Natural Language Processing (CS-472) Spring-2023

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NUST
Defining futures
School of Electrical Engineering
& Computer Science

What do you expect from this course?

Overview of this week’s lecture

Introduction to NLP

- Rationale of NLP

- NLP Pipeline

- Course Plan

Objectives of this course are three fold

- To establish the foundation of effective modern methods of deep learning applied to NLP.

- To provide a broader understanding of natural languages and challenges in understanding and producing them.

- To afford sound command of and ability to build systems for some of the major NLP problems.

    - Word meaning

    - Machine translation

    - Question answering

    - and more …

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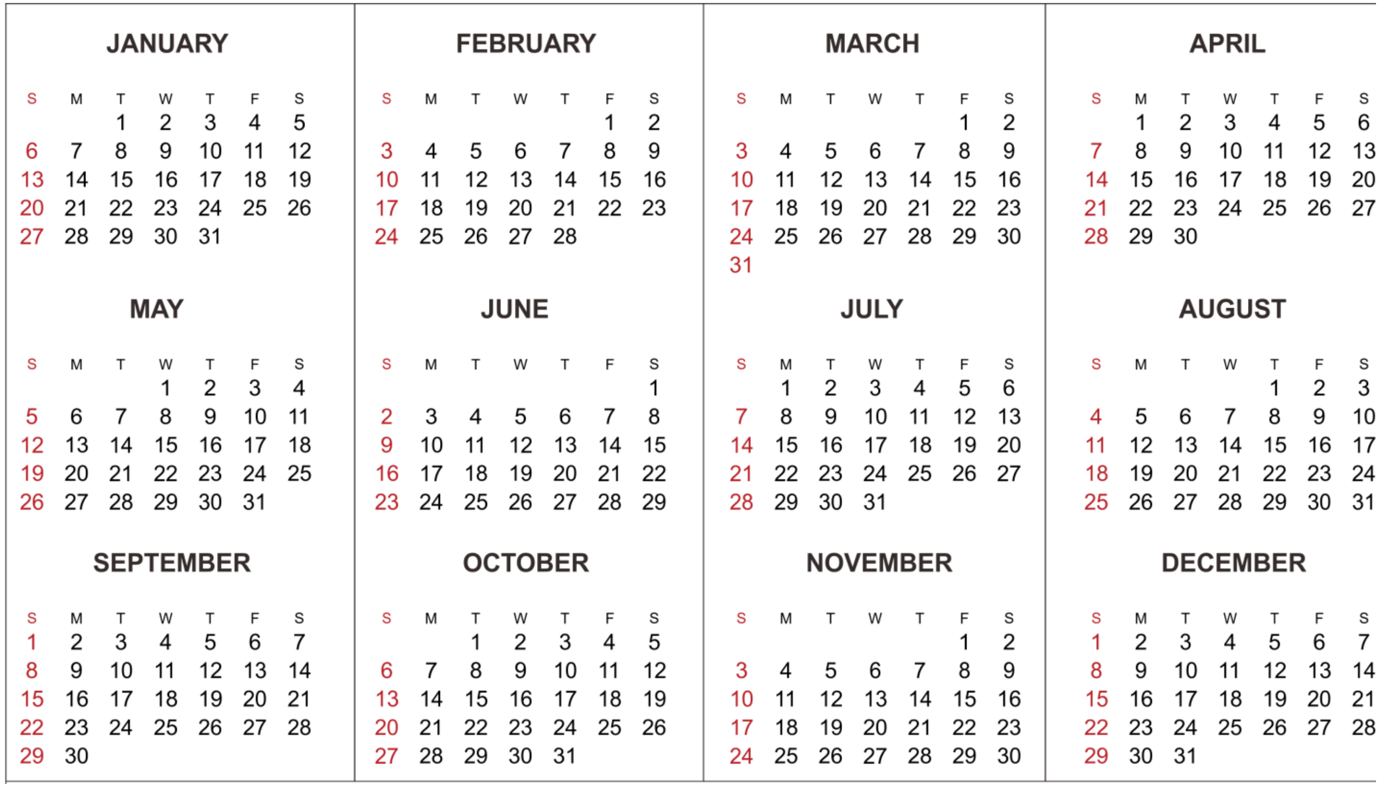

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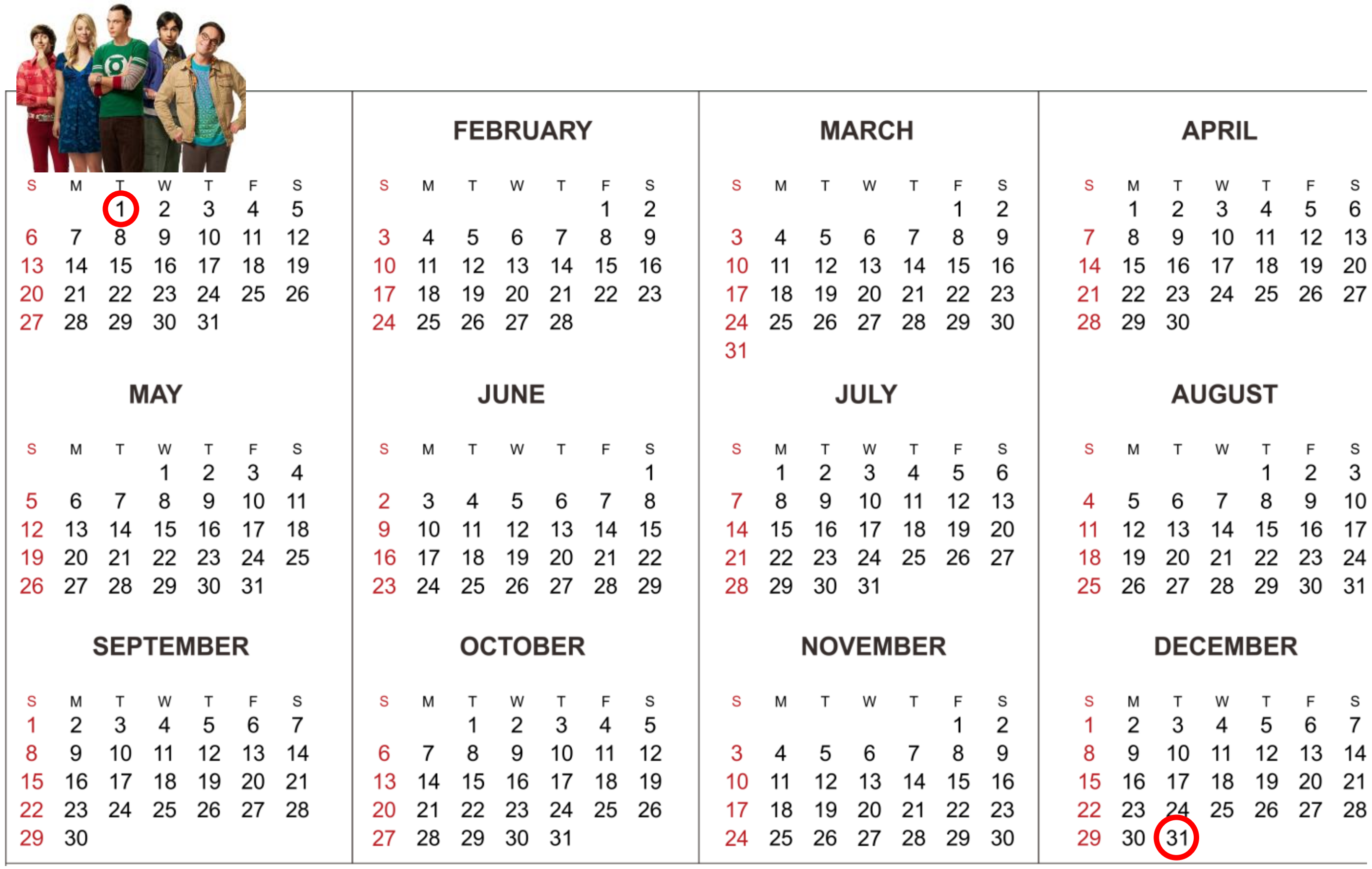

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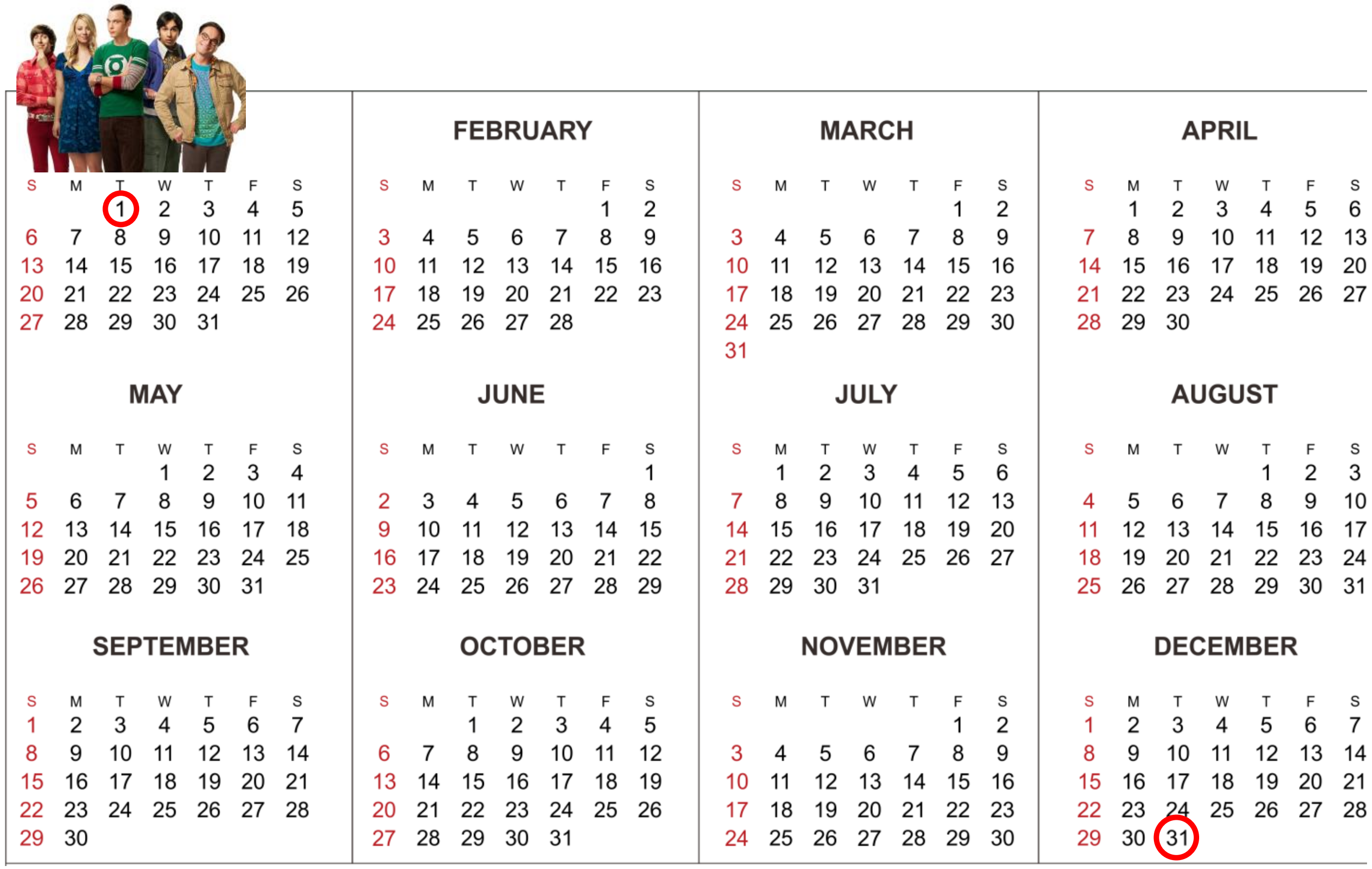

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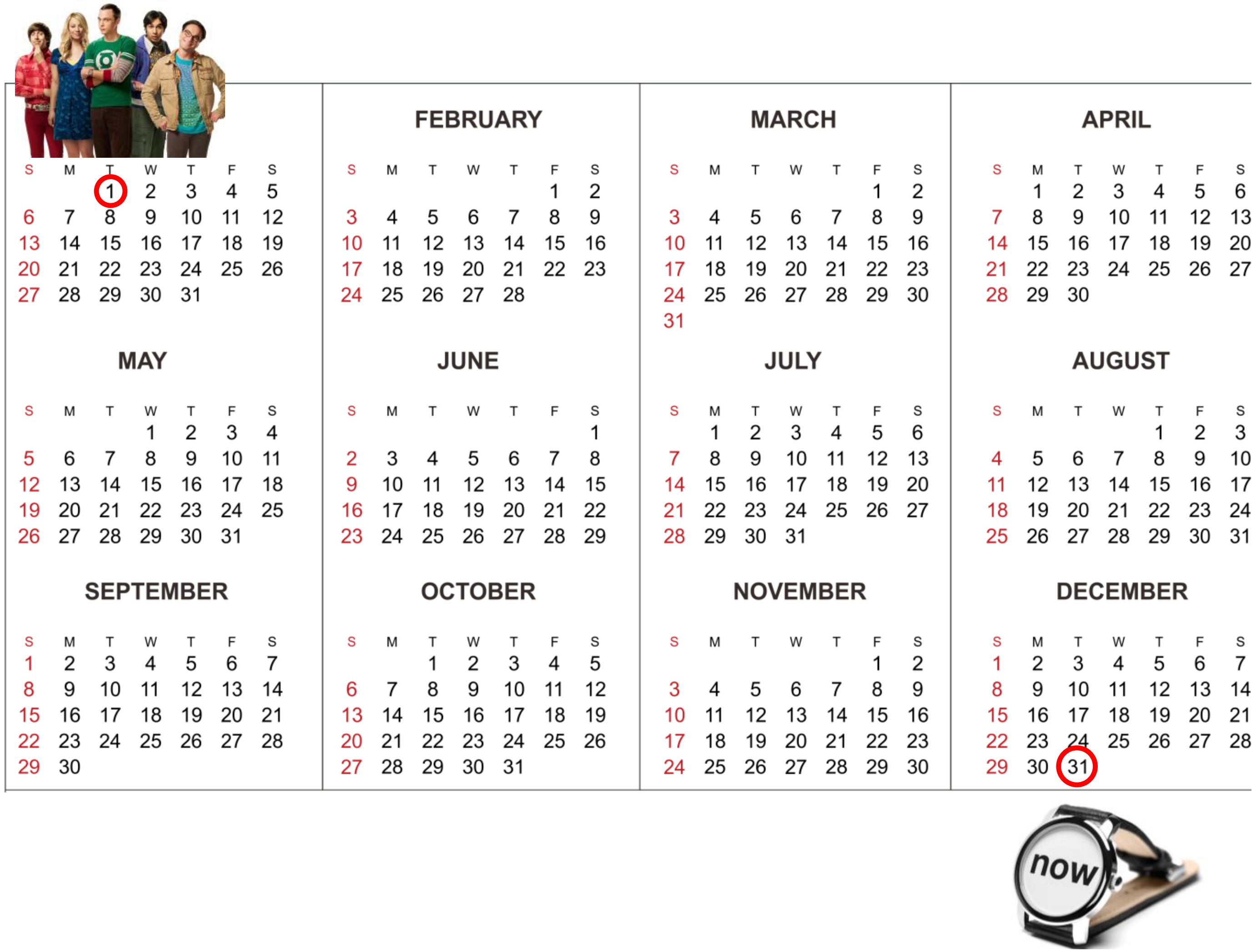
- Writing emerged around 5000 years ago. (11 – 12 seconds ago.)



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- NLP is a multidisciplinary field
  - It borrows concepts from AI, Computational Linguistics, and Cognitive Science among others.

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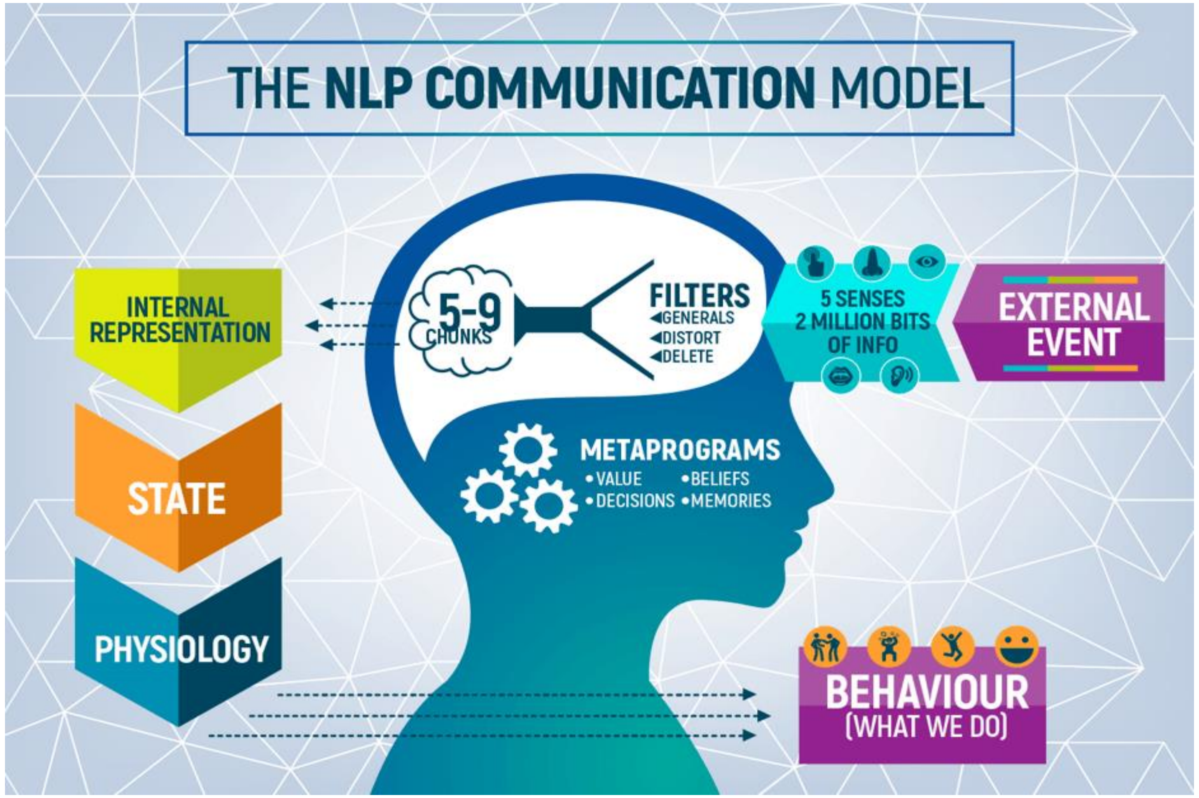
HOW HAVE YOU FARED, SINCE LAST WE SAW EACH OTHER?
SINCE LAST YOU SAW ME, OR LAST I SAW YOU?
I SAW YOUR ATTEMPT TO SEE ME. TWAS' SUCH A SIGHT TO SEE.
AH, BUT I DO BELIEVE I HAVE SEEN YOU EVEN MORE RECENTLY THAN WHEN YOU SAW ME, SEEING YOU.
YOU... I... UH...
ANYBODY HERE?
NOPE.
CAN WE JUST SPEAK NORMALLY THEN?
OH MY GOD YES! THIS CONVERSATION HAS BEEN SIMPLY EXHAUSTING.
WANNA GRAB A CUP OF COFFEE AND TALK ABOUT THE REALM?

"VERBOSITY" - A COMIC BY 1D4ROUNDS

Why is NLP?

- Language helps preserve and propagate knowledge.
    - Across time, across space
- Bandwidth of humans to generate, process and propagate knowledge is limited.
- If computers can understand natural language it can greatly help advance human civilisation.



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- Natural languages make use of compression.
  - Requires knowledge of listener and context to fill the gaps.

Pipeline of NLP consists of three main components

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There could be additional steps depending upon application

Pre-processing operations depend on the use case

- **Cleaning:** Remove irrelevant items like HTML tags, symbols and non-alphabetic characters.

- **Normalisation:** Convert all words to lowercase and removing punctuation and extra spaces.

- **Tokenisation:** Split the text into words, also known as tokens.

- **Stop Words Removal:** Remove the most common words (a, an, the, etc.).

- **Parts of Speech Tagging:** Identify the parts of speech for the remaining words.

- **Named Entity Recognition:** Recognize the named entities in the data

- **Stemming and Lemmatisation:** Convert words into their canonical / dictionary forms, using stemming and/or lemmatization.

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- Text is represented by ASCII or Unicode which maps each character to a number.
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  - Individual characters don’t carry much information/meaning.
  - Representing words as a sequence of ASCII/Unicode numbers does not capture the meaning of a word and its relationship with other words.
- Suitable representation of text data depends on the task.
  - For document-level tasks like sentiment analysis, BOW or doc2vec may be used.
  - For word-level tasks like language generation or machine translation word2vec or GloVe may be used.

Finally an NLP model is trained on the data and evaluated

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- Once again, picking the right model depends upon the task.

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- Advanced Topics:
    - Biases in AI
    - Model Analysis and Explanations

The course logistics will be as follows

- A Term Project (up to 10 marks): Make a group of 2-3.

  - Four deliverables:
    - Proposal (Introduction)
    - Mid-Semester Report (Progress Report)
    - Final Report (IEEE conference format)
    - Presentation (5 minutes each group)

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- Assignments (up to 10 marks):
    - Individual/Group assignments
    - Discussion/exchanging notes is allowed. Copying is prohibited.

Do you have any problem?

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