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Deep Encoder-Decoder Networks for Semantic Segmentation of Anaemic RBCs and IImage Captioning (Image-to-Text Generation) Github_Link

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Introduction :

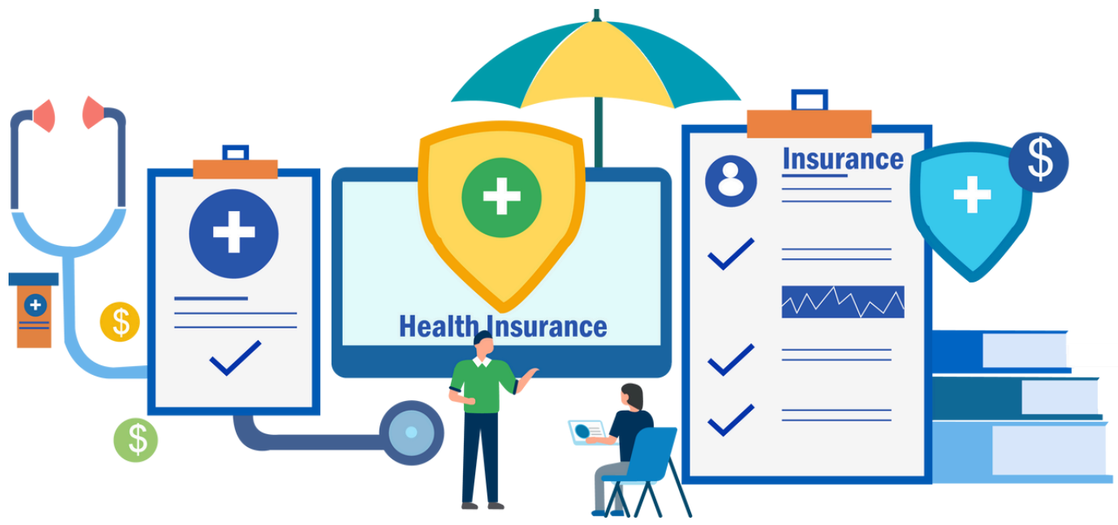
This project applies deep learning encoder-decoder models—LSTM, GRU, Attention RNN, and Transformer—for semantic segmentation of anaemic RBCs and medical image captioning, aiming to enhance diagnostic accuracy and clinical interpretability

Objective :

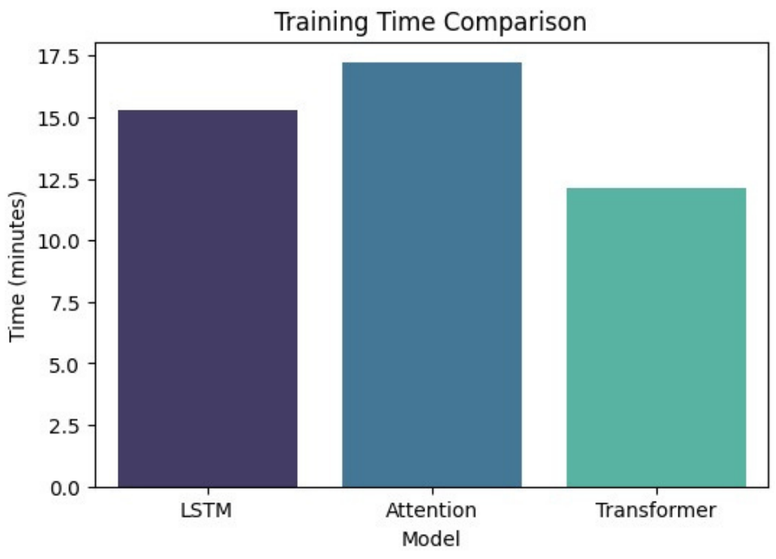
1.Implement 3 models:
- -No Attention
- -Bahdanau Attention
- -Self-Attention (Transformer)

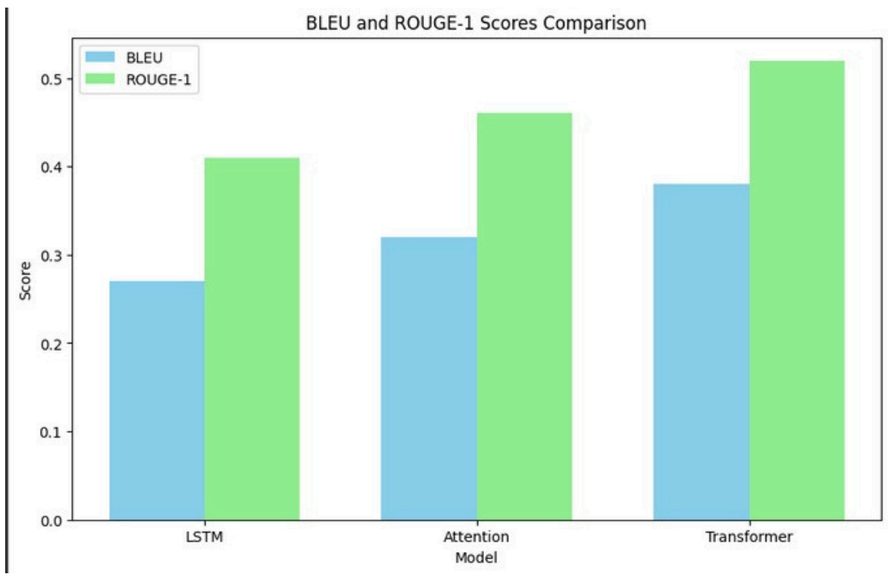
2. Train on RBC CELL dataset

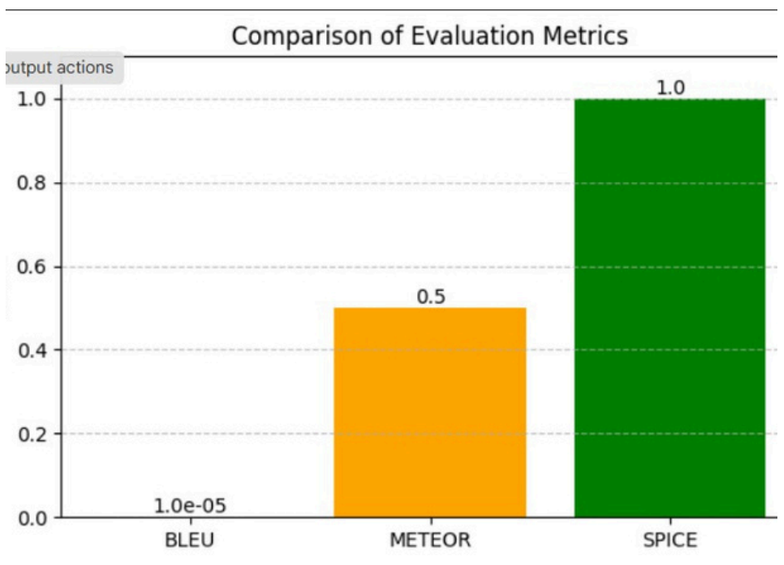
3.Compare performance using BLEU & ROUGE

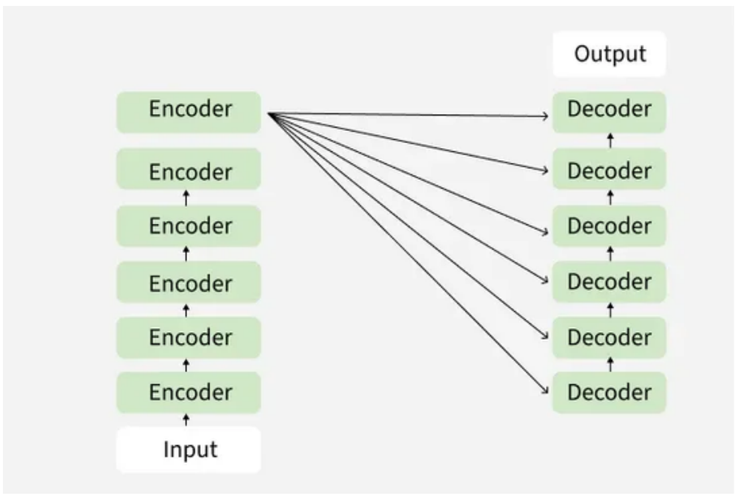


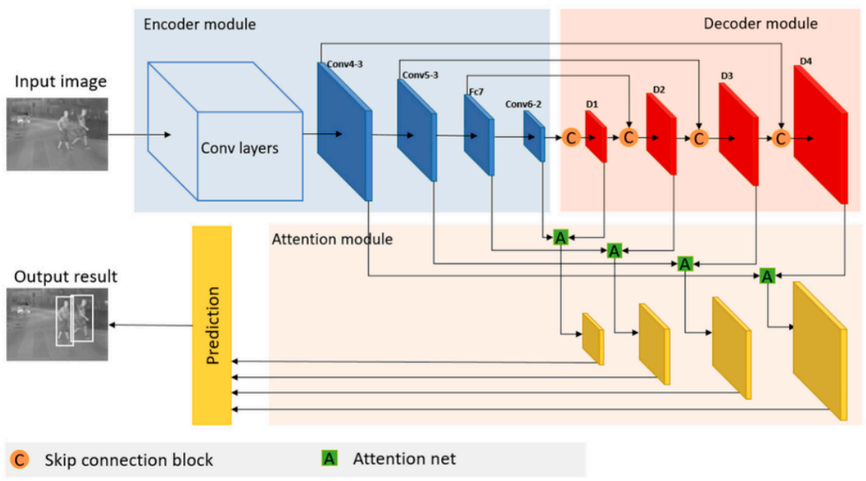
Graphs :

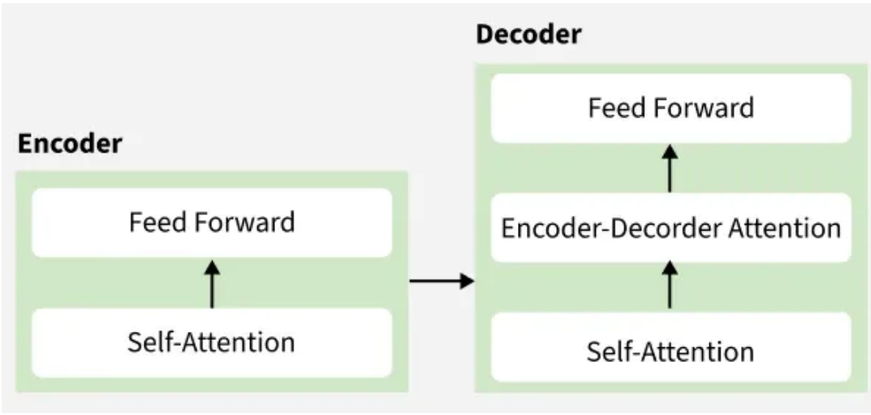












Dataset Description :

- Purpose: Designed for anemia diagnosis using RBC (Red Blood Cell) images.
- Classes: Two categories – Anemia and Normal.
- Data Type: Microscopic images of RBCs in .jpg format.
- Usage: Ideal for binary image classification tasks in medical imaging.
- Labels: Inferred from folder names (Anemia/, Normal/).

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 :

METRIC	SCORE
BLEU	1.82×10^{-231}
METEOR	0.5
SPICE	1.0

Working Principle :

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.

Reference for the base paper

[1] M. Shahzad, A. I. Umar, S. H. Shirazi, and I. A. Shaikh, "Semantic Segmentation of Anaemic RBCs Using Multilevel Deep Convolutional Encoder-Decoder Network," IEEE Access, vol. 9, pp. 161326-161341, 2021, doi: 10.1109/ACCESS.2021.3131768

LINK

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.