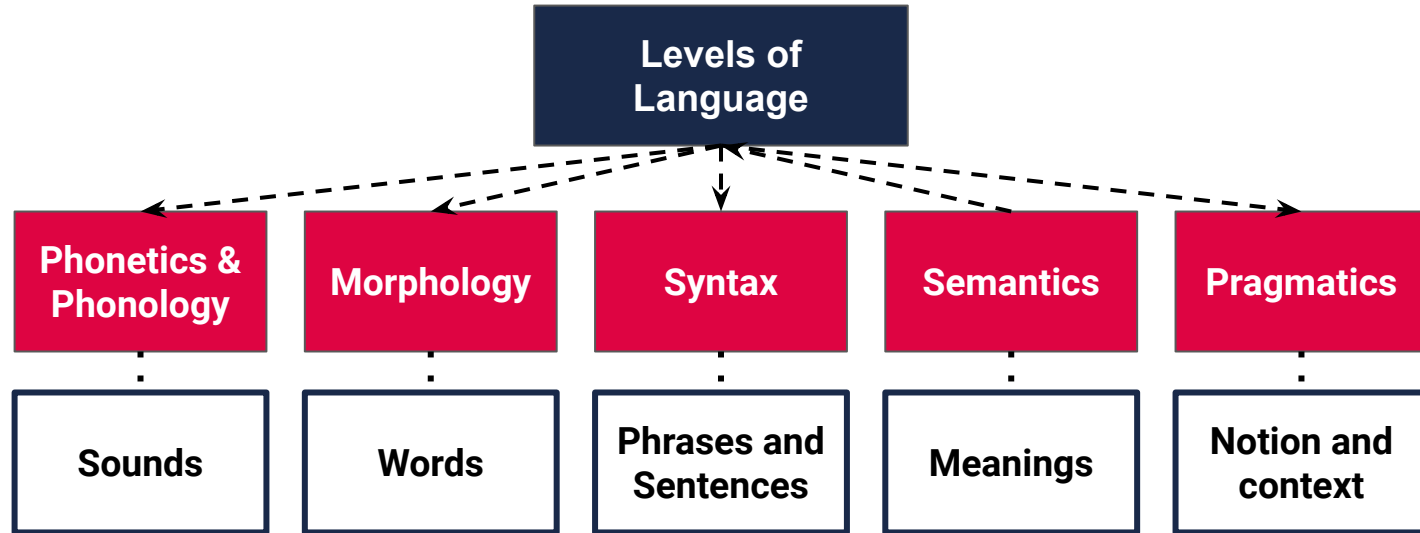


Natural Language Processing

Improving Human Communication with NLP

How does Natural Languages Look Like?



Source:
https://www.uni-due.de/SHE/REV_Levels_Chart.htm

What is Natural Language Processing?

- Natural language processing (NLP) is a field of study concerned with enabling computers and machines to understand human language
- Turing test specified that a computer or machine must have human-like conversational abilities in order to be considered intelligent
- Knowledge and understanding of linguistic system is important in comprehension application of natural language processing technologies
- However, natural languages are essentially vast in vocabulary, unrestrictive in nature and ambiguous at times
- This in turn accelerated the adoption of AI in this field as classical fixed rules are rendered obsolete due to the dynamic nature of natural languages

Source:

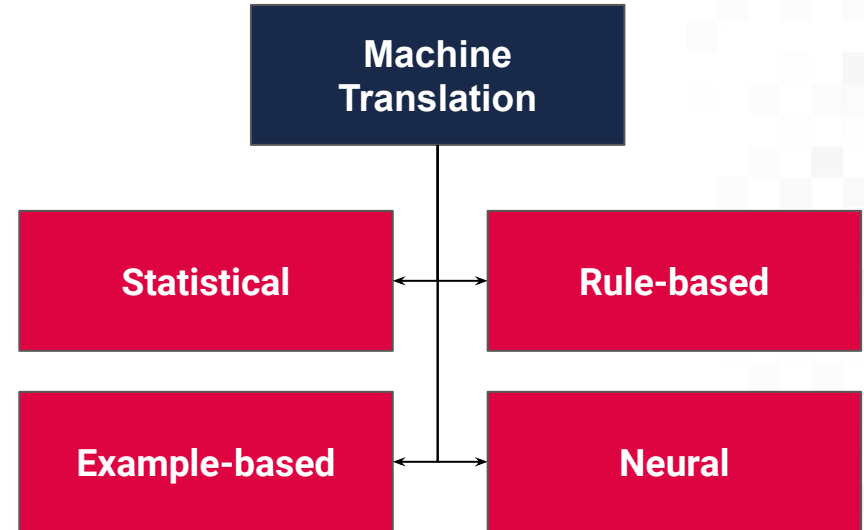
Nadkarni et al. (2011). Natural Language Processing: an introduction. Journal of American Medical Informatics Association. Vol 18, p. 544 551.

Kurdi., M.Z. (2016). Natural Language Processing and Computational Linguistics 1. Cognitive Science Series. USA: John Wiley & Sons, Inc,

<https://aloz.ai/natural-language-processing-a-short-introduction-to-get-you-started/>

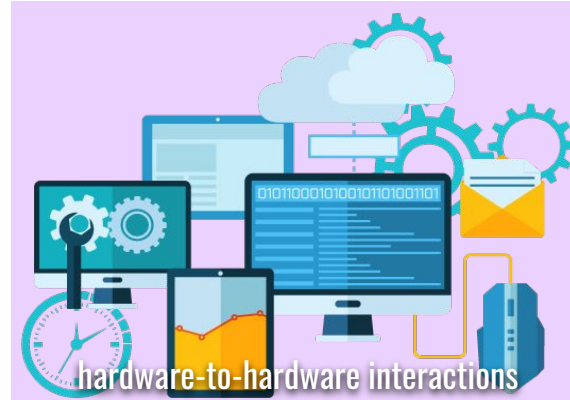
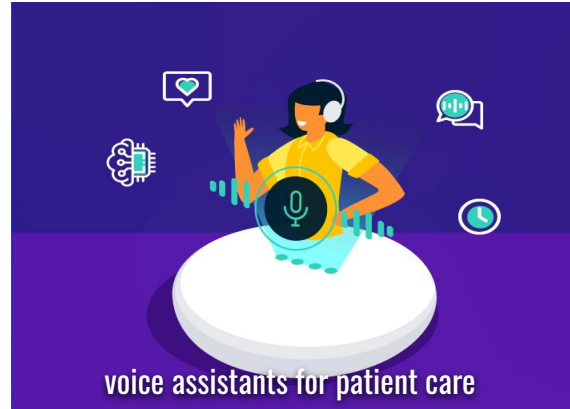
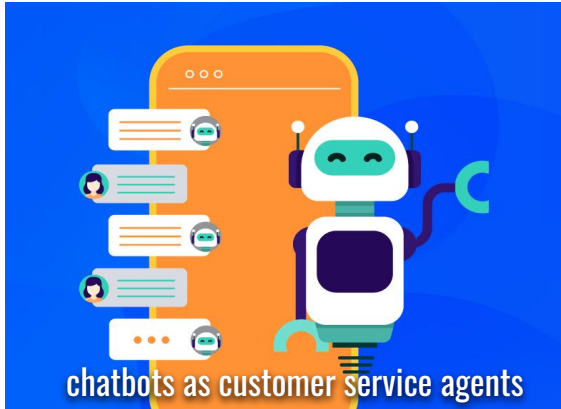
Subdomains in NLP

- Four main types of machine translation models: statistical (SMT), rule-based (RBMT), example-based (EBMT) and neural (NMT)
- Before NMT was invented, SMT was predominantly used, supplanting more classical methods such as rule-based and example-based methods
- Currently, NMT which utilises the neural networks, is the most dominant method in machine translation due to its versatility



Source:
Nadkarni et al. (2011). Natural Language Processing: an introduction. Journal of American Medical Informatics Association. Vol 18, p. 544 551.

How does natural language processing helps communication?



Source:
<https://freshdesk.com/customer-engagement/virtual-assistant-chatbot-blog/>

Natural Language Processing

Chatbots and Virtual Assistants

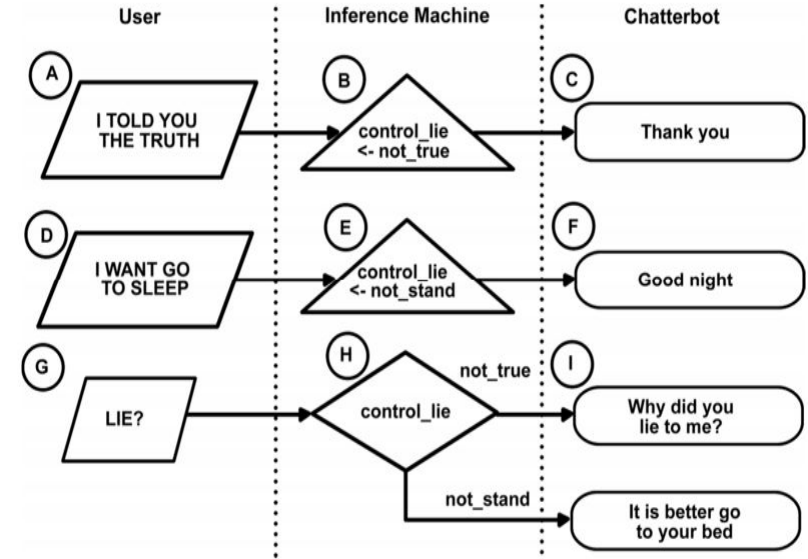
NLP Application 1: Customer Service Chatbot

- Chatbot collect information from customer and pass information to Robotic Process Automation (RPA).
- RPA perform fills information to the system, retrieve status from system and etc.
- Information is then passed back to chatbot to continue conversation



Chatting Robots

- It is shown that humans are less confident when communication with another human, as opposed to a chatbot
- By using chatbots monitored by a human, messages can be delivered more effectively
- Current chatbots use decision tree, which is a Machine Learning technique
- In recent development, researchers in India use NLP to process user inputs and assign tags based on the sentiment and meaning
- The algorithm will turn to an Artificial Intelligence Markup Language (AIML) database and look for appropriate responses based on tags



Haristiani, N. (2019). Artificial Intelligence (AI) *Chatbot* as Language Learning Medium: An inquiry. *J. Phys.: Conf. Ser.* 1387 012020

Wailthare, S., Gaikwad, T., Khadse, K., Dubey, P. (2018). Artificial Intelligence Based Chat-bot. *International Research Journal of Engineering and Technology*. Vol. 5, Issue 3.

Marietto, Maria & Aguiar, Rafael & Barbosa, Gislene & Botelho, Wagner & Pimentel, Edson & Franca, Robson & Silva, Vera. (2013). Artificial Intelligence MArkup Language: A Brief Tutorial. *International Journal of Computer Science and Engineering Survey*. 04. 10.5121/ijcses.2013.4301.

NLP Application 2: Patient Communication

- Traditionally, patients inform nurses of their needs using a press of a button
- However, the signal contains no additional information or context
- Oftentimes patient's requests are non-emergency and menial tasks: adjusting pillows; other times, patient might need immediate crucial help

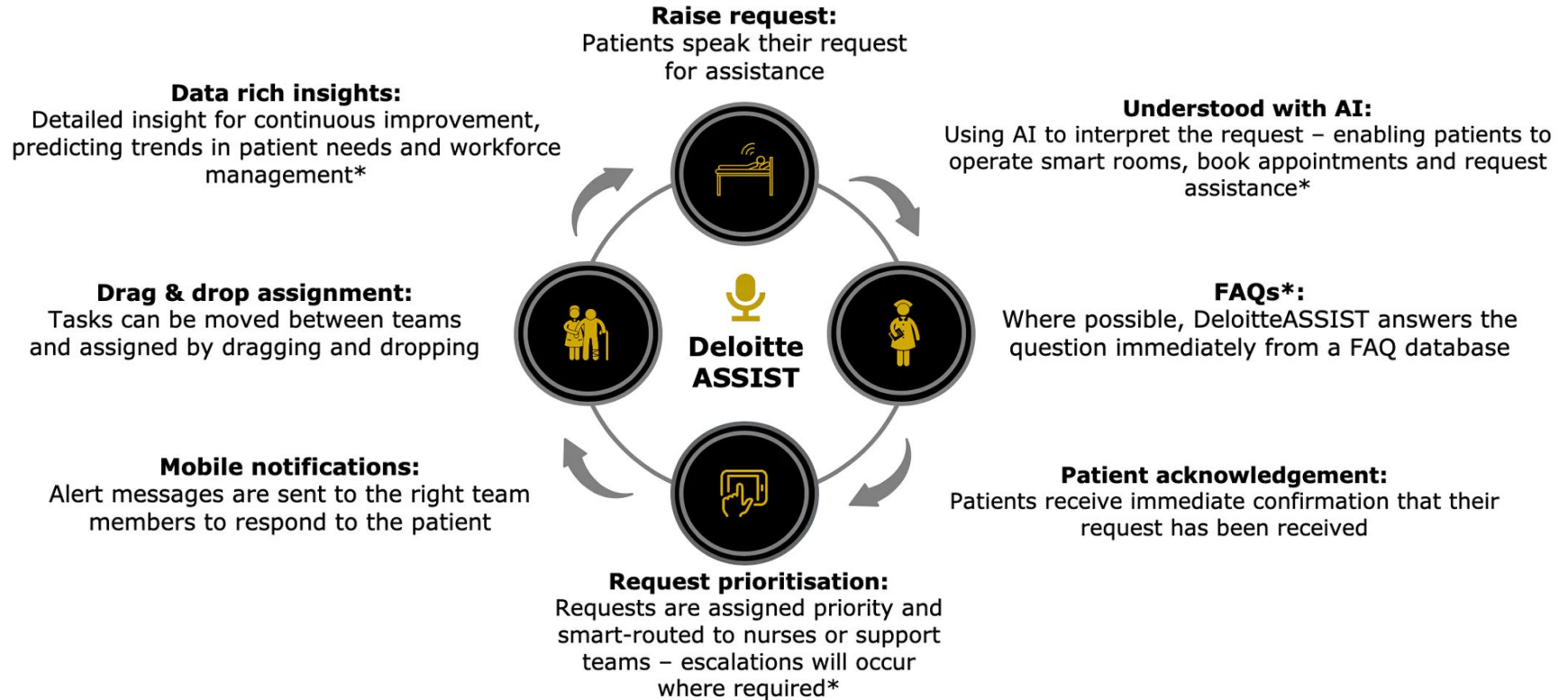
Recent Advances

- Patient can raise requests through Alexa
- With NLP, informational context can be added into signal
- Coupled with path scheduling techniques, these devices can dispatch nurses according to priorities



Source: <https://sloanreview.mit.edu/article/ais-communication-upside/>
Figure from:
<https://which-50.com/deloitte-brings-amazons-alexa-into-wards-to-improve-patient-care/>

AI-enabled Patient Communication



Natural Language Processing

Machine Translation, Text Mining and Sentiment Analysis

NLP Application 3: Translation

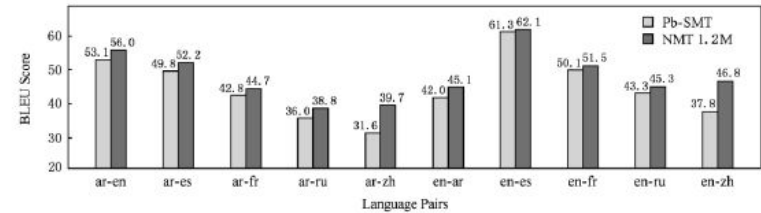
- In 2016, Google made a breakthrough in machine translation and introduced neural machine translation (NMT), nearly a decade later than its predecessor: phrase-based statistical machine translation (SMT)
- Previously, researchers use SMT to find the most probable translation
- NMT capitalises on the capability of deep learning to implement accurate translations
- Currently, Google deploys NMT in Google Translate, replacing SMT



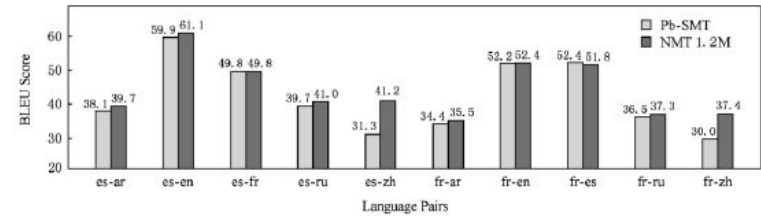
Source:
Zong, Zhaorong & Hong, Changchun. (2018). On Application of Natural Language Processing in Machine Translation. 506-510.
10.1109/ICMCCE.2018.00112.

A Multi-lingual Robot

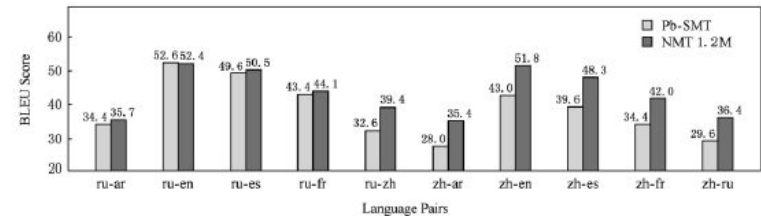
- From the figure, we can see that NMT performs better than SMT in more languages
- NMT is able to produce accurate translations by using an encoder-decoder framework which resembles a deep neural network



(a) The first group



(b) The second group



(c) The third group

Source:
Zong, Zhaorong & Hong, Changchun. (2018). On Application of Natural Language Processing in Machine Translation. 506-510.
10.1109/ICMCCE.2018.00112.

NLP Application 4: Text Mining

- Refers to extraction of relevant information from textual sources.
- Processing of unstructured information in text and transforming it into a suitable format for analysis

Motivation of study

- Unstructured data is the more commonly available type of data
- Enables effective and efficient analysis of big textual data

Contemporary Challenges of Text Mining

- Interpretation of unstructured content is complex for machines caused by
 - Presence of ambiguity in natural languages
 - Meaning to heavily rely on context and background knowledge
- Commonly uses supervised Machine Learning approach which is often computationally expensive as large number of annotated documents required
- High dimension of attribute space



Problems Text Mining is Used to Solve

- Two main tasks of Text Mining are
 - Information patterns search
 - Matching structure identification
- Examples of tasks:

Text summarization	Produce condensed representation of the input
Document retrieval	Identify and return most relevant documents given a collection of documents according to user's query
Text categorization	Assign a predefined category according to the content
Document clustering	Groups of documents are sought by creating links between similar documents

NLP Application 5: Sentiment Analysis

- Also known as opinion mining
- The study analyzing people's opinions towards a certain item such as products, services, issues, or topics.
- Opinions can be an important piece of information to arrive to a decision
- Due to its potential influence, more attention is being put towards opinion mining

Motivation of study

- Diverse commercial applications
- Growth of social media content



Negative



Neutral



Positive

Sentiment Analysis

- Determine if the expression towards a particular topic, product, etc. is positive, negative, or neutral
- Example: Reviews, Tweets, Facebook posts, Comments

Charu Agrawal @CharuAg68478676 · Feb 14
Replying to @AirAsia
Stop giving guidelines during holiday to help prevent Coronavirus. Start refunding people hard earned money as we are scared to travel.
[@narendramodi](#) [@HardeepSPuri](#) sir pls help us!![@goibibo](#) [@aayush89](#)

6 4 15

goibibo @goibibo · Feb 15
We regret it's taking longer than the expected time frame, however, we are working on the concern to get it resolved in the best possible manner and we'll update you accordingly. We would humbly request your patience in the interim. Thanks, JS

1

1 more reply

Wening @weningeling · Feb 27
Replying to @AirAsia
If no one from @AirAsia or @AirAsiaSupport or @AirAsiaGoID get in contact with me regarding my payment status ASAP, then I would say that buying AirAsia ticket is pretty much nightmare-ish experience for me.

4 4

21 Comments

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Marysa Labrone
High quality product and customer service is extra quick!
Like · Reply · 12 · 12h

3.5 ★★★★★ 1,560 reviews

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All take away 10 toast 287 boiled eggs 81 nasi lemak 79 +6

Local Guide · 64 reviews · 116 photos
★★★★★ a month ago
Classic spot in the city for eggs on toast. Simple, fast, efficient and cheap. We had lemon iced tea also and it was good. Enjoy

Like

Firdaus Bachik
Local Guide · 50 reviews · 125 photos
★★★★★ 2 months ago
Came here on Monday about 9AM, it wasn't that crowded but still had to queue.
Sadly, there is nothing special about this place, totally overrated. The food is ... More

Like 1

Thank You

