

## Compulsory Task 2

- Read up on any innovative technology using NLP (by companies such as Google or IBM, for instance) and write a brief summary about the technology, what it achieves/does, and an overview of how it works (250 - 500 words).

### **Google Translate/Machine translation**

Language barriers have been a problem for as long as humanity has existed. Solving this problem using machine translation has been an ongoing process since computers have existed.

In 2006, Google launched their bid to break down language barriers with the machine translation service Google Translate. Originally launched as a statistical machine translation service, it has undergone continual development since 2006, most notably transitioning, in 2016, to a Neural Machine Translation system.

In 2023, Google Translate exists not only as a website interface and browser integration allowing translation of any website you are reading but as a feature of Google Docs, as an app, and in API form, which, among other things, permits communication with messaging apps and translates text when sending messages.

It enables you to choose input and output languages but will also automatically detect language and translate speech as well as text.

When combined with other types of machine learning, it is possible to recognise text in photos and translate it or provide translation of handwritten text and spoken word.

Google Translate, in its current iteration, utilises advanced technology to tackle the complexity of language translation. It goes beyond mere token translation and considers crucial elements like grammar, syntax, and semantics for effective translation.

To achieve this, Google Translate leverages the power of Recurrent Neural Networks (RNNs) within the Encoder-Decoder Architecture. The RNN, trained on vast amounts of data, converts text from the input language into vectors and then reconstructs them as text in the desired output language. The network is designed to be BiDirectional, taking into account the words that precede and follow a given word during translation. This attention to context is vital in aligning input and output translations.

The effectiveness of Google Translate's translation quality is further enhanced by employing multiple Encoder-Decoder architectures. Instead of a single system, Google Translate utilises eight such architectures, enabling a deeper understanding of the nuances of semantics and grammar. This multi-architecture approach allows Google Translate to produce translations that closely align with the original text.

The significance of grammar is evident in the accuracy of translations, particularly in languages with similar syntax and semantics. For example, languages like Danish and Swedish, which are closely linked, tend to yield more accurate translation outputs.

By combining the power of RNNs, attention mechanisms, and multiple Encoder-Decoders, Google Translate has scaled up its AI capabilities.

Machine translation, exemplified by Google Translate, has seen significant advancements through the integration of deep learning techniques. Its applications are many and varied

but, in essence, allow written and verbal communication where communication was not previously possible without a human translator present. While not a substitute for human translators, machine translation technology continues to bridge language barriers.