Project Report - Latent Diffusion for Language

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Brief Overview

This project aims to implement the techniques proposed in the paper titled **"Latent Diffusion for Language Generation"**. The paper introduces a novel approach to language generation by leveraging latent diffusion models in the continuous latent space of a pretrained encoder-decoder network, such as BART or T5. The project demonstrates significant improvements in language generation tasks, especially in reducing the sampling steps and maintaining high output quality. The project implementation is available on GitHub: `https://github.com/justinlovelace/latent-diffusion-for-language`.

Impact of Implementing Suggested Modifications

Since the training time was too high earlier as well, I had obtained results for training for lesser number of train steps, so here again for comparison, I am comparing the impact of the modifications keeping the same number of training steps. It is hard to predict, whether the actual results at full training would beat the results mentioned in paper.
Here is the analysis of impact of various modifications tried:

- Using GRU gating: This method gave slightly better results but at cost of higher training time. Since earlier we were simply passing the residual but here we are using GRU which is definitely more complex.
- Using ScaleNorm instead of LayerNorm: This combined with GRU gating improved the results a bit without adding any overhead.
- Using dynamic positional embedding: This method did not work very well as the results got too much worse. Not sure about the exact reason behind this but I think that the model could not well adjust for these embeddings.

Updated Results

Metric	**Older Value**	**Updated Value**
Unique Word Count	1173	1215
2-gram Repetition	0.263	0.258
3-gram Repetition	0.048	0.046
4-gram Repetition	0.009	0.009
Diversity	0.695	0.687
Perplexity	39.22	37.64
Memorization	0.328	0.334
MAUVE Score	0.768	0.771

Table 1: Comparison of various metrics before and after making suggested modifications

References

- Paper Link: `https://arxiv.org/pdf/2212.09462`

- GitHub link for implementation:
  `https://github.com/justinlovelace/latent-diffusion-for-language`