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#Matematyka Konkretna
#Laboratorium 9
#Senecki Daniel https://github.com/Debenter/MKLab9
#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
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loss, accuracy = model.evaluate(X, y, verbose=0)
print(f'Treningowa dokładność: {accuracy * 100:.2f}%')
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Epoch 1/100
1/1 [==============================] - 5s 5s/step - loss: 3.0469 -
accuracy: 0.0476
Epoch 2/100
1/1 [==============================] - 0s 34ms/step - loss: 3.0415 -
accuracy: 0.0476
Epoch 3/100
1/1 [==============================] - 0s 33ms/step - loss: 3.0361 -
accuracy: 0.0952
Epoch 4/100
1/1 [==============================] - 0s 29ms/step - loss: 3.0305 -
accuracy: 0.1905
Epoch 5/100
1/1 [==============================] - 0s 28ms/step - loss: 3.0245 -
accuracy: 0.1905
Epoch 6/100
1/1 [==============================] - 0s 37ms/step - loss: 3.0180 -
accuracy: 0.1905
Epoch 7/100
1/1 [==============================] - 0s 34ms/step - loss: 3.0107 -
accuracy: 0.1905
Epoch 8/100
1/1 [==============================] - 0s 29ms/step - loss: 3.0025 -
accuracy: 0.1905
Epoch 9/100
1/1 [==============================] - 0s 41ms/step - loss: 2.9929 -
accuracy: 0.1905
Epoch 10/100
1/1 [==============================] - 0s 34ms/step - loss: 2.9815 -
accuracy: 0.1429
Epoch 11/100
1/1 [==============================] - 0s 41ms/step - loss: 2.9678 -
accuracy: 0.1429
Epoch 12/100
1/1 [==============================] - 0s 32ms/step - loss: 2.9509 -
accuracy: 0.1429
Epoch 13/100
1/1 [==============================] - 0s 53ms/step - loss: 2.9298 -
accuracy: 0.1429
Epoch 14/100
1/1 [==============================] - 0s 37ms/step - loss: 2.9032 -
accuracy: 0.1429
Epoch 15/100
1/1 [==============================] - 0s 37ms/step - loss: 2.8700 -
accuracy: 0.1429
Epoch 16/100
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1/1 [==============================] - 0s 44ms/step - loss: 2.8300 -
accuracy: 0.1905
Epoch 17/100
1/1 [==============================] - 0s 44ms/step - loss: 2.7862 -
accuracy: 0.1905
Epoch 18/100
1/1 [==============================] - 0s 41ms/step - loss: 2.7436 -
accuracy: 0.1905
Epoch 19/100
1/1 [==============================] - 0s 49ms/step - loss: 2.6950 -
accuracy: 0.1905
Epoch 20/100
1/1 [==============================] - 0s 37ms/step - loss: 2.6337 -
accuracy: 0.1429
Epoch 21/100
1/1 [==============================] - 0s 34ms/step - loss: 2.5791 -
accuracy: 0.1429
Epoch 22/100
1/1 [==============================] - 0s 36ms/step - loss: 2.5399 -
accuracy: 0.1905
Epoch 23/100
1/1 [==============================] - 0s 37ms/step - loss: 2.4799 -
accuracy: 0.1905
Epoch 24/100
1/1 [==============================] - 0s 32ms/step - loss: 2.4333 -
accuracy: 0.1429
Epoch 25/100
1/1 [==============================] - 0s 32ms/step - loss: 2.4097 -
accuracy: 0.2381
Epoch 26/100
1/1 [==============================] - 0s 30ms/step - loss: 2.3613 -
accuracy: 0.1429
Epoch 27/100
1/1 [==============================] - 0s 31ms/step - loss: 2.3369 -
accuracy: 0.1905
Epoch 28/100
1/1 [==============================] - 0s 34ms/step - loss: 2.3040 -
accuracy: 0.1905
Epoch 29/100
1/1 [==============================] - 0s 35ms/step - loss: 2.2622 -
accuracy: 0.1429
Epoch 30/100
1/1 [==============================] - 0s 29ms/step - loss: 2.2361 -
accuracy: 0.1905
Epoch 31/100
1/1 [==============================] - 0s 29ms/step - loss: 2.1845 -
accuracy: 0.2381
Epoch 32/100
1/1 [==============================] - 0s 28ms/step - loss: 2.1575 -
accuracy: 0.2857
Epoch 33/100
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1/1 [==============================] - 0s 33ms/step - loss: 2.1044 -
accuracy: 0.2857
Epoch 34/100
1/1 [==============================] - 0s 40ms/step - loss: 2.0827 -
accuracy: 0.2857
Epoch 35/100
1/1 [==============================] - 0s 33ms/step - loss: 2.0342 -
accuracy: 0.2381
Epoch 36/100
1/1 [==============================] - 0s 46ms/step - loss: 2.0130 -
accuracy: 0.2381
Epoch 37/100
1/1 [==============================] - 0s 48ms/step - loss: 1.9919 -
accuracy: 0.3333
Epoch 38/100
1/1 [==============================] - 0s 45ms/step - loss: 1.9408 -
accuracy: 0.3333
Epoch 39/100
1/1 [==============================] - 0s 35ms/step - loss: 1.9188 -
accuracy: 0.2381
Epoch 40/100
1/1 [==============================] - 0s 39ms/step - loss: 1.9173 -
accuracy: 0.3333
Epoch 41/100
1/1 [==============================] - 0s 32ms/step - loss: 1.8570 -
accuracy: 0.4762
Epoch 42/100
1/1 [==============================] - 0s 38ms/step - loss: 1.8238 -
accuracy: 0.4762
Epoch 43/100
1/1 [==============================] - 0s 35ms/step - loss: 1.8234 -
accuracy: 0.4286
Epoch 44/100
1/1 [==============================] - 0s 33ms/step - loss: 1.7821 -
accuracy: 0.3333
Epoch 45/100
1/1 [==============================] - 0s 34ms/step - loss: 1.7444 -
accuracy: 0.4286
Epoch 46/100
1/1 [==============================] - 0s 39ms/step - loss: 1.7208 -
accuracy: 0.4286
Epoch 47/100
1/1 [==============================] - 0s 34ms/step - loss: 1.7103 -
accuracy: 0.5714
Epoch 48/100
1/1 [==============================] - 0s 44ms/step - loss: 1.7345 -
accuracy: 0.5238
Epoch 49/100
1/1 [==============================] - 0s 38ms/step - loss: 1.6516 -
accuracy: 0.6667
Epoch 50/100
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1/1 [==============================] - 0s 31ms/step - loss: 1.6168 -
accuracy: 0.7619
Epoch 51/100
1/1 [==============================] - 0s 36ms/step - loss: 1.6235 -
accuracy: 0.6190
Epoch 52/100
1/1 [==============================] - 0s 39ms/step - loss: 1.6191 -
accuracy: 0.5714
Epoch 53/100
1/1 [==============================] - 0s 36ms/step - loss: 1.6351 -
accuracy: 0.4286
Epoch 54/100
1/1 [==============================] - 0s 37ms/step - loss: 1.5382 -
accuracy: 0.6190
Epoch 55/100
1/1 [==============================] - 0s 31ms/step - loss: 1.6825 -
accuracy: 0.3810
Epoch 56/100
1/1 [==============================] - 0s 27ms/step - loss: 1.6165 -
accuracy: 0.3810
Epoch 57/100
1/1 [==============================] - 0s 32ms/step - loss: 1.6709 -
accuracy: 0.3810
Epoch 58/100
1/1 [==============================] - 0s 40ms/step - loss: 1.4979 -
accuracy: 0.5714
Epoch 59/100
1/1 [==============================] - 0s 41ms/step - loss: 1.5930 -
accuracy: 0.3333
Epoch 60/100
1/1 [==============================] - 0s 30ms/step - loss: 1.5030 -
accuracy: 0.5238
Epoch 61/100
1/1 [==============================] - 0s 37ms/step - loss: 1.4597 -
accuracy: 0.6667
Epoch 62/100
1/1 [==============================] - 0s 51ms/step - loss: 1.5122 -
accuracy: 0.5714
Epoch 63/100
1/1 [==============================] - 0s 38ms/step - loss: 1.4508 -
accuracy: 0.7143
Epoch 64/100
1/1 [==============================] - 0s 36ms/step - loss: 1.4013 -
accuracy: 0.8095
Epoch 65/100
1/1 [==============================] - 0s 38ms/step - loss: 1.4452 -
accuracy: 0.5238
Epoch 66/100
1/1 [==============================] - 0s 32ms/step - loss: 1.3968 -
accuracy: 0.5238
Epoch 67/100
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1/1 [==============================] - 0s 39ms/step - loss: 1.3603 -
accuracy: 0.7143
Epoch 68/100
1/1 [==============================] - 0s 31ms/step - loss: 1.3842 -
accuracy: 0.6667
Epoch 69/100
1/1 [==============================] - 0s 42ms/step - loss: 1.3514 -
accuracy: 0.7143
Epoch 70/100
1/1 [==============================] - 0s 33ms/step - loss: 1.3122 -
accuracy: 0.9048
Epoch 71/100
1/1 [==============================] - 0s 33ms/step - loss: 1.3260 -
accuracy: 0.7619
Epoch 72/100
1/1 [==============================] - 0s 34ms/step - loss: 1.3030 -
accuracy: 0.8571
Epoch 73/100
1/1 [==============================] - 0s 32ms/step - loss: 1.2678 -
accuracy: 0.9048
Epoch 74/100
1/1 [==============================] - 0s 28ms/step - loss: 1.2730 -
accuracy: 0.8095
Epoch 75/100
1/1 [==============================] - 0s 31ms/step - loss: 1.2536 -
accuracy: 0.8095
Epoch 76/100
1/1 [==============================] - 0s 29ms/step - loss: 1.2213 -
accuracy: 0.9048
Epoch 77/100
1/1 [==============================] - 0s 32ms/step - loss: 1.2237 -
accuracy: 0.7143
Epoch 78/100
1/1 [==============================] - 0s 35ms/step - loss: 1.2020 -
accuracy: 0.7619
Epoch 79/100
1/1 [==============================] - 0s 37ms/step - loss: 1.1773 -
accuracy: 0.9048
Epoch 80/100
1/1 [==============================] - 0s 30ms/step - loss: 1.1762 -
accuracy: 0.8571
Epoch 81/100
1/1 [==============================] - 0s 38ms/step - loss: 1.1499 -
accuracy: 0.9048
Epoch 82/100
1/1 [==============================] - 0s 39ms/step - loss: 1.1353 -
accuracy: 0.8571
Epoch 83/100
1/1 [==============================] - 0s 39ms/step - loss: 1.1281 -
accuracy: 0.8571
Epoch 84/100
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1/1 [==============================] - 0s 39ms/step - loss: 1.1017 -
accuracy: 0.9048
Epoch 85/100
1/1 [==============================] - 0s 42ms/step - loss: 1.0967 -
accuracy: 0.8571
Epoch 86/100
1/1 [==============================] - 0s 56ms/step - loss: 1.0767 -
accuracy: 0.9048
Epoch 87/100
1/1 [==============================] - 0s 49ms/step - loss: 1.0643 -
accuracy: 0.8571
Epoch 88/100
1/1 [==============================] - 0s 33ms/step - loss: 1.0511 -
accuracy: 0.9524
Epoch 89/100
1/1 [==============================] - 0s 68ms/step - loss: 1.0348 -
accuracy: 1.0000
Epoch 90/100
1/1 [==============================] - 0s 48ms/step - loss: 1.0254 -
accuracy: 1.0000
Epoch 91/100
1/1 [==============================] - 0s 35ms/step - loss: 1.0068 -
accuracy: 1.0000
Epoch 92/100
1/1 [==============================] - 0s 34ms/step - loss: 0.9992 -
accuracy: 1.0000
Epoch 93/100
1/1 [==============================] - 0s 44ms/step - loss: 0.9829 -
accuracy: 1.0000
Epoch 94/100
1/1 [==============================] - 0s 28ms/step - loss: 0.9715 -
accuracy: 1.0000
Epoch 95/100
1/1 [==============================] - 0s 29ms/step - loss: 0.9613 -
accuracy: 1.0000
Epoch 96/100
1/1 [==============================] - 0s 37ms/step - loss: 0.9436 -
accuracy: 1.0000
Epoch 97/100
1/1 [==============================] - 0s 32ms/step - loss: 0.9365 -
accuracy: 1.0000
Epoch 98/100
1/1 [==============================] - 0s 34ms/step - loss: 0.9244 -
accuracy: 1.0000
Epoch 99/100
1/1 [==============================] - 0s 28ms/step - loss: 0.9094 -
accuracy: 1.0000
Epoch 100/100
1/1 [==============================] - 0s 32ms/step - loss: 0.8982 -
accuracy: 1.0000
Treningowa dokładność: 100.00%
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