

# Exploring Prompting Techniques for AI Audio Generation

## Aim

The experiment aims to explore how different prompt styles influence AI-generated audio, such as music, sound effects, and speech. It focuses on understanding prompt engineering and optimizing prompt design for better and more relevant outputs.

## Softwares Required

- **Python (3.8+)** and an IDE (Jupyter, VS Code).
- **Libraries:** requests, openai, torchaudio (optional for playback).
- **APIs:** OpenAI (Whisper for speech synthesis), Google Cloud Text-to-Speech, Hugging Face (MusicGen for music, Sound Effects models).
- **API Keys:** Required for OpenAI, Google Cloud, and Hugging Face.

## Key Concepts

- **Prompt Engineering:** Crafting input prompts that guide AI models to generate desired audio outputs.
- **Audio Generation:** Using AI models to create speech, music, or sound effects based on given prompts.
- **Prompt Optimization:** Refining prompt inputs for improved quality and control over the audio output.

## Experiment Design

### Experiment 1: Speech Generation

- **Prompts Used:**
  - Basic Prompt: "Say hello in a friendly tone."
  - Detailed Prompt: "Generate a professional greeting message for a virtual assistant."
  - Contextual Prompt: "Speak as if you are introducing a new product at a tech conference."

#### Python Code:

```
import requests

API_KEY = "your_google_api_key"
url = "https://texttospeech.googleapis.com/v1/text:synthesize"
```

```

def generate_speech(prompt):
    headers = {"Authorization": f"Bearer {API_KEY}"}
    payload = {
        "input": {"text": prompt},
        "voice": {"languageCode": "en-US", "name": "en-US-Wavenet-D"},
        "audioConfig": {"audioEncoding": "MP3"}
    }
    response = requests.post(url, headers=headers, json=payload)
    if response.status_code == 200:
        with open("speech.mp3", "wb") as file:
            file.write(response.content)
        print("Speech generated: speech.mp3")
    else:
        print("Error in generation:", response.json())

```

**Analysis:** Listen to the generated audio and note differences in tone and clarity based on prompt style.

## Experiment 2: Music Generation Using MusicGen

- **Prompts Used:**
  - Genre-Specific: "Create a classical piano melody."
  - Mood-Specific: "Generate an upbeat electronic dance track."
  - Detailed: "Compose a relaxing acoustic guitar tune with ambient background sounds."

### Python Code:

```

import requests

API_KEY = "your_huggingface_api_key"
url = "https://api-inference.huggingface.co/models/facebook/musicgen"
def generate_music(prompt):
    headers = {"Authorization": f"Bearer {API_KEY}"}
    payload = {"inputs": prompt}
    response = requests.post(url, headers=headers, json=payload)
    audio_url = response.json().get("audio_url", "No URL")
    print("Generated Music URL:", audio_url)

```

**Analysis:** Compare the generated music tracks for variations in genre, tempo, and mood.

## Experiment 3: Sound Effect Generation

- **Prompts Used:**
  - Simple Prompt: "Sound of rain."
  - Detailed Prompt: "Soft rain on a metal roof at night."
  - Contextual Prompt: "A busy city street with distant honking and people talking."

### Python Code:

```
def generate_sound_effect(prompt):  
    url = "https://api-inference.huggingface.co/models/sound-effect-model"  
    headers = {"Authorization": f"Bearer your_huggingface_api_key"}  
    payload = {"inputs": prompt}  
    response = requests.post(url, headers=headers, json=payload)  
    print("Sound Effect URL:", response.json().get("audio_url", "No URL"))
```

**Analysis:** Listen to the generated sound effects and assess the realism and detail based on prompt specificity.

## Output and Result

1. **Speech Generation:** Detailed prompts produce clearer and more expressive speech.
2. **Music Generation:** Genre and mood-specific prompts yield more stylistically accurate music.
3. **Sound Effect Generation:** Context-rich prompts create more vivid and realistic sounds.