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E23CSEU2189

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# ================= IMPORTS =================
import tensorflow as tf
import numpy as np

# ================= LOAD DATASET FROM FILE =================
with open("sample text.txt", "r", encoding="utf-8") as f:
    text = f.read().lower()

# ================= TOKENIZATION =================
tokenizer = tf.keras.preprocessing.text.Tokenizer(char_level=True)
tokenizer.fit_on_texts([text])

encoded = tokenizer.texts_to_sequences([text])[0]
vocab_size = len(tokenizer.word_index) + 1

# ================= CREATE SEQUENCES =================
seq_len = 50
X, y = [], []

for i in range(len(encoded) - seq_len):
    X.append(encoded[i:i + seq_len])
    y.append(encoded[i + seq_len])

X = np.array(X)
y = np.array(y)

# ================= TRANSFORMER BLOCK =================
def transformer_block(x, num_heads, key_dim, ff_dim):
    attn_output = tf.keras.layers.MultiHeadAttention(
        num_heads=num_heads,
        key_dim=key_dim
    )(x, x)

    x = tf.keras.layers.LayerNormalization(epsilon=1e-6)(x + attn_output)

    ffn = tf.keras.Sequential([
        tf.keras.layers.Dense(ff_dim, activation="relu"),
        tf.keras.layers.Dense(x.shape[-1])
    ])

    ffn_output = ffn(x)
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    return tf.keras.layers.LayerNormalization(epsilon=1e-6)(x + ffn_output)

# ================= BUILD MODEL =================
inputs = tf.keras.Input(shape=(seq_len,))

# Token embedding
token_embedding = tf.keras.layers.Embedding(vocab_size, 64)(inputs)

# ✅ Positional embedding (SAFE)
positions = tf.range(start=0, limit=seq_len, delta=1)
pos_embedding = tf.keras.layers.Embedding(seq_len, 64)(positions)

x = token_embedding + pos_embedding

# Stack Transformer blocks
for _ in range(2):
    x = transformer_block(x, num_heads=4, key_dim=64, ff_dim=128)

x = tf.keras.layers.GlobalAveragePooling1D()(x)
outputs = tf.keras.layers.Dense(vocab_size, activation="softmax")(x)

model_transformer = tf.keras.Model(inputs, outputs)

model_transformer.compile(
    loss="sparse_categorical_crossentropy",
    optimizer=tf.keras.optimizers.Adam(learning_rate=1e-3)
)

# ================= TRAIN =================
model_transformer.fit(X, y, epochs=100, batch_size=64)

# ================= TEMPERATURE SAMPLING =================
def sample_with_temperature(preds, temperature=0.8):
    preds = np.asarray(preds).astype("float64")
    preds = np.log(preds + 1e-8) / temperature
    exp_preds = np.exp(preds)
    preds = exp_preds / np.sum(exp_preds)
    return np.random.choice(len(preds), p=preds)

# ================= TEXT GENERATION =================
def generate_text(seed, length=600, temperature=0.8):
    result = seed

    for _ in range(length):
        seq = tokenizer.texts_to_sequences([seed])[0]
        seq = seq[-seq_len:]
        seq = tf.keras.preprocessing.sequence.pad_sequences(
            [seq], maxlen=seq_len
        )
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        preds = model_transformer.predict(seq, verbose=0)[0]
        next_idx = sample_with_temperature(preds, temperature)
        next_char = tokenizer.index_word[next_idx]

        result += next_char
        seed = seed[1:] + next_char

    return result

# ================= OUTPUT =================
seed_text = text[:50]

print("\nGenerated Text (Transformer – Stable Version):\n")
print(generate_text(seed_text))
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Epoch 96/100
34/34 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - loss: 0.0033
Epoch 97/100
34/34 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - loss: 0.0033
Epoch 98/100
34/34 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - loss: 0.0031
Epoch 99/100
34/34 ━━━━━━━━━━━━━━━━━━━━ 0s 9ms/step - loss: 0.0030
Epoch 100/100
34/34 ━━━━━━━━━━━━━━━━━━━━ 0s 9ms/step - loss: 0.0029

Generated Text (Transformer — Stable Version):


artificial intelligence is one of the most important technological advancements of the modern era.
it refers to the ability of machines to perform tasks that normally require human intelligence such as
learning, reasoning, problem solving, perception, and decision making.

artificial intelligence systems are widely used in healthcare for disease diagnosis, medical imaging,
drug discovery, and patient monitoring. in the education sector, artificial intelligence enables
personalized learning experiences by adapting content based on student performance and behavior.

machine learning is a core subfield of artificial intelligence that focuses on
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