

AI Application Natural Language Processing

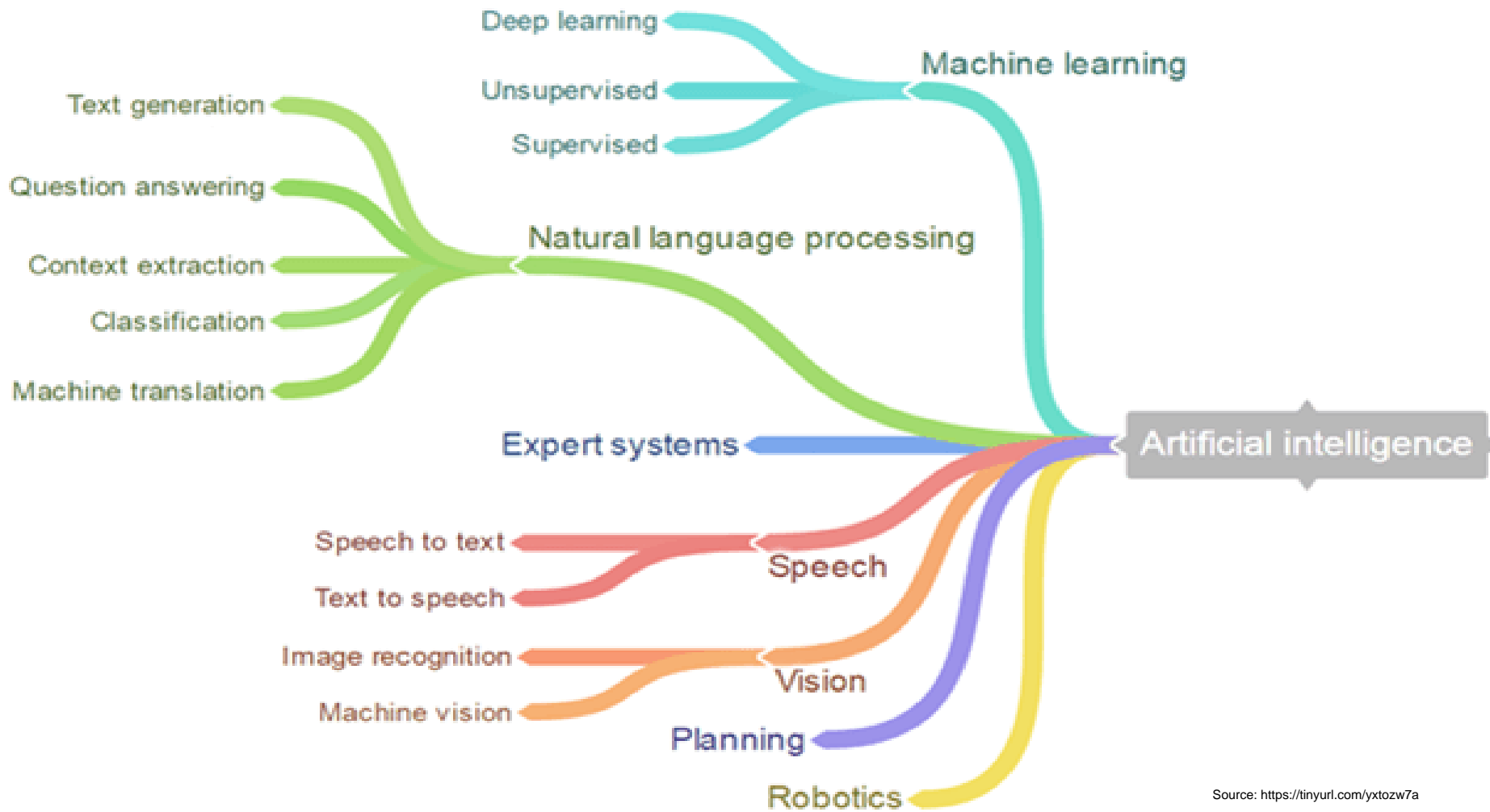


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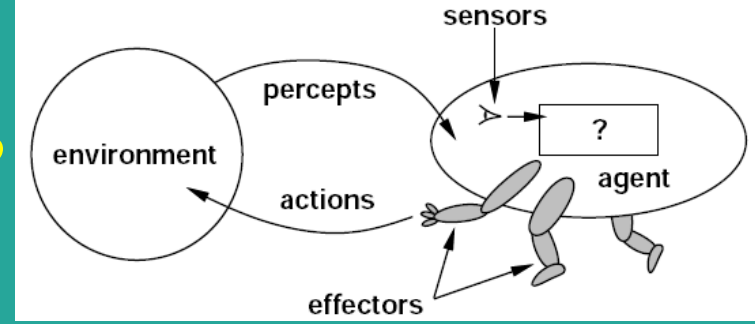
*What is Natural Language Processing?
What is Artificial Intelligence?*

What is Natural Language Processing?

Natural language processing (NLP) is a subfield 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.

Source: https://en.wikipedia.org/wiki/Natural_language_processing

What is Artificial Intelligence?

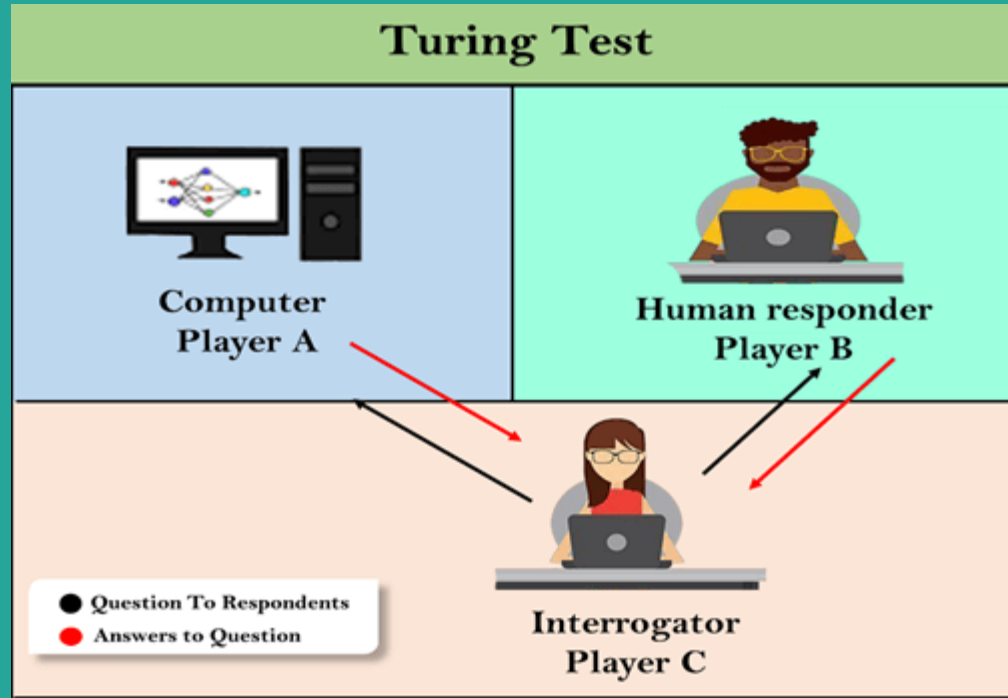


Artificial intelligence (AI), is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals. Leading AI textbooks define the field as the study of "intelligent agents": any device that perceives (inputs) its environment and takes actions that maximize its chance of successfully achieving its **goals**.

Source: https://en.wikipedia.org/wiki/Artificial_intelligence

Turing Test

A Turing Test is a method of inquiry in artificial intelligence (AI) for determining whether or not a computer is capable of thinking like a human being. The Turing test, originally called the imitation game by Alan Turing, is a test of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human. Turing proposed that a human evaluator would judge natural language conversations between a human and a machine designed to generate human-like responses.

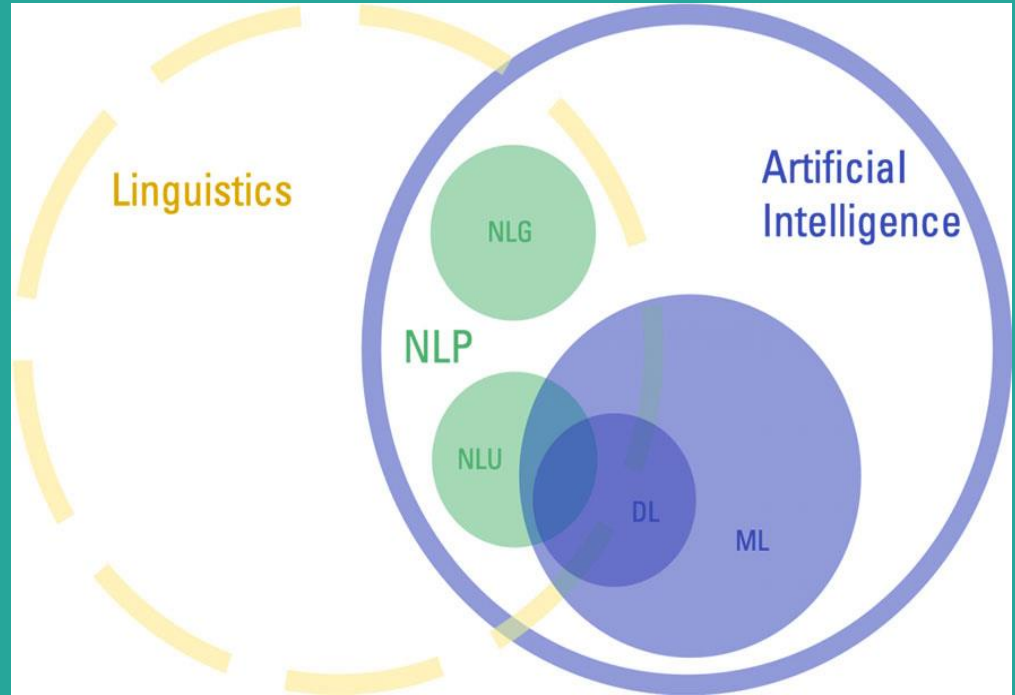


Source: https://en.wikipedia.org/wiki/Turing_test

PC: <https://www.javatpoint.com/turing-test-in-ai>

Where we are?

- Linguistics
- Computational Linguistics
- Natural Language Processing
- Artificial Intelligence
- Machine Learning
- Deep Learning

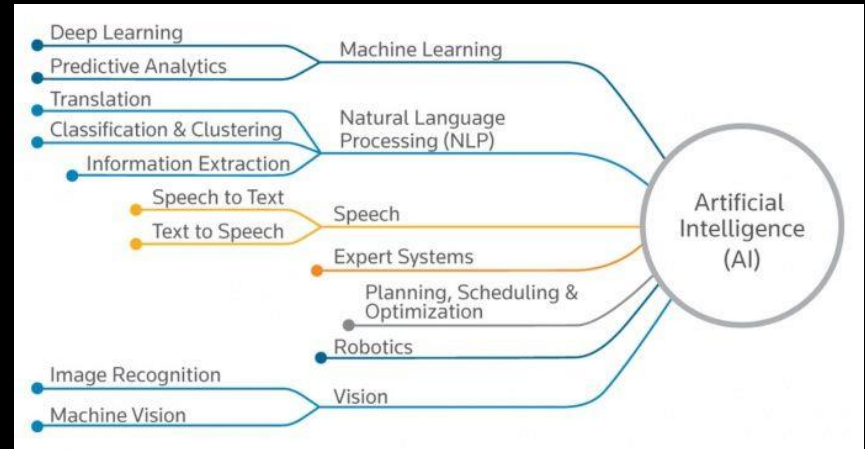


About NLP!

Why Language Technology is required?

Tell me about:

- Linguistics
- Computational Linguistics
- Natural Language Processing
- Artificial Intelligence



Linguistics

Linguistics is the scientific study of language.

It involves analysis of language form, language meaning, and language in context, as well as an analysis of the social, cultural, historical, and political factors that influence language.

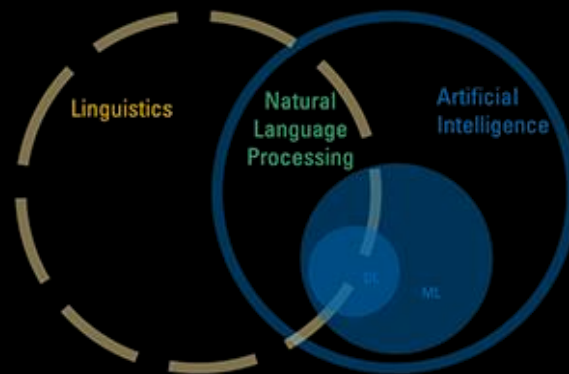
<https://en.wikipedia.org/wiki/Linguistics>

Computational Linguistics

Computational linguistics is an interdisciplinary field concerned with the computational modelling of natural language, as well as the study of appropriate computational approaches to linguistic questions.

Relation

AI, NLP, Linguistics



NLP Research!

Machine Translation

- Indian Languages: Hindi, Assamese, Mizo, Mising, Apatani, Nishi, Khasi, Odia etc.
- Foreign Language: Amharic (Ethiopia)

Text Summarization

- Multimodal Based
- Summary Evaluation - Semantic Based

ChatBot for Healthcare

- Multimodal Based

Information Retrieval

- Math formula retrieval

Caption Generation from Images

- Math formula retrieval

Semantic Textual Similarity

Cooking Recipe/ Ingredients Identification & QA

Cyber Security & NLP

Question Answering

Contents

NLP Trends and Machine Translation

PAST

PRESENT

FUTURE

→ Various Applications - current trends

- ◆ Question Answering: Recipes
- ◆ Caption Generation from Images
- ◆ Information Retrieval: Math IR
- ◆ ChatBot: Healthcare Domain (medicbot.in)
- ◆ Machine Translation - Low Resource Languages.
- ◆ Generative AI - Language Model, ChatGPT
- ◆ Quantum ML for NLP application

NLP Applications

- Text Similarity
- Named entity recognition (NER)
- Question answering
- Text Categorization
- Text Mining
- Machine Translation
- Language Teaching/Learning
- Spelling correction
- Automatic summarization (text summarization)
- Dialogue based system: like ChatBot

Can u think of anything else ??

Forms of Natural Language

Input/output of a NLP system can be:

- Text
- Images
- Speech

To process Natural Language text:

- Phonology, Lexical, Syntactic, Semantic Knowledge about the language
 - Discourse information, real world knowledge
-

Natural Language

Language = Words + rules + exceptions

Ambiguity at all levels.

We speak different languages..

And language is a cultural entity..

So they are not equivalent..

Highly systematic but also complex..

Keeps changing..

New words, New rules and New exceptions..

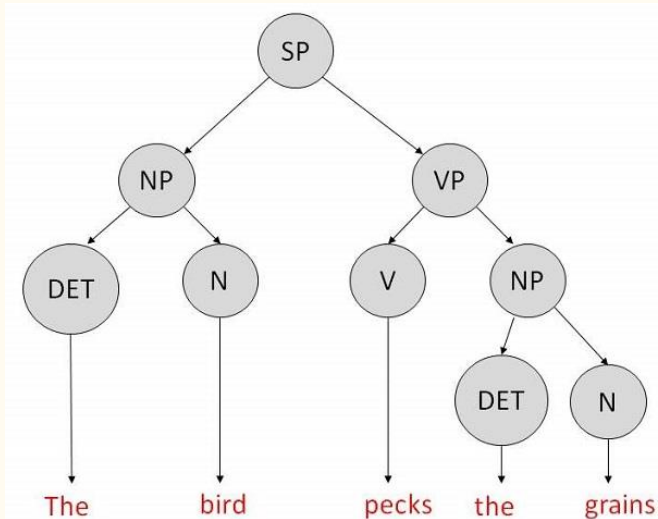
Phonology

- Speech processing
 - Humans process speech remarkably well.
 - Speech interface can replace keyboards and monitors.
 - Convert Acoustic signals to Text.
 - Phonemes are the smallest recognizable speech unit in a language.
 - Speech ambiguity – Homonyms
 - I ate eight cakes
 - That band is banned
 - I went to the mall near by to buy some food
 - The Finnish were the first ones to finish
 - I know no James Bond.
-

Morphology

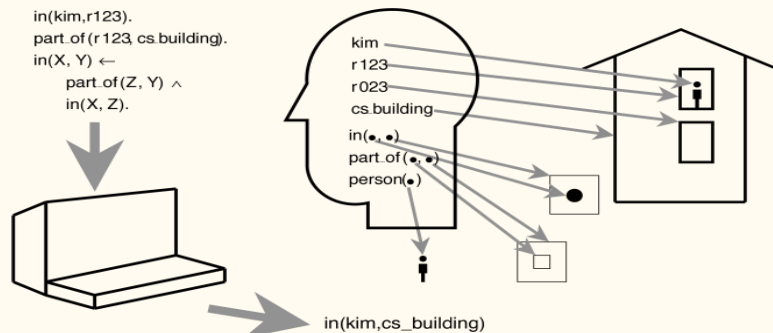
- Morphology is all about the words.
 - Structures and patterns in words
 - Analyzes how words are formed from minimal units of meaning, or morphemes, e.g., cats= cat+s.
 - Words are a sequence of Morphemes.
 - Morpheme – smallest meaningful unit in a word. Free & Bound.
 - Inflectional Morphology – Same Part of Speech
 - Buses = Bus + es
 - Carried = Carry + ed
 - Derivational Morphology – Change PoS.
 - Destruct + ion = Destruction (Noun)
 - Beauty + ful = Beautiful (Adjective)
 - Affixes – Prefixes, Suffixes & Infixes
 - Rules govern the fusion.
-

Syntax



- Words convey meaning. But when they are put together they convey more.
 - Syntax is the grammatical structure of the sentence. Just like the syntax in programming languages.
 - *structures and patterns in phrases*
 - *how phrases are formed by smaller phrases and words*
 - Identifying the structure is the first step towards understanding the meaning of the sentence.
 - Syntactic Analysis (Parsing) = Process of assigning a parse tree to a sentence.
 - Constituents
 - Grammatical relations
 - subcategorization and dependencies
-

Semantics



The role of semantics: The meaning of the symbols are in the user's head. The computer takes in symbols and outputs symbols. The output can be interpreted by the user according to the meaning the user places on the symbols.

- Words – Lexical Semantics
- Sentences – Compositional Semantics
- Converting the syntactic structures to semantic format – meaning representation.
- Semantics: the meaning of a word or phrase within a sentence

Pragmatics & Discourse

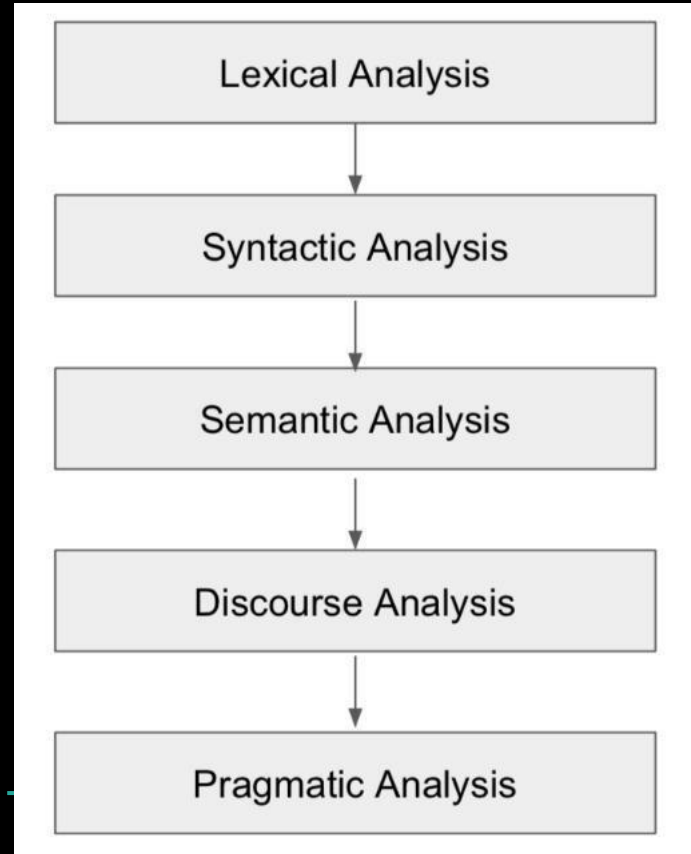


- **Pragmatics:** structures and patterns in discourses
 - Sentence standing alone may not mean so much. It may be ambiguous.
 - What information is contained in the contextual sentences that is not conveyed in the actual sentence?
 - Discourse / Context makes utterances more complicated.

 - **Speech acts:**
 - Do you know the time?
 - **Anaphora** – Resolving the pronoun’s reference. Co-reference resolution
 - “I read the book by Dr. Kalam. It was great”
 - “*We gave the monkeys the bananas because they were hungry*”

 - **Ellipsis** – Incomplete sentences
 - “What’s your name?”
 - “Srini, and yours?”
 - The second sentence is not complete, but what it means can be inferred from the first one.
-

Levels



Ambiguity

- The ability of being understood in more than one way. In simple terms, we can say that ambiguity is the capability of being understood in **more than one way**.
-

Lexical Ambiguity

The ambiguity of a single word is called lexical ambiguity.

For example, treating the word silver as a noun, an adjective, or a verb.

What about this...

Bank ?

Bank

Financial: Bank

River: Bank

Blood: Bank

As well as Noun and Verb



Syntactic Ambiguity

Syntactic Ambiguity This kind of ambiguity occurs when a sentence is parsed in different ways.

For example, the sentence:

“The man saw the girl with the telescope”.

What about this?

“I saw old man and woman in the park”.

Syntactic Ambiguity

Syntactic Ambiguity This kind of ambiguity occurs when a sentence is parsed in different ways.

For example, the sentence “*The man saw the girl with the telescope*”. It is ambiguous whether the man saw the girl carrying a telescope or he saw her through his telescope.

What about this?

I saw old man and woman in the park.

I saw old man and woman in the park.

(old man) and woman

old (man and woman)



Semantic Ambiguity

This kind of ambiguity occurs when the meaning of the words themselves can be misinterpreted. In other words, semantic ambiguity happens when a sentence contains an ambiguous word or phrase.

For example, the sentence “**The car hit the pole while it was moving**” is having semantic ambiguity because the interpretations can be “The car, while moving, hit the pole” and “The car hit the pole while the pole was moving”.

Discourse Ambiguity

This kind of ambiguity arises due to the use of anaphora entities in discourse.

For example, “**The horse ran up the hill. It was very steep. It soon got tired.**” Here, the anaphoric reference of “it” in two situations cause ambiguity.

Your Task!

Tell me
How many ambiguities are here?

*The camera man shot the man with
the gun when he was near
Tendulkar.*

Example!

The cameraman shot the man
with the gun when he was near
Tendulkar.

Ambiguity because of

- “**Shot**” → 2 meanings (Camera , Gun)
- “**With the gun**” → 2 attachment points
(shot,man)
- “**when he was near Tendulkar**” → 2 possibilities
he’s reference (the man or the cameraman)

Total = $(2*2*2)$ 8 Possibilities



GRACIAS

ARIGATO

SHUKURIA

JUSPAXAR

DANKSCHEEN

TASHAKKUR ATU

YAQHANYELAY

SUKSAMA EKHMET

GRAZIE

MEHRBANI

BOLZIN

MERCY

THANK

YOU

BIYAN

SHUKRIA

TINGKI