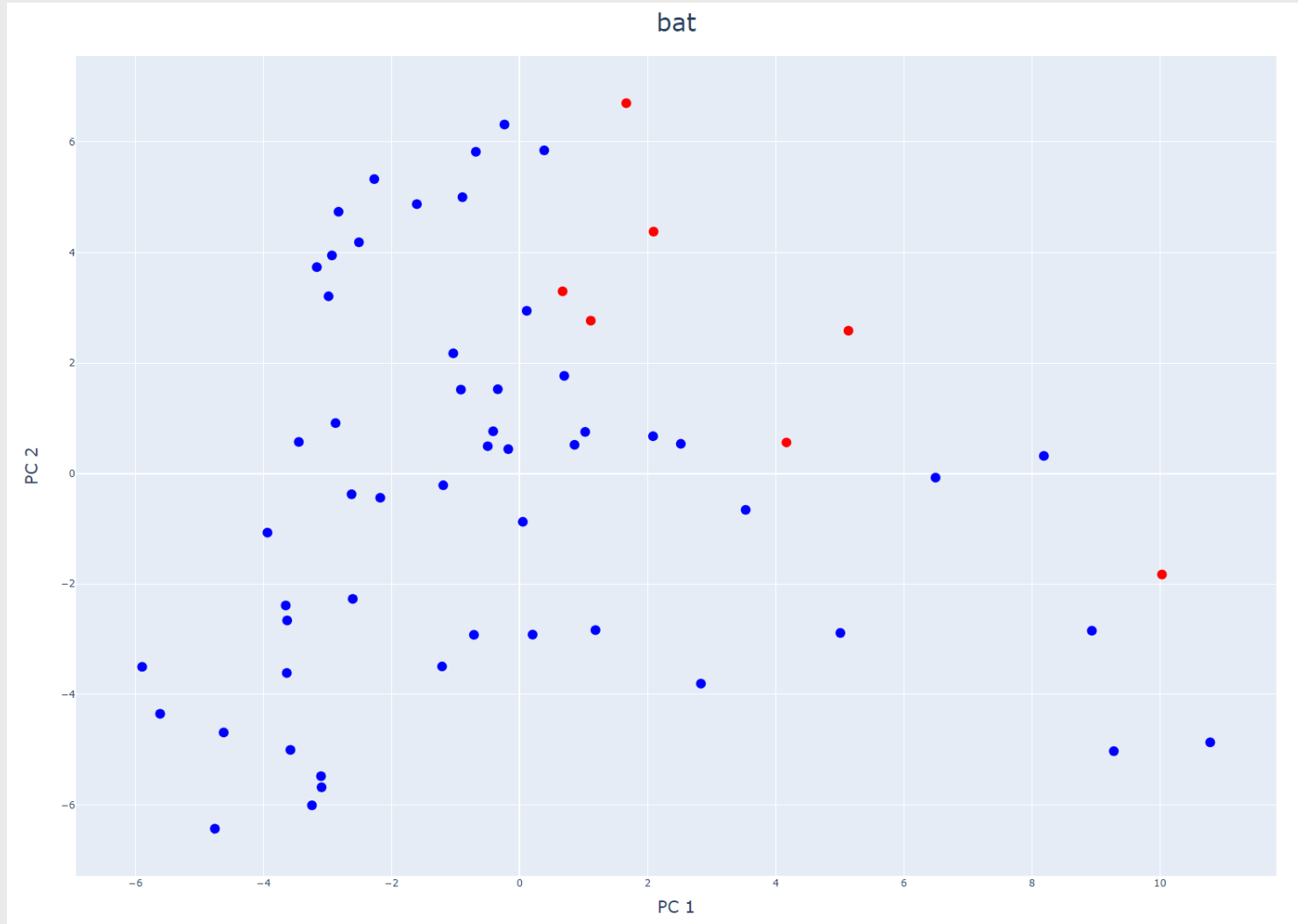


Context Dependent Embeddings

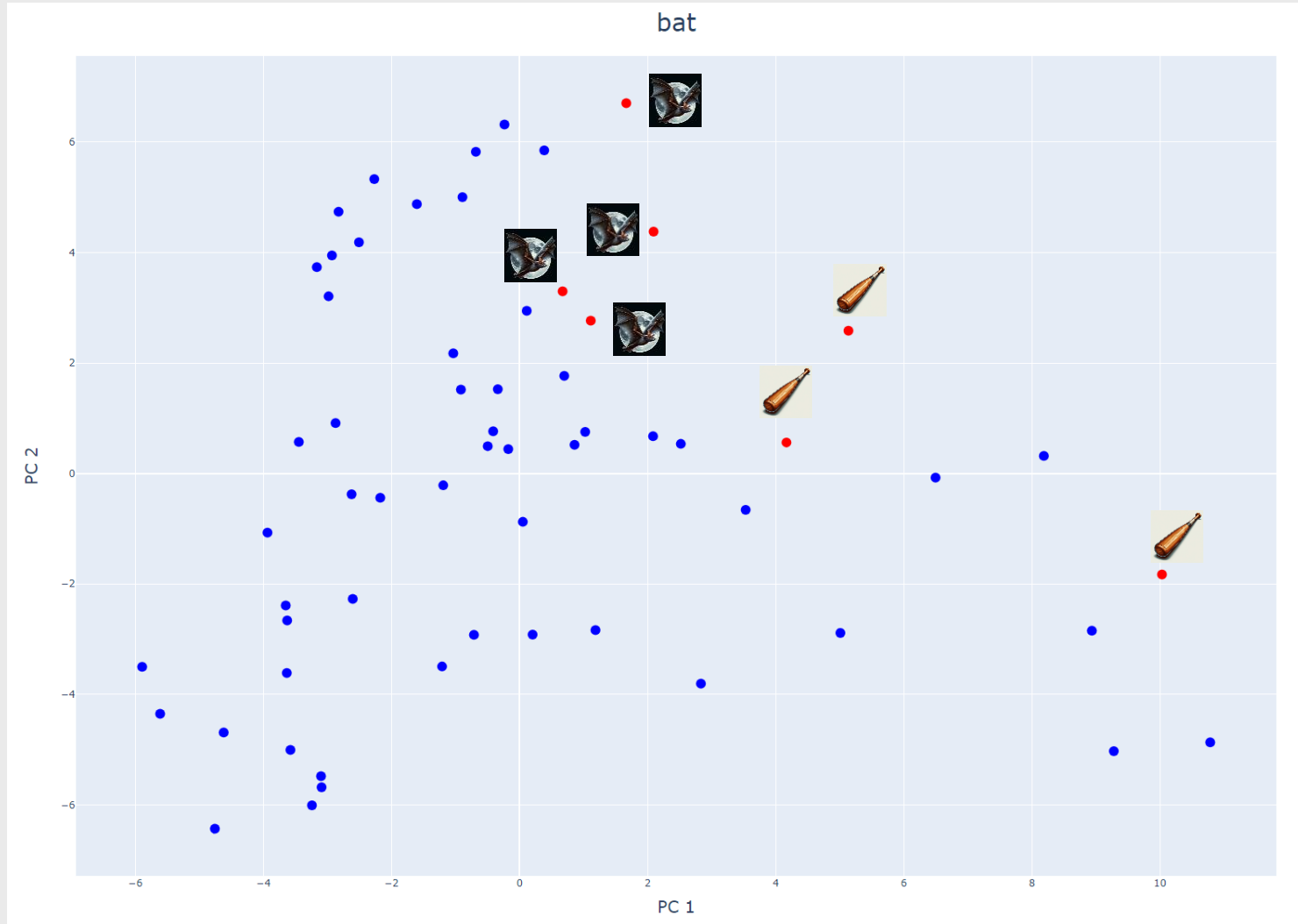
- The transformer outputs a context dependent embedding vector for each word in each sentence
- Let's see if the bat embeddings differ depending on the meaning of the word



Context Dependent Embeddings

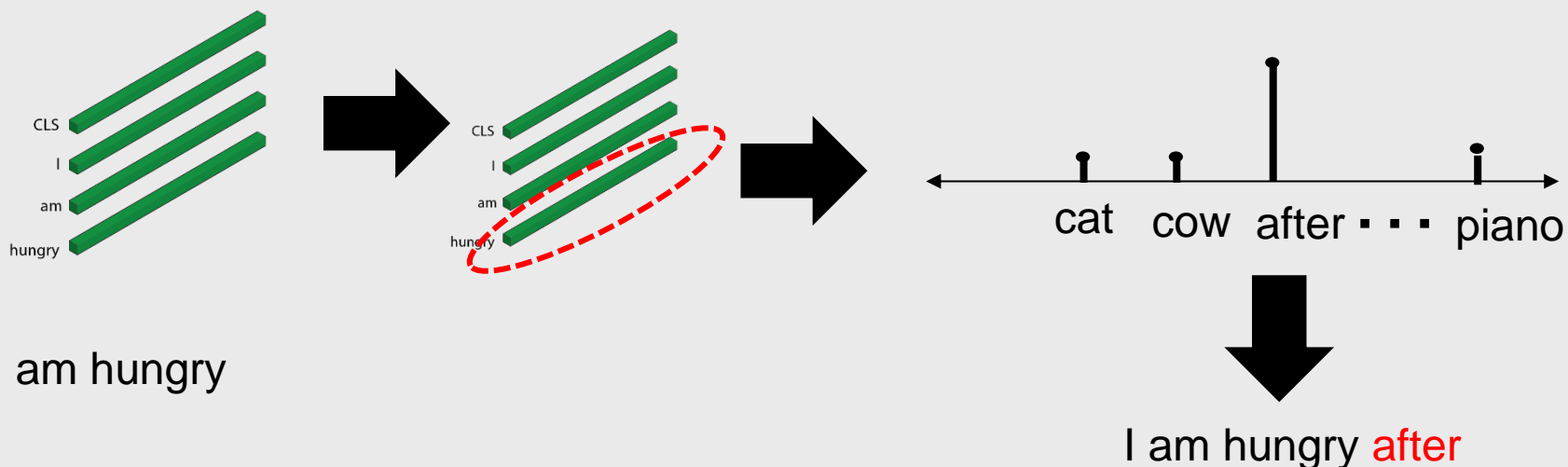


Context Dependent Embeddings



Generative Transformers

- A generative transformer turns the word embedding vector into a probability distribution over all words in the vocabulary
 - Ex) GPT, GPT-2, GPT-3, ChatGPT, GPT-4
- Text is generated by sampling from this distribution
- These types of transformers are also called large language models (LLMs)



ChatGPT

- GPT = **Generative** Pre-trained Transformer
- ChatGPT Released in 2023 by OpenAI
- Newest version of ChatGPT (GPT-4) has over 1.8 trillion parameters
 - More than 120 layers
 - More than 96 attention heads per layer
 - At least 12,288 dimensional word embedding
- Trained on all text data in the world + human labeled data



Transformer Basic Training

- A transformer is trained to complete the masked language task (MLT)
 - Fill in the masked word
- Unsupervised process – no labeled data needed

Data	Prediction
I went to the [MASK]	[MASK] = store
I went to the store to buy [MASK]	[MASK] = eggs
I went to the store to buy eggs and they were [MASK]	[MASK] = expensive



ChatGPT (GPT-3.5)

- ChatGPT (GPT-3.5) was a major advancement in generative AI
- Trained using a clever technique: reinforcement learning from human feedback (RLHF)

ChatGPT Is a Tipping Point for AI

by Ethan Mollick

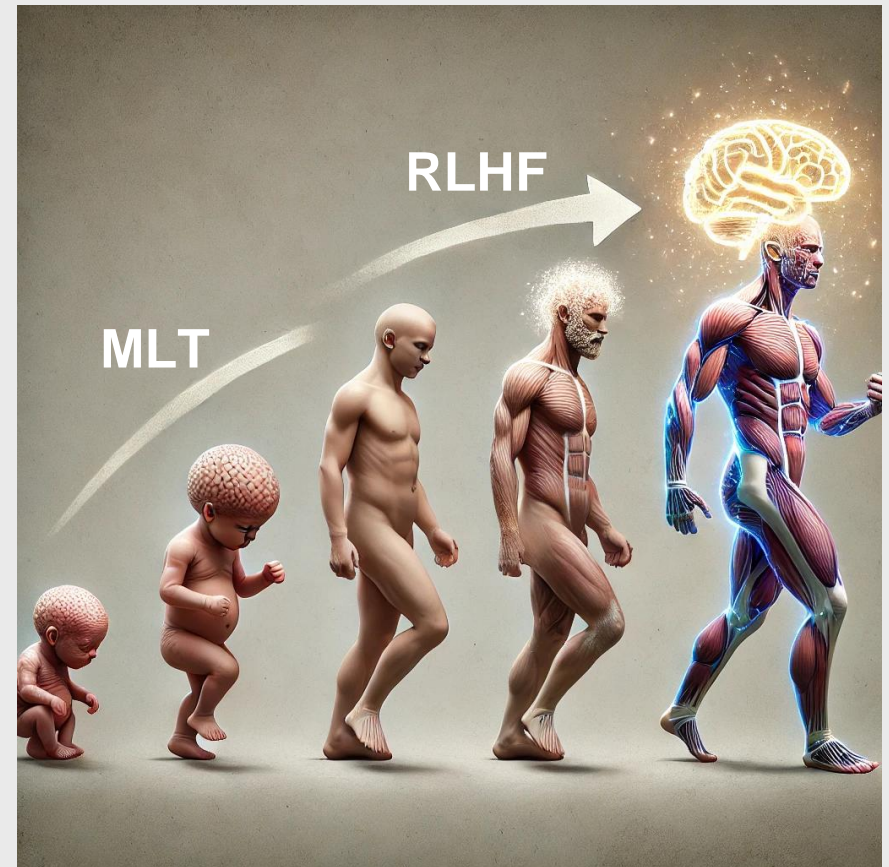
December 14, 2022



Tetiana Lazunova/Getty Images

Transformer Advanced Training

- Masked language task (MLT) takes a transformer from a baby to a child
- To go from a child to a superhuman a new training technique was needed:
Reinforcement Learning from Human Feedback (RLHF)
 1. Fine-tune on human created data
 2. Train a reward model to score how good the transformer is
 3. Let the transformer try to beat its high score



Fine Tuning

Step 1

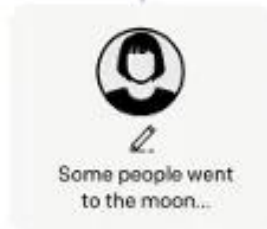
**Collect demonstration data,
and train a supervised policy.**

A prompt is
sampled from our
prompt dataset.



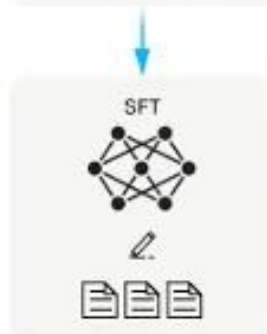
Prompt dataset is a series of
prompts previously submitted to
the Open API

A labeler
demonstrates the
desired output
behavior.



40 contractors
hired to write
responses to
prompts

This data is used
to fine-tune GPT-3
with supervised
learning.



Input / output pairs are used to
train a supervised model on
appropriate responses to
instructions.



Reward Model

Step 2

**Collect comparison data,
and train a reward model.**

A prompt and
several model
outputs are
sampled.

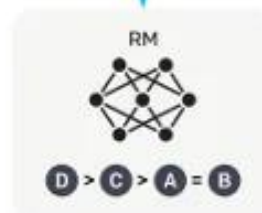


Responses are generated by
the SFT model

A labeler ranks
the outputs from
best to worst.



This data is used
to train our
reward model.



$\binom{k}{2}$ combinations of
rankings served to the
model as a batch datapoint



Beat High Score with Reinforcement Learning

Step 3

Optimize a policy against the reward model using reinforcement learning.

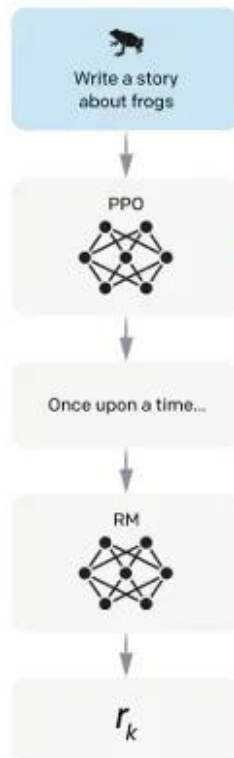
Leverages Proximal Policy Optimization (PPO)

A new prompt is sampled from the dataset.

The policy generates an output.

The reward model calculates a reward for the output.

The reward is used to update the policy using PPO.

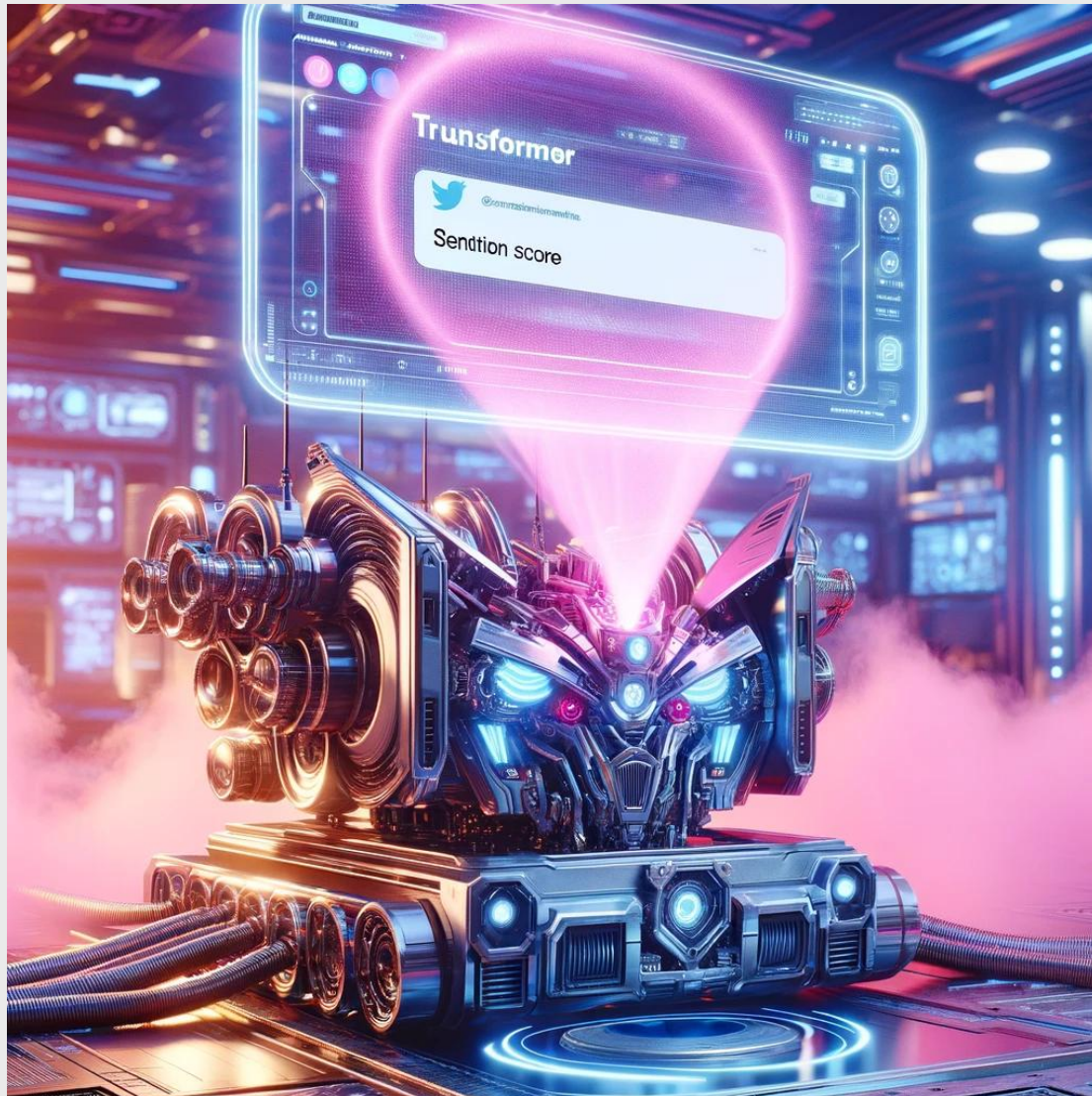


A policy is, a strategy that an agent uses in pursuit of goals

Kullback-Leibler penalty for SFT model to avoid overfitting



Sentiment Analysis with Transformers



Measuring Sentiment with Pre-Trained Transformers

- In the old days, we would have to train a transformer to measure sentiment
 - Collect and label data ☹️
 - Train for hours on a GPU ☹️
- Today, we have AI
 - No training data needed
 - No training needed
 - Sometimes you don't even need any examples

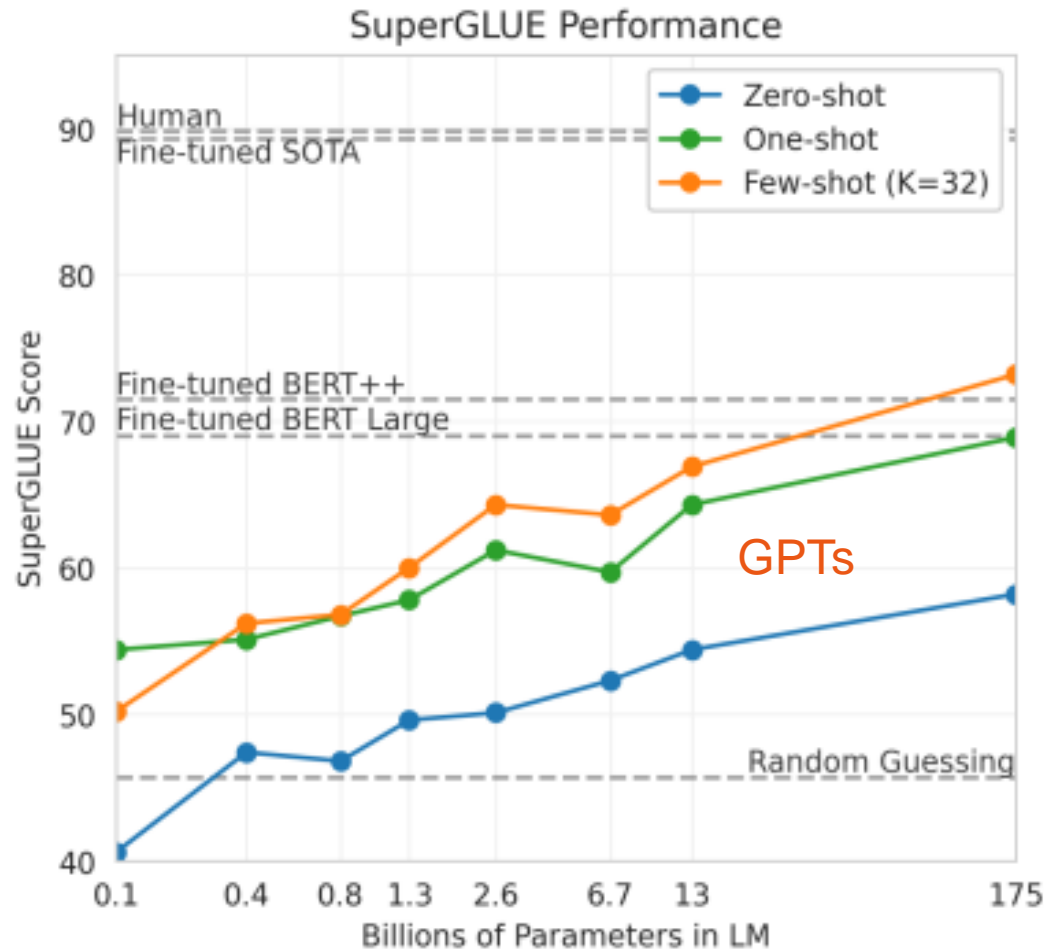


Few-Shot Learning

- How do we make the language model generate text for a specific task?
- Old way – fine tune on new set of data
 - Collect and label data ☹
 - Train for hours on a GPU ☹
- New way – few-shot learning
 - Put a few example texts in the input
 - No training needed
 - Works surprisingly well if the model is large enough



Few-Shot Learning



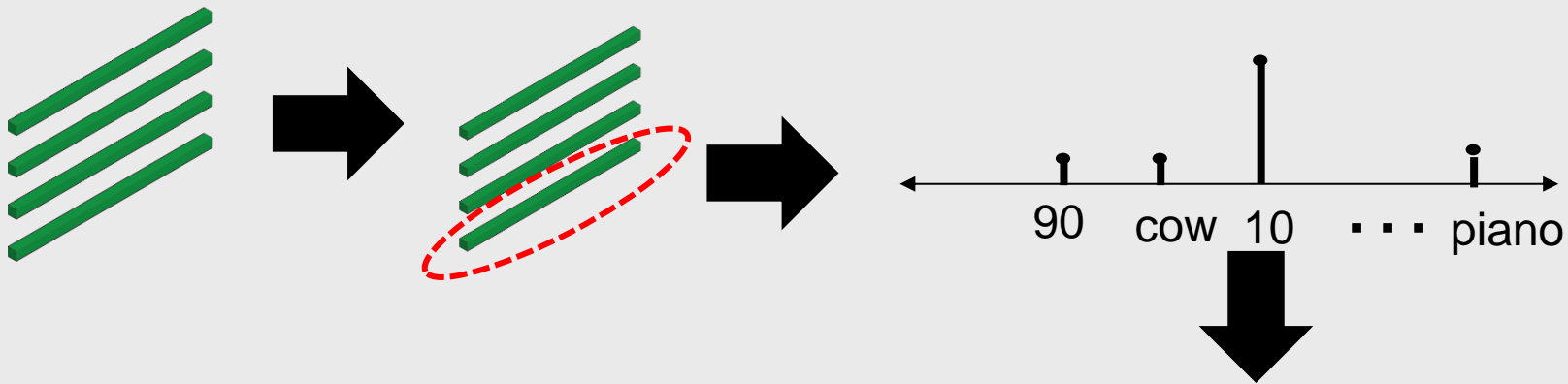
Emergent Behavior

- The transformer was trained to complete sentences
- It has shown the ability to perform many behaviors it was not trained on
- These are emergent behaviors – but no one really understands why they emerge
- Emergent behaviors are the reason why transformers are so powerful

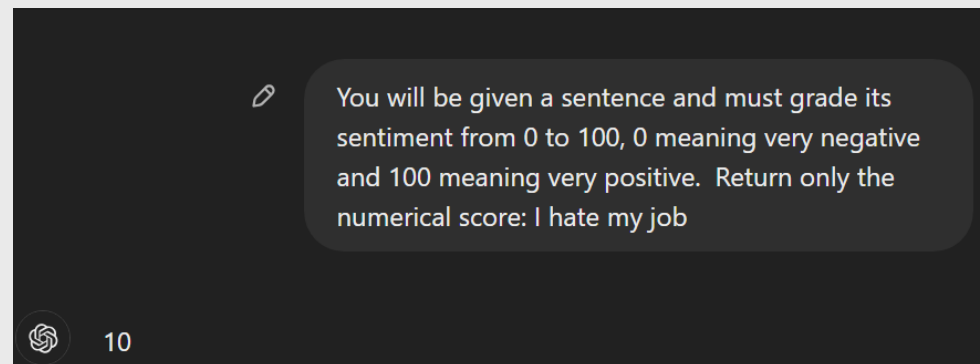


Measuring Sentiment with ChatGPT

- ChatGPT can measure sentiment based on a prompt
- Ex) “You will be given a sentence and must grade its sentiment from 0 to 100, 0 meaning very negative and 100 meaning very positive. Return only the numerical score: I hate my job





You will be given a sentence and must grade its sentiment from 0 to 100, 0 meaning very negative and 100 meaning very positive. Return only the numerical score: I hate my job



Measuring Complex Sentiment with AI

- AI can give us more nuanced sentiment and explain why

 You will be given a sentence and must grade its Ekman's Six Basic Emotions from 0 to 100: Return a table of the scores and explanation why: I hate my job

 Here is an analysis of the sentence "I hate my job," graded on **Ekman's Six Basic Emotions** (Anger, Fear, Joy, Sadness, Disgust, and Surprise), along with explanations for each score:

Emotion	Score (0-100)	Explanation
Anger	85	The word "hate" conveys strong negative feelings and frustration, indicating anger.
Fear	40	The sentiment may imply fear of being stuck in an undesirable situation or uncertainty about the future.
Joy	0	The sentence expresses no happiness or positivity, as "hate" and "job" in this context are negative.
Sadness	75	The phrase suggests unhappiness, disappointment, or distress about the situation.
Disgust	90	The word "hate" evokes a sense of aversion or repulsion, strongly tied to disgust.
Surprise	10	There is little indication of surprise in the sentence, as it reflects ongoing dissatisfaction.



COURSE LOGISTICS



Grading

- **Grading:**
 - **Homework Assignments: 40%**
 - **Final Project Report: 50%**
 - **Final Project Presentation: 10%**



Homework Assignments

- Weekly homework assignments (usually)
- Homeworks submissions are
 - Python code file (.py)
 - Google Colab notebook file (.ipynb)
- Should be completed **individually** (AI assist is ok)
- Late homework will not be accepted ***unless you have a really good excuse***



Final Project

- **Topic – Something that involves the novel analysis or creation of social media data**
- **Examples**
 - Build a web app where you can upload your vacation images and it writes a photoblog with information about the sites in your photos
 - Build a web app that creates virtual podcasts between celebrities on a topic of your choice
- **Teams must be formed by July 4th (next week)**
- **Topics chosen by July 9th (before break)**
- **Final presentation during last day of class**
- **Final report due on last day of class**



Final Project Teams

1 person



2 people



3 people



Next Class: Coding Session

- We will learn to measure complex tweet sentiment with AI
- We will do some vibe coding in Google Colab

You will be given a sentence and must grade its Ekman's Six Basic Emotions from 0 to 100: Return a table of the scores and explanation why: I hate my job

Here is an analysis of the sentence "I hate my job," graded on Ekman's Six Basic Emotions (Anger, Fear, Joy, Sadness, Disgust, and Surprise), along with explanations for each score:

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Disgust	90	The word "hate" evokes a sense of aversion or repulsion, strongly tied to disgust.
Surprise	10	There is little indication of surprise in the sentence, as it reflects ongoing dissatisfaction.



Before Next Class

- **Create Google account**
- **Get ready to vibe code in Python**

