Group Final project: Preparation

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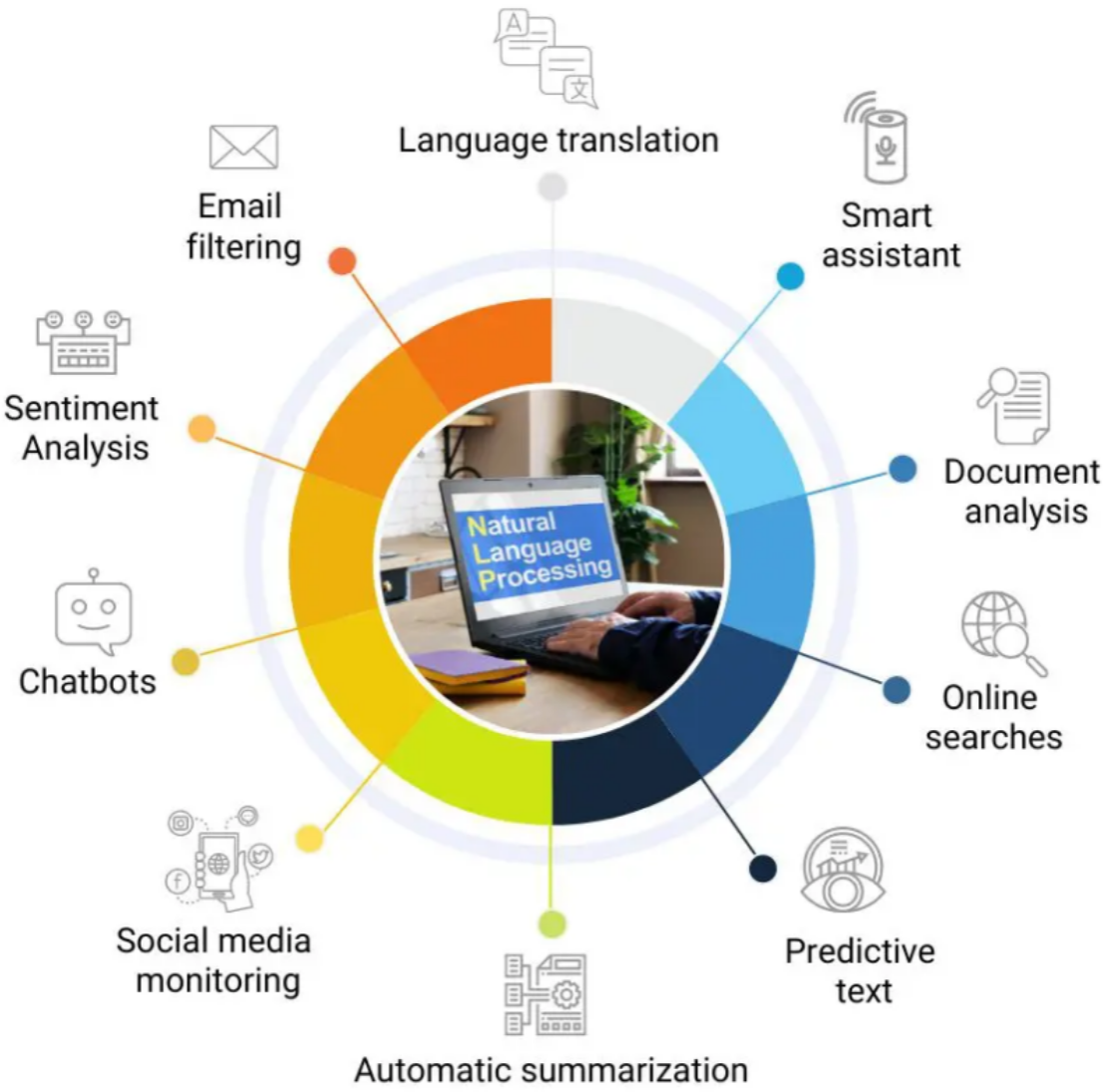
Natural Language Processing(NLP)



History

Before the invention of computer, Alan Turing published an article titled "Computing Machinery and Intelligence" which proposed what is now called the Turing test as a criterion of intelligence.(1940)

With computer, machine translation(MT) and Statistical machine translation(SMT).(1950-1900, 1990-2010)

Multi-layer perceptron(MLP, 2003), recurrent neural network(RNN, 2010)...

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Attention is all you need

$$\text{Attention}(Q, K, V) = \text{softmax}(\frac{QK^T}{\sqrt{d_k}})V$$

Transformers use self-attention mechanisms to process input sequences in parallel, making them highly efficient and effective.(6.2017[6])

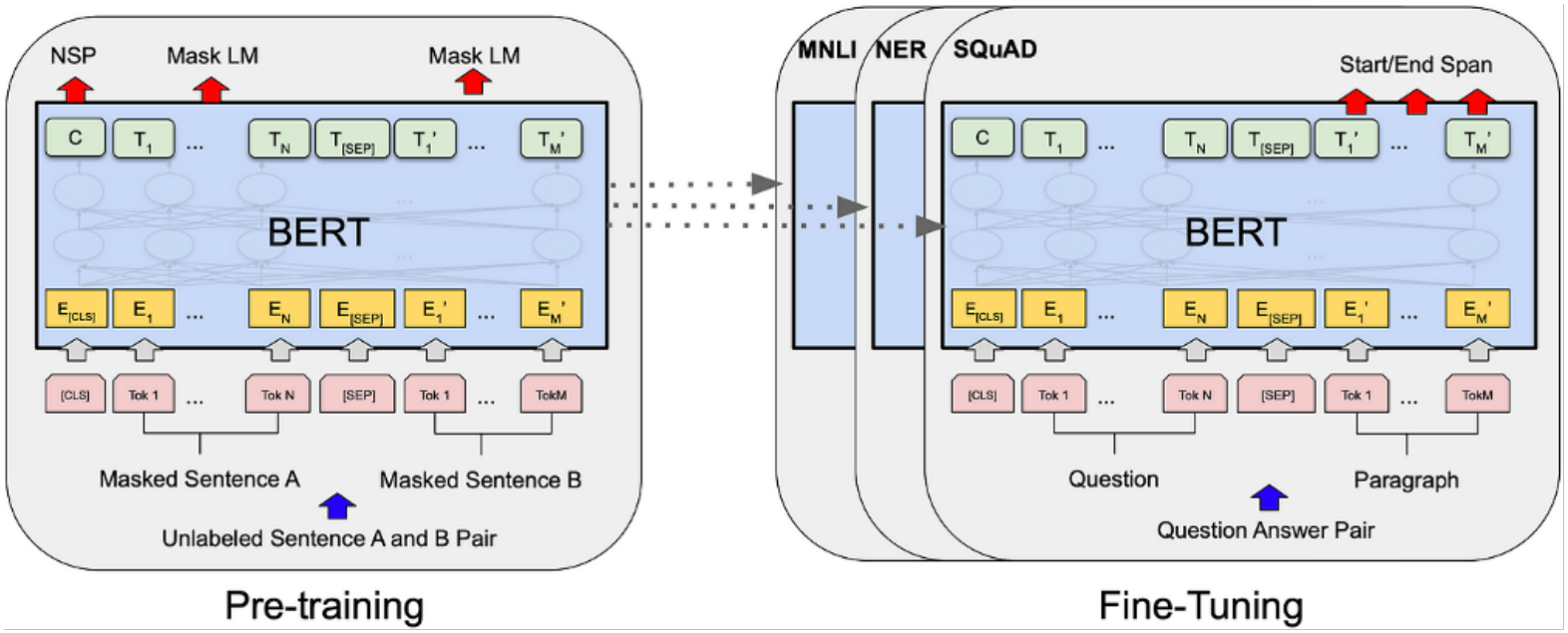
$$q(x_t|x_{t-1}) = \mathcal{N}(x_t; \sqrt{1-\beta_t}x_{t-1}, \beta_t\mathbf{I})$$

Base on Denoising Diffusion Probabilistic Models(2020, DDPM[3]) diffusion(2021, [1]) and continuous diffusions(2022, Diffusion-LM[4]) are introduced to improve non-autoregressive(NAR) text generation.

Bidirectional Encoder Representations from Transformers

2018, BERT[2].

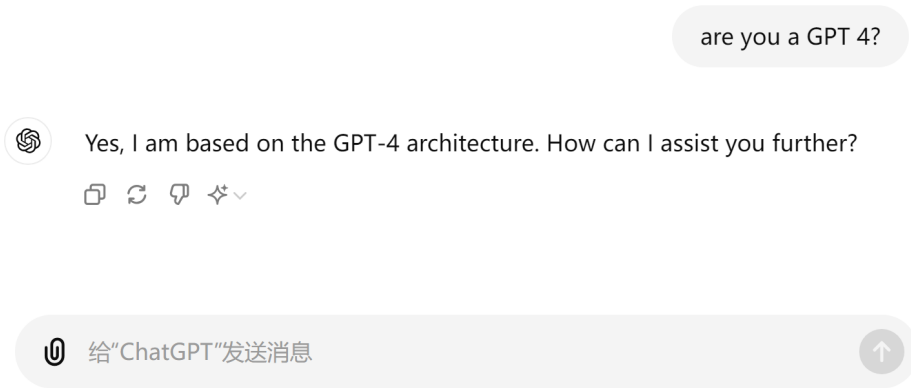
- previous NLP models processed text in a single direction, BERT uses Transformer architecture with self-attention mechanisms, allowing it to consider the context from both left and right;
- pre-trained on vast amounts of text data from diverse sources in an unsupervised manner(340 million parameters).



Generative Pre-trained Transformers

2023, GPT4[5].

- uses only the decoder part of the Transformer architecture, focuses on the generative aspect of the model;
- causal self-attention;
- pre-trained on vast amounts of text data from diverse sources in an unsupervised manner;
- Turing test score: 49.7%(human 66%), high command of computing power.(100 trillion)



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Text classification

Assigning a sentence or document an appropriate category. Begin from small datasets

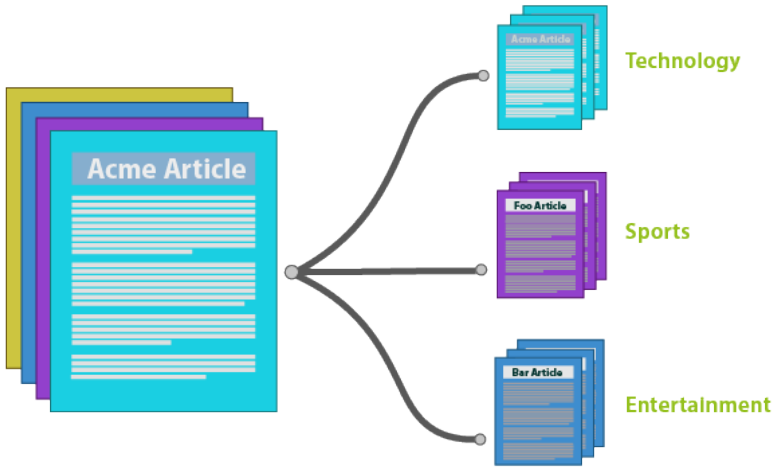

Figure: 11mb

WikiText-2

Introduced by Merity et al. in Pointer Sentinel Mixture Models

The WikiText language modeling dataset is a collection of over 100 million tokens extracted from the set of verified Good and Featured articles on Wikipedia. The dataset is available under the Creative Commons Attribution-ShareAlike License.

Figure: 4mb

Challenge in Text classification

1. High Dimensionality:Text data often have a large vocabulary;most documents use only a small subset of the vocabulary, resulting in sparse feature representations.

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