

AI as a Tool, Not a Crutch
Navigating the Use of ChatGPT in Education and Research

John Aoga

Lunchtime Seminar #8
30th Jan. 2024

IFRI NLP Crew MIFY

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BIOGRAPHY

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30th Jan. 2024

<https://johnaoga.github.io/>

John Aoga, PhD

Who am I?
Doctor & Engineer in Science and Technology
Specialist in Data science & AI
Online Content author and Teacher
Co Founder of MIFY SARL company

Goals and Aspirations
Promote and develop AI 4 Africa In Africa
Promote and develop Education tools

Domains & Interests
Algorithms and Optimization
Data/Pattern Mining Approaches and applications
Deep Learning & NLP for local languages
Social Data Analysis

Scientific References

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AGENDA

Lunchtime Seminar #8
30th Jan. 2024

01	Introduction to AI	05	Art of Prompt Engineering
02	What's NLP	06	Academic Use Cases
03	NLP Challenges	07	Additive Uses & Ethics
04	Understanding ChatGPT	08	Conclusion & Future

() NLP Seminar 3

3-1

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Introduction To AI



ARTIFICIAL INTELLIGENCE

What is AI?

PROGRAMM
MACHINE
OBJECT

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McCarty, 2011 + Russell and Norvig (2010)

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5-1



ARTIFICIAL INTELLIGENCE

What is AI?

PROGRAMM
MACHINE
OBJECT

Reasoning
Simulate reasoning
(understanding)



McCarty, 2011 + Russell and Norvig (2010)

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5-2



ARTIFICIAL INTELLIGENCE

What is AI?

PROGRAMM
MACHINE
OBJECT

Reasoning
Simulate reasoning
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Not necessary
from Human

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McCarty, 2011 + Russell and Norvig (2010)

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5-3

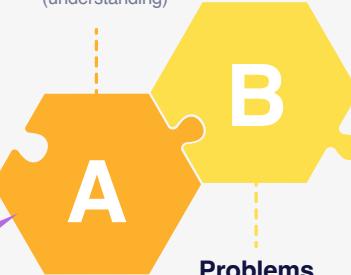


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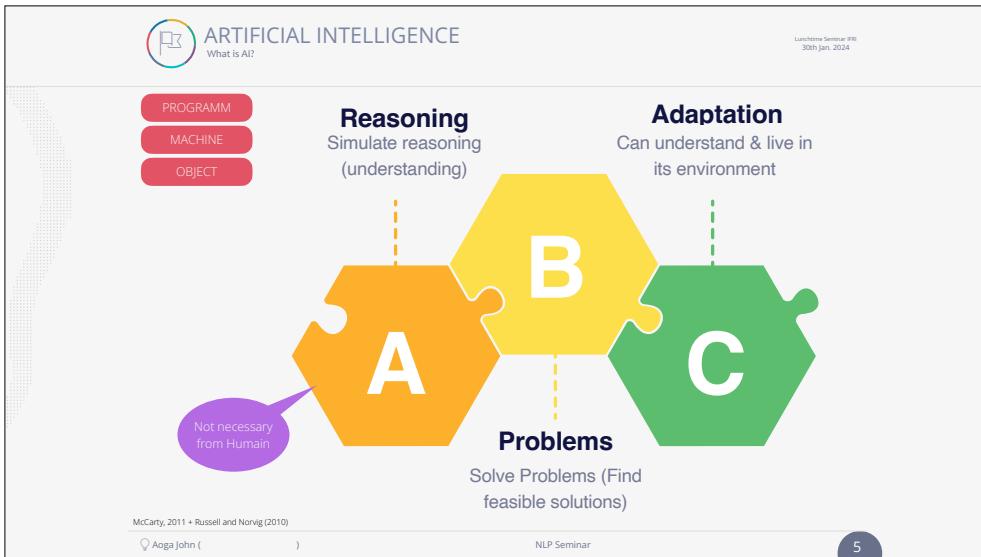
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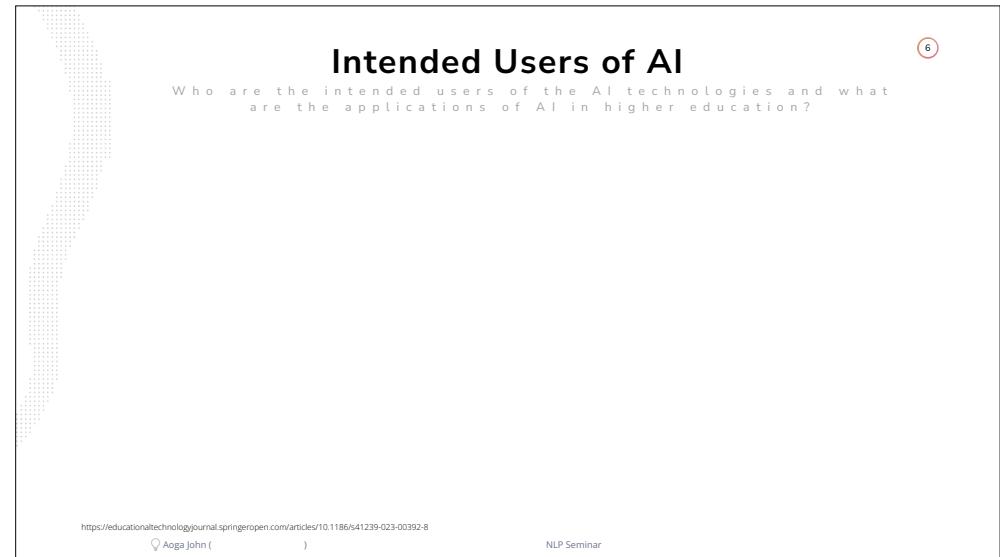
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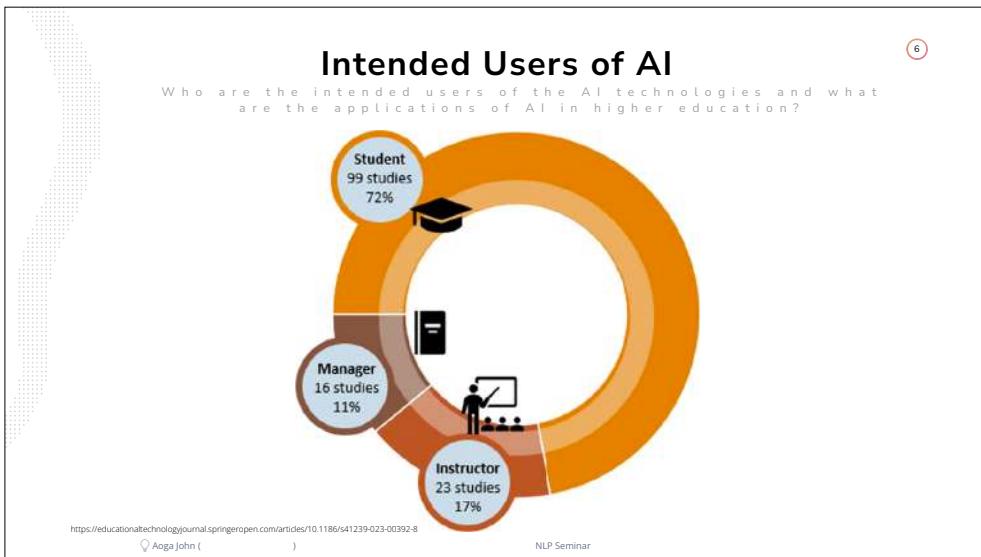
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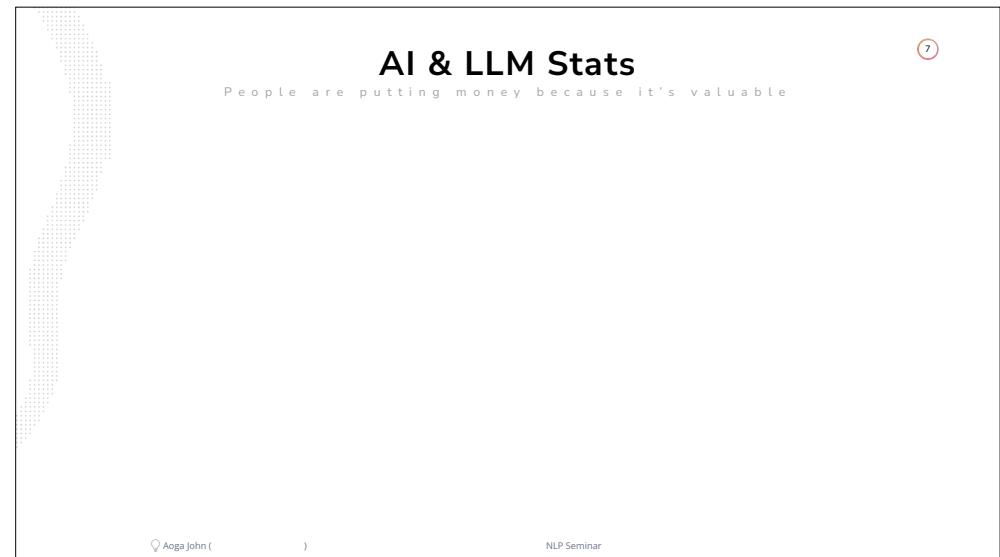
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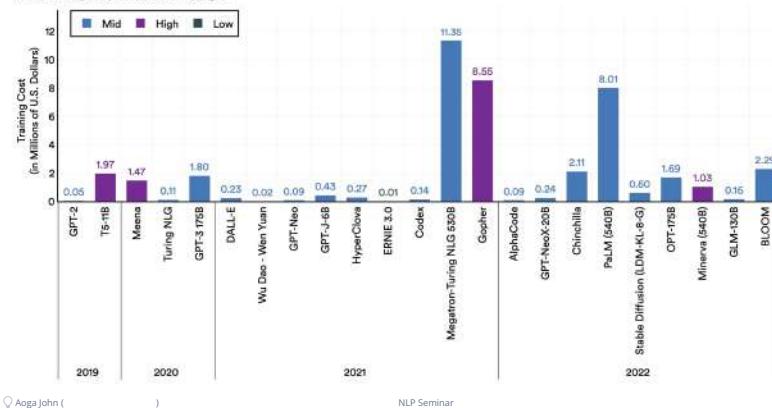
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AI & LLM Stats

People are putting money because it's valuable

Estimated Training Cost of Select Large Language and Multimodal Models

Source: AI Index, 2022 | Chart: 2023 AI Index Report



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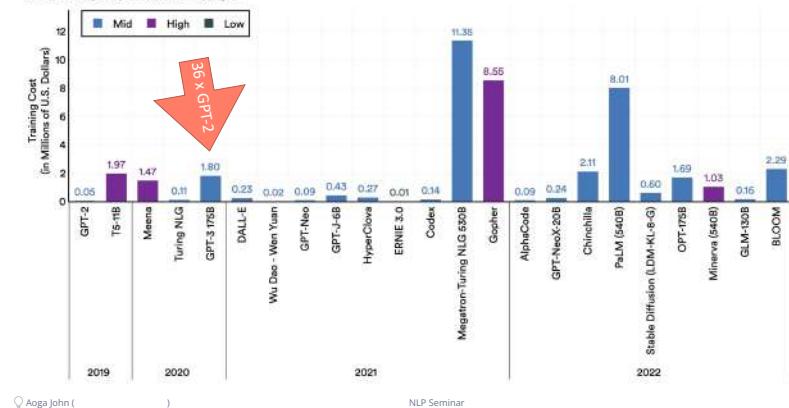
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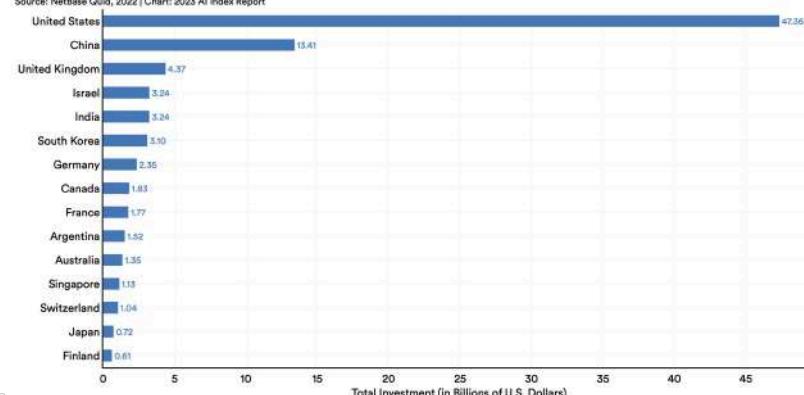
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AI & LLM Stats

The most developed countries are also the one putting big effort in AI

Private Investment in AI by Geographic Area, 2022

Source: NetBase Quid, 2022 | Chart: 2023 AI Index Report



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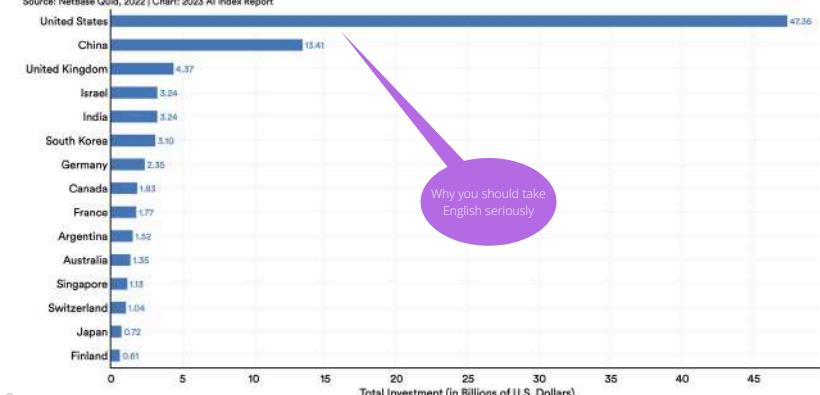
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AI & LLM Stats

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Q

8-2

What is NLP?

9

Humain & Computer communication



10-1

Humain & Computer communication



Before: Programming Language

```
1 def play_audio_file(fname):
2     """Simple callback function to play a wave file.
3
4     :param str fname: wave file name
5     :return: None
6     """
7     ding_wav = wave.open(fname, 'rb')
8     ding_data = ding_wav.readframes(ding_wav.getnframes())
9     audio = pyaudio.PyAudio()
10    stream_out = audio.open(
11        format=audio.get_format_from_width(ding_wav.getsampwidth()),
12        channels=ding_wav.getnchannels(),
13        rate=ding_wav.getframerate(), input=False, output=True)
14    stream_out.start_stream()
15    stream_out.write(ding_data)
16    time.sleep(0.2)
17    stream_out.stop_stream()
18    stream_out.close()
19    audio.terminate()
```

10-2

Humain & Computer communication



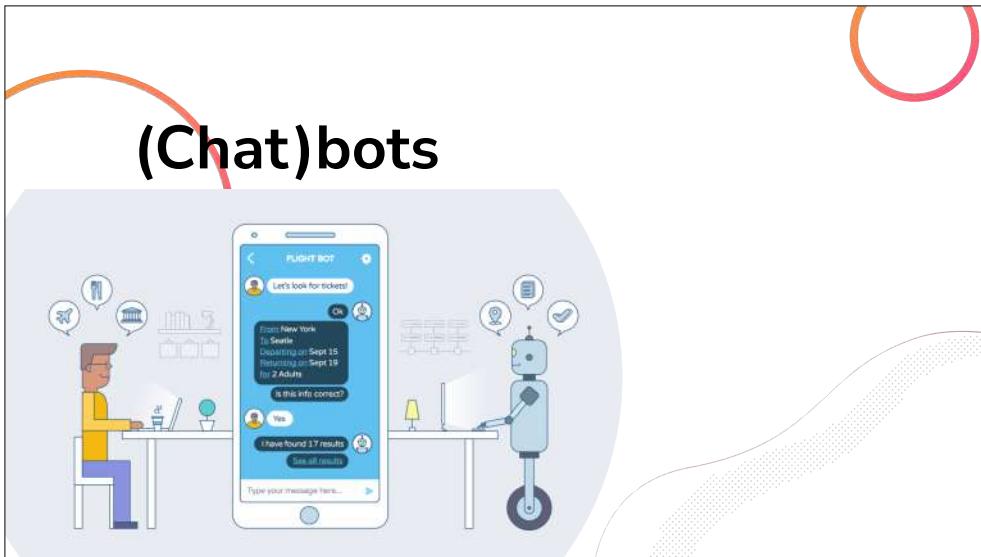
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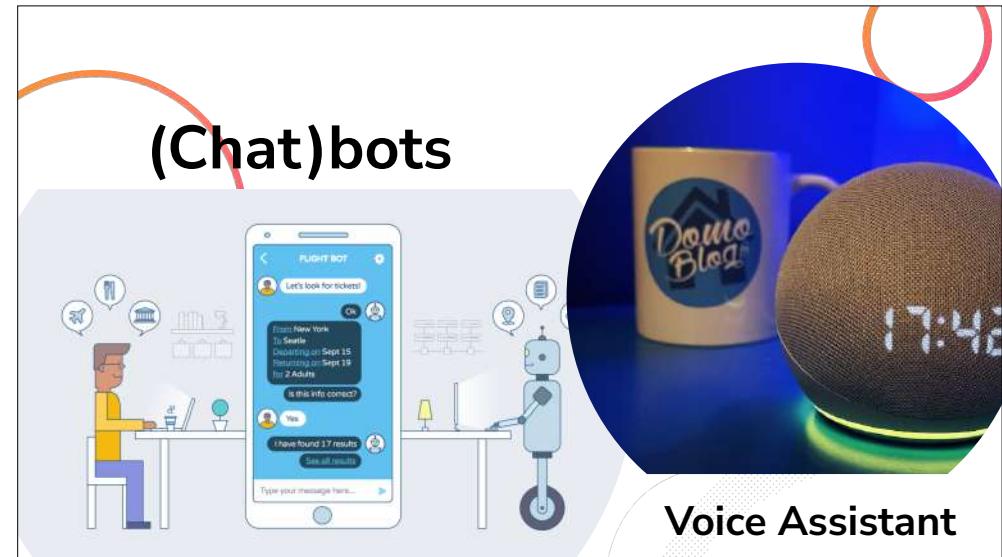
After: Natural Language



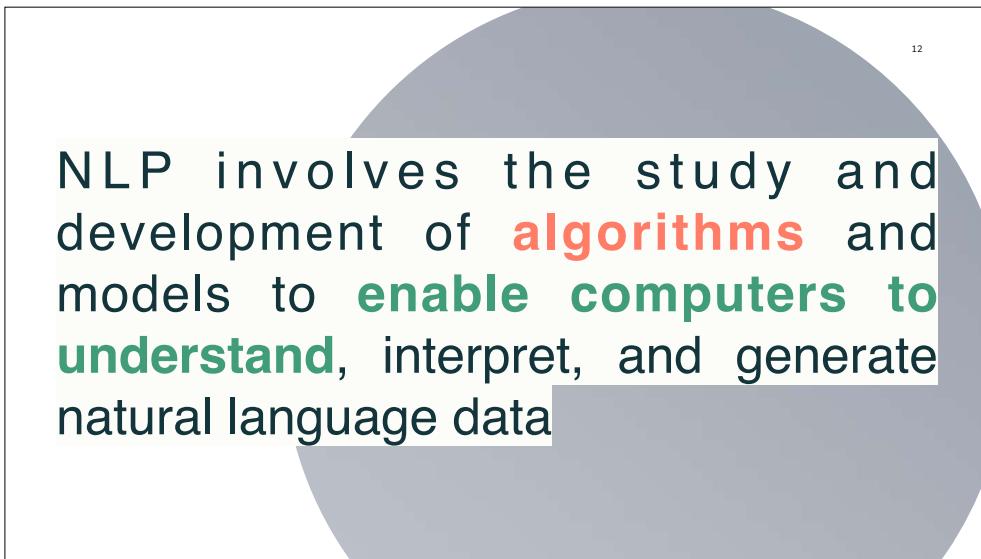
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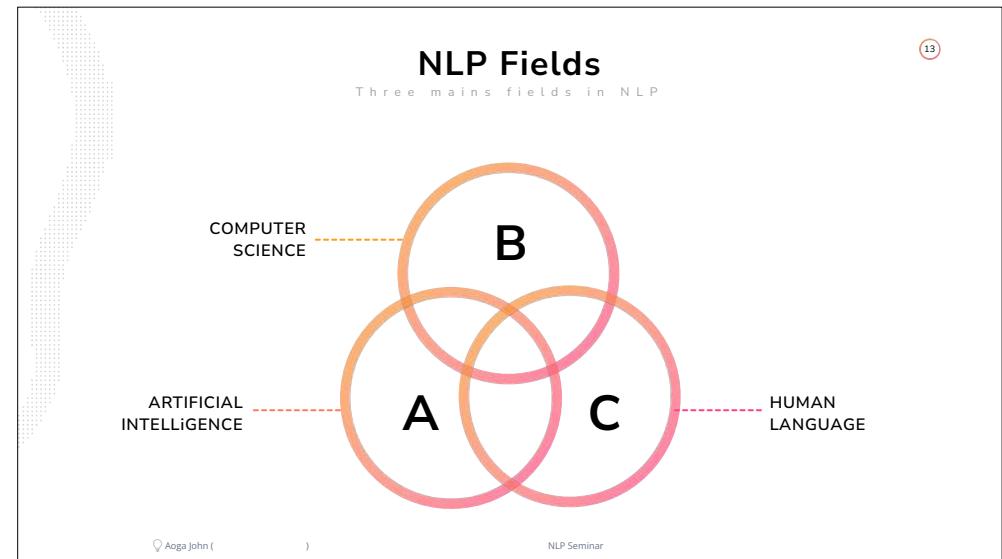
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11-2



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Basic Apps of NLP

Two main components

@ NL Understanding

Mapping input to useful representation
and Analyzing different of languages

1 Question and Answering

2 Sentiment analysis

@ NL Generation

Produce meaningful phrases following a
structure of a languages

1 Text Summarization

2 Text To Speech / Speech to Text

3 Machine Translation (Text & Speech)

4 Auto-completion / Story completion

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Basic Apps of NLP

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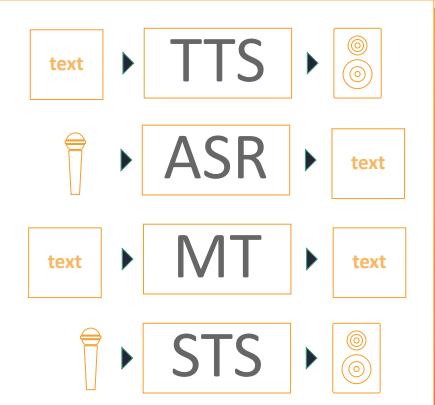
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15-1

Basic Apps of NLP

Two main components



@ NL Generation

Produce meaningful phrases following a
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1 Text Summarization

2 Text To Speech / Speech to Text

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15-2

NLP vs Large Language Models

04 pain points highlights here

1 LLM is part of broad NLP field

2 LLMs are deep learning models trained
to generate text and perform various
NLP tasks

LLMs = advanced deep learning models
(transformers) for massive language datasets

3 Text generation oriented

Design to mainly generate text

#Deep learning
#Transformers
#Attention mechanism
#Massive datasets
#Advanced Algorithms

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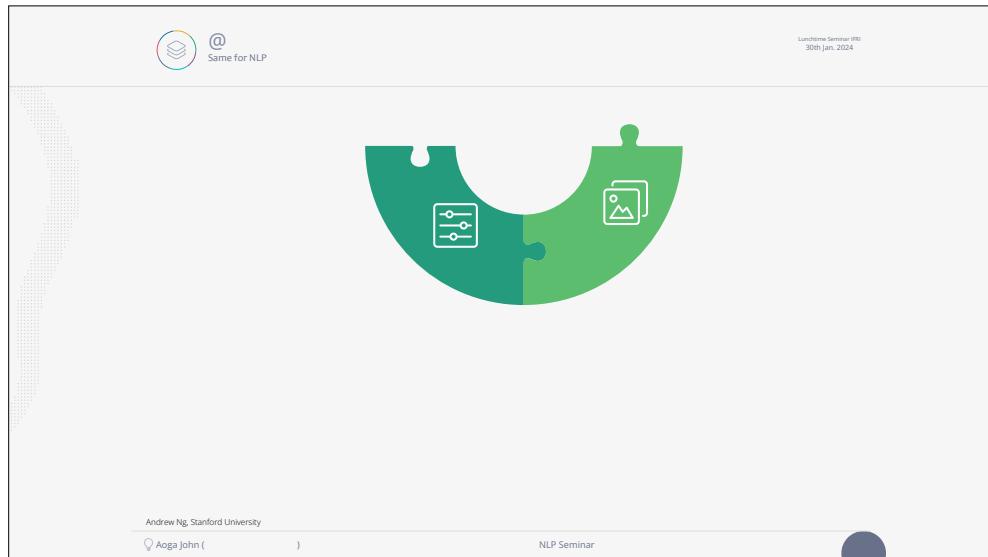
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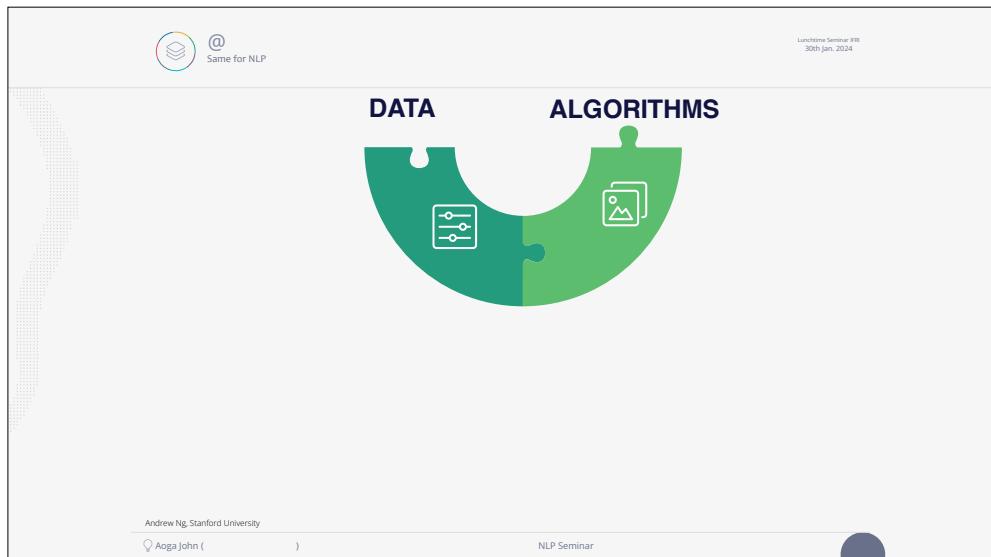
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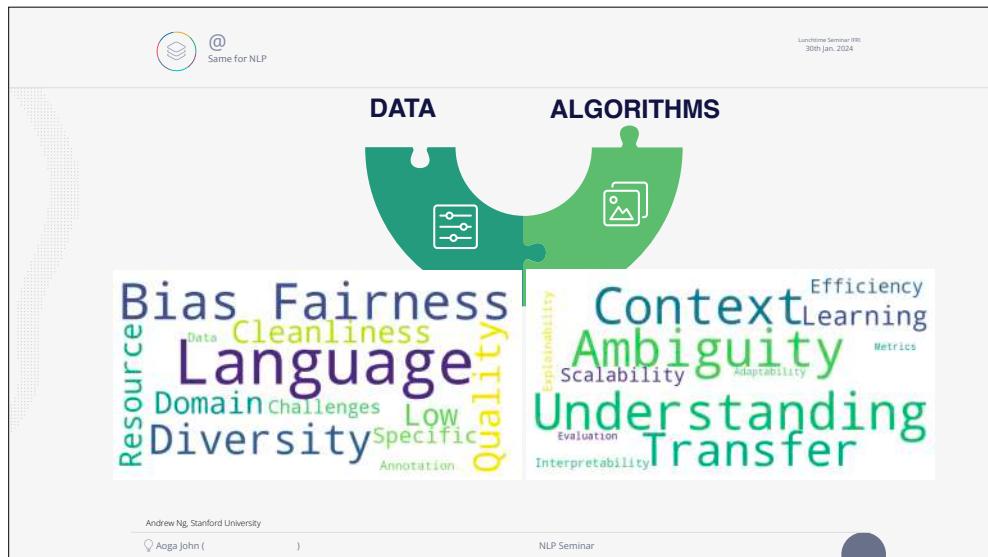
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18-1



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18-3

ML principles

Basics

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$1, 2, 3, 4, \dots \rightarrow x^2 \rightarrow 1, 4, 9, 16, \dots$



$1, 2, 3, 4, \dots$
 & $\rightarrow ? \rightarrow x^2$
 $1, 4, 9, 16, \dots$

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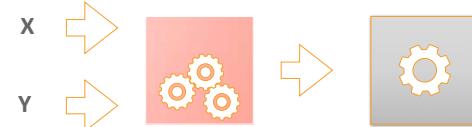
ML Phases

Learning & tests

20



$1, 2, 3, 4, \dots \rightarrow x^2 \rightarrow 1, 4, 9, 16, \dots$



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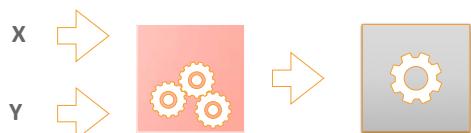
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ML Phases

Learning & tests

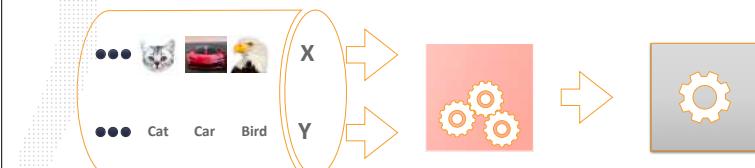
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ML Phases

Learning & tests

20



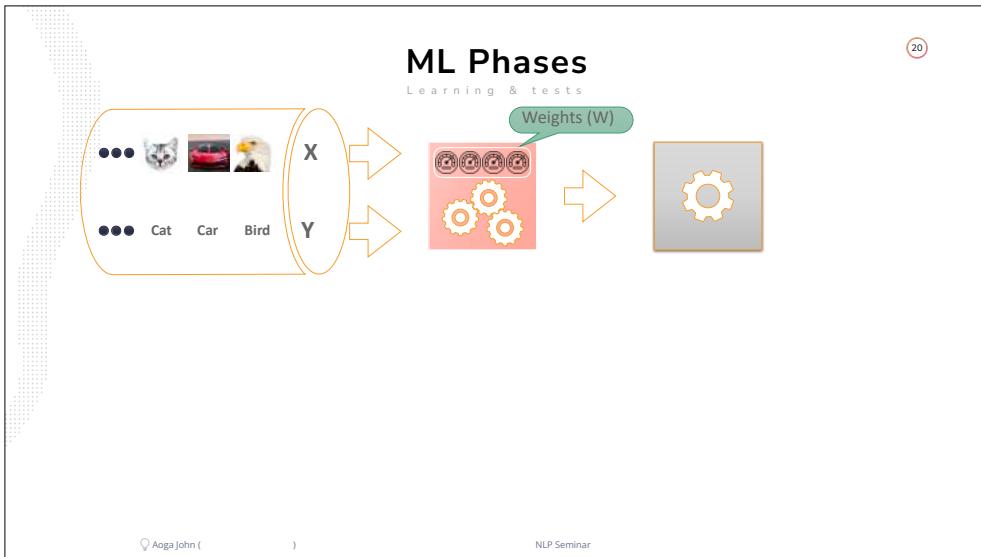
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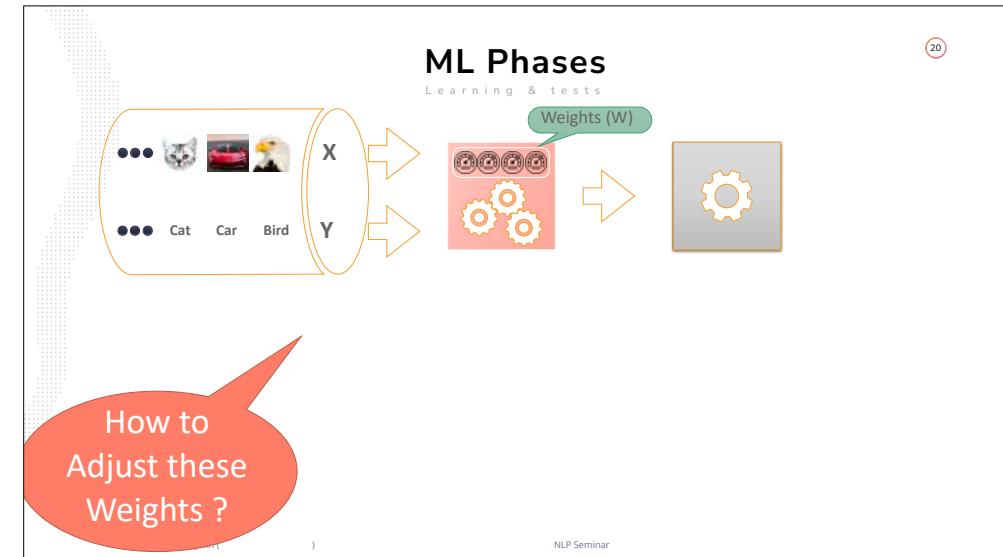
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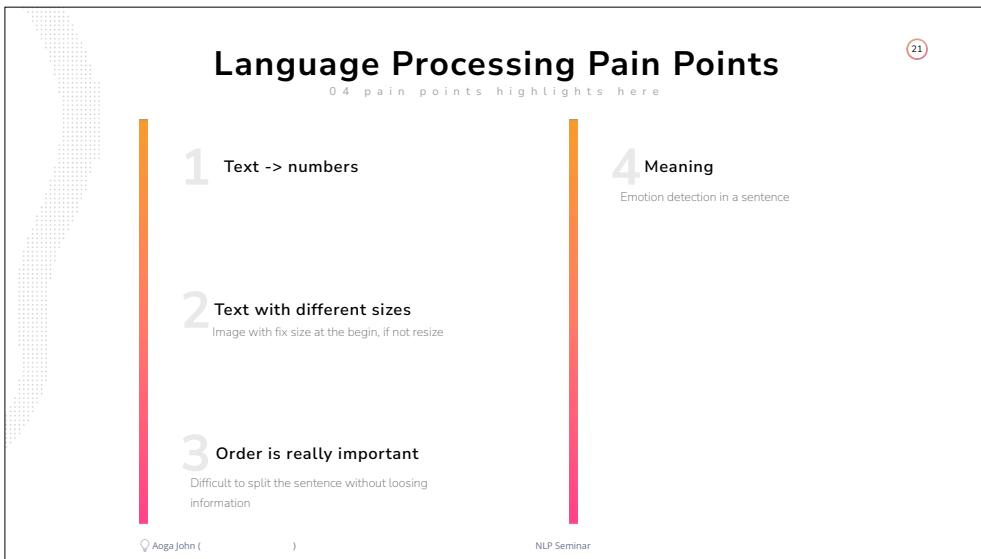
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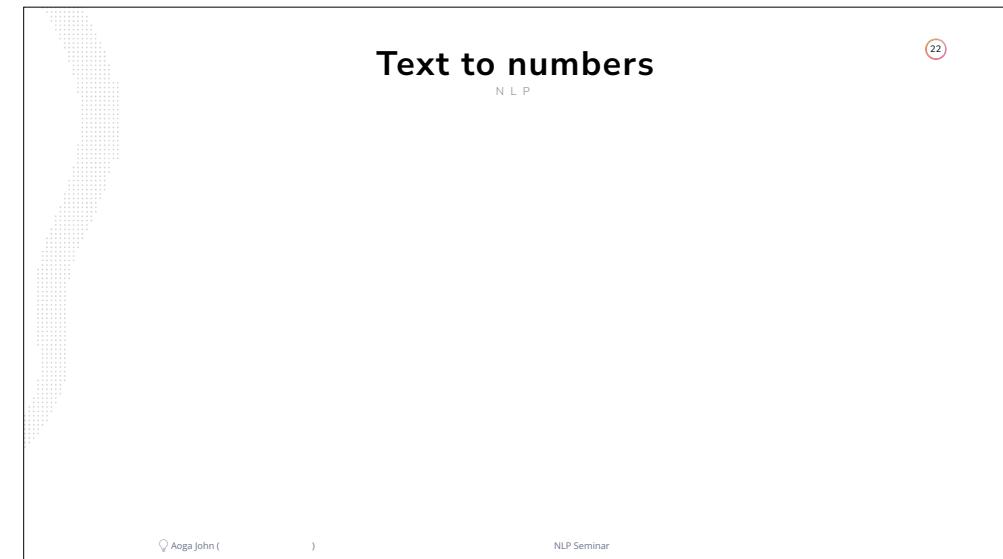
20-4



20-5



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22-1

Text to numbers

N L P

22

CAT

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22-2

Text to numbers

N L P

22

CAT

DOG

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22-3

Text to numbers

N L P

22

TIGER

CAT

DOG

Q Aoga John (

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NLP Seminar

22-4

Text to numbers

N L P

22

TIGER

FOX

CAT

DOG

Q Aoga John (

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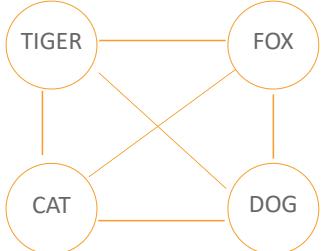
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22-5

Text to numbers

NLP

22



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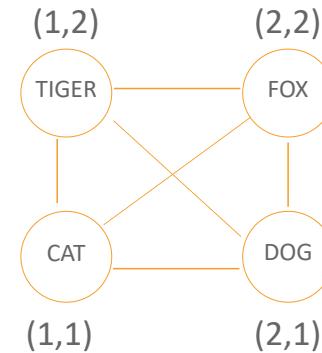
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22-6

Text to numbers

NLP

22



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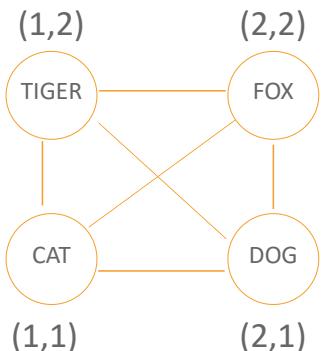
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Text to numbers

NLP

22



In Real, more than
300 dimensions

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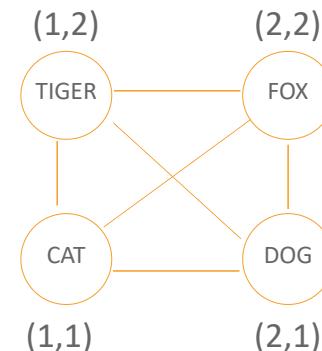
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22-8

Text to numbers

NLP

22



In Real, more than
300 dimensions

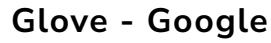
Word2vec
GloVe

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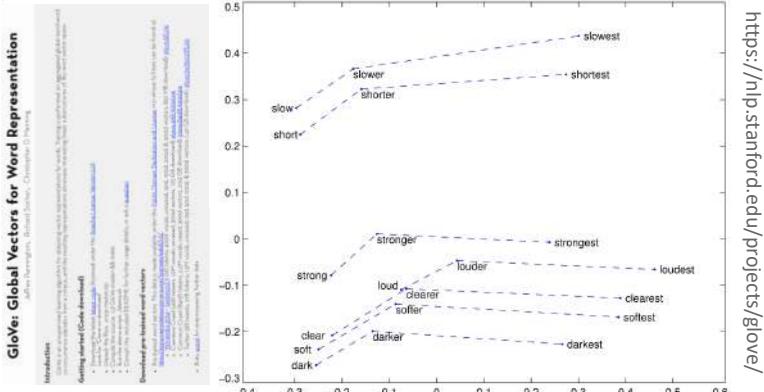
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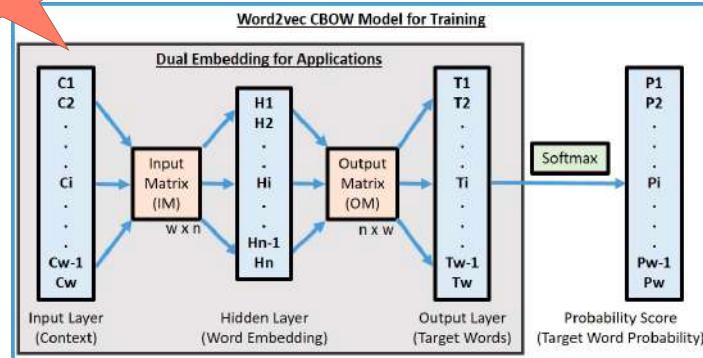
<https://nlp.stanford.edu/projects/glove/>

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LIVE EXAMPLE

No numbers : Word2Vec with CBOW

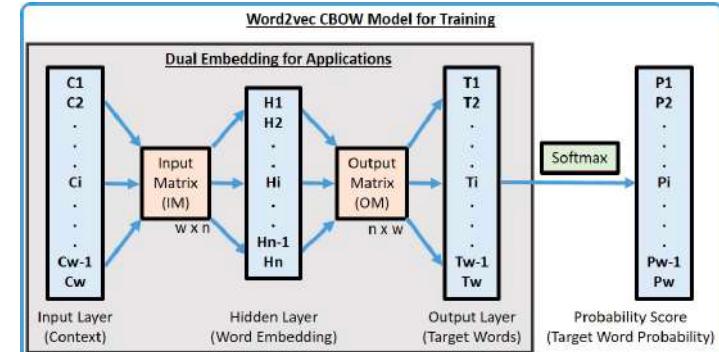
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24-2

Text to numbers : Word2Vec with CBOW

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24-1

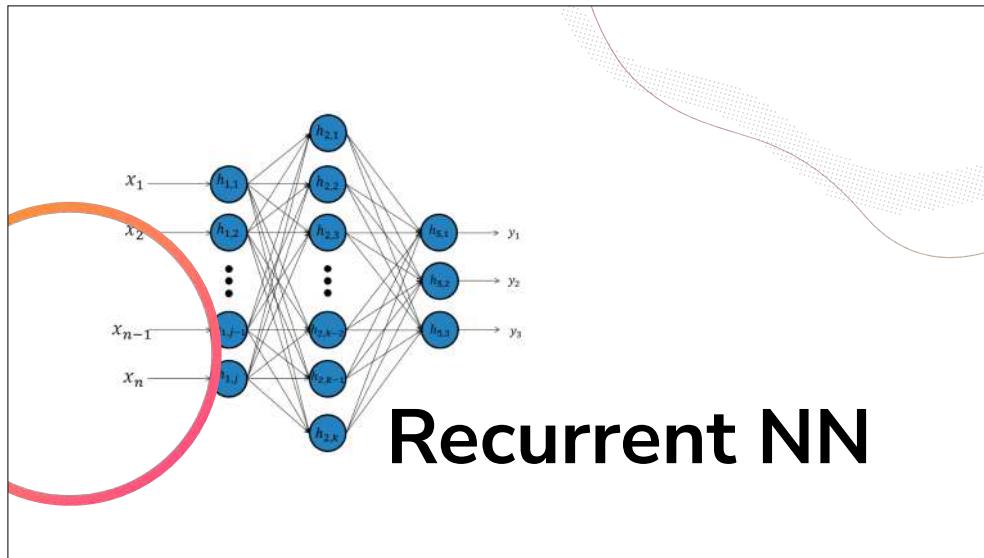
Text to numbers : Word2Vec with CBOW

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The diagram illustrates the forward pass of a neural network for word embeddings. It consists of several layers:

- Input Layer:** One-hot encoded vector for words like "passes".
- Word-Embedding matrix - a.k.a "Lookup table":** A matrix where columns represent words and rows represent dimensions.
- Hidden (Projection) Layer for center word (*passes*):** The input vector is multiplied by the word-embedding matrix to produce a hidden state h .
- Word-Embedding matrix for context words (*the, who*):** The hidden state h is multiplied by the transpose of the word-embedding matrix to produce a vector of scores.
- Softmax Output Layer of range [0, 1] Sum = 1:** The scores are passed through a softmax function to produce probabilities for the words "the" and "who".
- Prediction Error - a.k.a function loss:** The predicted probabilities are compared against the true labels (one-hot vectors) to calculate the loss.

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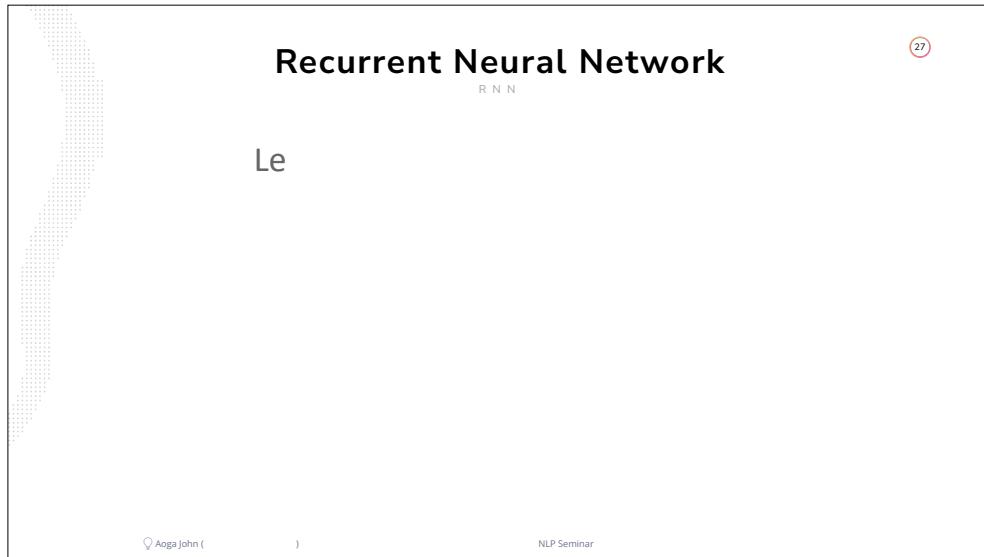
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Recurrent Neural Network

R N N

Le chat mange goulument la souris

27



27-2

Recurrent Neural Network

R N N

Le chat

27

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Q Aoga John ()

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27-3

Recurrent Neural Network

R N N

27

Le chat mange

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27-4

Recurrent Neural Network

R N N

27

Le chat mange goulument

Q Aoga John (

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NLP Seminar

27-5

Recurrent Neural Network

R N N

27

Le chat mange goulument la

Q Aoga John (

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27-6

Recurrent Neural Network

R N N

27

Le chat mange goulument la souris

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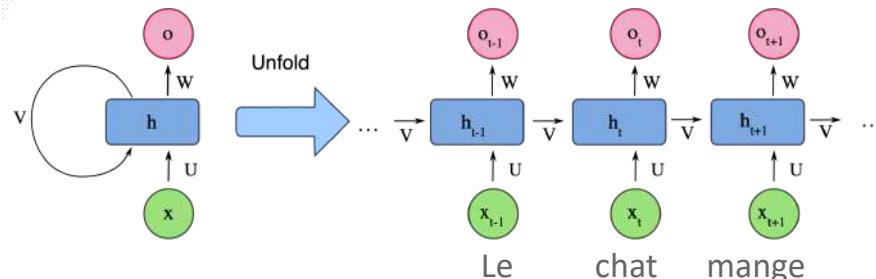
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27-7

Recurrent Neural Network

RNN

Le chat mange goulument la souris



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27-8

Recurrent Neural Network

RNN

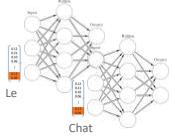
Le chat mange goulument la souris

Thinking
vector

Recurrent Neural Network

R N N

Le chat mange goulument la souris



28

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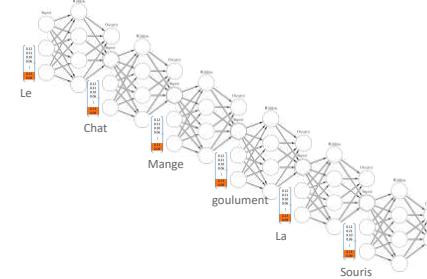
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28-3

Recurrent Neural Network

R N N

Le chat mange goulument la souris



28

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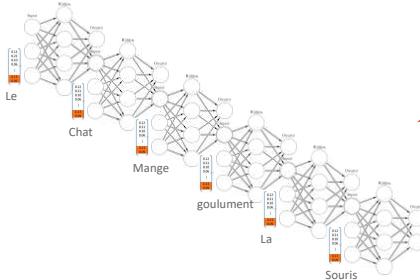
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Recurrent Neural Network

R N N

Le chat mange goulument la souris



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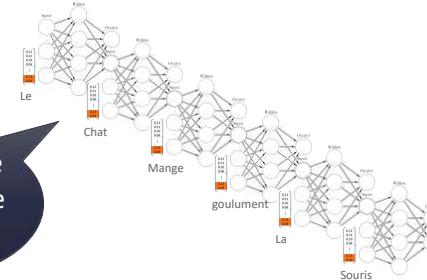
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28-5

Recurrent Neural Network

R N N

Le chat mange goulument la souris



28

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28-6

Recurrent Neural Network

RNN

Encodeur

Décodeur

Aoga John (

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NLP Seminar

29

29-1

Recurrent Neural Network

RNN

Encodeur

Le chat mange

Décodeur

Aoga John (

)

NLP Seminar

29

29-2

Recurrent Neural Network

RNN

Encodeur

Décodeur

Le chat mange

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29

29-3

Recurrent Neural Network

I issue

Bohicon est une très belle ville du Benin, j'est vécu cinq et c'est là j'ai appris à parler ...

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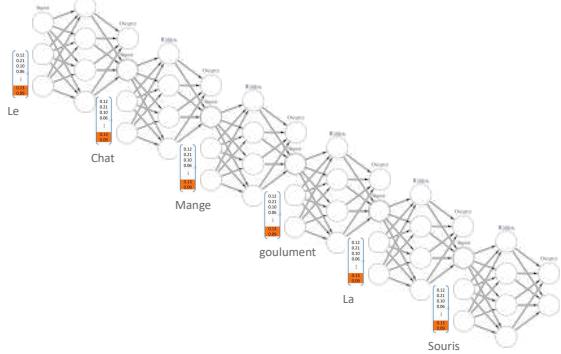
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Recurrent Neural Network

R N N

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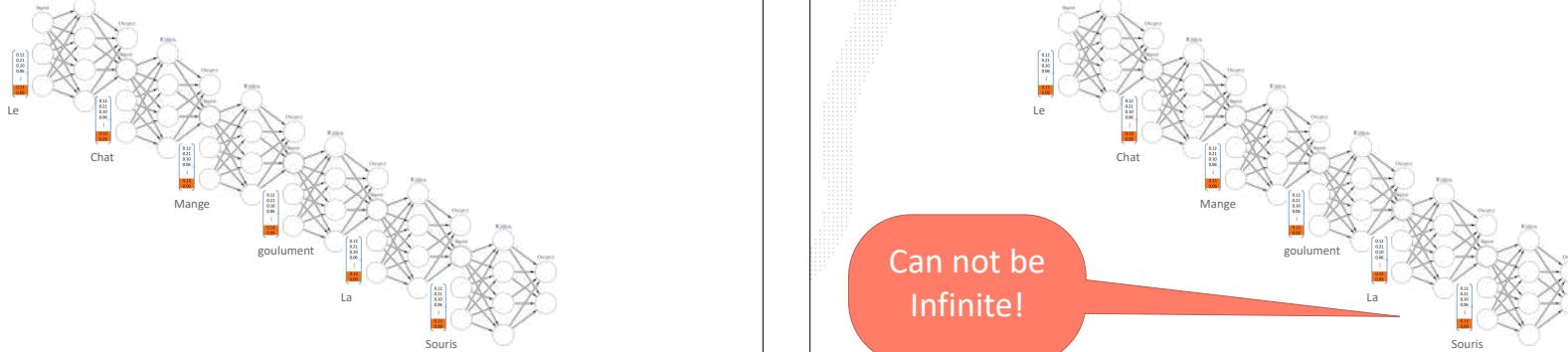
31-1

Recurrent Neural Network

R N N

31

Can not be
Infinite!



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31-2

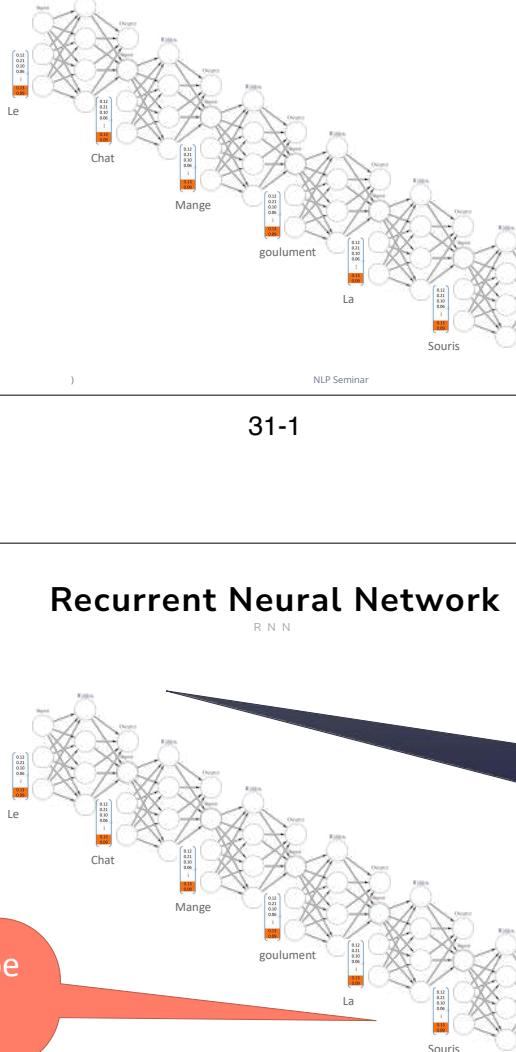
Recurrent Neural Network

R N N

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How to keep
long-term
information
without loosing
short-term ones

Can not be
Infinite!



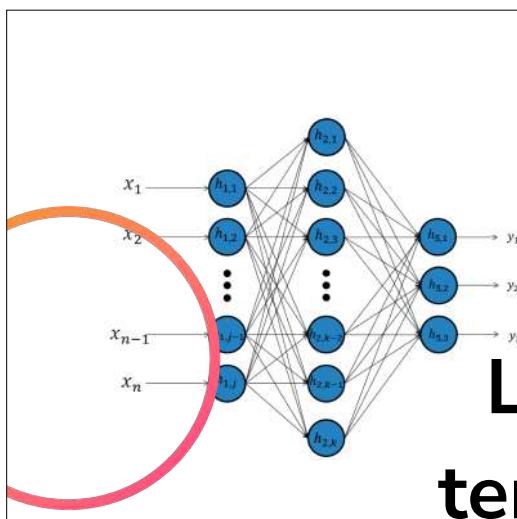
Agga John (

)

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31-3

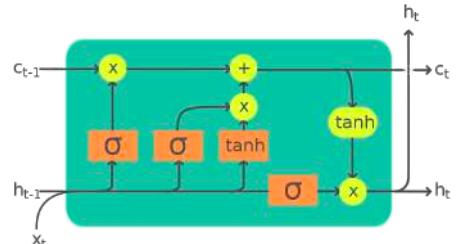
Long short
term memory



32

Long Short Term Memory

L s t m



Legend: Layer ComponentwiseCopy Concatenate

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33

Understanding ChatGPT

34

The Art of Prompt Engineering

35

General Prompt Template

You should try to use this as much as possible

<https://www.promptingguide.ai/>

- **Instruction** - a specific task or instruction you want the model to perform
- **Context** - external information or additional context that can steer the model to better responses
- **Input Data** - the input or question that we are interested to find a response for
- **Output Indicator** - the type or format of the output.

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)

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36-1

General Prompt Template

You should try to use this as much as possible

<https://www.promptingguide.ai/>

- **Instruction** - a specific task or instruction you want the model to perform

Prompt:

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

- **Output Indicator** - the type or format of the output.

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)

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36-2

General Prompt Template

You should try to use this as much as possible

<https://www.promptingguide.ai/>

- **Instruction** - a specific task or instruction you want the model to perform

Prompt:

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

- **Output Indicator** - the type or format of the output.

Instruction

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36-3

General Prompt Template

You should try to use this as much as possible

<https://www.promptingguide.ai/>

- **Instruction** - a specific task or instruction you want the model to perform

Prompt:

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

- **Input Data** - the input or question that we are interested to find a response for

Instruction Input Data

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36-4

General Prompt Template

You should try to use this as much as possible

<https://www.promptingguide.ai/>

- **Instruction** - a specific task or instruction you want the model to perform

Prompt:

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

- **Input Data** - the input or question that we are interested to find a response for

Instruction Input Data Output indicator

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)

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36-5

General Prompt Template

You should try to use this as much as possible

<https://www.promptingguide.ai/>

• **Instruction** - a specific task or instruction you want the model to perform

• **Context** - external information or additional context that can steer the model to better responses

• **Input Data** - the input or question that we are interested to find a response for

• **Output Indicator** - the type or format of the output.

Prompt:
Feel free to not use all the template components

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

Instruction **Input Data** **Output indicator**

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36-6

ZERO-shot Prompting

Techniques

- Provide key elements to allow it to properly **guess the correct answer** => here is done with **Sentiment**

Prompt:

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

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37-1

ZERO-shot Prompting

Techniques

- Provide key elements to allow it to properly **guess the correct answer** => here is done with **Sentiment**

Prompt:

Classify the text into neutral, negative or positive.
Text: I think the vacation is okay.
Sentiment:

Output:

Neutral

<https://www.promptingguide.ai/>

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37-2

Few-shot Prompting

People are putting money because it's valuable

- Give **(few) examples** of what you want => work well for example to generate code in a project

Prompt:

This is awesome! // Negative
This is bad! // Positive
Wow that movie was rad! // Positive
What a horrible show! //

Output:

Negative

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38-1

Few-shot Prompting

People are putting money because it's valuable

- Give (few) examples of what you want => work well for example to generate code in a project

Prompt:

```
This is awesome! // Negative  
This is bad! // Positive  
Wow that movie was rad! // Positive  
What a horrible show! //
```

4-shot

Output:

Negative

<https://www.promptingguide.ai/>

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38-2

38

Few-shot Chain-of-Thought (CoT) Prompting

People are putting money because it's valuable

- Give (few) examples of what you want + elaborate on your examples and ask the same

(a) Few-shot

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?
A: The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?
A:
(Output) The answer is 8. ✗

(c) Zero-shot

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?
A: The answer (arabic numerals) is

(Output) 8 ✗

(b) Few-shot-CoT

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?
A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. $5 + 6 = 11$. The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?
A:
(Output) The juggler can juggle 16 balls. Half of the balls are golf balls. So there are $16 / 2 = 8$ golf balls. Half of the golf balls are blue. So there are $8 / 2 = 4$ blue golf balls. The answer is 4. ✓

(d) Zero-shot-CoT (Ours)

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?
A: Let's think step by step.
(Output) There are 16 balls in total. Half of the balls are golf balls. That means that there are 8 golf balls. Half of the golf balls are blue. That means that there are 4 blue golf balls. ✓

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Advanced Techniques: Prompt Chaining

You should try to use this as much as possible

<https://www.promptingguide.ai/>

● **Instruction** - a specific task or instruction you want the model to perform

● **Context** - external information or additional context that can steer the model to better responses

● **Input Data** - the input or question that we are interested to find a response for

● **Output Indicator** - the type or format of the output.

```
### Instruction ###  
Convert the following text into diagram  
  
### Input ###  
- Choose the number of clusters (K): Determine the desired number of clusters based on domain knowledge or using techniques like the elbow method.  
- Initialize centroids: Randomly select K data points from the dataset as the initial cluster centroids.  
- Assignment step: Assign each data point to the cluster with the nearest centroid, i.e., the one with the least squared Euclidean distance.  
- Update centroids: Calculate the new centroid for each cluster by taking the mean of all data points assigned to that cluster.  
- Repeat steps 3 and 4 until convergence: Continue iterating until the centroids no longer change significantly or a predefined stopping criterion is met.  
  
### Output Format ###  
The result is a sequence diagram presented as a Mermaid code that I can run in diagrams.helpful.dev
```

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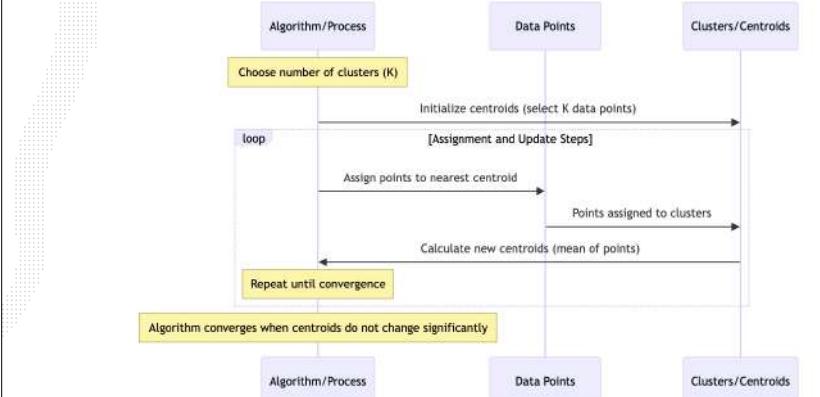
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40

40

Advanced Techniques: Prompt Chaining (GPT-4)

You should try to use this as much as possible



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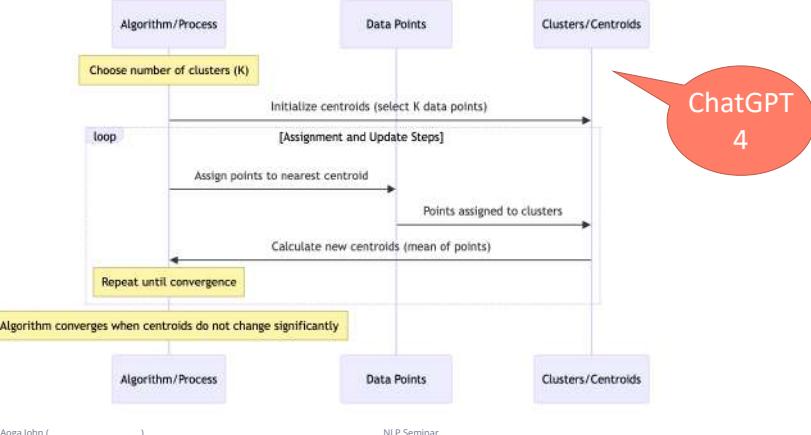
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41-1

41

Advanced Techniques: Prompt Chaining (GPT-4)⁴¹

You should try to use this as much as possible

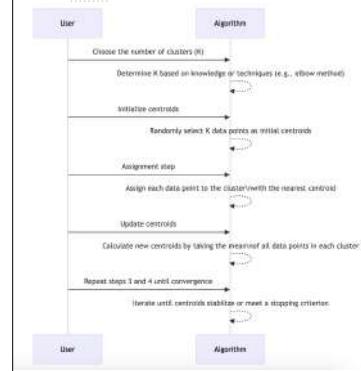


ChatGPT
4

41-2

Advanced Techniques: Prompt Chaining (GPT-3)⁴²

You should try to use this as much as possible

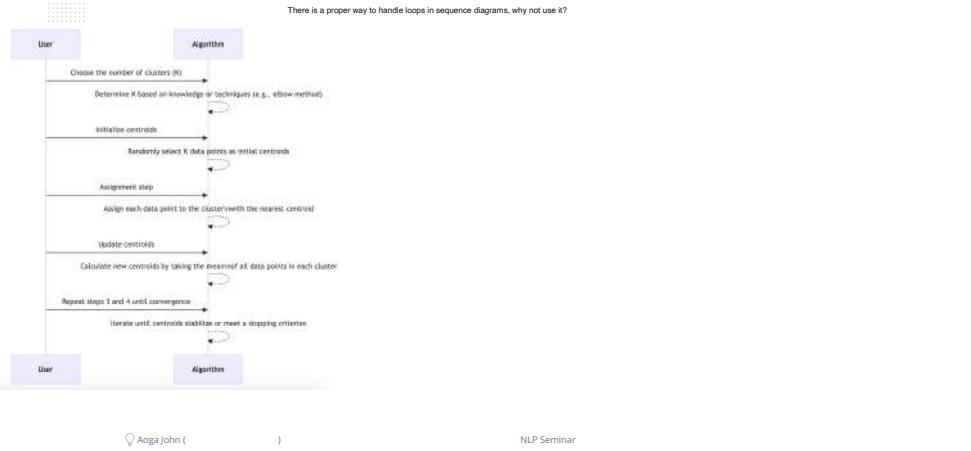


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42-1

Advanced Techniques: Prompt Chaining (GPT-3)⁴²

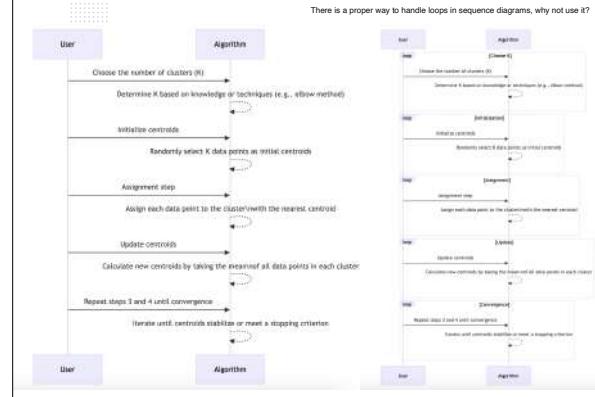
You should try to use this as much as possible



42-2

Advanced Techniques: Prompt Chaining (GPT-3)⁴²

You should try to use this as much as possible



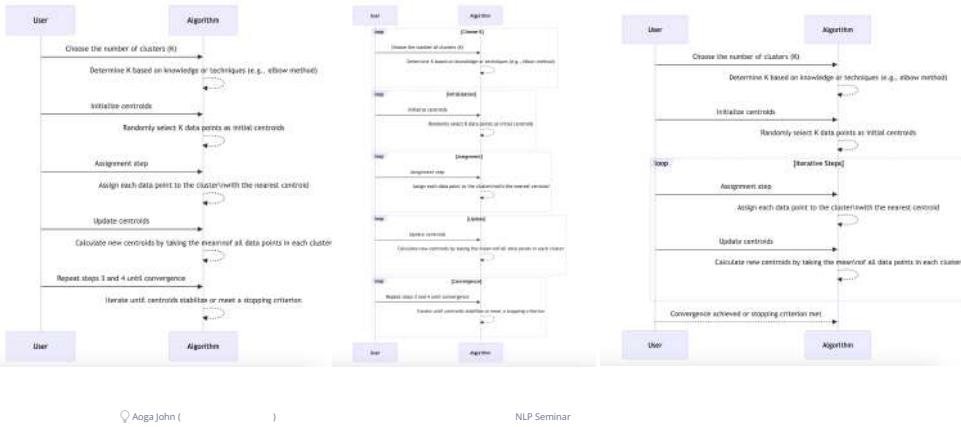
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42-3

Advanced Techniques: Prompt Chaining (GPT-3) 42

You should try to use this as much as possible

There is a proper way to handle loops in sequence diagrams, why not use it? Great! But it's not all the step that needs to loop, it should be only the iterative part that should be in loop



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42-4

General Prompt Template 43

You should try to use this as much as possible

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43-1

General Prompt Template 43

You should try to use this as much as possible

LIVE DEMO
GENERATE

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43-2

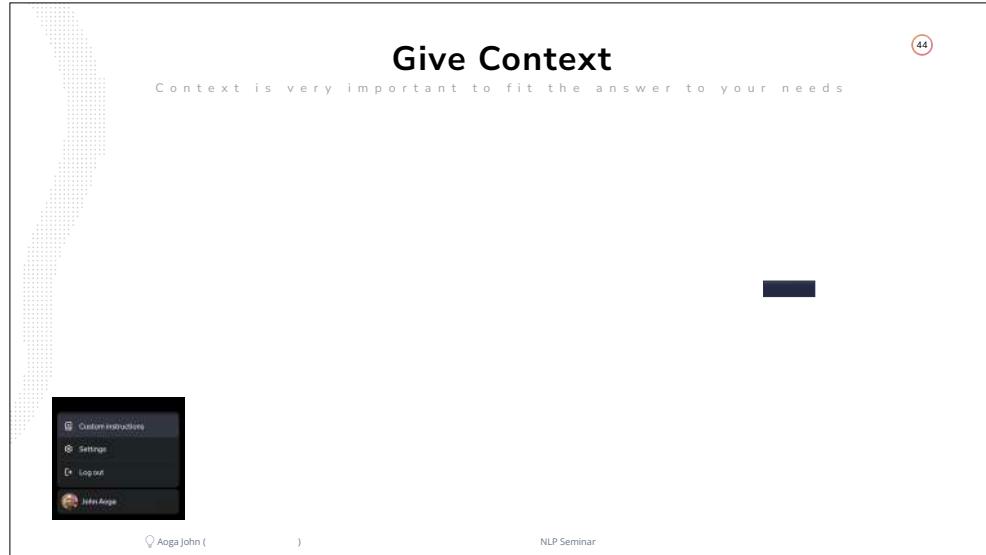
Give Context 44

Context is very important to fit the answer to your needs

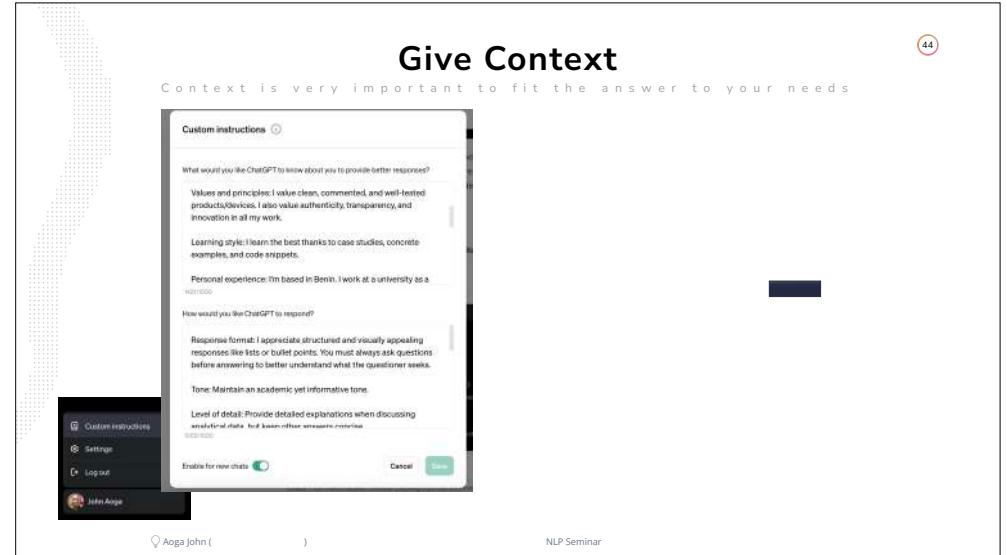
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44-1



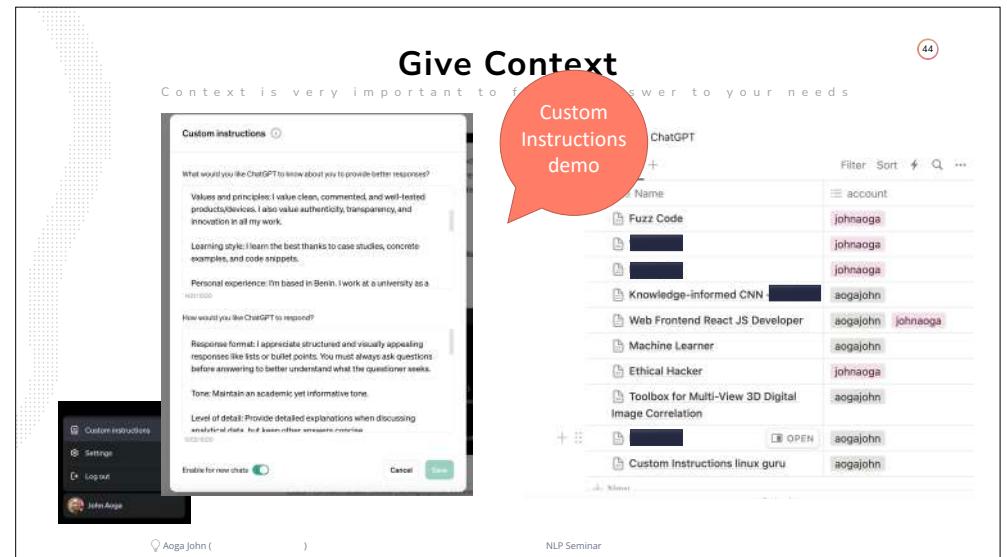
44-2



44-3



44-4



44-5

Give Context

Context is very important to fit the answer to your needs

Custom instructions

What would you like ChatGPT to know about you to provide better responses?

Values and principles: I value clean, commented, and well-tested products/services. I also value authenticity, transparency, and innovation in all my work.

Learning style: I learn the best thanks to case studies, concrete examples, and code snippets.

Personal experience: I'm based in Berlin. I work at a university as a researcher.

How would you like ChatGPT to respond?

Response format: I appreciate structured and visually appealing responses like lists or bullet points. You must always ask questions before answering to better understand what the questioner seeks.

Tone: Maintain an academic yet informative tone.

Level of detail: Provide detailed explanations when discussing analytical data, but keep other answers concise.

Custom Instructions demo

ChatGPT

Name	Owner
Fuzz Code	johnaoga
Mes GPTs	+ Crée un GPT
Kno	johnaoga
Wat	johnaoga
Mac	johnaoga
Ethical Hacker	johnaoga
Toolbox for Multi-View 3D Digital Image Correlation	aogajohn
Custom Instructions linux guru	aogajohn

Filter Sort ⚡ Q ...

44

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44-6

Custom instructions (Detail)

Context is very important to fit the answer to your needs

Context

Role: I'm a web frontend React JS developer.

Current Project/Challenge: I'm working on building a new visual programming platform using React JS and Rete JS.

Interest: I'm interested in building fluid, efficient, and robust web applications.

Values and principles: I value clean, commented, and well-tested code. I also value modularity (building over components) in all my work.

Learning style: I learn the best thanks to case studies, concrete examples, and code snippets.

Personal experience: I'm based in Belgium and work at a web development company. I mainly use JS Framework to create web applications.

Goal: My short-term goal is to finish my current project quickly and efficiently. For a long-term goal, I would like to impose visual programming as the best way to learn programming.

Preferences: I'm a virtual person and prefer rich multimedia content. My work

Format

Response format: I appreciate structured and visually appealing responses like lists or bullet points. You must always ask questions before answering to better understand what the questioner seeks.

Tone: Maintain a standard yet informative tone.

Level of detail: Provide detailed explanations when discussing analytical data, but keep other answers concise.

Types of suggestions: Suggest ideas for creating web applications.

Types of questions: ask questions that stimulate creative thinking for efficient code writing.

Checks and balances: check suggested ideas against other React developers' code and style.

Source references: Cite reliable URLs when suggesting new tools or Plugins.

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Addictive Uses

stackoverflow Aware of symptoms

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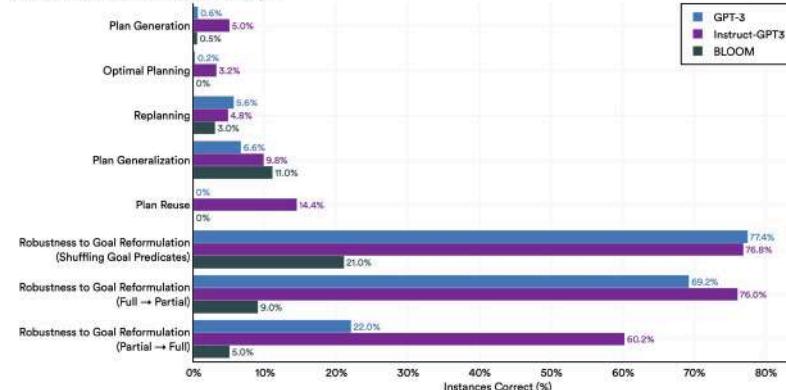
47

Know the Limits of your Tools

Three main fields in NLP

Select Large Language Models on the BlocksDomain: Instances Correct

Source: Valmiki et al., 2022 | Chart: 2023 AI Index Report



48

Flaws Awareness

Be aware about errors

49

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Flaws Awareness

Be aware about errors

LIVE DEMO

49

Flaws Awareness

Be aware about errors

- Make effort,
- Think,
- Read
- Cross Information
- Tweak
- Learn

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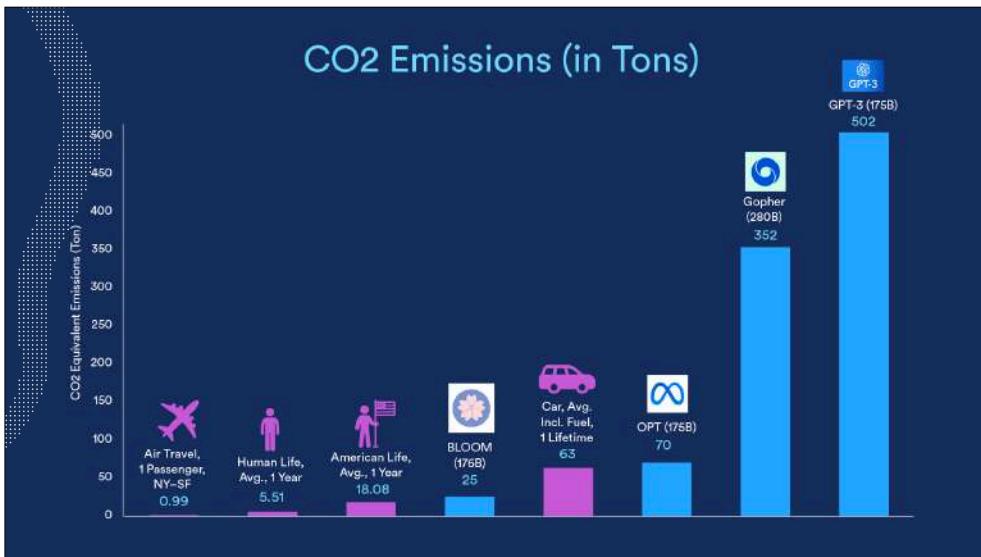
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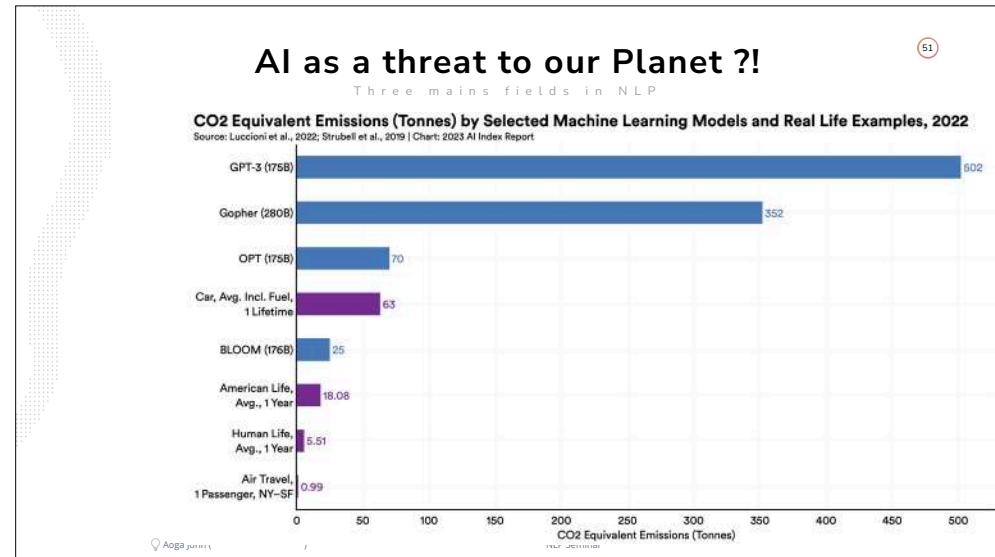
49-3



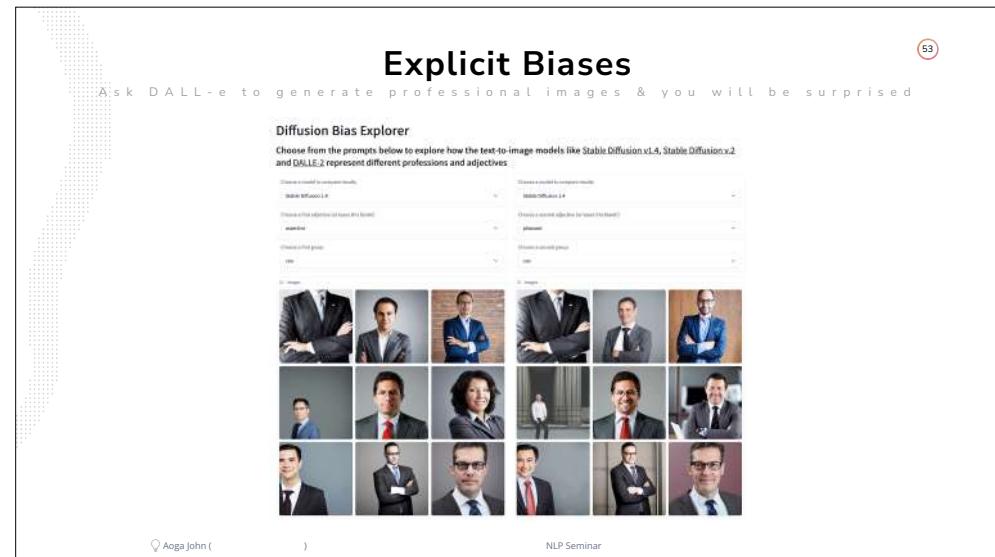
50



52



51



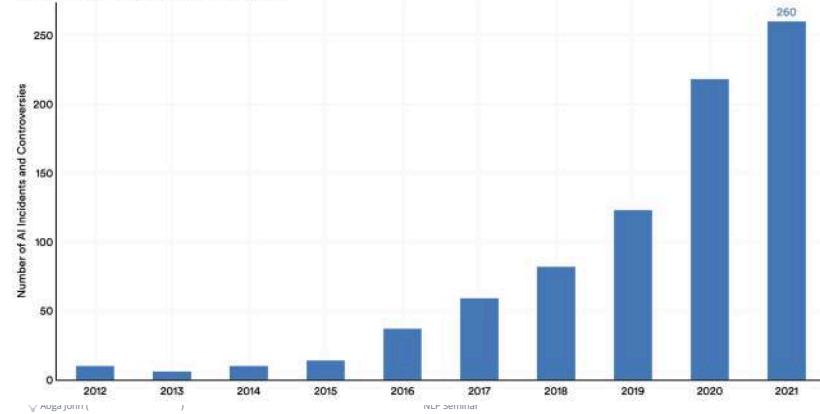
53

AI & Growing Controversies

It's more than Five time no twenty-five times now

Number of AI Incidents and Controversies, 2012–21

Source: AIAAIC Repository, 2022 | Chart: 2023 AI Index Report



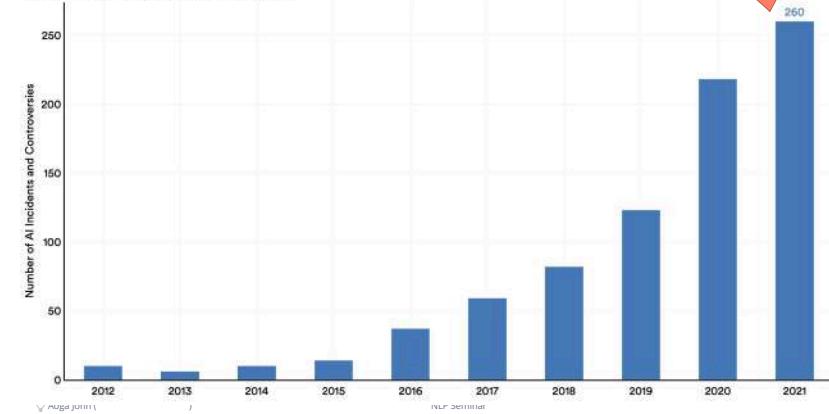
54-1

AI & Growing Controversies

It's more than Five time no twenty-five times now

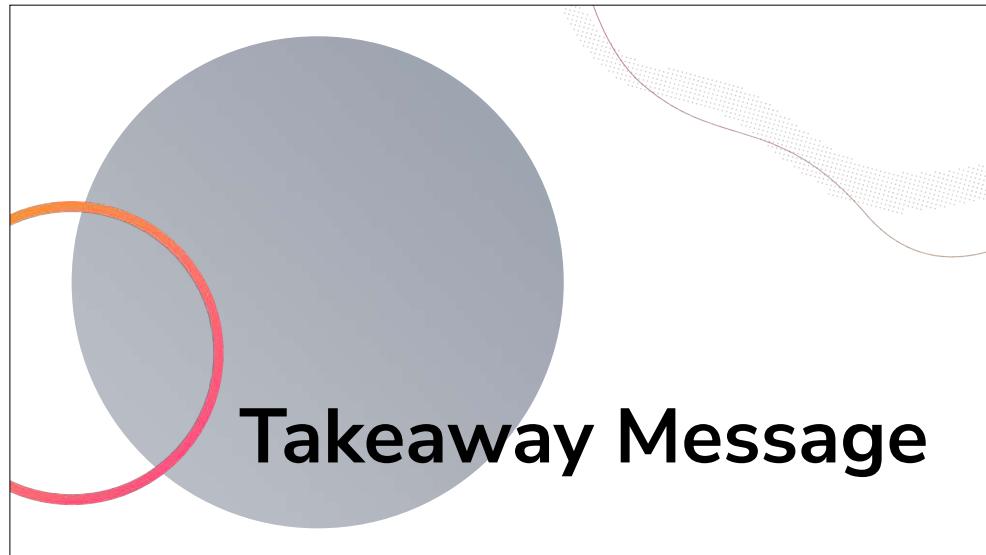
Number of AI Incidents and Controversies, 2012–21

Source: AIAAIC Repository, 2022 | Chart: 2023 AI Index Report



54-2

Takeaway Message



55

Takeaway Messages

Use it but use it wisely, do your job and be aware about ethics implications



AWARENESS

What AI & NLP can give you, what they can't.
Don't be ChatGPT Developer
Bias & ethics implications
Contribution to climate disaster



KNOWLEDGE

Definitively source of knowledge
Better than Google if you're precise
Books are still important



REINFORCEMENT

Use it to learn, to teach, to research
Use it to improve things to improve yourself



DESIRE

Understanding that there's a need for change and wanting change to happen are two different things.
When people honestly want to see positive change, they'll go.



ABILITY

Know what it's capable of
Use it to get job
Prompt engineers are becoming everything

56

Takeaway Messages

Use it but use it wisely, do your job and be aware about ethics implications

57



MY MESSAGE

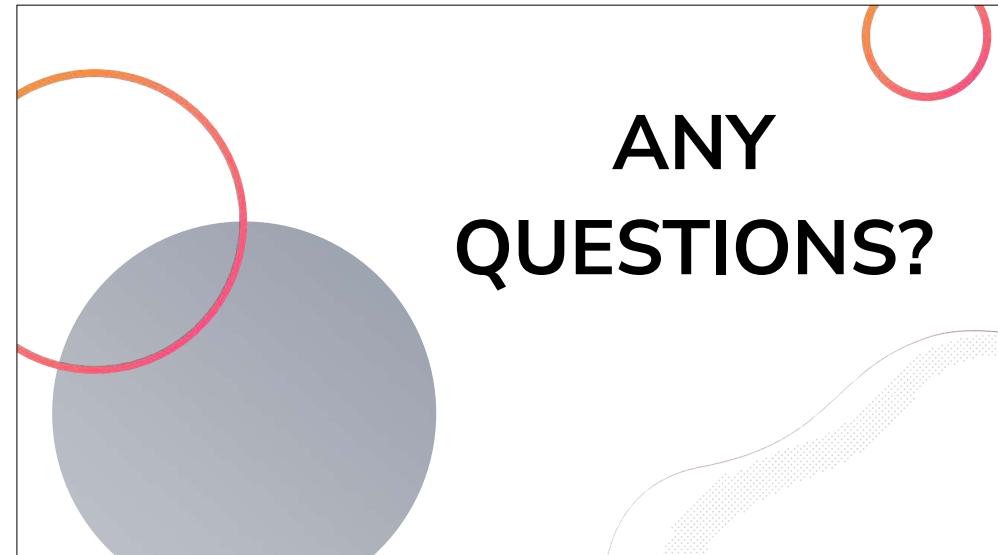
Als can be very useful for boosting your productivity if you know how to choose well and ask for specific things in a judicious and thoughtful way, but do your job and don't be lazy to think that AI can give you everything, be critical of the answers you receive, don't leave it to the last minute and, be aware of prejudices and biases.

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Next Steps

58

ANY
QUESTIONS?



59