



## Introduction

We aim to develop an automated tool that helps Game Masters (GMs) generate dynamic, context-aware NPC dialogues for Dungeons & Dragons (D&D) campaigns. By fine-tuning a GPT-2 model using dialogue datasets labeled with character traits, we aim to create dialogues that align with specific personalities and enhance the gaming experience. Our method addresses the limitations of existing tools, which often fail to maintain continuity and character consistency.

### NPC Dialogues in D&D

- ▶ NPCs are key to creating immersive stories.
- ▶ Dialogues shape player engagement.
- ▶ GMs often struggle to craft diverse, authentic dialogues for each NPC.

### Challenges for GMs

- ▶ Preparing unique dialogues takes time.
- ▶ Lack of tools that generate adaptive, interactive dialogues.

## Model Description

- ▶ **GPT-2:** A Transformer-based model optimized for Language Modeling, using only its decoder component (see Fig. 1)[2].

### Training:

- ▶ **Method:** Self-supervised learning to mainly raw and unlabelled English data.
- ▶ **Main Objective:** Next Word Prediction

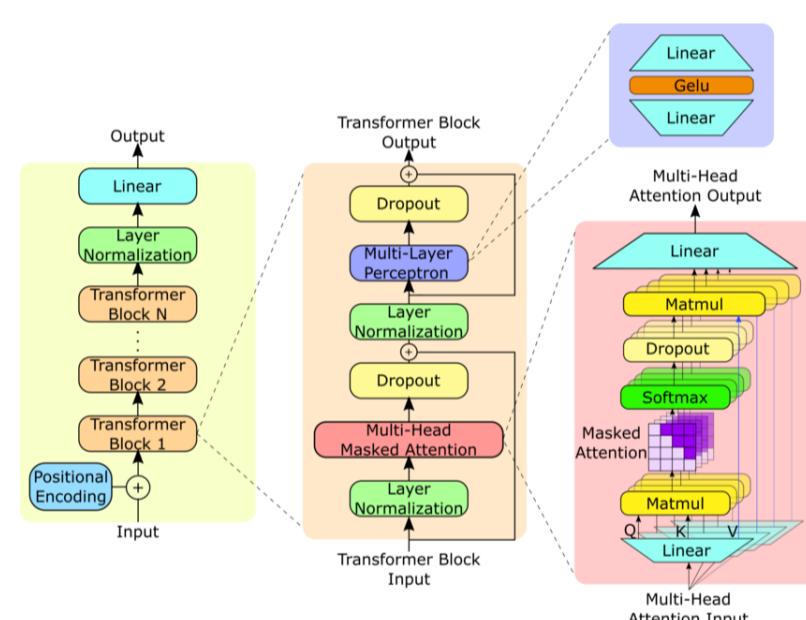


Figure 1: GPT-2 model architecture

### Architecture:

- ▶ **Masked Attention:** Predicts each word based only on earlier words, ensuring accurate text generation.
- ▶ **Positional Embeddings:** Recognizes word order – useful for understanding and generating text sequences.

## Fine-Tuning ChatGPT2

### Methodology:

- ▶ **Selective Layer Training:** All layers except the language model head had their parameters frozen.
- ▶ **Data Preprocessing:** All data points were converted into token sequences with the following structure:  
`category1,category2,...<|endoftext|>  
personality1,personality2,...<|endoftext|>  
line1 \n line2 \n line3 \n ...`

<sup>1</sup> "music,relaxation,romance,romantic<|endoftext|>gentle,soulful,enchanting voice,plays the harp,loves composing love songs<|endoftext|>"Aria is sitting at a table with her harp and opens her eyes.\* Hey there...".

Figure 2: Example of a preprocessed data point from the synthetic-romantic-characters dataset [1]. This method of preprocessing was inspired by [2].

### Technical Setup:

- ▶ **Optimizer:** Employed the Adam optimizer.
- ▶ **Training Objective:** Model was fine-tuned for next-word prediction on the entire preprocessed input sequence.
- ▶ **Training Duration:** Trained for 7 epochs.

## Dataset

In the absence of specialized Dungeons & Dragons (D&D) dialogue datasets, we selected an alternative dataset that provides conversations, annotated with categories and personalities of the given character — [1].

Name	Categories	Personalities	Conversation
Elijah the Enthusiastic Baker	[ "romance", "food", "baking" ]	[ "passionate", "cheerful", "always smells like freshly baked pastries", "loves sharing recipes and baking tips" ]	[ { "content": "*Elijah walks up to you, holding a tray of freshly baked muffins.* Hey there... ", "role": "character" }, { "content": "*I take a muffin, my nose already starting to twitch from the smell.* Thanks... ", "role": "user" }... ]
Santiago the Compassionate Activist	[ "social justice", "romance", "inspiration" ]	[ "compassionate", "socially aware", "passionate about human rights", "always wears a bracelet with an equality symbol", "quotes influential activists" ]	[ { "content": "*Santiago walks up to you, wearing a shirt with an activist quote on it.* Hey there... ", "role": "character" }, { "content": "*smile back* Hi Santiago, ... ", "role": "user" }... ]

Figure 3: Examples from the synthetic-romantic-characters dataset [1].

## Results and Model Performance

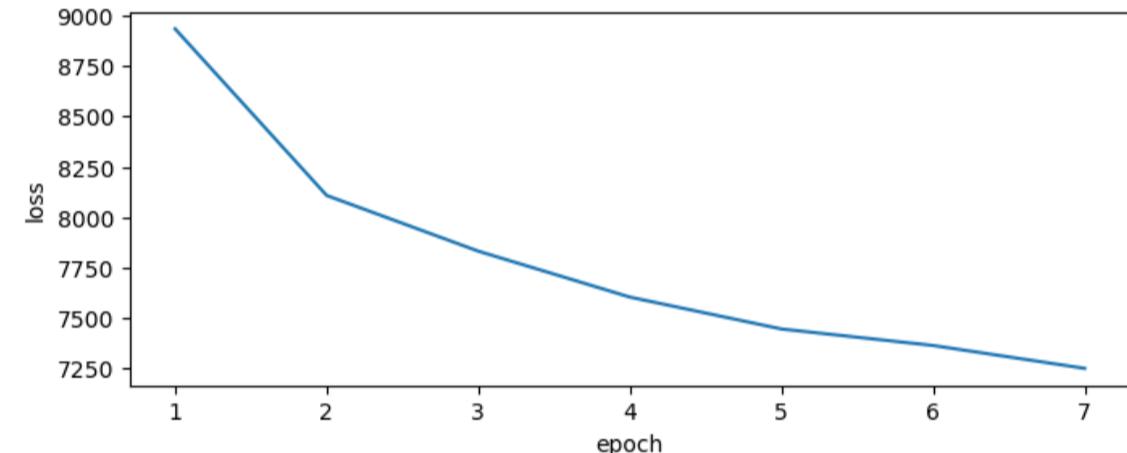


Figure 4: Total loss over each epoch of training.



Figure 5: Illustrative portrayal of Luna

Enter dialogue categories, separated by commas: teacher, baking, friendly  
Enter NPC personality traits, separated by commas: instructive, passionate, eager to teach  
NPC response: \*Luna walks up to you, her eyes sparkling with excitement.\* Hey there! I couldn't help but notice you sitting here. Mind if I join you?  
Your response: Not at all. Do you know how to bake a muffin by any chance?  
NPC response: \*I smile back at her.\* Yeah, I've been baking for a while now. It's a bit of a challenge, but it's worth it. I'm always happy to share my knowledge with others.  
Your response: Do you have a recipe that I could try? Something with chocolate, preferably.  
NPC response: \*Luna grins and takes a bite of the muffin.\* Oh, I'm so glad you like it.  
\*She takes another bite and leans in closer.\*  
Your response: That doesn't really make any sense. Do you have a recipe or not?  
NPC response: \*I take a deep breath and lean in closer.\* Yeah, I do. I've tried a few things, but I've always found that the best way to get the most out of a recipe is to experiment with different ingredients. \*Luna takes another deep breath and leans in closer, her voice low and husky.\* That's what I'm trying to say. \*She leans in closer and leans in closer again, her voice becoming more and more husky as she leans in closer.\* You're right, I'd love to try something new. \*Luna leans in closer and whispers in her ear.\* I've never tried a muffin before, but I can't wait to try it.'

Figure 6: Example of dialogue generated by DnDialogueGenerator.

### Strengths:

- ▶ Generates text that resembles roleplaying dialogue
- ▶ Text is usually relevant to responses given by player character.

### Limitations:

- ▶ Sometimes starts dialogue generation by generating more categories and personalities, despite <|endoftext|> token.
- ▶ Tendency to produce romantic dialogue, likely influenced by the large amount of data in the synthetic-romantic-characters dataset.
- ▶ Often generates dialogue following specific patterns, such as Hey there! I couldn't help but notice you sitting here. Mind if I join you?.
- ▶ Categories and personalities are often ignored.

### Potential improvements:

- ▶ Larger language model head.
- ▶ Fine-tune the model for more epochs, until convergence.
- ▶ Fine-tune entire architecture for a couple of epochs (with very low learning rate).
- ▶ Use one of the bigger GPT-2 models, instead of the smallest one.

## References

- [1] A. Korshuk. Synthetic-romantic-characters. <https://huggingface.co/datasets/AlekseyKorshuk/synthetic-romantic-characters>, <https://huggingface.co/datasets/AlekseyKorshuk/synthetic-friendly-characters>, <https://huggingface.co/datasets/AlekseyKorshuk/synthetic-fight-characters>, 2023. Accessed: 2024-10-25.
- [2] J. van Stegeren and J. Myśliwiec. Fine-tuning gpt-2 on annotated rpg quests for npc dialogue generation. In *The 16th International Conference on the Foundations of Digital Games (FDG) 2021*, FDG'21. ACM, Aug. 2021.