

RESULTS

Figure 1: Experiment 3 - Trial 1: Generalization Gap EEGNet+Transformer vs. with STFT and cGANs

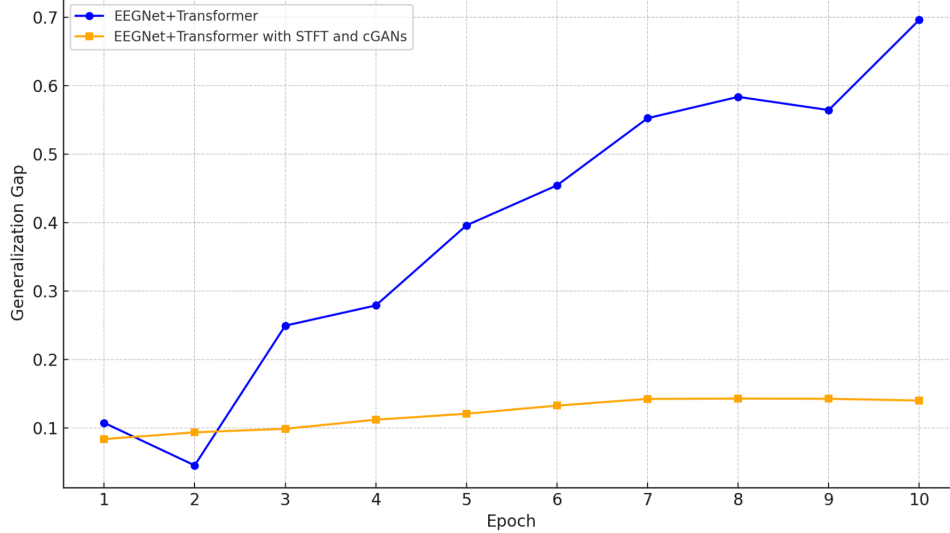


Figure 1 shows a comparison of the generalization gap per epoch for EEGNet+Transformer and EEGNet+Transformer with STFT and cGANs. The EEGNet+Transformer model shows a gradual increase in the gap which suggests the presence of overfitting during training.

The model with STFT and cGANs maintains a stable and low gap across all epochs without signs of overfitting. At epoch ten the gap in EEGNet+Transformer reaches 0.6964 while the proposed model remains at 0.1398. Both trials confirm that STFT and cGANs help stabilize training and improve performance across epochs.

Table 1: Comparison by Number of Epochs – EEGNet + Transformer (Original Model)

Batch Size	Learning Rate	Epochs	Accuracy (%)	Precision (%)	F1 Score (%)
16	0.001	10	89.02	69.67	50.53
16	0.001	15	89.11	70.06	51.12
16	0.001	20	89.56	71.90	51.79

Table 1 shows the performance of EEGNet+Transformer trained with 10, 15, and 20 epochs using a fixed batch size of 16. The model shows minor improvement in accuracy, precision and F1 score as the number of epochs increases from 10 to 20. The F1 score rises slowly from 50.53 at epoch 10 to 51.79 at epoch 20 with limited gains overall. These results suggest that longer training helps but the effect is minimal for this configuration.

Table 2: Comparison by Number of Epochs – EEGNet + Transformer with STFT and cGANs (Proposed Model)

Batch Size	Learning Rate	Epochs	Accuracy (%)	Precision (%)	F1 Score (%)
16	0.001	10	91.87	78.72	84.09
16	0.001	15	92.28	80.42	79.91
16	0.001	20	92.28	83.04	76.76

Table 2 presents results for the proposed model EEGNet+Transformer with STFT and cGANs under the same training conditions. The model shows high performance across all epochs obtaining up to 92.28% in accuracy. The F1-score reaches 84.09% at epoch 10 while precision increases from 78.72% at 10 epochs to 83.04% at 20 epochs. The results show that the proposed model achieves a better performance than EEGNet + Transformer with fewer epochs.