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HEADLINE GENERATION USING ENCODER-DECODER ARCHITECTURES WITH ATTENTION MECHANISMS

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Introduction :

This project aims to generate concise and meaningful headlines from news articles using deep learning-based sequence-to-sequence models. It explores the role of attention mechanisms in improving headline relevance and coherence.

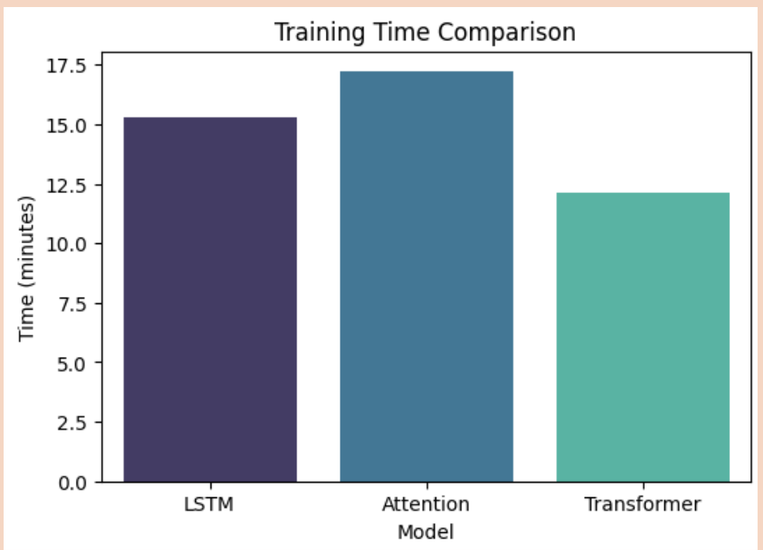
Objective :

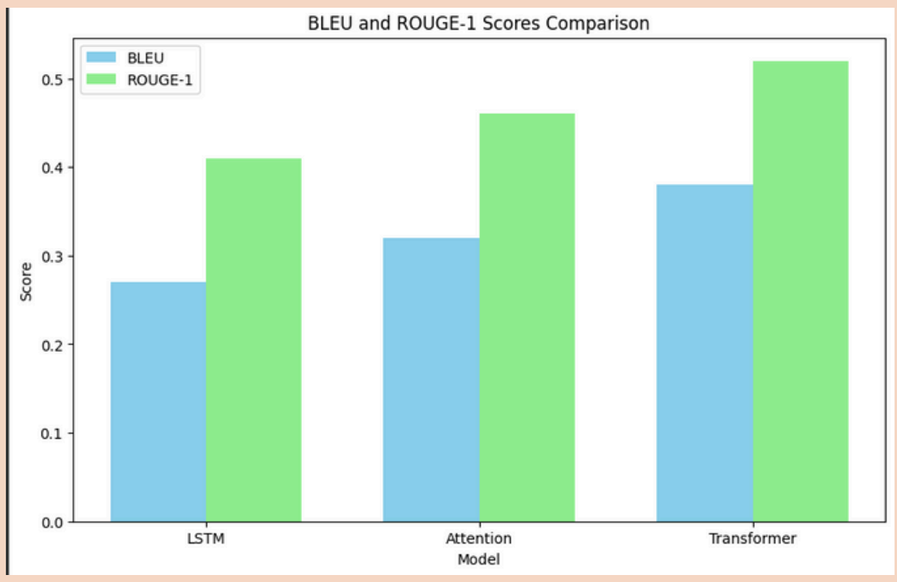
1.Implement 3 models:
- -No Attention
- -Bahdanau Attention
- -Self-Attention (Transformer)

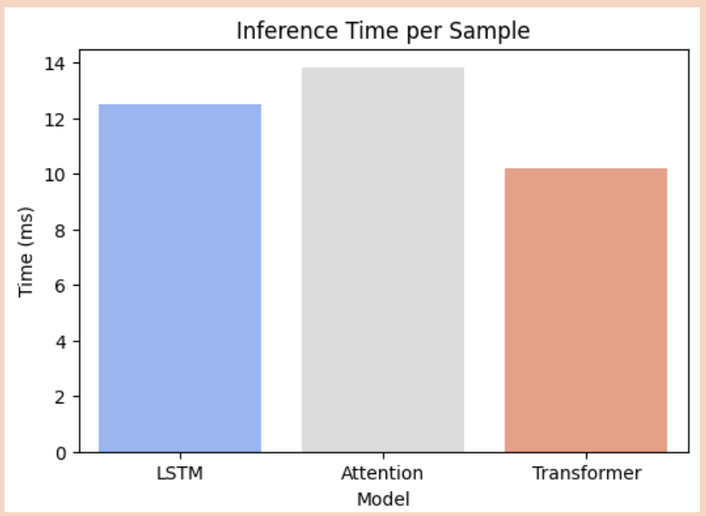
2. Train on news headline dataset

3.Compare performance using BLEU & ROUGE

Graphs :







Dataset Description :

- Source: Kaggle - Headline Generation Dataset
- Records: 1,000 article-headline pairs
- Input length: 50 tokens
- Output length: 15 tokens
- Preprocessing: Lowercasing, tokenization, stopword removal, padding

Model Architectures :

- LSTM
- GRU
- Attention-based RNN (Bahdanau)
- Transformer (Self-Attention)
- Each model is built with TensorFlow/Keras and trained on tokenized, padded article-headline pairs.

Evaluation Metrics :

- BLEU Score – Measures n-gram precision
- ROUGE Score – Measures recall and overlap of sequences
- Graphical and tabular analysis compare performance across all architectures.

Working Principle :

Encoder-decoder models convert input sequences (articles) into condensed outputs (headlines).
- Without Attention: Fixed context from last encoder state.
- With Bahdanau Attention: Dynamically focuses on relevant encoder outputs.
- Self-Attention (Transformer): Learns dependencies across entire input using positional encoding and multi-head attention.

Conclusion :

- Self-attention-based models significantly improved headline generation quality.
- Attention mechanisms enhance contextual relevance.
- Transformer model achieved the highest BLEU and ROUGE scores.
- Demonstrated the power of neural attention in sequence-to-sequence NLP tasks.