

LECTURER: TAI LE QUY

# ARTIFICIAL INTELLIGENCE

TOPIC OUTLINE

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History of AI

1

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Modern AI Systems

2

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Reinforcement Learning

3

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Natural Language Processing – Part 1

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Natural Language Processing – Part 2

5

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Computer Vision

6

**UNIT 4**

# **NATURAL LANGUAGE PROCESSING**

## **PART 1**



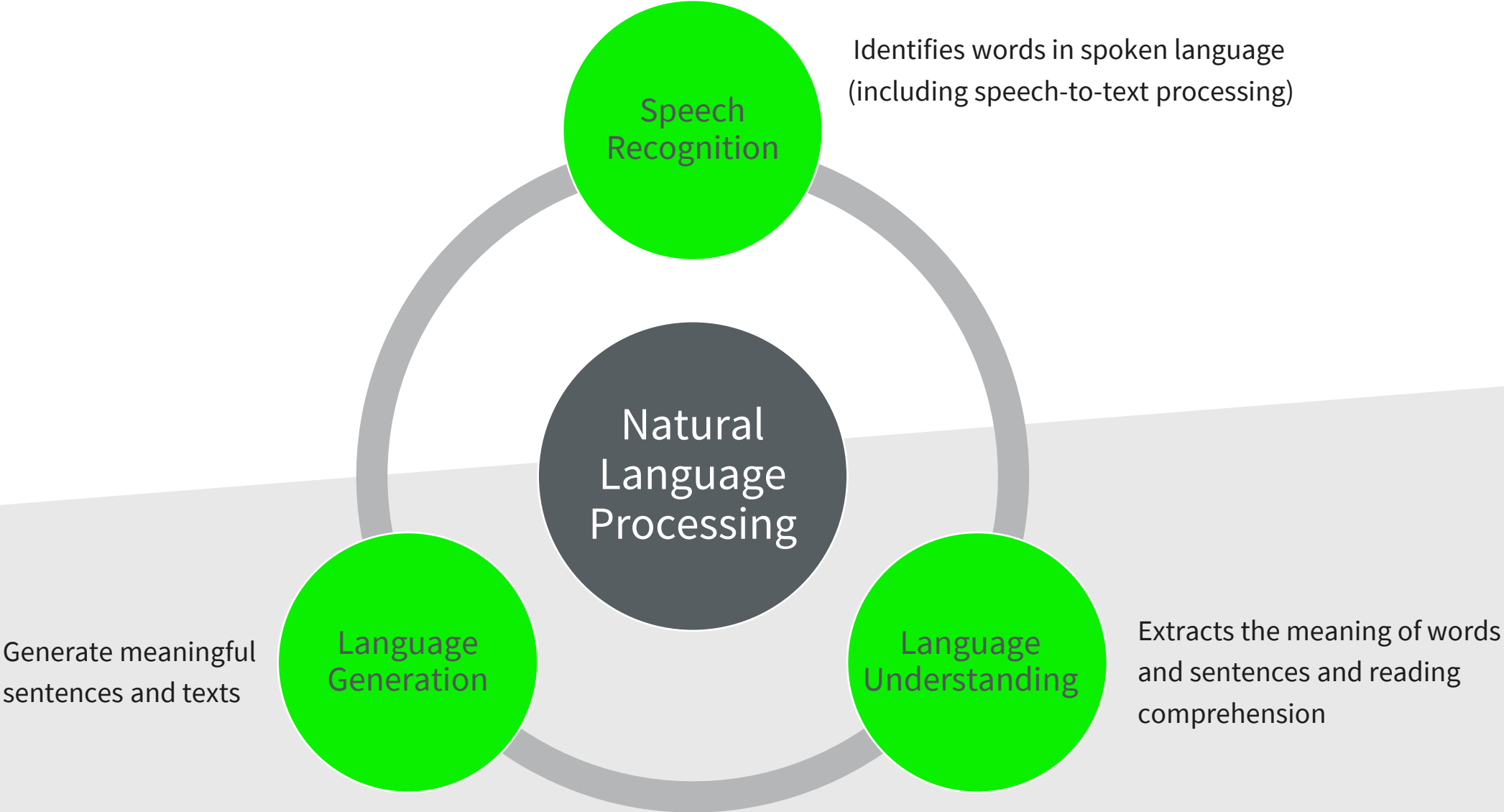
- On the completion of this unit, you will be able to...
  - ... identify the subdomains of NLP.
  - ... explain the historical background of NLP.
  - ... name the most important areas of application.



1. What are the three subdomains of NLP?
2. How did NLP develop?
3. What are the most important application areas for NLP?

- Natural language processing (NLP) is an interdisciplinary field of linguistics, computer science, and artificial intelligence concerned with the interactions between computers and human language, in particular how to program computers to process and analyze large amounts of natural language data.
- Three subdomains in NLP:
  - Speech recognition
  - Natural language understanding
  - Natural language generation

SUBDOMAINS OF NLP

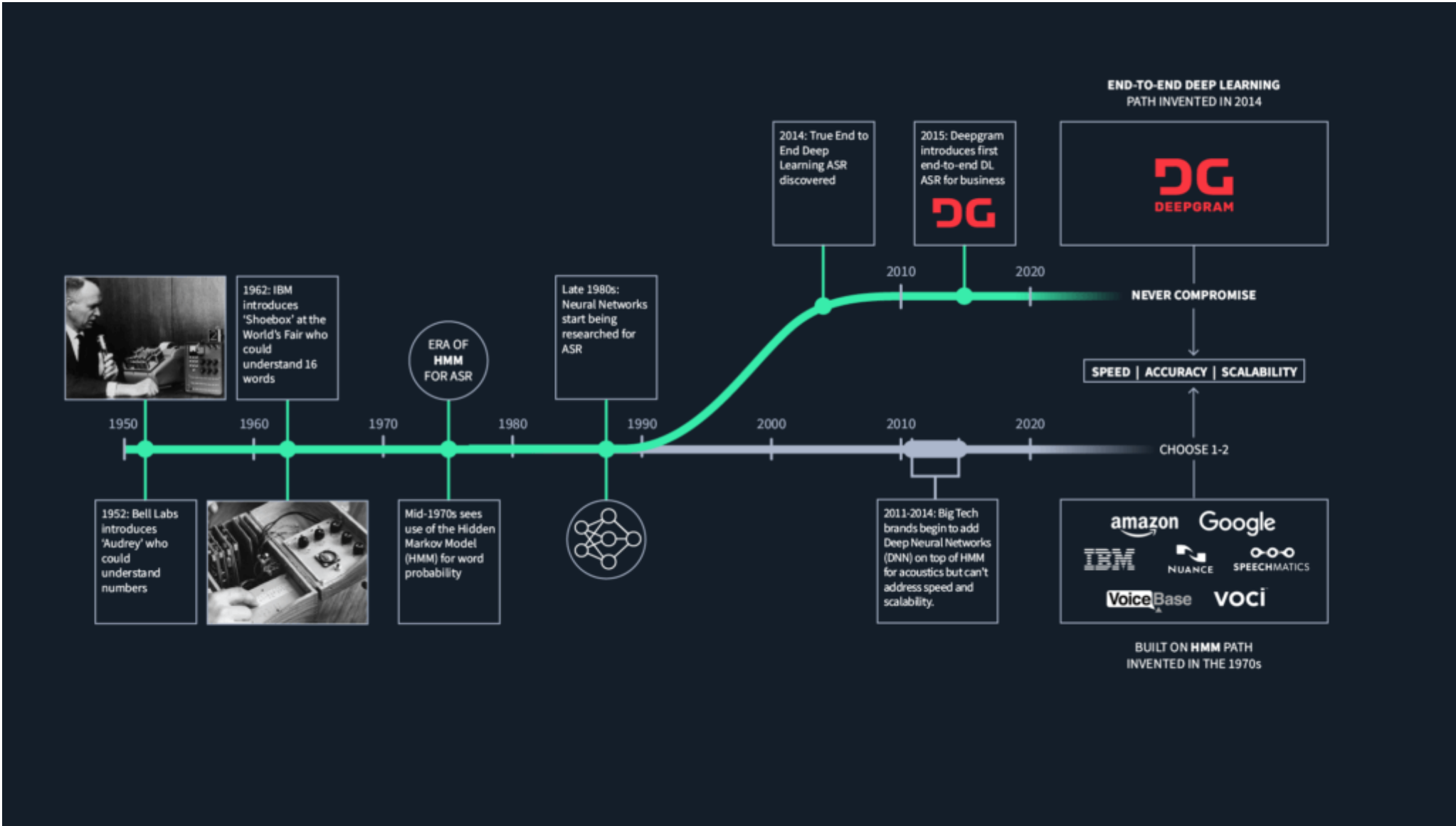


## SPEECH RECOGNITION

- Speech recognition is an interdisciplinary subfield of computational linguistics that develops methodologies and technologies that enable the recognition and translation of spoken language into text by computers
- It is also known as **automatic speech recognition** (ASR), **computer speech recognition** or **speech to text** (STT)
- The reverse process is **speech synthesis**.



# SPEECH RECOGNITION - HISTORY



## SPEECH RECOGNITION - STEPS

- Audio capture
  - Microphone, environment, recording, file format & sampling rate
- Pre-processing
  - Noise reduction, normalization, segmentation
- Feature extraction
  - Converts speech frames into a feature vector
- Language modeling
  - Enables computers to understand and generate human language
- Decoding
  - Transcribes the text

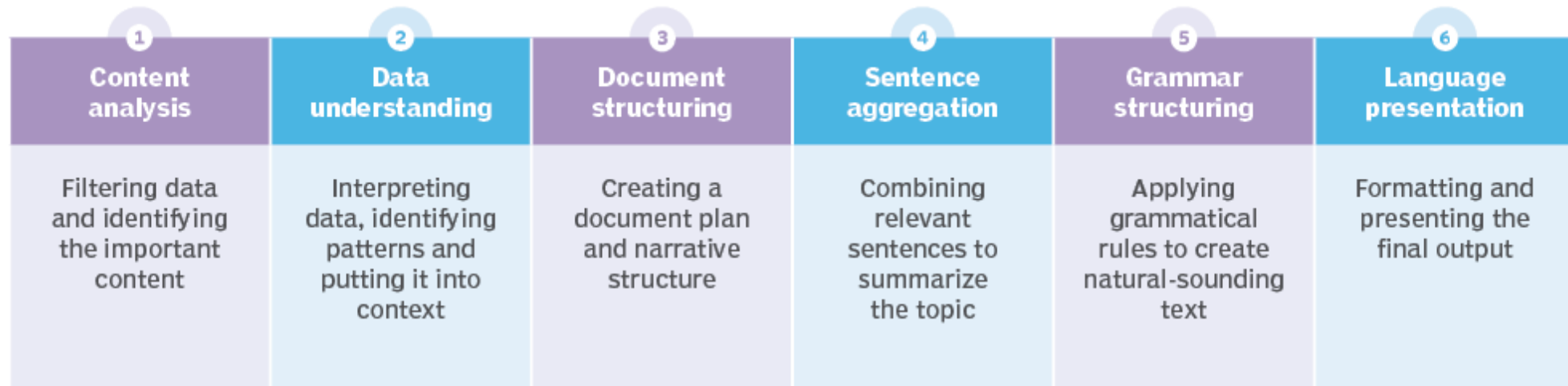
## NATURAL LANGUAGE UNDERSTANDING

- Natural language understanding (NLU) or natural language interpretation (NLI) is a subtopic of NLP that deals with machine reading comprehension. Natural language understanding is considered an AI-hard problem.
- Application to automated reasoning, machine translation, question answering, news-gathering, text categorization, voice-activation, archiving, and large-scale content analysis

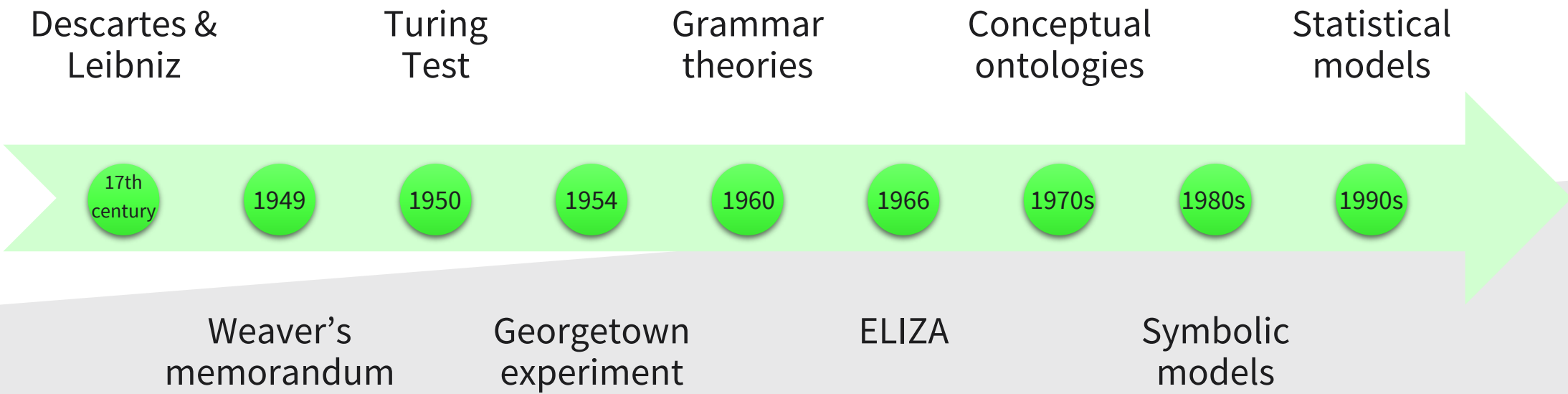
## NATURAL LANGUAGE GENERATION

- Natural language generation (NLG) is a software process that produces natural language output.
- NLG is the subfield of artificial intelligence and computational linguistics that is concerned with the construction of computer systems than can **produce understandable texts** in English or other human languages from some underlying non-linguistic representation of information.
- Common applications of NLG: patient reports, image captions, and chatbots.

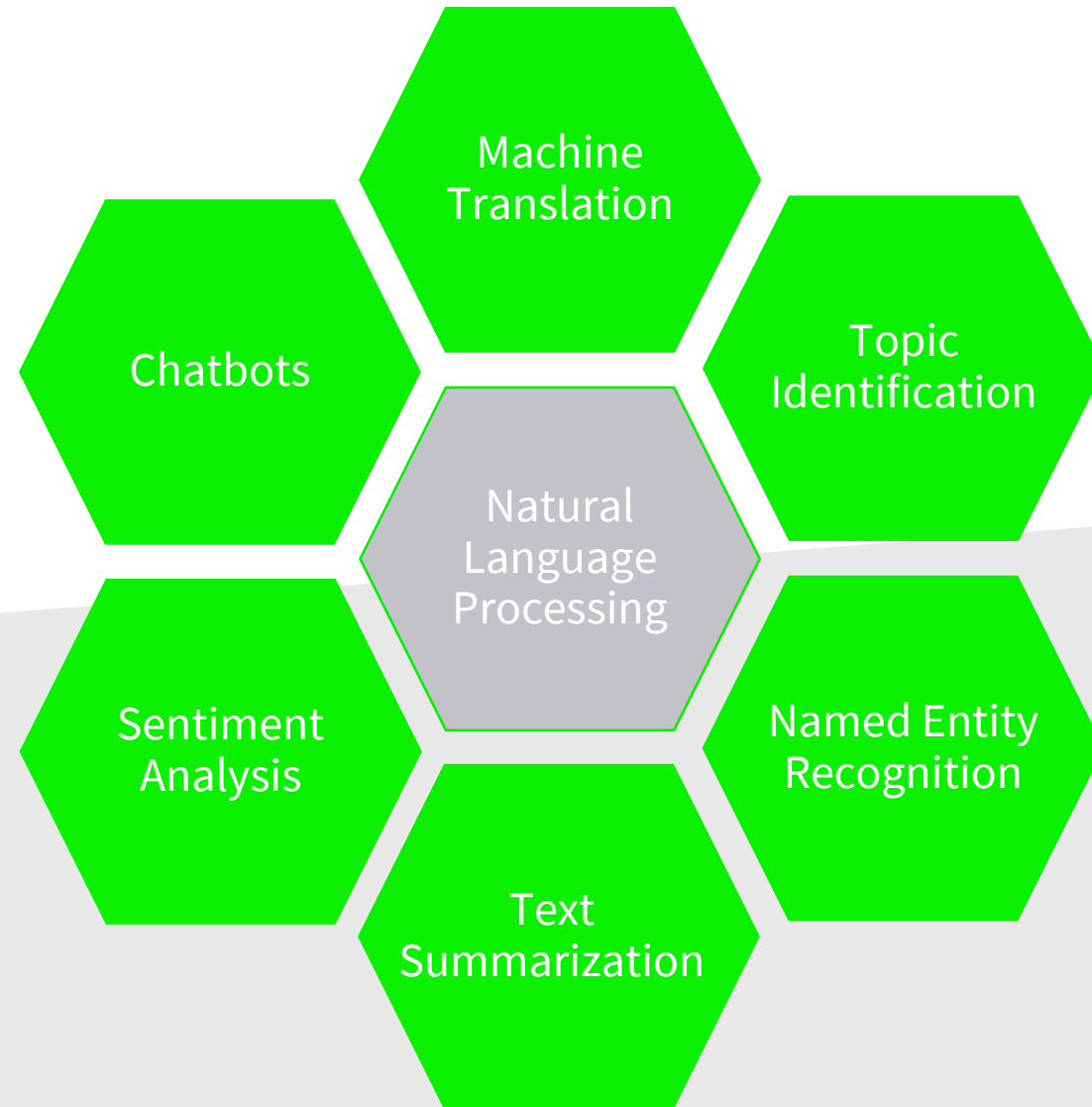
# 6 steps to natural language generation



HISTORICAL BACKGROUND



## TYPICAL AREAS OF APPLICATION FOR NLP

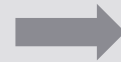


## TOPIC IDENTIFICATION



<topic>

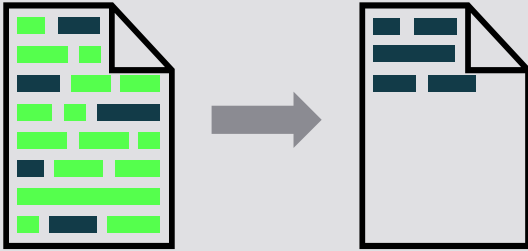
“One quick way to summarize the milestones in AI history is to list the Turing Award winners: Marvin Minsky (1969) and John McCarthy (1971) for defining the foundations of the field based on representation and reasoning; Allen Newell and Herbert Simon (1975) for symbolic models of problem solving and human cognition” (Russell & Norvig, 2021, p. 35).



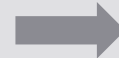
history



## TEXT SUMMARIZATION

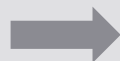
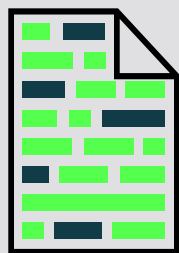


“Mr and Mrs Dursley, of number four, Privet Drive, were proud to say that they were perfectly normal, thank you very much. They were the last people you’d expect to be involved in anything strange or mysterious, because they just didn’t hold with such nonsense” (Rowling, 1998, p. 1).

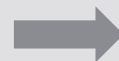


Mr and Mrs Dursley were perfectly normal. They were the last people to be involved in anything mysterious.

SENTIMENT ANALYSIS



“Exactly what I thought it would be. Perfect early Father's Day gift for my husband – we had so much fun playing ping pong at a resort recently I just had to get it for him.”

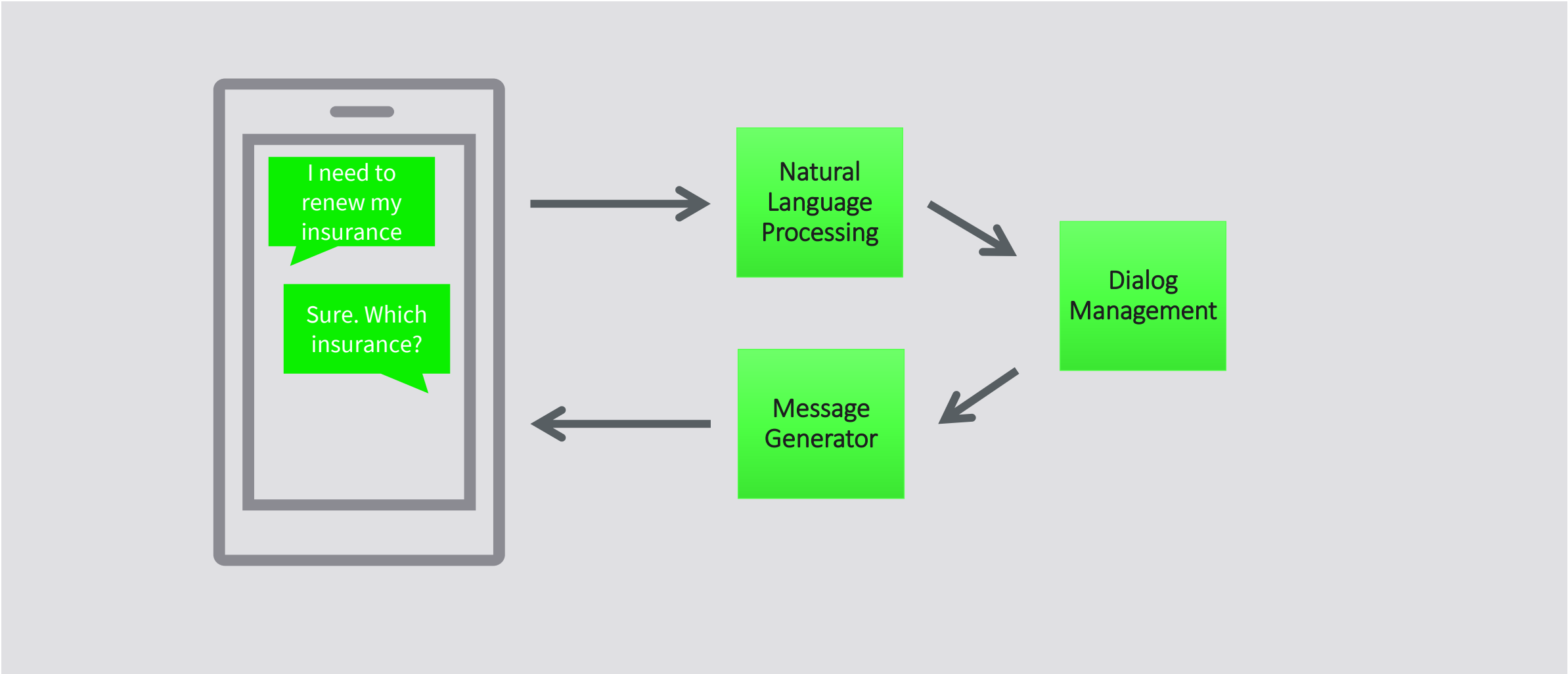


NAMED ENTITY RECOGNITION

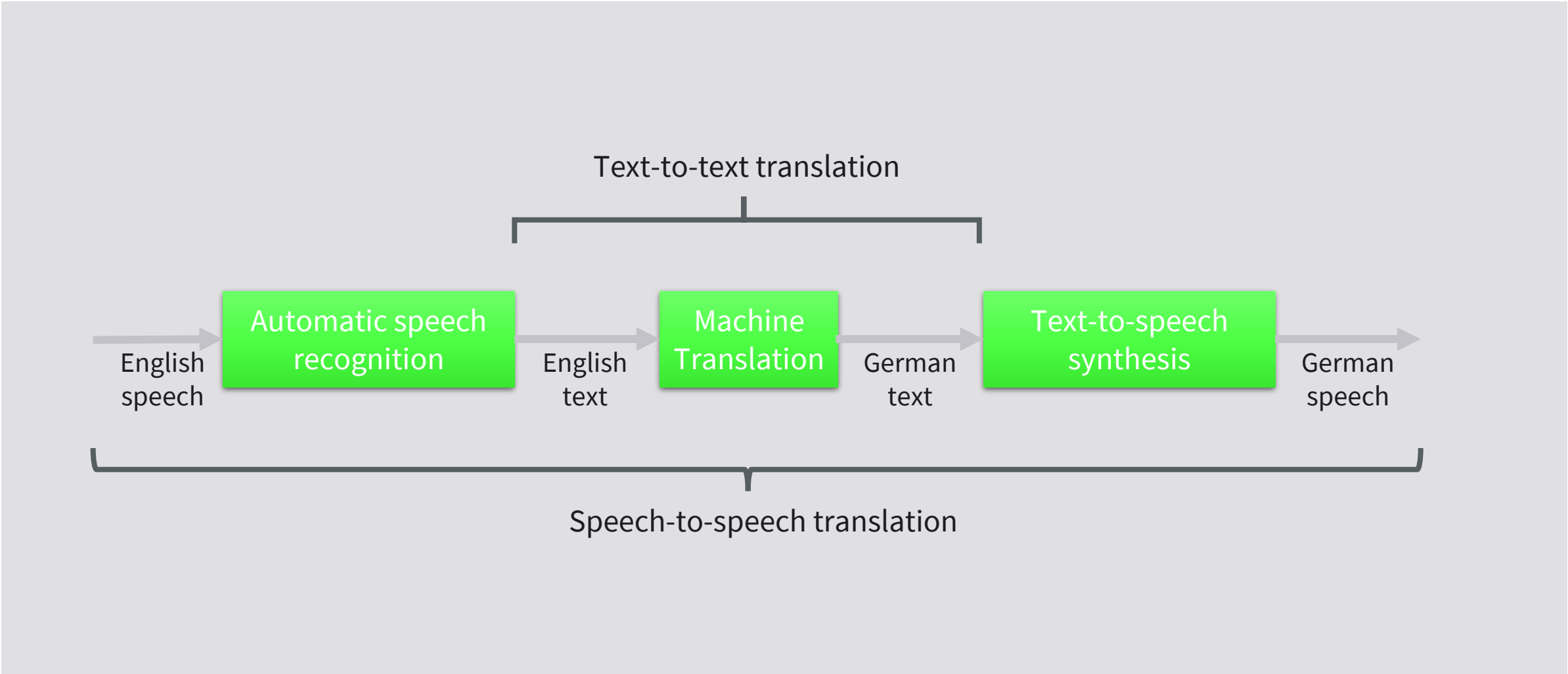
DATE PERSON  
Tomorrow Bill Gates will meet

CARDINAL NORP GPE  
two German friends in Berlin.

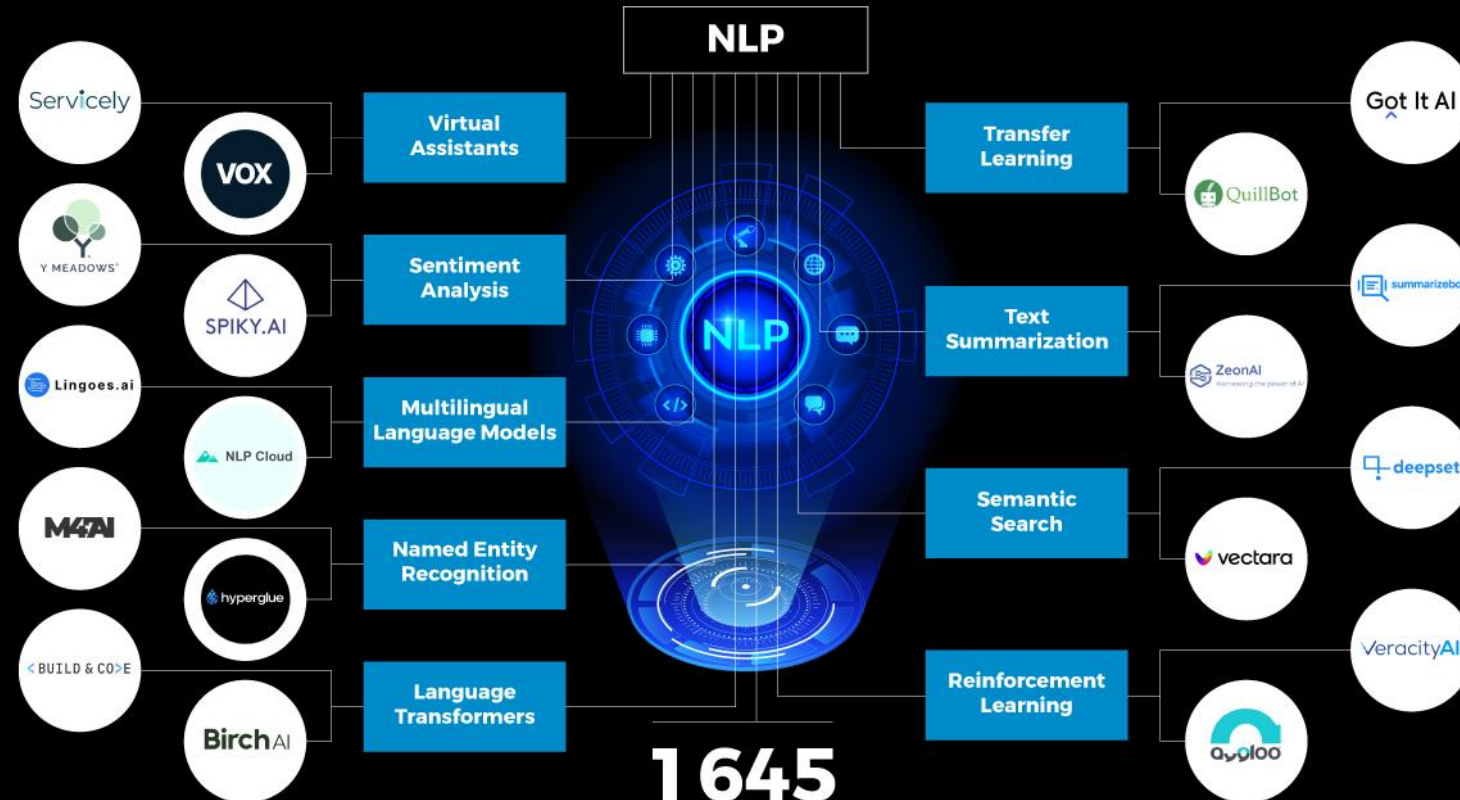
CHATBOTS



MACHINE TRANSLATION



# Top 9 Natural Language Processing Trends in 2023



1 645

Startups & emerging companies analyzed

Data provided by StartUs insights November 2022



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SESSION 4

# TRANSFER TASK



## TRANSFER TASKS

1. Describe how NLP can be used for marketing purposes.



2. Assume you want to build a system that simultaneously translates language from a Spanish speaker for a French speaking audience.

- a) Which components are required for this system?
- b) Which data do you need to train the system?

TRANSFER TASK  
PRESENTATION OF THE RESULTS

Please present your  
results.

The results will be  
discussed in plenary.





1. Which type of approaches were used in early NLP?
  - a. Statistical-based approaches
  - b. Neural networks
  - c. Rule-based approaches
  - d. Logical inference



2. What aspects of a text does sentiment analysis deal with?

- a. Subjective aspects
- b. Objective aspects
- c. Spoken aspects
- d. Linguistic aspects



3. Which of the following statements is true?
- a. Speech-to-speech translation is a part of text-to-text translation.
  - b. Speech-to-Speech translation is a part of machine translation.
  - c. Text-to-text translation requires a component for automatic speech recognition.
  - d. Text-to-text translation is a part of speech-to-speech translation.

## LIST OF SOURCES

Jay, L. (2016, June 17). Perfect early Father's Day gift for my husband [Review of the product *JOOLA midsize compact table tennis table great for small spaces and apartments – multi-use free standing table - compact storage fits in most closets - net set included - no assembly required*]. Amazon.com. [https://www.amazon.com/review/R25UZZH51JWYF5/ref=cm\\_cr\\_srp\\_d\\_rdp\\_perm?ie=UTF8&ASIN=B0012QJZTI](https://www.amazon.com/review/R25UZZH51JWYF5/ref=cm_cr_srp_d_rdp_perm?ie=UTF8&ASIN=B0012QJZTI)

Rowling, J. K. (1998). *Harry Potter and the sorcerer's stone*. Scholastic.

Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson.

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