```python
#Matematyka Konkretna
#Laboratorium 11
#Zboś Maciej https://github.com/Myriks123/MK
#Wariant 1

import numpy as np
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense

text = "Artificial intelligence (AI) is intelligence—perceiving,
synthesizing, and inferring information—demonstrated by machines, as
opposed to intelligence displayed by non-human animals or by humans"

tokenizer = Tokenizer()
tokenizer.fit_on_texts([text])
total_words = len(tokenizer.word_index) + 1

input_sequences = []
for i in range(1, len(text.split())):
    n_gram_sequence = text.split()[:i+1]
    input_sequences.append(" ".join(n_gram_sequence))

max_sequence_len = max([len(seq.split()) for seq in input_sequences])
input_sequences =
pad_sequences(tokenizer.texts_to_sequences(input_sequences),
                              maxlen=max_sequence_len,
padding='pre')

X, y = input_sequences[:, :-1], input_sequences[:, -1]
y = to_categorical(y, num_classes=total_words)

model = Sequential()
model.add(Embedding(total_words, 50, input_length=max_sequence_len-1))
model.add(LSTM(100))
model.add(Dense(total_words, activation='softmax'))
model.compile(loss='categorical_crossentropy', optimizer='adam',
metrics=['accuracy'])

model.fit(X, y, epochs=100, verbose=1)

# Ocenianie dokładności na danych treningowych
loss, accuracy = model.evaluate(X, y, verbose=0)
print(f'Treningowa dokładność: {accuracy * 100:.2f}%')
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Epoch 1/100
1/1 [==============================] - 2s 2s/step - loss: 3.0433 -
accuracy: 0.1429
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Epoch 2/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0372 -
accuracy: 0.0952
Epoch 3/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0309 -
accuracy: 0.1429
Epoch 4/100
1/1 [==============================] - 0s 10ms/step - loss: 3.0244 -
accuracy: 0.1429
Epoch 5/100
1/1 [==============================] - 0s 8ms/step - loss: 3.0173 -
accuracy: 0.1429
Epoch 6/100
1/1 [==============================] - 0s 8ms/step - loss: 3.0094 -
accuracy: 0.1429
Epoch 7/100
1/1 [==============================] - 0s 11ms/step - loss: 3.0005 -
accuracy: 0.1429
Epoch 8/100
1/1 [==============================] - 0s 8ms/step - loss: 2.9901 -
accuracy: 0.1429
Epoch 9/100
1/1 [==============================] - 0s 9ms/step - loss: 2.9778 -
accuracy: 0.1429
Epoch 10/100
1/1 [==============================] - 0s 9ms/step - loss: 2.9628 -
accuracy: 0.1429
Epoch 11/100
1/1 [==============================] - 0s 9ms/step - loss: 2.9443 -
accuracy: 0.1429
Epoch 12/100
1/1 [==============================] - 0s 10ms/step - loss: 2.9213 -
accuracy: 0.1429
Epoch 13/100
1/1 [==============================] - 0s 10ms/step - loss: 2.8935 -
accuracy: 0.1429
Epoch 14/100
1/1 [==============================] - 0s 9ms/step - loss: 2.8639 -
accuracy: 0.1429
Epoch 15/100
1/1 [==============================] - 0s 9ms/step - loss: 2.8454 -
accuracy: 0.1429
Epoch 16/100
1/1 [==============================] - 0s 9ms/step - loss: 2.8419 -
accuracy: 0.1429
Epoch 17/100
1/1 [==============================] - 0s 8ms/step - loss: 2.8222 -
accuracy: 0.1429
Epoch 18/100
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1/1 [==============================] - 0s 10ms/step - loss: 2.7914 -
accuracy: 0.1429
Epoch 19/100
1/1 [==============================] - 0s 10ms/step - loss: 2.7632 -
accuracy: 0.1429
Epoch 20/100
1/1 [==============================] - 0s 9ms/step - loss: 2.7395 -
accuracy: 0.1429
Epoch 21/100
1/1 [==============================] - 0s 9ms/step - loss: 2.7156 -
accuracy: 0.1905
Epoch 22/100
1/1 [==============================] - 0s 9ms/step - loss: 2.6869 -
accuracy: 0.1429
Epoch 23/100
1/1 [==============================] - 0s 9ms/step - loss: 2.6511 -
accuracy: 0.1429
Epoch 24/100
1/1 [==============================] - 0s 10ms/step - loss: 2.6082 -
accuracy: 0.1905
Epoch 25/100
1/1 [==============================] - 0s 11ms/step - loss: 2.5594 -
accuracy: 0.1905
Epoch 26/100
1/1 [==============================] - 0s 10ms/step - loss: 2.5073 -
accuracy: 0.1429
Epoch 27/100
1/1 [==============================] - 0s 10ms/step - loss: 2.4547 -
accuracy: 0.1429
Epoch 28/100
1/1 [==============================] - 0s 9ms/step - loss: 2.4031 -
accuracy: 0.1429
Epoch 29/100
1/1 [==============================] - 0s 9ms/step - loss: 2.3526 -
accuracy: 0.1429
Epoch 30/100
1/1 [==============================] - 0s 10ms/step - loss: 2.3004 -
accuracy: 0.1429
Epoch 31/100
1/1 [==============================] - 0s 12ms/step - loss: 2.2493 -
accuracy: 0.1905
Epoch 32/100
1/1 [==============================] - 0s 10ms/step - loss: 2.1988 -
accuracy: 0.1905
Epoch 33/100
1/1 [==============================] - 0s 10ms/step - loss: 2.1487 -
accuracy: 0.1905
Epoch 34/100
1/1 [==============================] - 0s 10ms/step - loss: 2.1015 -
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accuracy: 0.2381
Epoch 35/100
1/1 [==============================] - 0s 10ms/step - loss: 2.0711 -
accuracy: 0.2857
Epoch 36/100
1/1 [==============================] - 0s 9ms/step - loss: 2.0450 -
accuracy: 0.3333
Epoch 37/100
1/1 [==============================] - 0s 10ms/step - loss: 1.9694 -
accuracy: 0.3810
Epoch 38/100
1/1 [==============================] - 0s 10ms/step - loss: 1.9996 -
accuracy: 0.2381
Epoch 39/100
1/1 [==============================] - 0s 10ms/step - loss: 1.9293 -
accuracy: 0.3810
Epoch 40/100
1/1 [==============================] - 0s 11ms/step - loss: 1.9168 -
accuracy: 0.3333
Epoch 41/100
1/1 [==============================] - 0s 10ms/step - loss: 1.8423 -
accuracy: 0.5238
Epoch 42/100
1/1 [==============================] - 0s 10ms/step - loss: 1.8554 -
accuracy: 0.2857
Epoch 43/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7844 -
accuracy: 0.4762
Epoch 44/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7916 -
accuracy: 0.4286
Epoch 45/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7243 -
accuracy: 0.4762
Epoch 46/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7374 -
accuracy: 0.3810
Epoch 47/100
1/1 [==============================] - 0s 9ms/step - loss: 1.6752 -
accuracy: 0.5714
Epoch 48/100
1/1 [==============================] - 0s 10ms/step - loss: 1.6777 -
accuracy: 0.5238
Epoch 49/100
1/1 [==============================] - 0s 8ms/step - loss: 1.6267 -
accuracy: 0.6190
Epoch 50/100
1/1 [==============================] - 0s 9ms/step - loss: 1.6242 -
accuracy: 0.4286
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Epoch 51/100
1/1 [==============================] - 0s 9ms/step - loss: 1.5805 -
accuracy: 0.5238
Epoch 52/100
1/1 [==============================] - 0s 9ms/step - loss: 1.5673 -
accuracy: 0.5714
Epoch 53/100
1/1 [==============================] - 0s 9ms/step - loss: 1.5424 -
accuracy: 0.6667
Epoch 54/100
1/1 [==============================] - 0s 9ms/step - loss: 1.5073 -
accuracy: 0.6190
Epoch 55/100
1/1 [==============================] - 0s 9ms/step - loss: 1.5026 -
accuracy: 0.6190
Epoch 56/100
1/1 [==============================] - 0s 9ms/step - loss: 1.4609 -
accuracy: 0.6190
Epoch 57/100
1/1 [==============================] - 0s 9ms/step - loss: 1.4522 -
accuracy: 0.6190
Epoch 58/100
1/1 [==============================] - 0s 10ms/step - loss: 1.4333 -
accuracy: 0.6667
Epoch 59/100
1/1 [==============================] - 0s 9ms/step - loss: 1.3959 -
accuracy: 0.6667
Epoch 60/100
1/1 [==============================] - 0s 9ms/step - loss: 1.3915 -
accuracy: 0.6667
Epoch 61/100
1/1 [==============================] - 0s 10ms/step - loss: 1.3725 -
accuracy: 0.6667
Epoch 62/100
1/1 [==============================] - 0s 10ms/step - loss: 1.3343 -
accuracy: 0.7143
Epoch 63/100
1/1 [==============================] - 0s 10ms/step - loss: 1.3297 -
accuracy: 0.7143
Epoch 64/100
1/1 [==============================] - 0s 11ms/step - loss: 1.3228 -
accuracy: 0.7143
Epoch 65/100
1/1 [==============================] - 0s 9ms/step - loss: 1.2820 -
accuracy: 0.6667
Epoch 66/100
1/1 [==============================] - 0s 9ms/step - loss: 1.2636 -
accuracy: 0.7143
Epoch 67/100
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1/1 [==============================] - 0s 9ms/step - loss: 1.2637 -
accuracy: 0.7619
Epoch 68/100
1/1 [==============================] - 0s 10ms/step - loss: 1.2379 -
accuracy: 0.7619
Epoch 69/100
1/1 [==============================] - 0s 9ms/step - loss: 1.2078 -
accuracy: 0.8095
Epoch 70/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1914 -
accuracy: 0.8095
Epoch 71/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1853 -
accuracy: 0.7619
Epoch 72/100
1/1 [==============================] - 0s 11ms/step - loss: 1.1806 -
accuracy: 0.7619
Epoch 73/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1520 -
accuracy: 0.7619
Epoch 74/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1267 -
accuracy: 0.8095
Epoch 75/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1103 -
accuracy: 0.7619
Epoch 76/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1043 -
accuracy: 0.7143
Epoch 77/100
1/1 [==============================] - 0s 8ms/step - loss: 1.1065 -
accuracy: 0.8095
Epoch 78/100
1/1 [==============================] - 0s 8ms/step - loss: 1.0835 -
accuracy: 0.7619
Epoch 79/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0608 -
accuracy: 0.8095
Epoch 80/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0391 -
accuracy: 0.7619
Epoch 81/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0238 -
accuracy: 0.8095
Epoch 82/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0146 -
accuracy: 0.8571
Epoch 83/100
1/1 [==============================] - 0s 8ms/step - loss: 1.0047 -
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accuracy: 0.7619
Epoch 84/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0051 -
accuracy: 0.8571
Epoch 85/100
1/1 [==============================] - 0s 10ms/step - loss: 0.9928 -
accuracy: 0.8095
Epoch 86/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9903 -
accuracy: 0.8571
Epoch 87/100
1/1 [==============================] - 0s 10ms/step - loss: 0.9505 -
accuracy: 0.8095
Epoch 88/100
1/1 [==============================] - 0s 10ms/step - loss: 0.9337 -
accuracy: 0.9524
Epoch 89/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9342 -
accuracy: 0.9048
Epoch 90/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9224 -
accuracy: 0.8571
Epoch 91/100
1/1 [==============================] - 0s 8ms/step - loss: 0.9090 -
accuracy: 0.9048
Epoch 92/100
1/1 [==============================] - 0s 9ms/step - loss: 0.8869 -
accuracy: 0.9524
Epoch 93/100
1/1 [==============================] - 0s 10ms/step - loss: 0.8793 -
accuracy: 0.9524
Epoch 94/100
1/1 [==============================] - 0s 8ms/step - loss: 0.8812 -
accuracy: 0.9048
Epoch 95/100
1/1 [==============================] - 0s 9ms/step - loss: 0.8596 -
accuracy: 0.9048
Epoch 96/100
1/1 [==============================] - 0s 9ms/step - loss: 0.8426 -
accuracy: 0.9048
Epoch 97/100
1/1 [==============================] - 0s 11ms/step - loss: 0.8326 -
accuracy: 0.9048
Epoch 98/100
1/1 [==============================] - 0s 11ms/step - loss: 0.8270 -
accuracy: 0.9524
Epoch 99/100
1/1 [==============================] - 0s 10ms/step - loss: 0.8257 -
accuracy: 0.9048
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Epoch 100/100
1/1 [==============================] - 0s 14ms/step - loss: 0.8065 -
accuracy: 0.9524
Treningowa dokładność: 95.24%
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