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import numpy as np
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.callbacks import EarlyStopping

# Tekst źródłowy do nauki
input_text = (
    "AI research has tried and discarded many different approaches,
    including "
    "simulating the brain, modeling human problem solving, formal
    logic, "
    "large databases of knowledge, and imitating animal behavior"
)

# Przygotowanie mapowania znaków
unique_chars = sorted(set(input_text))
char2int = {ch: idx for idx, ch in enumerate(unique_chars)}
int2char = {idx: ch for ch, idx in char2int.items()}

# Parametry sekwencji
sequence_len = 40

# Generowanie danych wejściowych i oczekiwanych wyjść
sequences = []
next_chars = []

for i in range(len(input_text) - sequence_len):
    seq = input_text[i:i + sequence_len]
    next_c = input_text[i + sequence_len]
    sequences.append([char2int[c] for c in seq])
    next_chars.append(char2int[next_c])

X = np.array(sequences)
y = to_categorical(next_chars, num_classes=len(unique_chars))

# Budowa sieci neuronowej
model = Sequential([
    Embedding(input_dim=len(unique_chars), output_dim=32),
    LSTM(128),
    Dense(len(unique_chars), activation='softmax')
])

# Kompilacja modelu
model.compile(optimizer=Adam(learning_rate=0.01),
              loss='categorical_crossentropy')

# Wczesne zatrzymanie uczenia przy braku poprawy

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stop_callback = EarlyStopping(monitor='loss', patience=10,
restore_best_weights=True)

# Trening
history = model.fit(X, y, batch_size=32, epochs=20,
callbacks=[stop_callback])

# Wynik końcowy
print(f"Final training loss: {history.history['loss'][-1]:.4f}")

```

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Epoch 1/20
5/5 _____ 2s 13ms/step - loss: 3.2286
Epoch 2/20
5/5 _____ 0s 12ms/step - loss: 3.0532
Epoch 3/20
5/5 _____ 0s 12ms/step - loss: 2.9430
Epoch 4/20
5/5 _____ 0s 12ms/step - loss: 2.8513
Epoch 5/20
5/5 _____ 0s 12ms/step - loss: 2.8036
Epoch 6/20
5/5 _____ 0s 12ms/step - loss: 2.6417
Epoch 7/20
5/5 _____ 0s 12ms/step - loss: 2.4741
Epoch 8/20
5/5 _____ 0s 12ms/step - loss: 2.1523
Epoch 9/20
5/5 _____ 0s 12ms/step - loss: 1.9568
Epoch 10/20
5/5 _____ 0s 12ms/step - loss: 1.6594
Epoch 11/20
5/5 _____ 0s 12ms/step - loss: 1.4406
Epoch 12/20
5/5 _____ 0s 12ms/step - loss: 1.1218
Epoch 13/20
5/5 _____ 0s 12ms/step - loss: 0.8029
Epoch 14/20
5/5 _____ 0s 12ms/step - loss: 0.5505
Epoch 15/20
5/5 _____ 0s 12ms/step - loss: 0.3969
Epoch 16/20
5/5 _____ 0s 12ms/step - loss: 0.2218
Epoch 17/20
5/5 _____ 0s 12ms/step - loss: 0.1419
Epoch 18/20
5/5 _____ 0s 12ms/step - loss: 0.0981
Epoch 19/20
5/5 _____ 0s 12ms/step - loss: 0.0800
Epoch 20/20

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5/5 ————— 0s 12ms/step - loss: 0.0581
Final training loss: 0.0561