

AI as a Tool, Not a Crutch

Navigating the Use of ChatGPT in Education and Research

John Aoga

1

BIOGRAPHY

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 SARTL 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 Approches and applications
 Deep Learning & NLP for local languages
 Social Data Analysis

Scientific References

2

AGENDA

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

3-1

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- 08 Conclusion & Future

3-2

AGENDA

Lunchtime Seminar #98
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

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3-3

AGENDA

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3-4

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3-5

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3-6

AGENDA Lunchtime Seminar #16
30th Jan, 2024

<p>01 Introduction to AI</p> <p>02 What's NLP</p> <p>03 NLP Challenges</p> <p>04 Understanding ChatGPT</p>	<p>05 Art of Prompt Engineering</p> <p>06 Academic Use Cases</p> <p>07 Additive Uses & Ethics</p> <p>08 Conclusion & Future</p>
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3-7

AGENDA Lunchtime Seminar #16
30th Jan, 2024

<p>01 Introduction to AI</p> <p>02 What's NLP</p> <p>03 NLP Challenges</p> <p>04 Understanding ChatGPT</p>	<p>05 Art of Prompt Engineering</p> <p>06 Academic Use Cases</p> <p>07 Additive Uses & Ethics</p> <p>08 Conclusion & Future</p>
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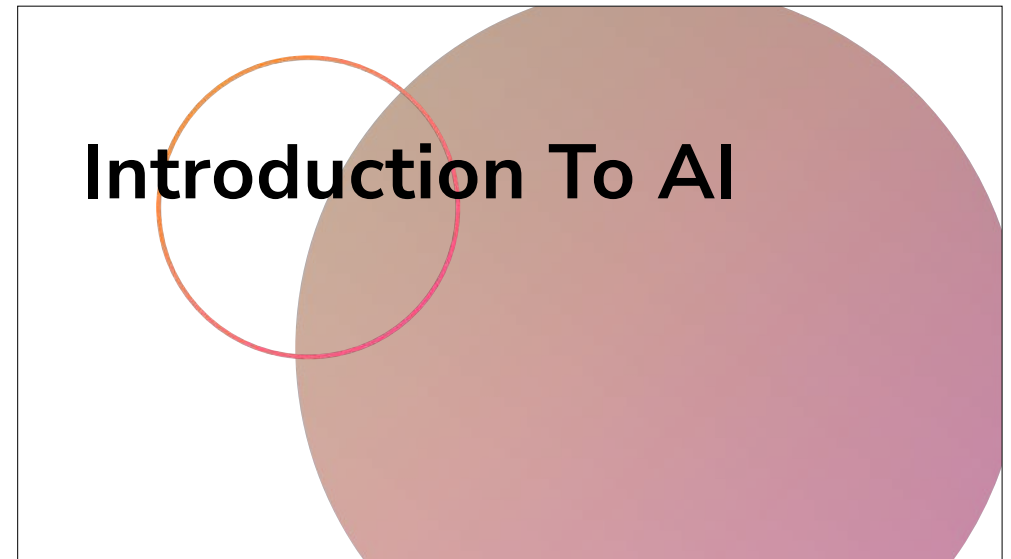
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AGENDA Lunchtime Seminar #16
30th Jan, 2024

<p>01 Introduction to AI</p> <p>02 What's NLP</p> <p>03 NLP Challenges</p> <p>04 Understanding ChatGPT</p>	<p>05 Art of Prompt Engineering</p> <p>06 Academic Use Cases</p> <p>07 Additive Uses & Ethics</p> <p>08 Conclusion & Future</p>
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3-9



4

ARTIFICIAL INTELLIGENCE
What is AI?

PROGRAMM
MACHINE
OBJECT

McCarthy, 2011 + Russell and Norvig (2010)

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5-1

ARTIFICIAL INTELLIGENCE
What is AI?

PROGRAMM
MACHINE
OBJECT

Reasoning
Simulate reasoning
(understanding)

McCarthy, 2011 + Russell and Norvig (2010)

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5-2

ARTIFICIAL INTELLIGENCE
What is AI?

PROGRAMM
MACHINE
OBJECT

Reasoning
Simulate reasoning
(understanding)

Not necessary from Human

McCarthy, 2011 + Russell and Norvig (2010)

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5-3

ARTIFICIAL INTELLIGENCE
What is AI?

PROGRAMM
MACHINE
OBJECT

Reasoning
Simulate reasoning
(understanding)

Not necessary from Human

Problems
Solve Problems (Find feasible solutions)

McCarthy, 2011 + Russell and Norvig (2010)

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5-4

ARTIFICIAL INTELLIGENCE
What is AI?

Lunenburg Seminar #19
20th Jan. 2024

PROGRAMM
MACHINE
OBJECT

Reasoning
Simulate reasoning
(understanding)

Adaptation
Can understand & live in
its environment

Problems
Solve Problems (Find
feasible solutions)

Not necessary
from Human

McCarthy, 2011 + Russell and Norvig (2010)

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5-5

Intended Users of AI

Who are the intended users of the AI technologies and what are the applications of AI in higher education?

<https://educationstechnologyjournal.springeropen.com/articles/10.1186/s41239-023-00392-8>

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6

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Intended Users of AI

Who are the intended users of the AI technologies and what are the applications of AI in higher education?

Student
99 studies
72%

Manager
16 studies
11%

Instructor
23 studies
17%

<https://educationstechnologyjournal.springeropen.com/articles/10.1186/s41239-023-00392-8>

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6-2

AI & LLM Stats

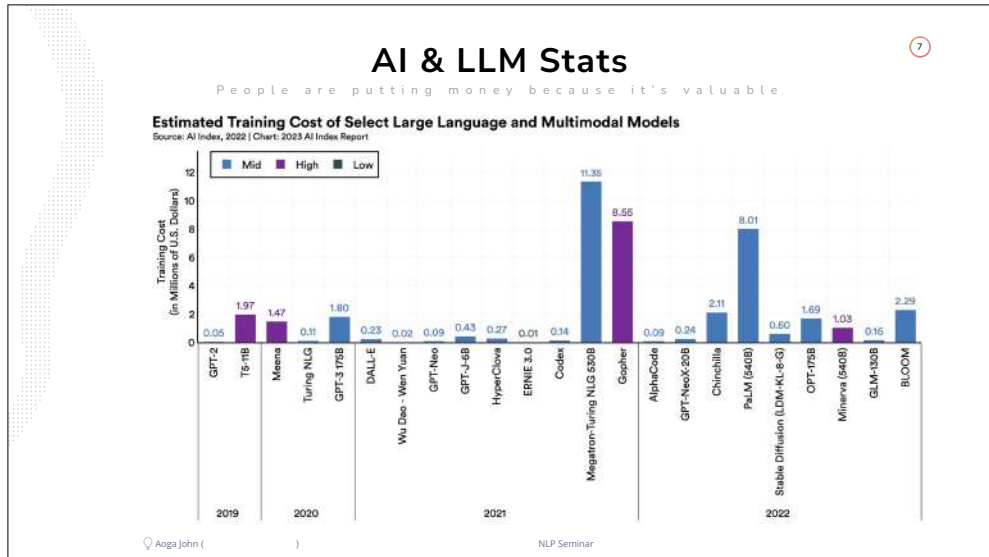
People are putting money because it's valuable

<https://educationstechnologyjournal.springeropen.com/articles/10.1186/s41239-023-00392-8>

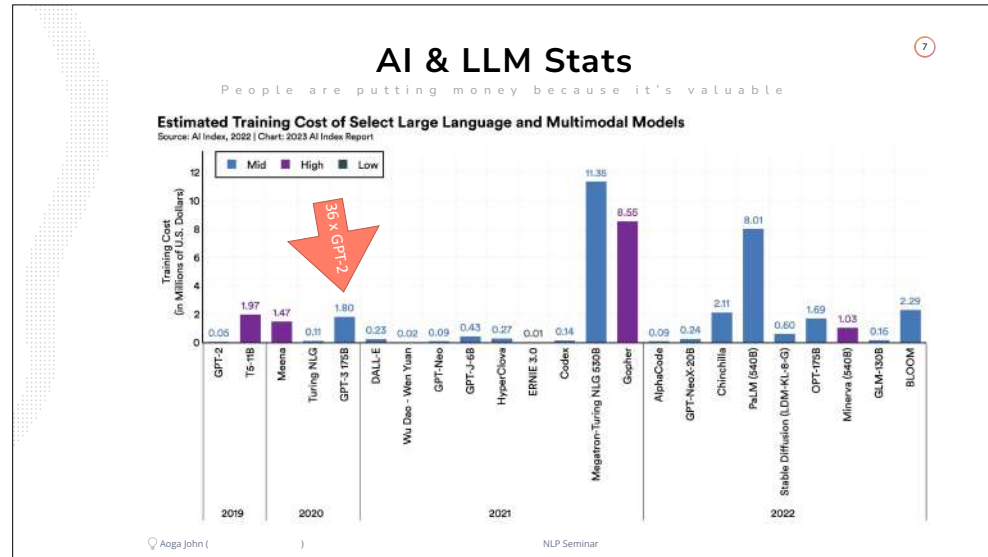
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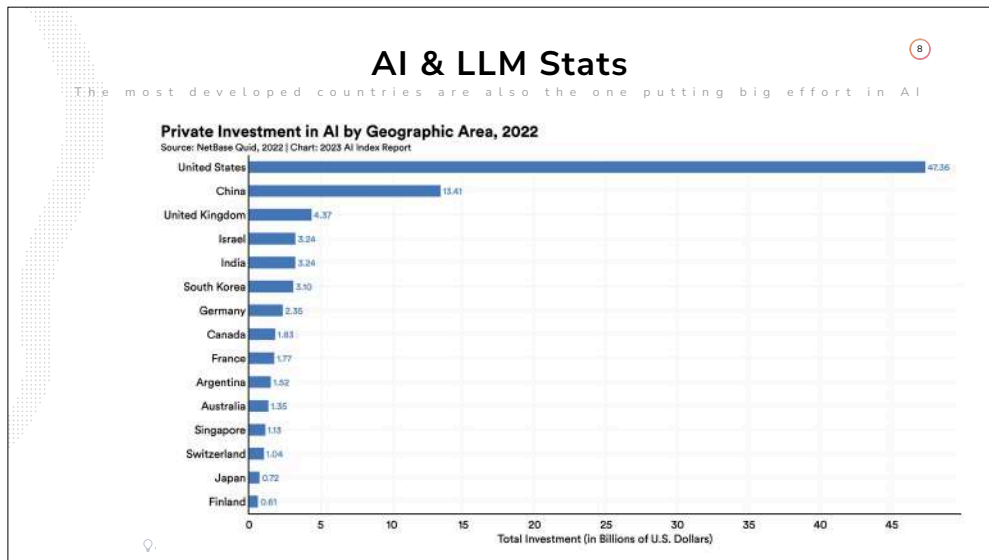
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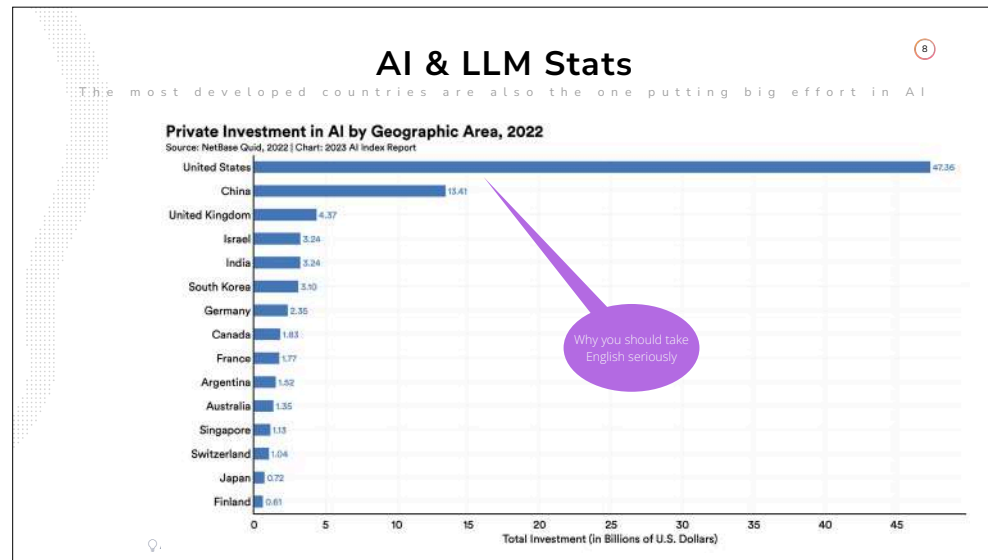
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7-3



8-1



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



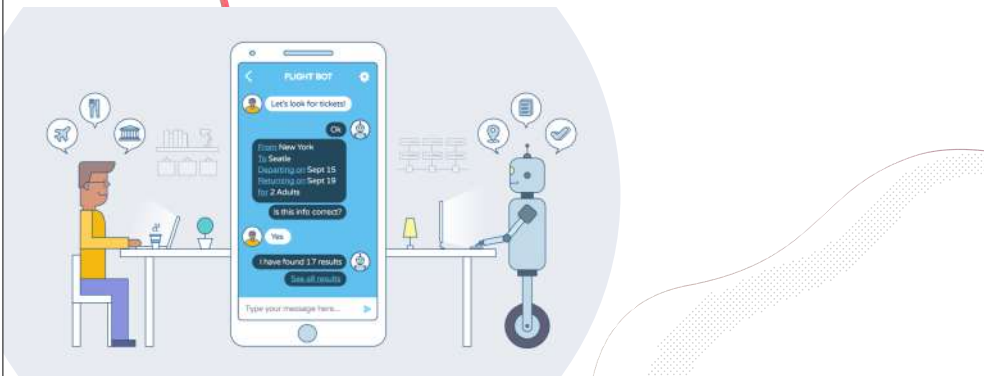
Before: Programming Language

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```

After: Natural Language

10-3

(Chat)bots



11-1

(Chat)bots

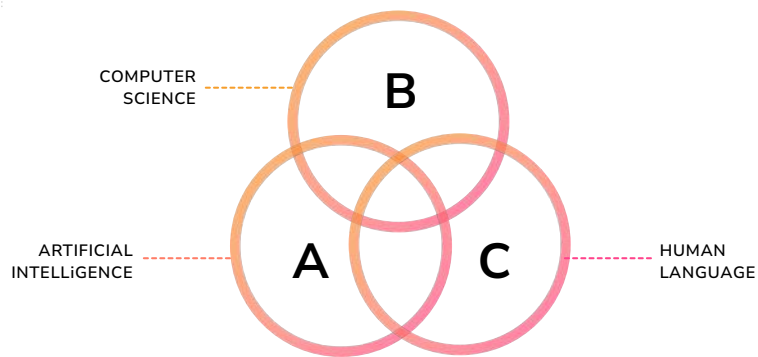


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NLP involves the study and development of **algorithms** and models to **enable computers to understand**, interpret, and generate natural language data

NLP Fields

Three main fields in NLP



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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14

Basic Apps of NLP

Two main components

@ NL Generation

Produce meaningful phrases following a structure of a languages

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15-1

Basic Apps of NLP

Two main components

@ NL Generation

Produce meaningful phrases following a structure of a languages

- 1 Text Summarization
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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

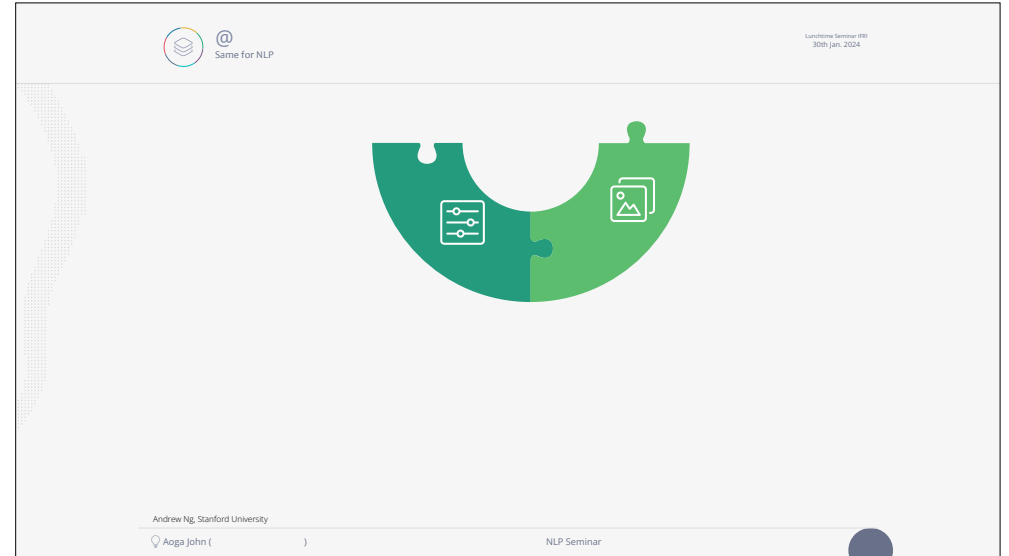
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 - #Deep learning
 - #Transformers
 - #Attention mechanism
 - #Massive datasets
 - #Advanced Algorithms

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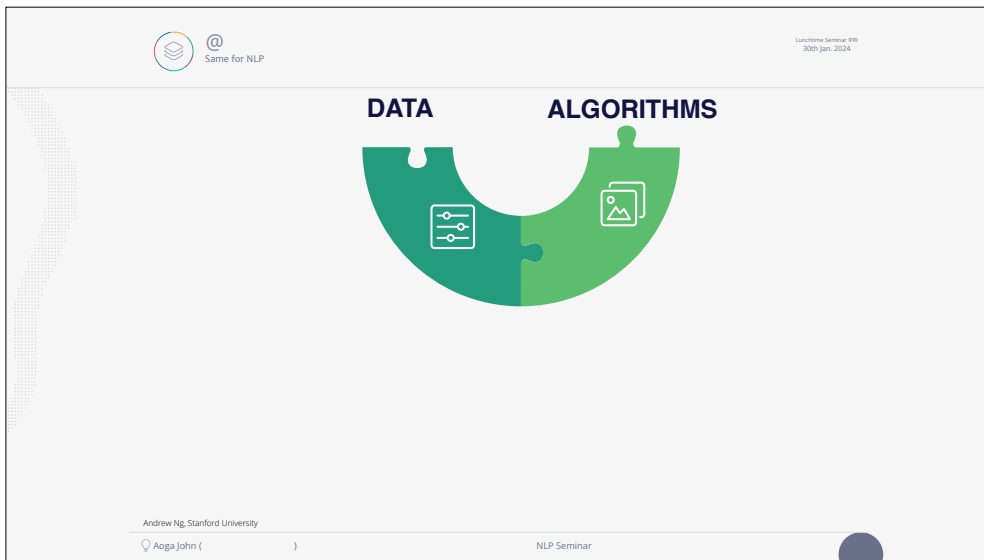
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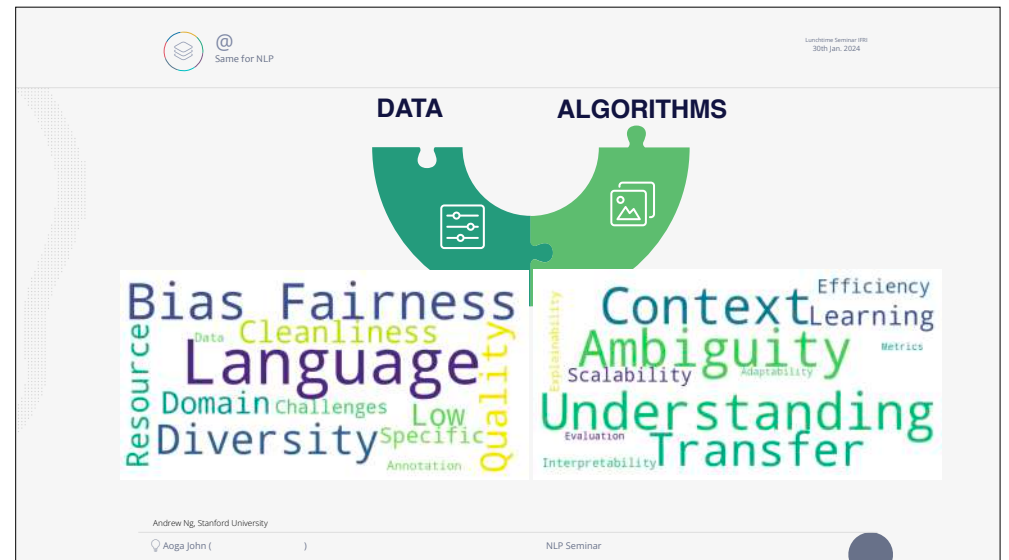
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18-1



18-2



18-3

ML principles

Basics

Input X

1, 2, 3, 4, ... → x^2 → 1, 4, 9, 16, ...

Output Y

Input X

1, 2, 3, 4, ...

Output Y

1, 4, 9, 16, ...

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19

ML Phases

Learning & tests

Input X

1, 2, 3, 4, ... → x^2 → 1, 4, 9, 16, ...

Output Y

X

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20-1

ML Phases

Learning & tests

X

Y

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20-2

ML Phases

Learning & tests

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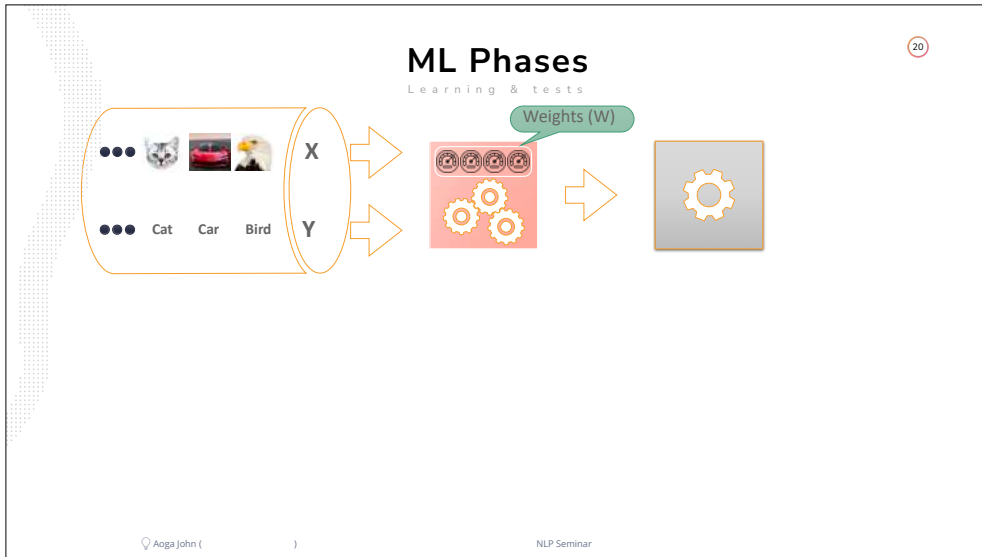
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X

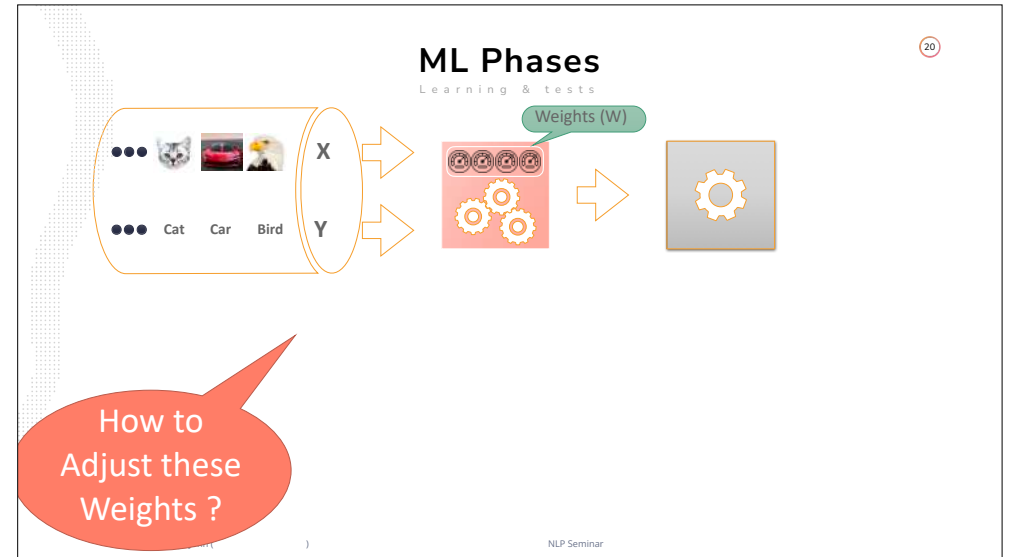
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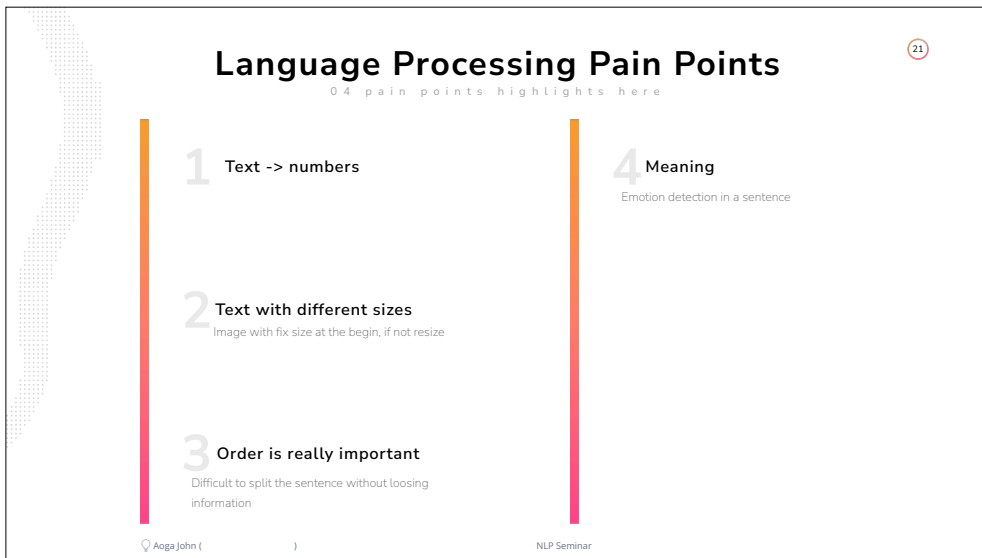
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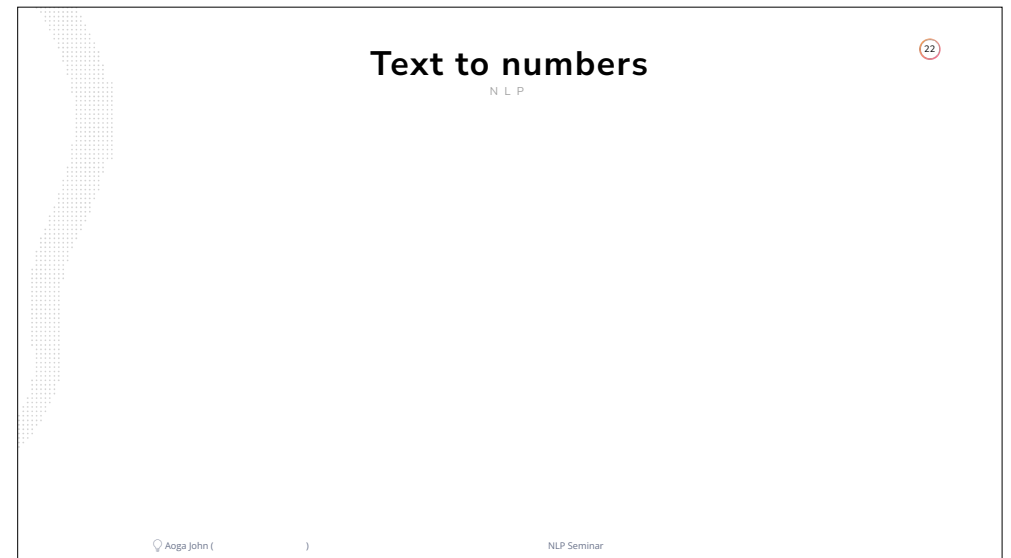
20-4



20-5



21



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

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22-4

Text to numbers
N L P

22

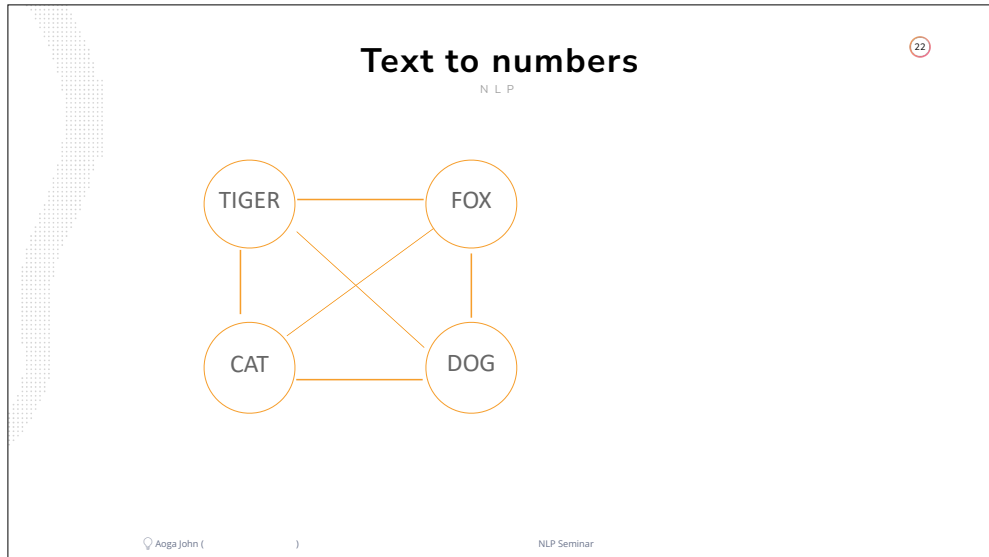
TIGER FOX

CAT DOG

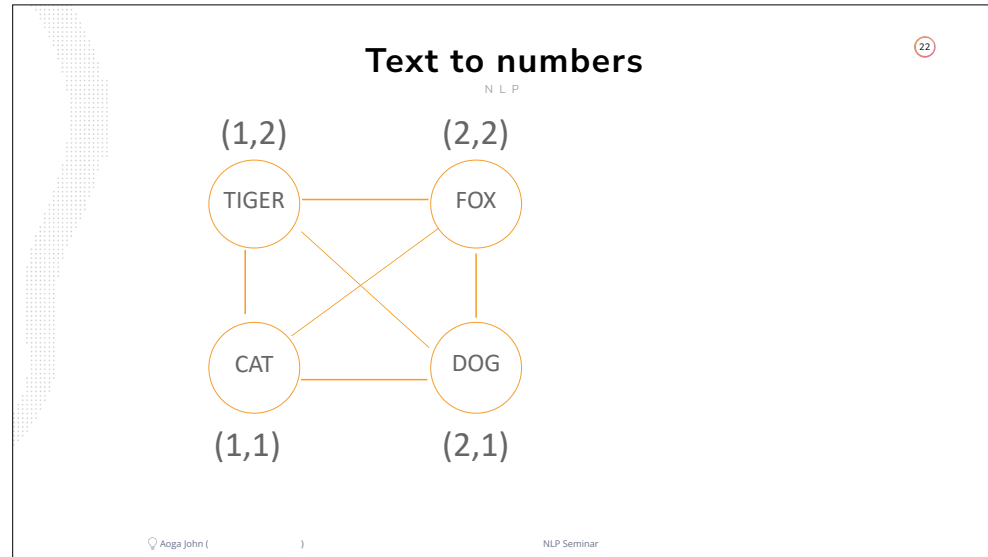
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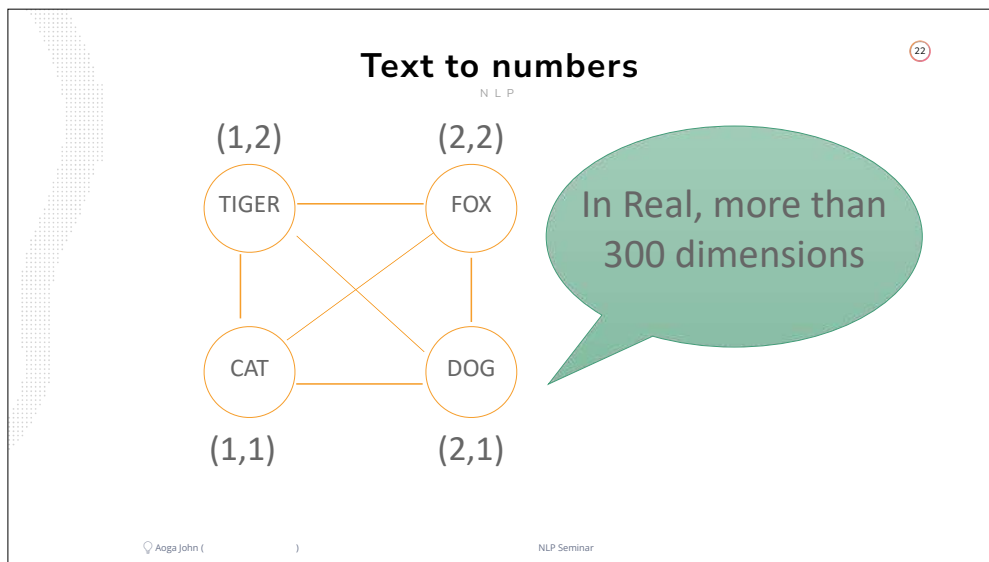
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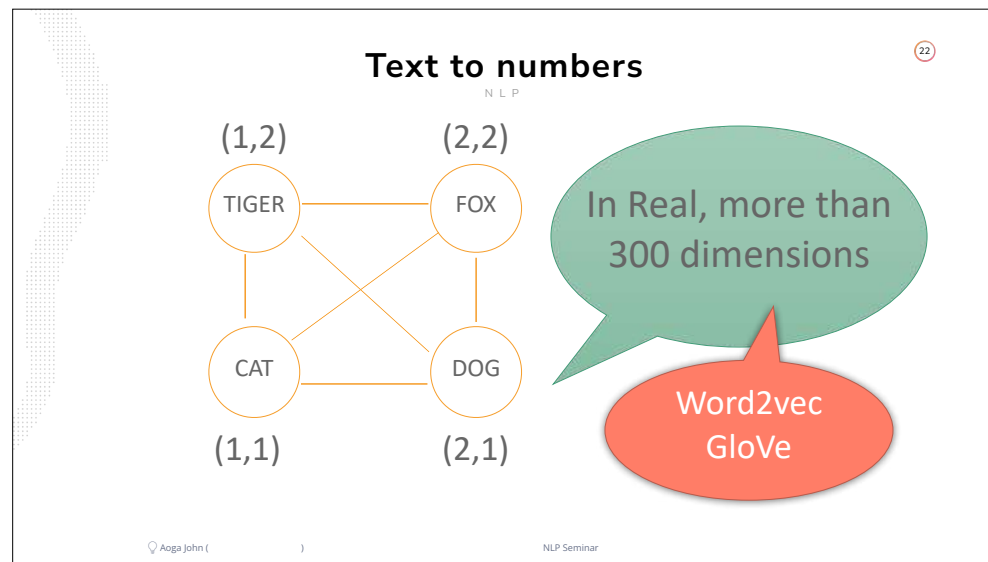
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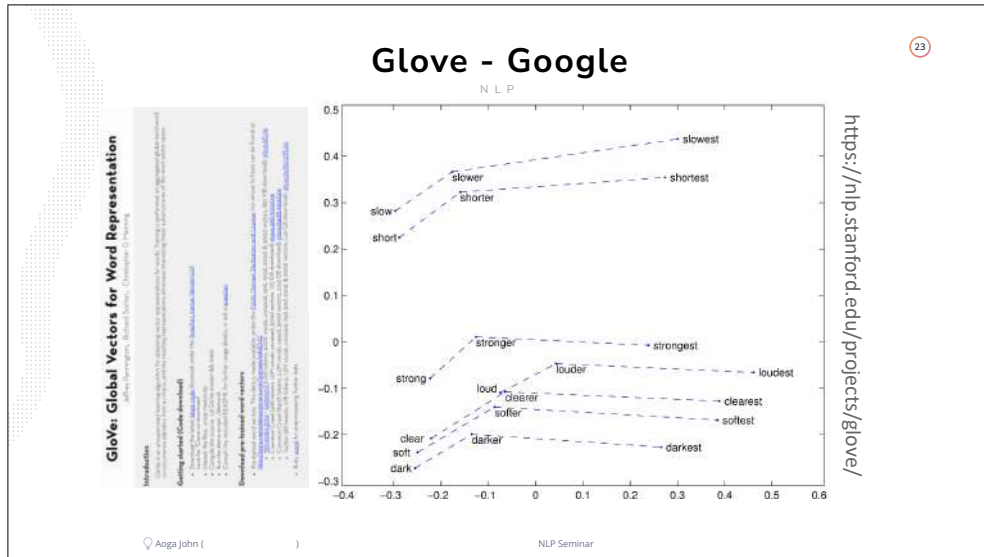
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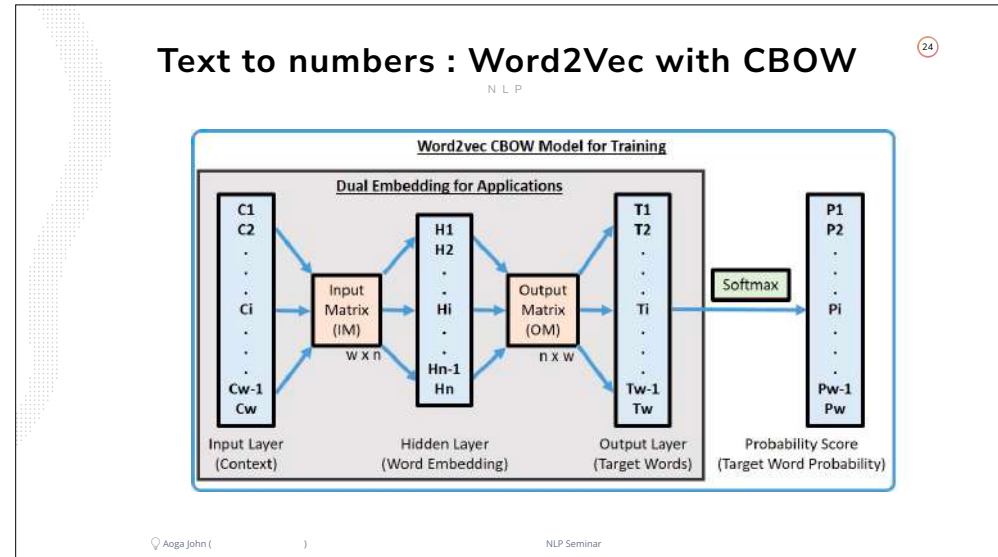
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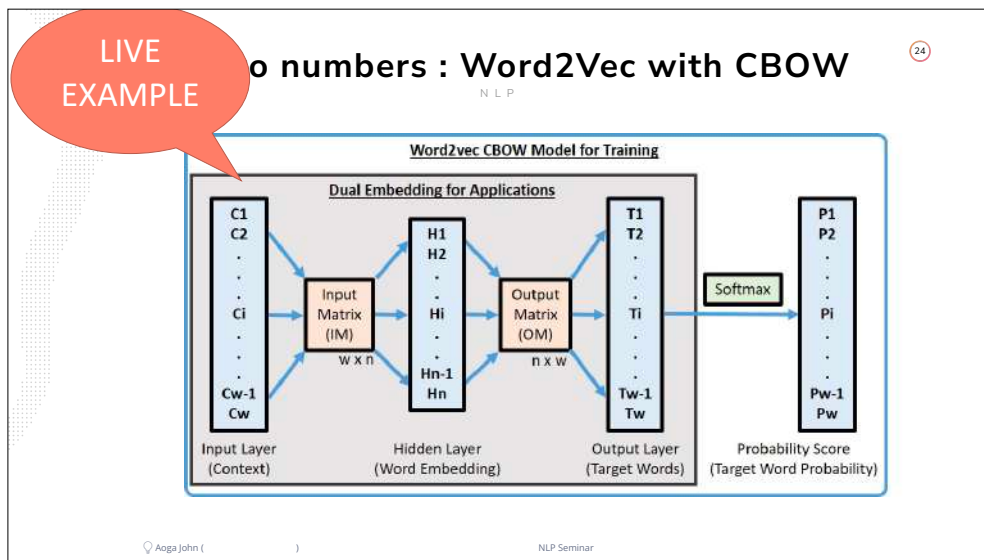
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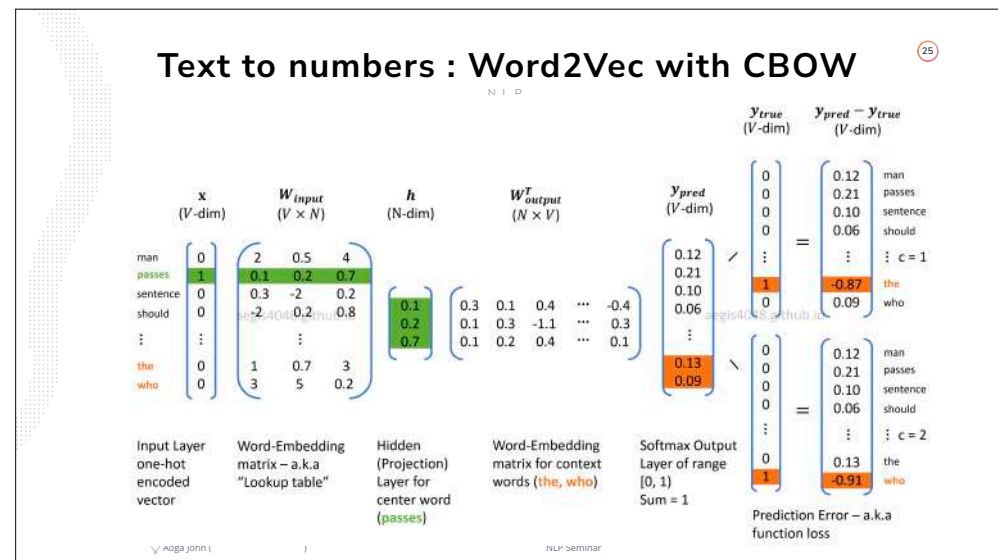
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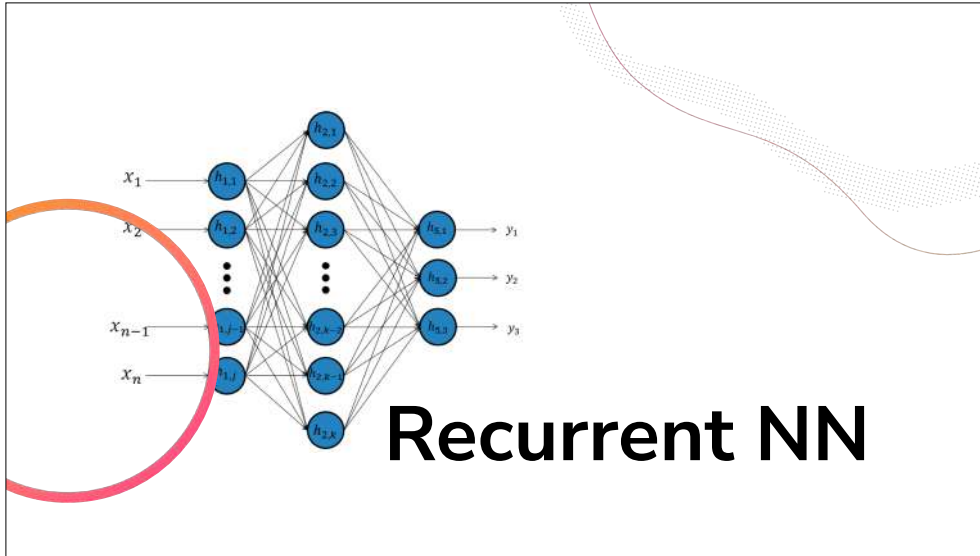
24-1



24-2



25



26

Recurrent Neural Network

R N N

Le chat mange goulument la souris

27

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27-1

Recurrent Neural Network

R N N

Le

27

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27-2

Recurrent Neural Network

R N N

Le chat

27

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27-3

Recurrent Neural Network
R N N

Le chat mange

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27-4

Recurrent Neural Network
R N N

Le chat mange goulument

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27-5

Recurrent Neural Network
R N N

Le chat mange goulument la

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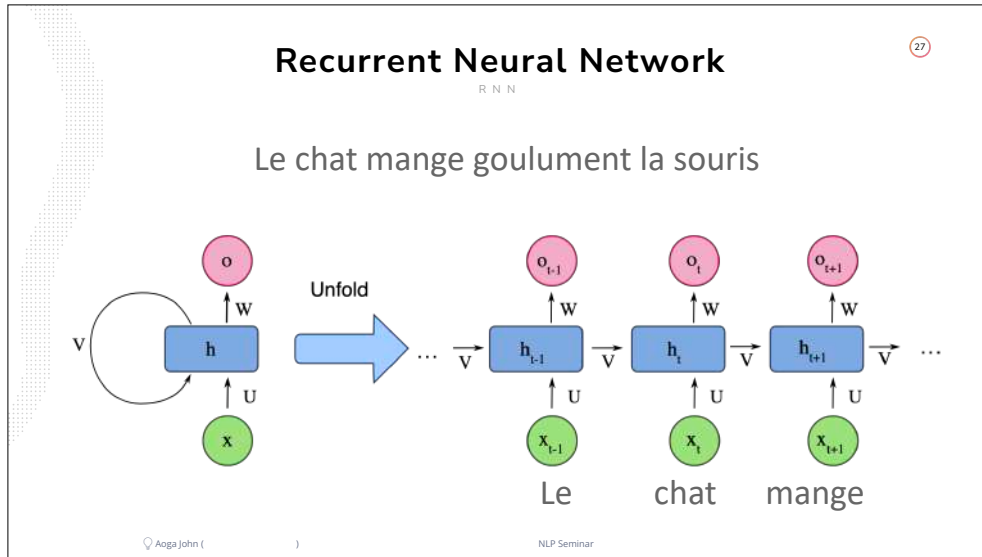
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Recurrent Neural Network
R N N

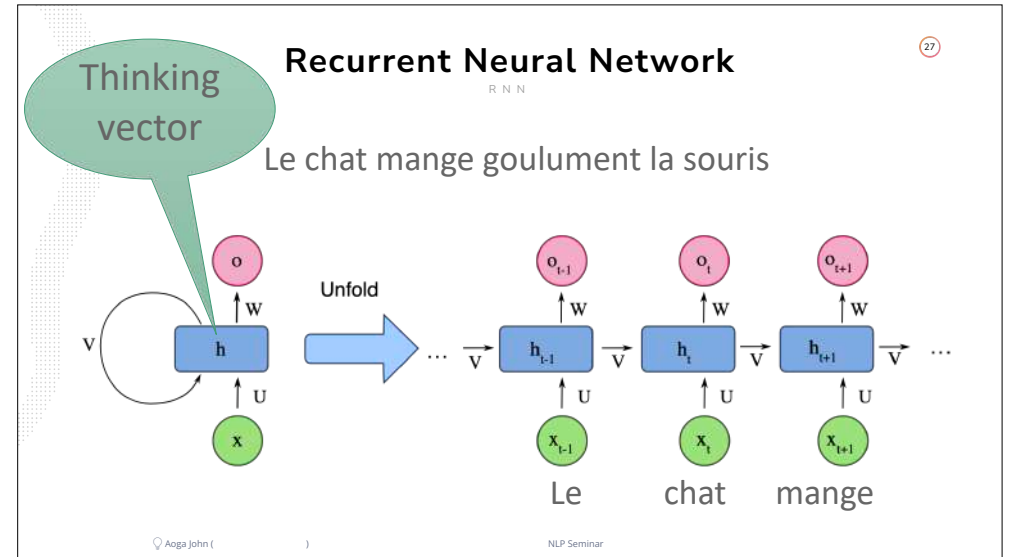
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27-8



27-9



28-1



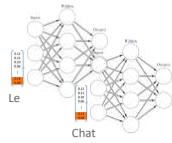
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Recurrent Neural Network

RNN

28

Le chat mange goulument la souris



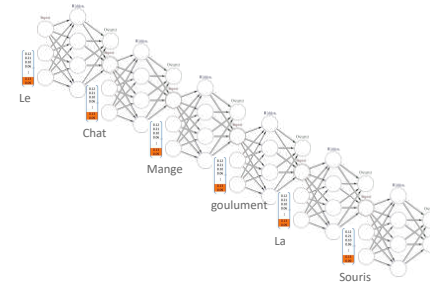
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Recurrent Neural Network

RNN

28

Le chat mange goulument la souris



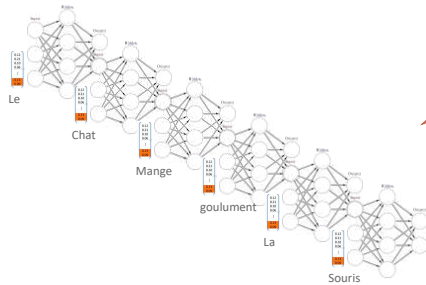
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Recurrent Neural Network

RNN

28

Le chat mange goulument la souris



So Deep!

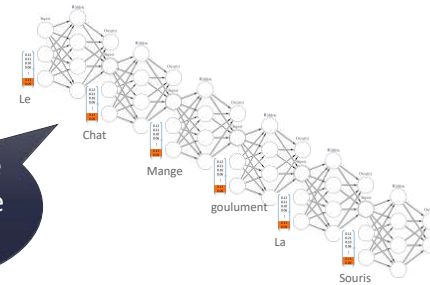
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Recurrent Neural Network

RNN

28

Le chat mange goulument la souris



But, It's done with only one network

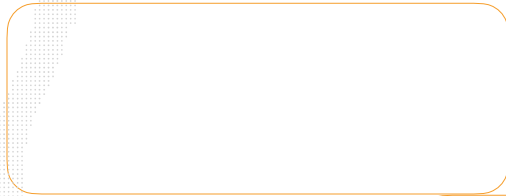
So Deep!

28-6

Recurrent Neural Network

RNN

29



Encodeur

Décodeur

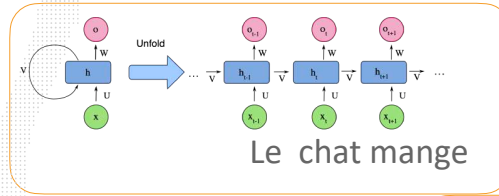


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Recurrent Neural Network

RNN

29



Le chat mange

Encodeur

Décodeur

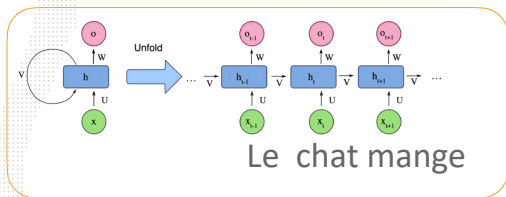


29-2

Recurrent Neural Network

RNN

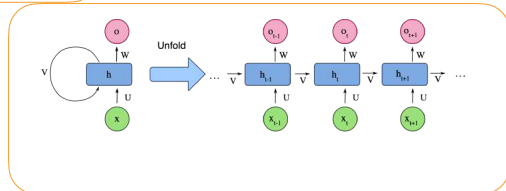
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Le chat mange

Encodeur

Décodeur



29-3

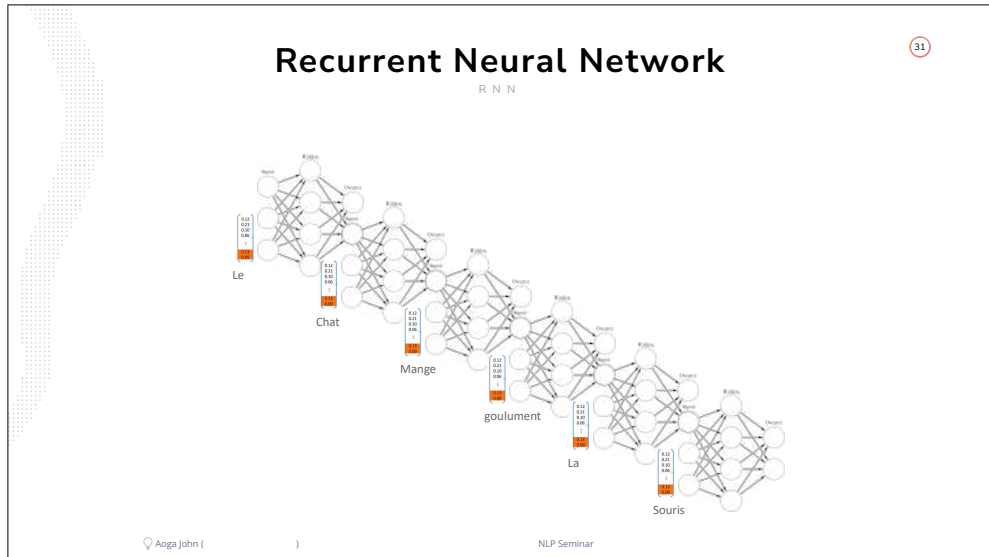
Recurrent Neural Network

Issue

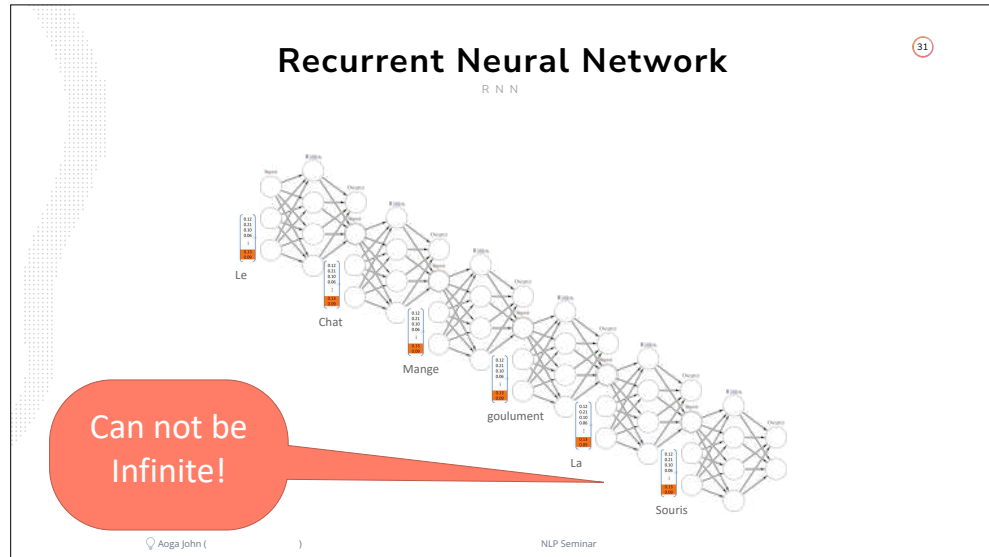
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Bohicon est une très belle ville du Benin, j'est vécu cinq et c'est là j'ai appris à parler ...

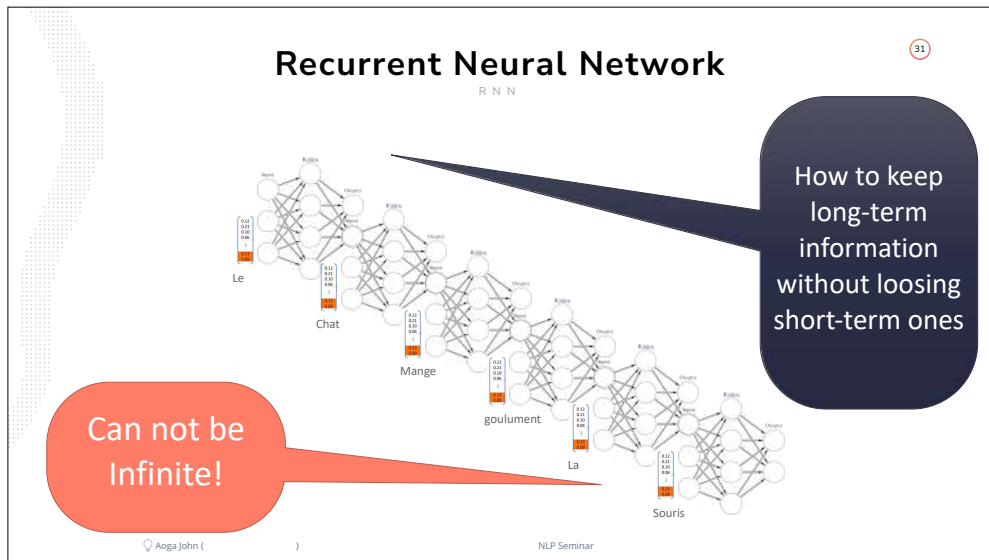
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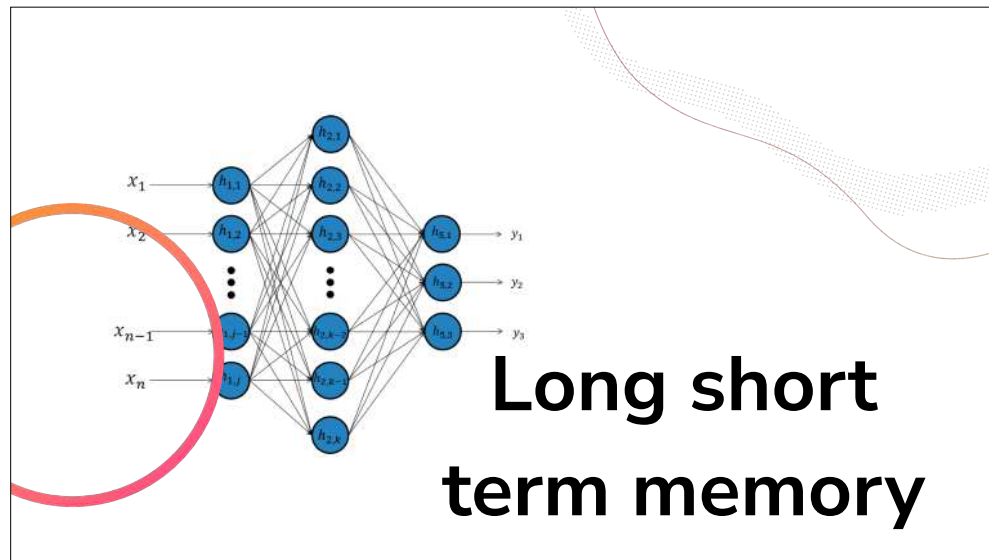
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31-2



31-3

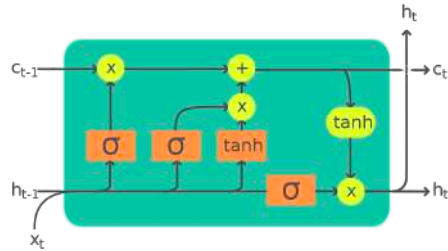


32

Long Short Term Memory

L s t m

33



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

36

<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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36-1

General Prompt Template

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Prompt:

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

Output:

Neutral

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36-2

General Prompt Template

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Instruction

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Instruction

Input Data

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36-4

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Neutral

Instruction

Input Data

Output indicator

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36-5

General Prompt Template

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Prompt:

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

Output:

Neutral

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

Feel free to not use all the template components

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36-6

ZERO-shot Prompting

Techniques

37

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

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

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

37

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

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

Prompt:

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

Output:

Neutral

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37-2

Few-shot Prompting

People are putting money because it's valuable

38

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

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

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

38

- 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

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

People are putting money because it's valuable

39

- 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. ✗
```

(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. ✓
```

(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 ✗
```

(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. ✓
```

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

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39

Advanced Techniques: Prompt Chaining

You should try to use this as much as possible

40

<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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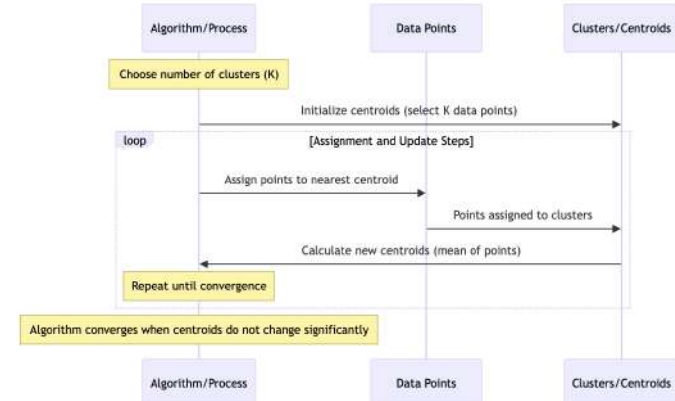
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40

Advanced Techniques: Prompt Chaining (GPT-4)

You should try to use this as much as possible

41



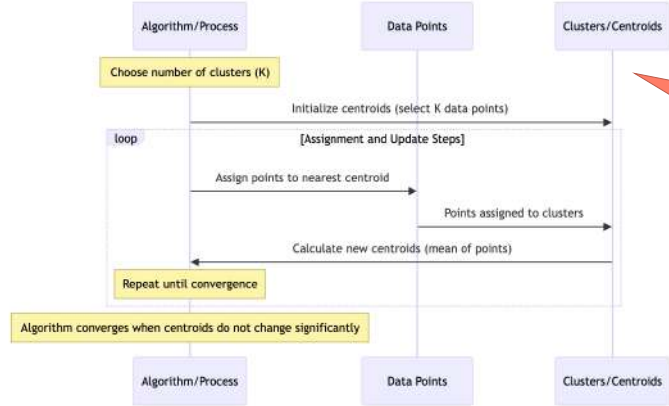
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41-1

Advanced Techniques: Prompt Chaining (GPT-4)⁴¹

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ChatGPT
4

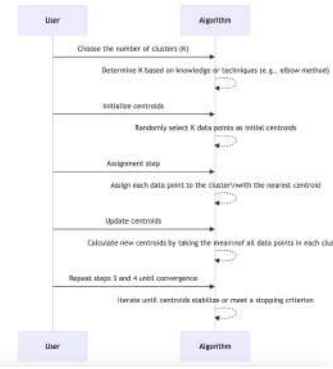
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41-2

Advanced Techniques: Prompt Chaining (GPT-3)⁴²

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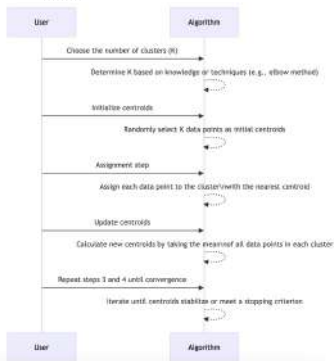
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42-1

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?



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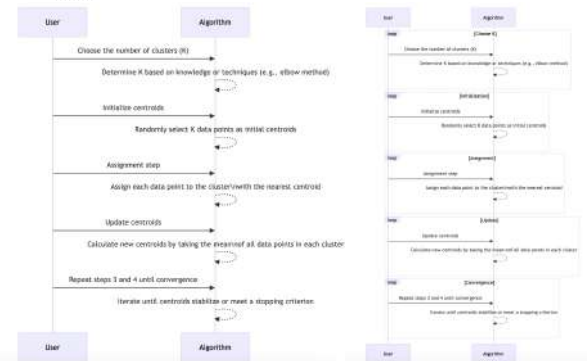
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42-2

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?



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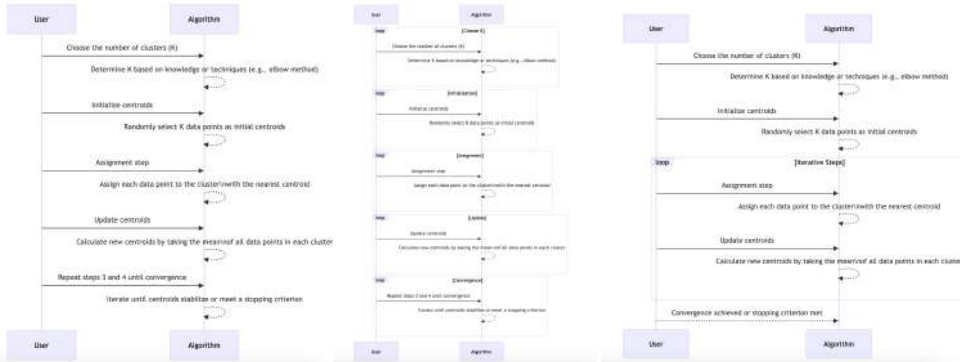
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42-3

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



42-4

General Prompt Template ⁴³

You should try to use this as much as possible

43-1

General Prompt Template ⁴³

You should try to use this as much as possible



43-2

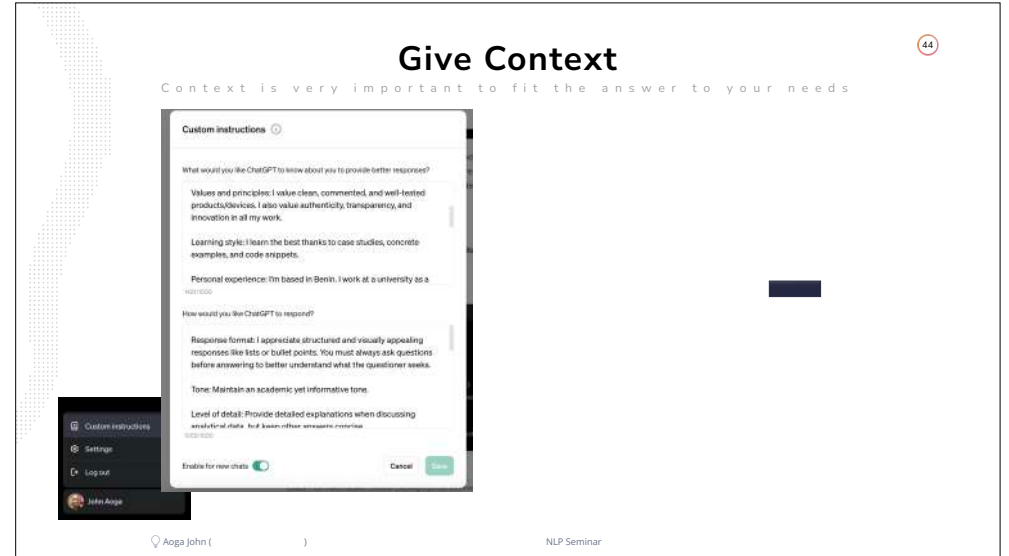
Give Context ⁴⁴

Context is very important to fit the answer to your needs

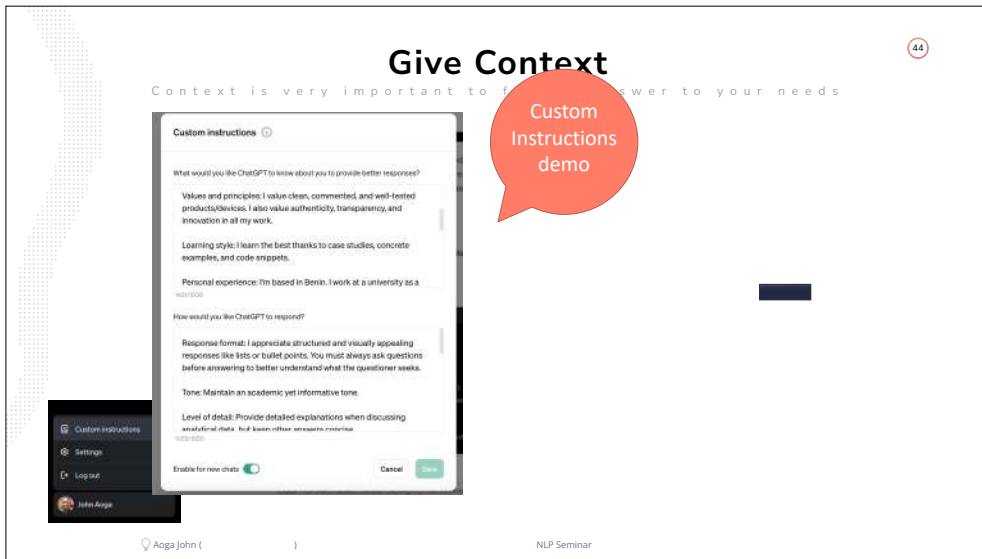
44-1



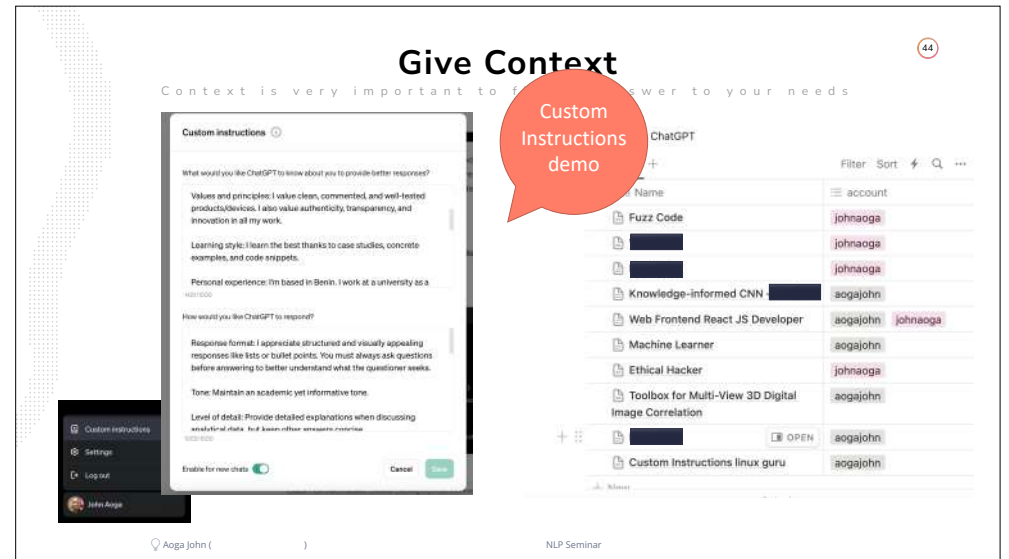
44-2



44-3



44-4



44-5

Give Context

Context is very important to fit the answer to your needs

Custom Instructions demo

ChatGPT

Filter Sort 🔍 ⋮

Name account

Fuzz Code johnaoga

Mes GPTs + Créer un GPT

Ethical Hacker johnaoga

Toolbox for Multi-View 3D Digital Image Correlation aogajohn

Custom Instructions linux guru aogajohn

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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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Addict ?

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46

Addictive Uses

Aware of symptoms

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47

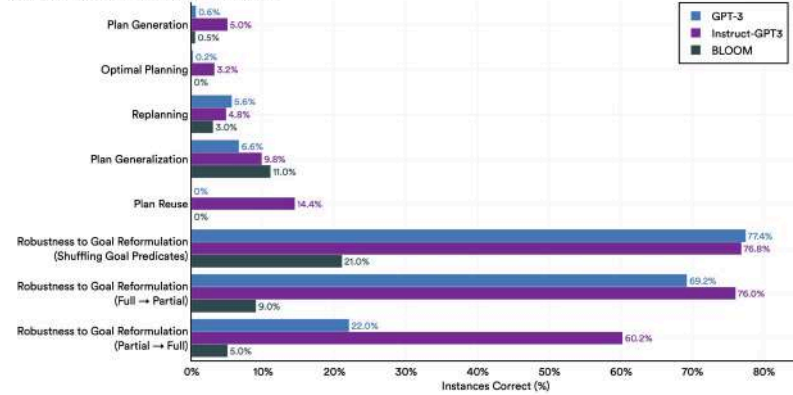
Know the Limits of your Tools

Three main fields in NLP

48

Select Large Language Models on the Blocksworld Domain: Instances Correct

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



48

Flaws Awareness

Be aware about errors

49

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49-1

Flaws Awareness

Be aware about errors

49



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49-2

Flaws Awareness

Be aware about errors

49



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

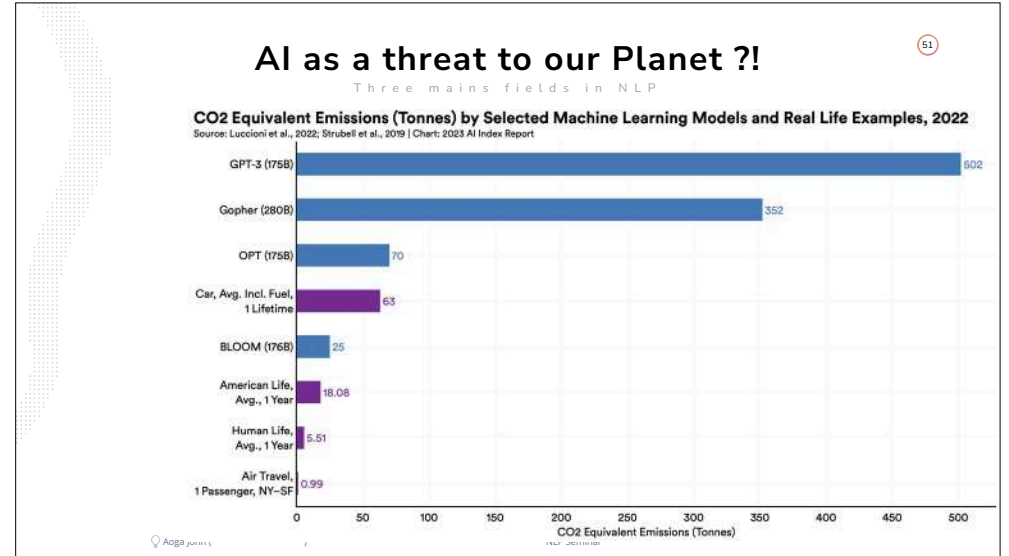
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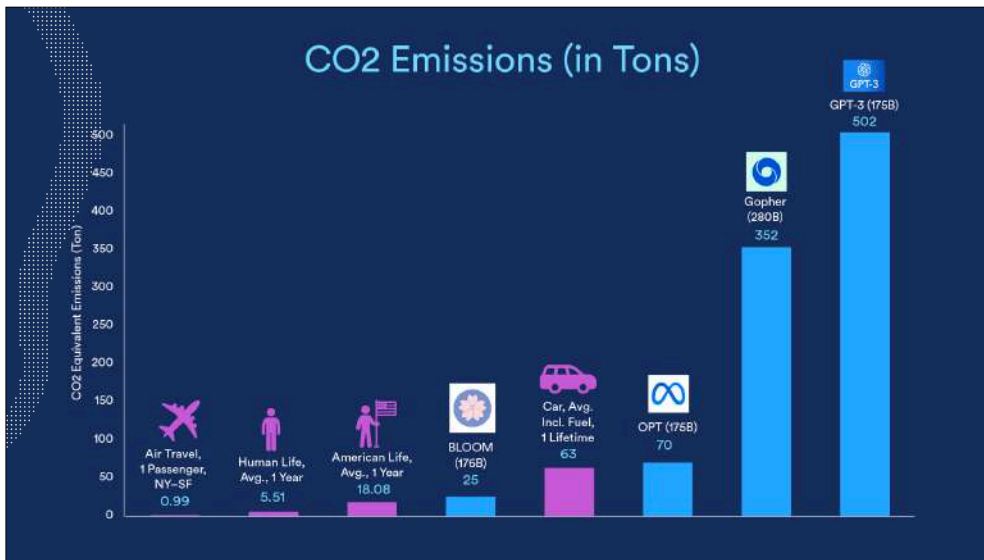
49-3



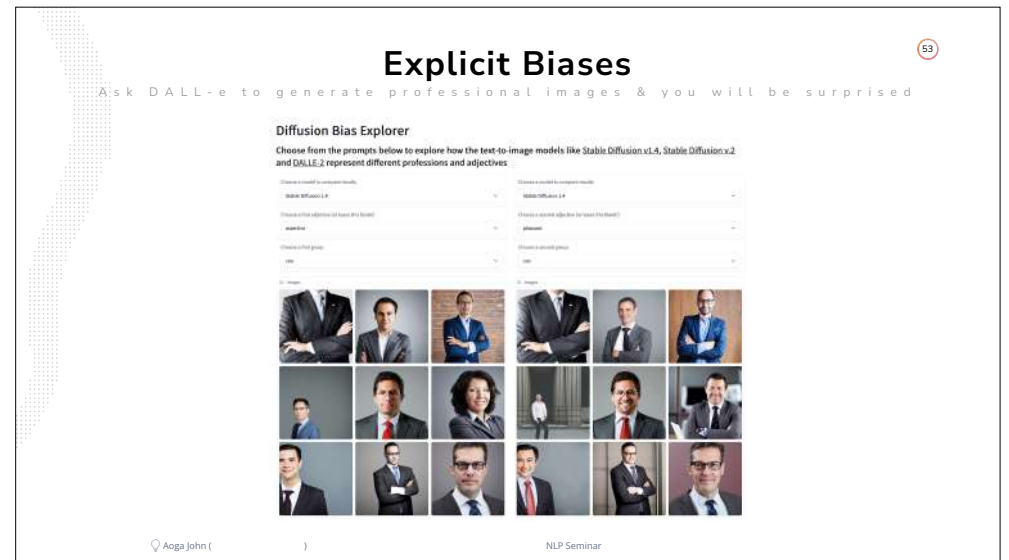
50



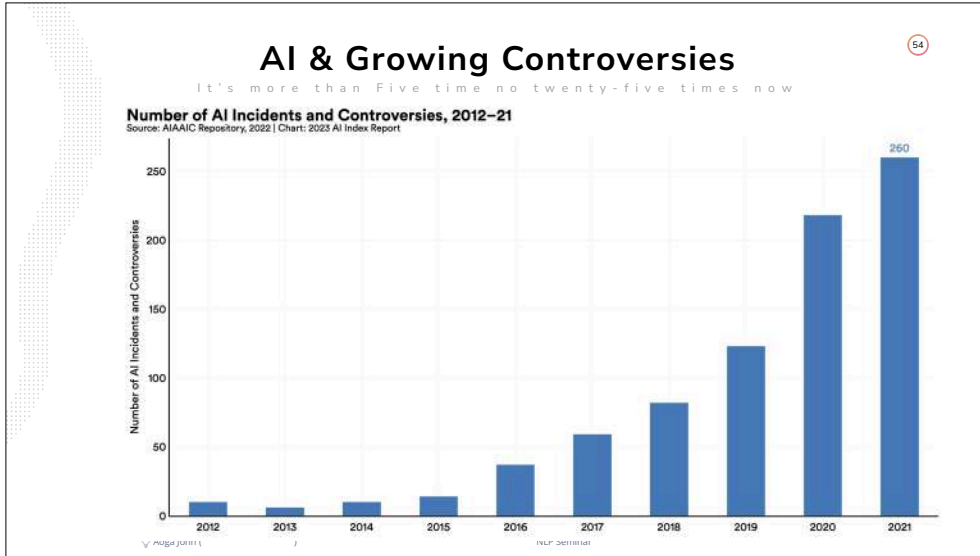
51



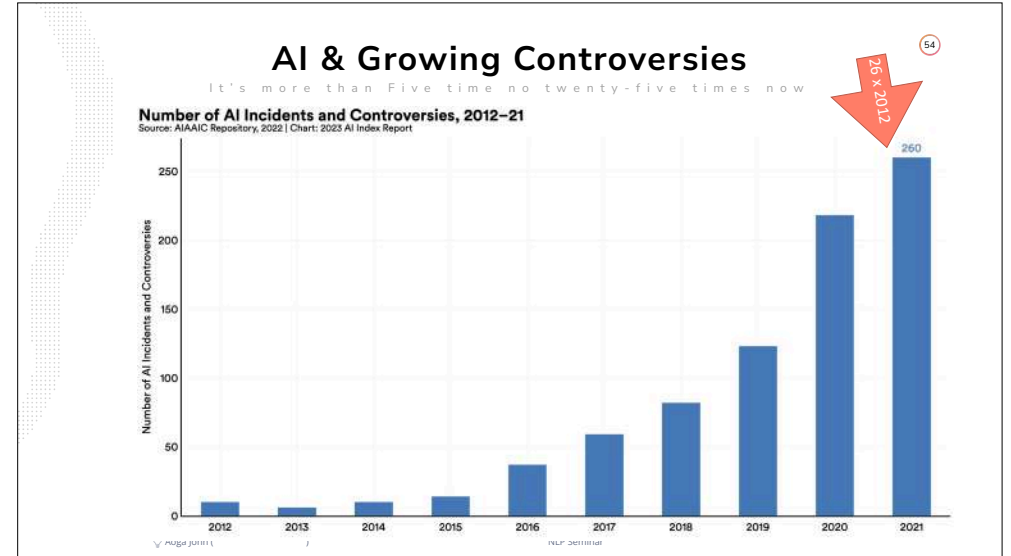
52



53



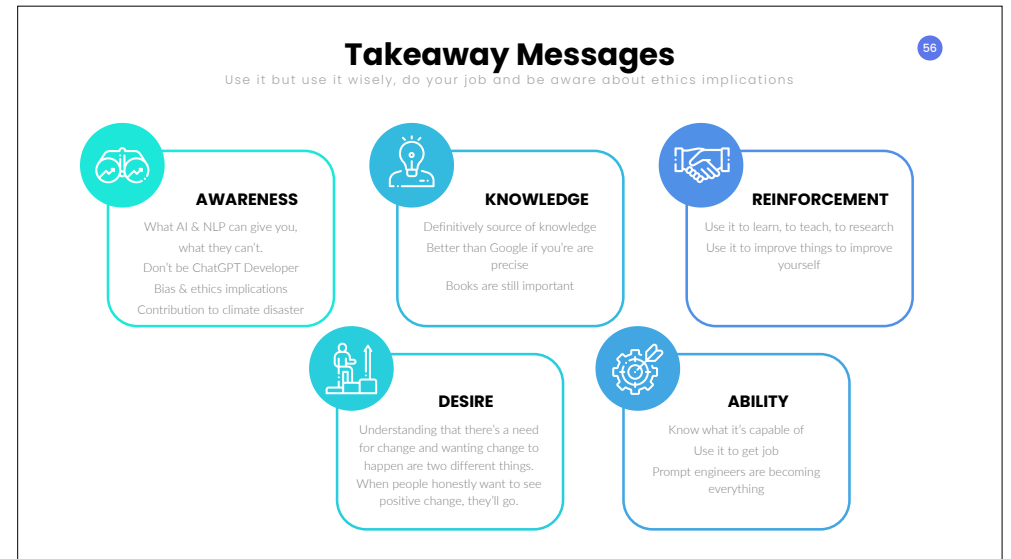
54-1



54-2



55



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.

57

Next Steps

58

ANY QUESTIONS?

59