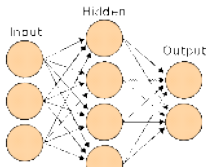
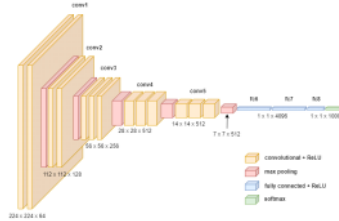


What is Transformer?

27 January 2024 18:41

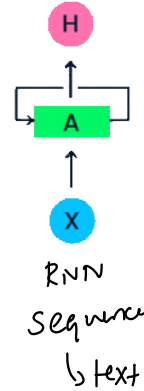


ANN
tabular



CNN
Image

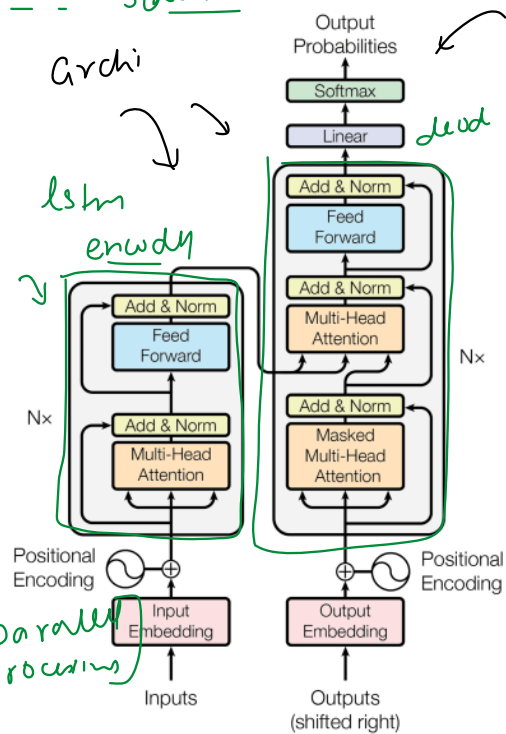
→ Self attention scalable



RNN
Sequence
↳ text

→ [Transformer] → seq2seq task
NN arch

- + machine translation
- + question ans
- + text summariz



[parallel processing]

[Attention Is All You Need]

2017

↳ Google Brain

Deep learning

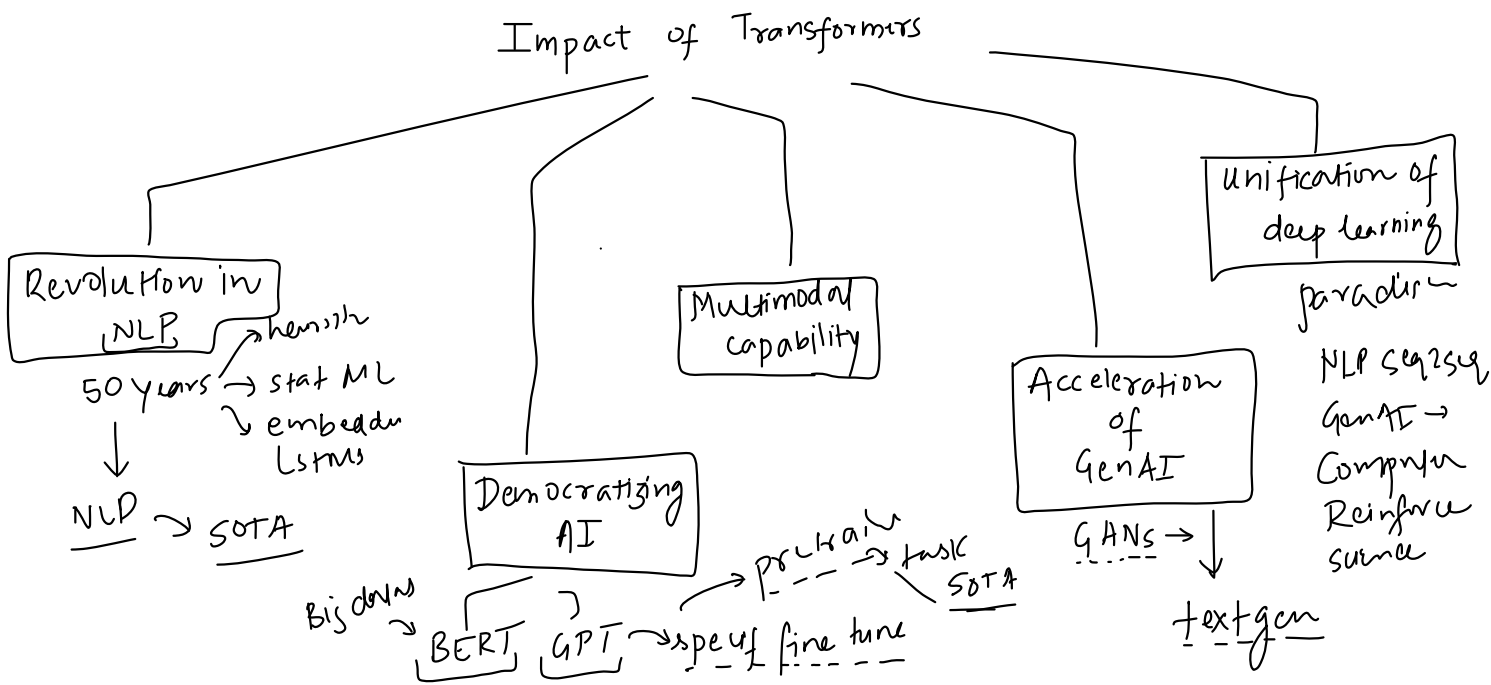
Ashish Vaswani* Google Brain avaswani@google.com	Noam Shazeer* Google Brain noam@google.com	Niki Parmar* Google Research nikip@google.com	Jakob Uszkoreit* Google Research usz@google.com
Llion Jones* Google Research llion@google.com	Aidan N. Gomez* [†] University of Toronto aidan@cs.toronto.edu	Lukasz Kaiser* Google Brain lukaszkaiser@google.com	
Illia Polosukhin* [‡] illia.polosukhin@gmail.com			

Abstract

The dominant sequence transduction models are based on complex recurrent or convolutional neural networks that include an encoder and a decoder. The best performing models also connect the encoder and decoder through an attention mechanism. We propose a new simple network architecture, the Transformer, based solely on attention mechanisms, dispensing with recurrence and convolutions entirely. Experiments on two machine translation tasks show these models to be superior in quality while being more parallelizable and requiring significantly less time to train. Our model achieves 28.4 BLEU on the WMT 2014 English-to-German translation task, improving over the existing best results, including ensembles, by over 2 BLEU. On the WMT 2014 English-to-French translation task, our model establishes a new single-model state-of-the-art BLEU score of 41.8 after training for 3.5 days on eight GPUs, a small fraction of the training costs of the best models from the literature. We show that the Transformer generalizes well to other tasks by applying it successfully to English constituency parsing both with large and limited training data.

Impact of Transformers

27 January 2024 20:03



The Origin Story!

27 January 2024 22:38

2014-15 → seq2seq machine

Sequence to Sequence Learning with Neural Networks

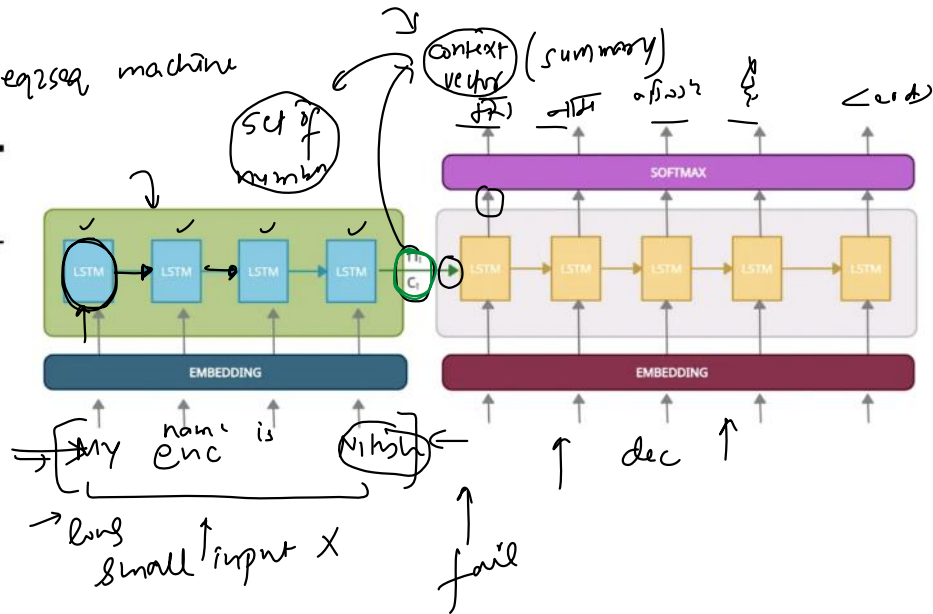
[Ilya Sutskever]
 Google
 ilyasu@google.com

Oriol Vinyals
 Google
 vinyals@google.com

Quoc V. Le
 Google
 qvl@google.com

Abstract

Deep Neural Networks (DNNs) are powerful models that have achieved excellent performance on difficult learning tasks. Although DNNs work well whenever large labeled training sets are available, they cannot be used to map sequences to sequences. In this paper, we present a general end-to-end approach to sequence learning that makes minimal assumptions on the sequence structure. Our method uses a multilayered Long Short-Term Memory (LSTM) to map the input sequence to a vector of a fixed dimensionality, and then another deep LSTM to decode the target sequence from the vector. Our main result is that on an English to French translation task from the WMT'14 dataset, the translations produced by the LSTM achieve a BLEU score of 34.8 on the entire test set, where the LSTM's BLEU score was penalized on out-of-vocabulary words. Additionally, the LSTM did not have difficulty on long sentences. For comparison, a phrase-based SMT system achieves a BLEU score of 33.3 on the same dataset. When we used the LSTM to rerank the 1000 hypotheses produced by the aforementioned SMT system, its BLEU score increases to 36.5, which is close to the previous best result on this task. The LSTM also learned sensible phrase and sentence representations that are sensitive to word order and are relatively invariant to the active and the passive voice. Finally, we found that reversing the order of the words in all source sentences (but not target sentences) improved the LSTM's performance markedly, because doing so introduced many short term dependencies between the source and the target sentence which made the optimization problem easier.



NEURAL MACHINE TRANSLATION BY JOINTLY LEARNING TO ALIGN AND TRANSLATE

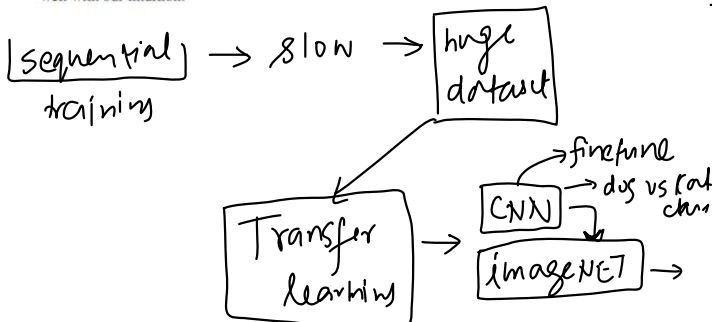
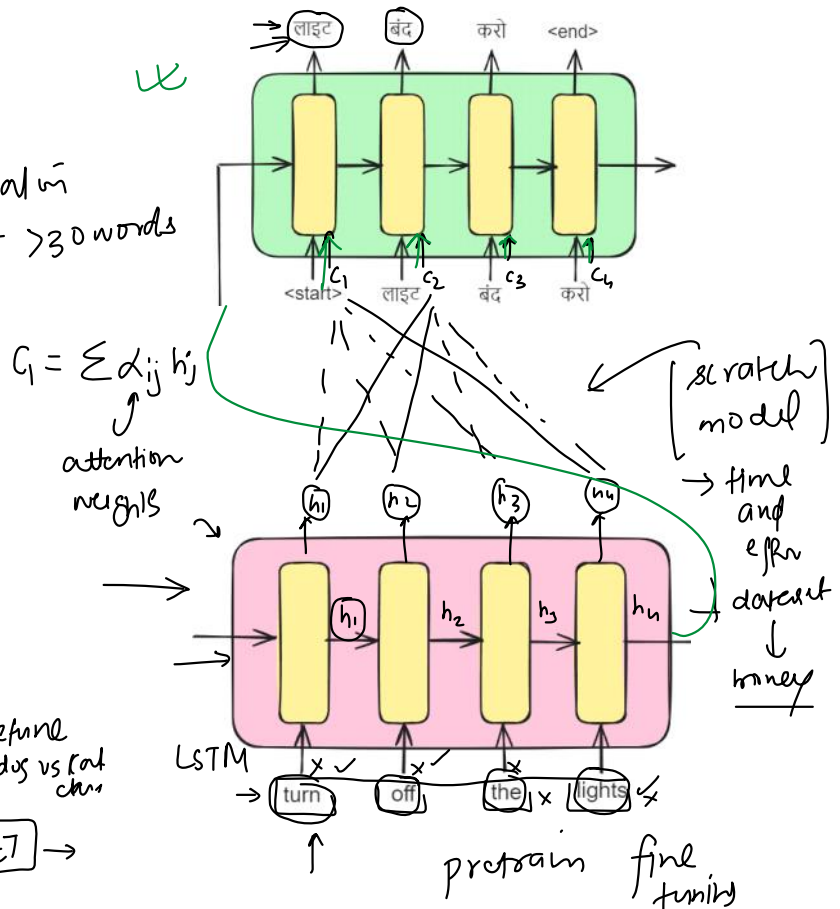
[Dmitry Bahdanau]
 Jacobs University Bremen, Germany

[KyungHyun Cho, Yoshua Bengio]
 Université de Montréal

ABSTRACT

Neural machine translation is a recently proposed approach to machine translation. Unlike the traditional statistical machine translation, the neural machine translation aims at building a single neural network that can be jointly tuned to maximize the translation performance. The models proposed recently for neural machine translation often belong to a family of encoder-decoders and encode a source sentence into a fixed-length vector from which a decoder generates a translation. In this paper, we conjecture that the use of a fixed-length vector is a bottleneck in improving the performance of this basic encoder-decoder architecture, and propose to extend this by allowing a model to automatically (soft-)search for parts of a source sentence that are relevant to predicting a target word, without having to form these parts as a hard segment explicitly. With this new approach, we achieve a translation performance comparable to the existing state-of-the-art phrase-based system on the task of English-to-French translation. Furthermore, qualitative analysis reveals that the (soft-)alignments found by the model agree well with our intuition.

translation sent > 30 words



research → incremental time
→ bureau → travel

Attention Is All You Need → 2017

→ LSTM/self → parallelly
 → stable
 → hypertune
 NLP → API → fine tune
 Output Probabilities

→ idea → transformer

Attention Is All You Need → 2017

Ashish Vaswani*
Google Brain
avaswani@google.com

Noam Shazeer*
Google Brain
noam@google.com

Niki Parmar*
Google Research
nikip@google.com

Jakob Uszkoreit*
Google Research
usz@google.com

Llion Jones*
Google Research
llion@google.com

Aidan N. Gomez* †
University of Toronto
aidan@cs.toronto.edu

Lukasz Kaiser*
Google Brain
lukaszkaier@google.com

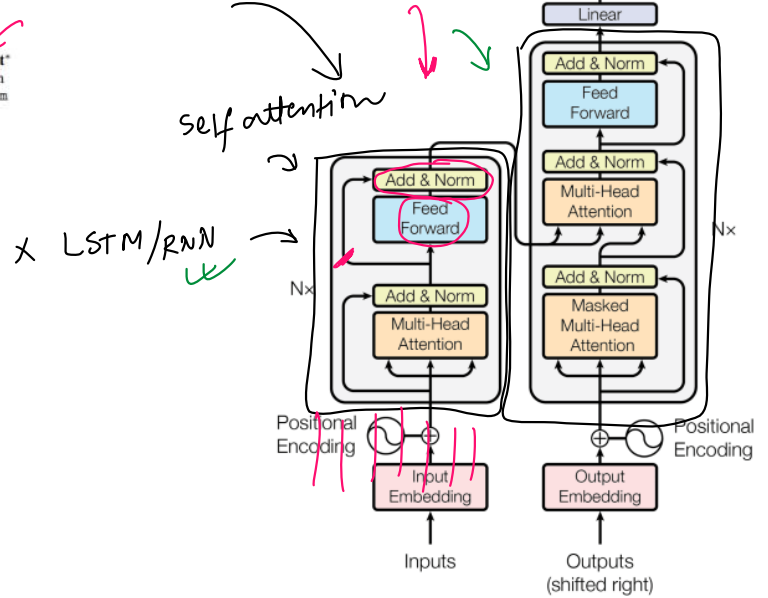
Illia Polosukhin* ‡
illia.polosukhin@gmail.com

Abstract

The dominant sequence transduction models are based on complex recurrent or convolutional neural networks that include an encoder and a decoder. The best performing models also connect the encoder and decoder through an attention mechanism. We propose a new simple network architecture, the Transformer, based solely on attention mechanisms, dispensing with recurrence and convolutions entirely. Experiments on two machine translation tasks show these models to be superior in quality while being more parallelizable and requiring significantly less time to train. Our model achieves 28.4 BLEU on the WMT 2014 English-to-German translation task, improving over the existing best results, including ensembles, by over 2 BLEU. On the WMT 2014 English-to-French translation task, our model establishes a new single-model state-of-the-art BLEU score of 41.8 after training for 3.5 days on eight GPUs, a small fraction of the training costs of the best models from the literature. We show that the Transformer generalizes well to other tasks by applying it successfully to English constituency parsing both with large and limited training data.

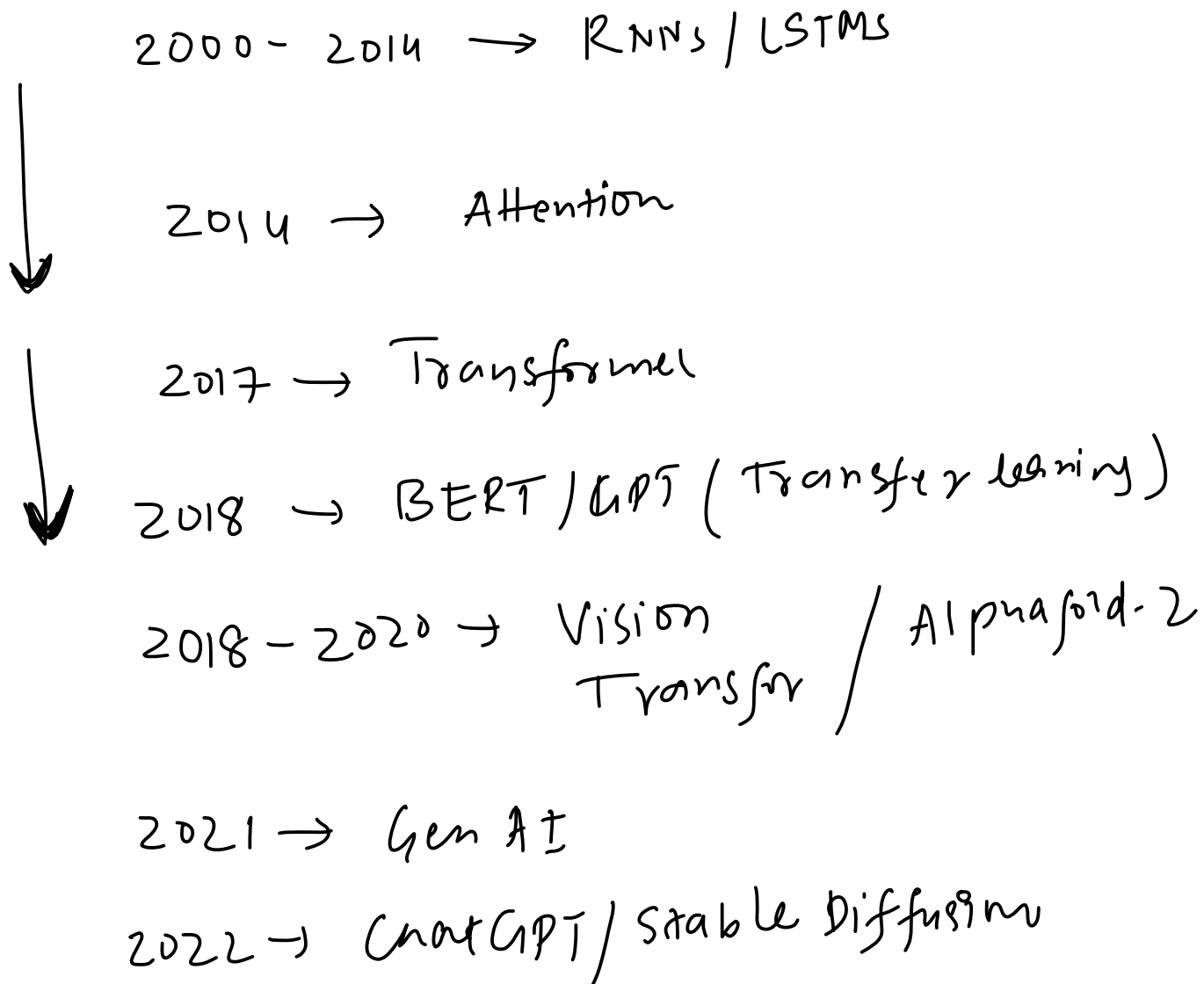
→ stable
→ hyperparameter
stable
robust

NLP → $n \times p$ → fine-tune



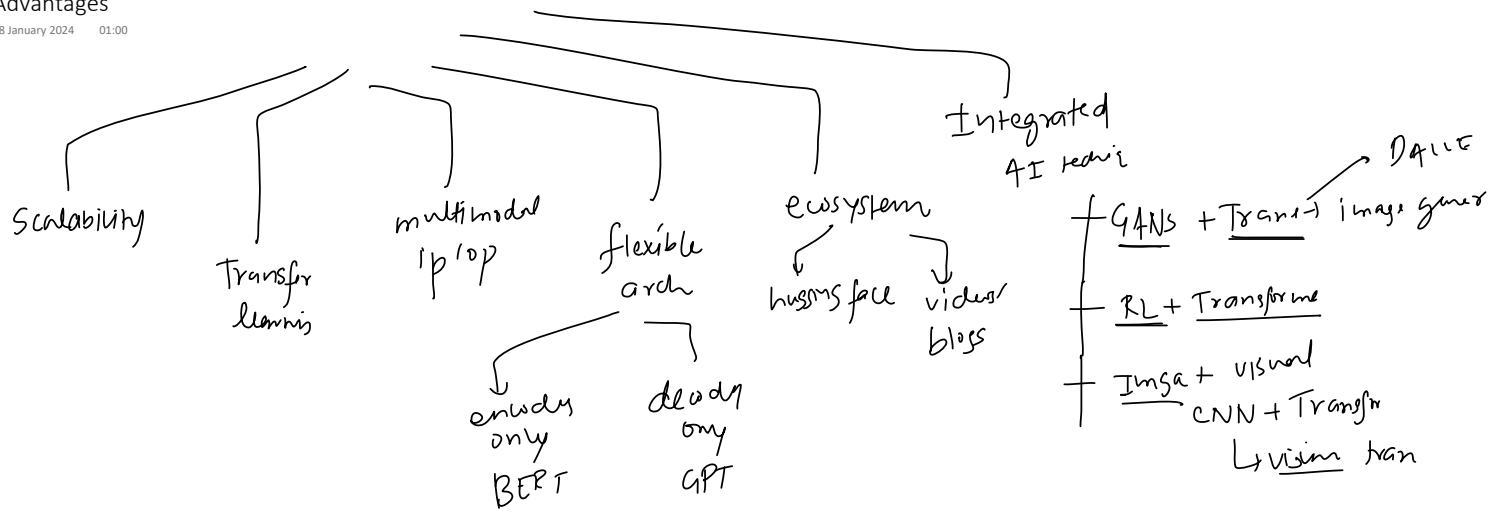
The Timeline

28 January 2024 00:55



Advantages

28 January 2024 01:00



Famous Applications

28 January 2024 01:17

Disadvantages

28 January 2024 01:51

