```python
#Matematyka Konkretna
#Laboratorium 11
#Biegun Daniel https://github.com/S1Daniel/MK
#Wariant 2

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 = "Example tasks in which this is done include speech
recognition, computer vision, translation between (natural) languages,
as well as other mappings of inputs"

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}%')


Epoch 1/100
1/1 [==============================] - 2s 2s/step - loss: 3.1325 -
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accuracy: 0.0909
Epoch 2/100
1/1 [==============================] - 0s 10ms/step - loss: 3.1273 -
accuracy: 0.0909
Epoch 3/100
1/1 [==============================] - 0s 9ms/step - loss: 3.1219 -
accuracy: 0.1818
Epoch 4/100
1/1 [==============================] - 0s 10ms/step - loss: 3.1162 -
accuracy: 0.1818
Epoch 5/100
1/1 [==============================] - 0s 9ms/step - loss: 3.1100 -
accuracy: 0.1818
Epoch 6/100
1/1 [==============================] - 0s 9ms/step - loss: 3.1030 -
accuracy: 0.1818
Epoch 7/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0951 -
accuracy: 0.1818
Epoch 8/100
1/1 [==============================] - 0s 10ms/step - loss: 3.0861 -
accuracy: 0.1818
Epoch 9/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0755 -
accuracy: 0.1818
Epoch 10/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0628 -
accuracy: 0.1818
Epoch 11/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0475 -
accuracy: 0.1818
Epoch 12/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0286 -
accuracy: 0.1818
Epoch 13/100
1/1 [==============================] - 0s 9ms/step - loss: 3.0050 -
accuracy: 0.1364
Epoch 14/100
1/1 [==============================] - 0s 9ms/step - loss: 2.9755 -
accuracy: 0.1364
Epoch 15/100
1/1 [==============================] - 0s 9ms/step - loss: 2.9389 -
accuracy: 0.1364
Epoch 16/100
1/1 [==============================] - 0s 9ms/step - loss: 2.8954 -
accuracy: 0.1364
Epoch 17/100
1/1 [==============================] - 0s 9ms/step - loss: 2.8480 -
accuracy: 0.1364
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Epoch 18/100
1/1 [==============================] - 0s 8ms/step - loss: 2.7992 -
accuracy: 0.1364
Epoch 19/100
1/1 [==============================] - 0s 9ms/step - loss: 2.7406 -
accuracy: 0.1364
Epoch 20/100
1/1 [==============================] - 0s 10ms/step - loss: 2.6695 -
accuracy: 0.1364
Epoch 21/100
1/1 [==============================] - 0s 9ms/step - loss: 2.6070 -
accuracy: 0.1818
Epoch 22/100
1/1 [==============================] - 0s 9ms/step - loss: 2.5557 -
accuracy: 0.1818
Epoch 23/100
1/1 [==============================] - 0s 10ms/step - loss: 2.4860 -
accuracy: 0.1818
Epoch 24/100
1/1 [==============================] - 0s 9ms/step - loss: 2.4364 -
accuracy: 0.1364
Epoch 25/100
1/1 [==============================] - 0s 9ms/step - loss: 2.3821 -
accuracy: 0.1364
Epoch 26/100
1/1 [==============================] - 0s 9ms/step - loss: 2.3195 -
accuracy: 0.2273
Epoch 27/100
1/1 [==============================] - 0s 9ms/step - loss: 2.2779 -
accuracy: 0.2727
Epoch 28/100
1/1 [==============================] - 0s 10ms/step - loss: 2.2155 -
accuracy: 0.3182
Epoch 29/100
1/1 [==============================] - 0s 8ms/step - loss: 2.1801 -
accuracy: 0.2727
Epoch 30/100
1/1 [==============================] - 0s 9ms/step - loss: 2.1200 -
accuracy: 0.2727
Epoch 31/100
1/1 [==============================] - 0s 9ms/step - loss: 2.0867 -
accuracy: 0.3182
Epoch 32/100
1/1 [==============================] - 0s 17ms/step - loss: 2.0332 -
accuracy: 0.3182
Epoch 33/100
1/1 [==============================] - 0s 11ms/step - loss: 1.9889 -
accuracy: 0.3182
Epoch 34/100
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1/1 [==============================] - 0s 12ms/step - loss: 1.9562 -
accuracy: 0.3636
Epoch 35/100
1/1 [==============================] - 0s 8ms/step - loss: 1.9015 -
accuracy: 0.3636
Epoch 36/100
1/1 [==============================] - 0s 9ms/step - loss: 1.8582 -
accuracy: 0.3182
Epoch 37/100
1/1 [==============================] - 0s 9ms/step - loss: 1.8412 -
accuracy: 0.4091
Epoch 38/100
1/1 [==============================] - 0s 9ms/step - loss: 1.8209 -
accuracy: 0.3636
Epoch 39/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7466 -
accuracy: 0.4091
Epoch 40/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7428 -
accuracy: 0.4091
Epoch 41/100
1/1 [==============================] - 0s 9ms/step - loss: 1.7430 -
accuracy: 0.4091
Epoch 42/100
1/1 [==============================] - 0s 9ms/step - loss: 1.6521 -
accuracy: 0.4545
Epoch 43/100
1/1 [==============================] - 0s 10ms/step - loss: 1.7040 -
accuracy: 0.3182
Epoch 44/100
1/1 [==============================] - 0s 9ms/step - loss: 1.6418 -
accuracy: 0.4545
Epoch 45/100
1/1 [==============================] - 0s 9ms/step - loss: 1.6199 -
accuracy: 0.4545
Epoch 46/100
1/1 [==============================] - 0s 10ms/step - loss: 1.5845 -
accuracy: 0.5455
Epoch 47/100
1/1 [==============================] - 0s 9ms/step - loss: 1.5437 -
accuracy: 0.6818
Epoch 48/100
1/1 [==============================] - 0s 10ms/step - loss: 1.5419 -
accuracy: 0.5455
Epoch 49/100
1/1 [==============================] - 0s 9ms/step - loss: 1.4999 -
accuracy: 0.6364
Epoch 50/100
1/1 [==============================] - 0s 10ms/step - loss: 1.4968 -
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accuracy: 0.6818
Epoch 51/100
1/1 [==============================] - 0s 9ms/step - loss: 1.4433 -
accuracy: 0.7727
Epoch 52/100
1/1 [==============================] - 0s 8ms/step - loss: 1.4487 -
accuracy: 0.6818
Epoch 53/100
1/1 [==============================] - 0s 9ms/step - loss: 1.4027 -
accuracy: 0.8182
Epoch 54/100
1/1 [==============================] - 0s 10ms/step - loss: 1.4098 -
accuracy: 0.7273
Epoch 55/100
1/1 [==============================] - 0s 9ms/step - loss: 1.3607 -
accuracy: 0.8182
Epoch 56/100
1/1 [==============================] - 0s 9ms/step - loss: 1.3644 -
accuracy: 0.7273
Epoch 57/100
1/1 [==============================] - 0s 9ms/step - loss: 1.3243 -
accuracy: 0.8636
Epoch 58/100
1/1 [==============================] - 0s 10ms/step - loss: 1.3266 -
accuracy: 0.7273
Epoch 59/100
1/1 [==============================] - 0s 10ms/step - loss: 1.2993 -
accuracy: 0.8182
Epoch 60/100
1/1 [==============================] - 0s 10ms/step - loss: 1.2812 -
accuracy: 0.8182
Epoch 61/100
1/1 [==============================] - 0s 10ms/step - loss: 1.2743 -
accuracy: 0.7273
Epoch 62/100
1/1 [==============================] - 0s 9ms/step - loss: 1.2399 -
accuracy: 0.8636
Epoch 63/100
1/1 [==============================] - 0s 10ms/step - loss: 1.2351 -
accuracy: 0.8182
Epoch 64/100
1/1 [==============================] - 0s 8ms/step - loss: 1.2137 -
accuracy: 0.8182
Epoch 65/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1919 -
accuracy: 0.9091
Epoch 66/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1853 -
accuracy: 0.8636
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Epoch 67/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1647 -
accuracy: 0.9091
Epoch 68/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1456 -
accuracy: 0.9545
Epoch 69/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1358 -
accuracy: 0.9091
Epoch 70/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1234 -
accuracy: 0.9091
Epoch 71/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1084 -
accuracy: 0.9091
Epoch 72/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0903 -
accuracy: 0.9545
Epoch 73/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0750 -
accuracy: 0.9545
Epoch 74/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0618 -
accuracy: 0.9545
Epoch 75/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0509 -
accuracy: 0.9545
Epoch 76/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0490 -
accuracy: 0.8636
Epoch 77/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0808 -
accuracy: 0.6818
Epoch 78/100
1/1 [==============================] - 0s 9ms/step - loss: 1.3089 -
accuracy: 0.5000
Epoch 79/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0113 -
accuracy: 0.9545
Epoch 80/100
1/1 [==============================] - 0s 10ms/step - loss: 1.3603 -
accuracy: 0.4091
Epoch 81/100
1/1 [==============================] - 0s 10ms/step - loss: 1.4737 -
accuracy: 0.4545
Epoch 82/100
1/1 [==============================] - 0s 11ms/step - loss: 1.6648 -
accuracy: 0.4091
Epoch 83/100
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1/1 [==============================] - 0s 10ms/step - loss: 1.2324 -
accuracy: 0.5909
Epoch 84/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1629 -
accuracy: 0.6364
Epoch 85/100
1/1 [==============================] - 0s 9ms/step - loss: 1.4171 -
accuracy: 0.4091
Epoch 86/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0733 -
accuracy: 0.7273
Epoch 87/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0678 -
accuracy: 0.7727
Epoch 88/100
1/1 [==============================] - 0s 8ms/step - loss: 1.2425 -
accuracy: 0.4545
Epoch 89/100
1/1 [==============================] - 0s 9ms/step - loss: 1.1142 -
accuracy: 0.7273
Epoch 90/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9741 -
accuracy: 1.0000
Epoch 91/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0744 -
accuracy: 0.6818
Epoch 92/100
1/1 [==============================] - 0s 10ms/step - loss: 1.1301 -
accuracy: 0.5455
Epoch 93/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0018 -
accuracy: 0.8636
Epoch 94/100
1/1 [==============================] - 0s 10ms/step - loss: 0.9634 -
accuracy: 0.9545
Epoch 95/100
1/1 [==============================] - 0s 9ms/step - loss: 1.0289 -
accuracy: 0.9545
Epoch 96/100
1/1 [==============================] - 0s 10ms/step - loss: 1.0317 -
accuracy: 0.9545
Epoch 97/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9603 -
accuracy: 0.9545
Epoch 98/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9367 -
accuracy: 0.9545
Epoch 99/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9781 -
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accuracy: 0.8636
Epoch 100/100
1/1 [==============================] - 0s 9ms/step - loss: 0.9789 -
accuracy: 0.8182
Treningowa dokładność: 95.45%
```