

#Matematyka konkretna
#Wariant 15 Karolina Baron

#Dane wejściowe składają się z 30 sekwencji po 20 kroków czasowych
każda. Każda sekwencja wejściowa jest generowana
#z jednolitego rozkładu losowego, który jest zaokrąglany do 0, 0.5 lub
1. Cele wyjściowe `t` to liczba wystąpień „0.5” w sekwencji.

```
import numpy as np
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import SimpleRNN, Dense

def generate_data_count(num_samples, seq_length):
    X = np.random.choice([0, 0.5, 1], size=(num_samples, seq_length,
1))
    y = np.sum(X == 0.5, axis=1)
    return X, y

num_samples = 30 #ustawiono 30 sekwencji
seq_length = 20 #20 kroków
input_dim = 1
output_dim = 1

X_train, y_train = generate_data_count(num_samples, seq_length)

model = Sequential()
model.add(SimpleRNN(units=10, input_shape=(seq_length, input_dim)))
model.add(Dense(units=output_dim, activation='linear'))

model.compile(optimizer='adam', loss='mean_squared_error',
metrics=['mae'])

model.fit(X_train, y_train, epochs=100, batch_size=1, verbose=2)

X_test, y_test = generate_data_count(3, seq_length)
predictions = model.predict(X_test)

for i in range(len(X_test)):
    print("Input:", X_test[i].flatten())
    print("True Output:", y_test[i])
    print("Predicted Output:", predictions[i][0])
    print("\n")
```

```
Epoch 1/100
30/30 - 1s - loss: 49.7461 - mae: 6.6439 - 841ms/epoch - 28ms/step
Epoch 2/100
30/30 - 0s - loss: 44.6880 - mae: 6.2673 - 71ms/epoch - 2ms/step
Epoch 3/100
30/30 - 0s - loss: 40.0739 - mae: 5.9050 - 93ms/epoch - 3ms/step
```

```
Epoch 4/100
30/30 - 0s - loss: 34.3589 - mae: 5.3995 - 74ms/epoch - 2ms/step
Epoch 5/100
30/30 - 0s - loss: 29.0501 - mae: 4.8704 - 95ms/epoch - 3ms/step
Epoch 6/100
30/30 - 0s - loss: 24.8892 - mae: 4.4476 - 90ms/epoch - 3ms/step
Epoch 7/100
30/30 - 0s - loss: 21.6040 - mae: 4.0663 - 84ms/epoch - 3ms/step
Epoch 8/100
30/30 - 0s - loss: 18.9057 - mae: 3.7234 - 78ms/epoch - 3ms/step
Epoch 9/100
30/30 - 0s - loss: 16.6259 - mae: 3.4430 - 83ms/epoch - 3ms/step
Epoch 10/100
30/30 - 0s - loss: 14.6403 - mae: 3.1923 - 62ms/epoch - 2ms/step
Epoch 11/100
30/30 - 0s - loss: 13.0117 - mae: 2.9723 - 66ms/epoch - 2ms/step
Epoch 12/100
30/30 - 0s - loss: 11.5316 - mae: 2.7970 - 81ms/epoch - 3ms/step
Epoch 13/100
30/30 - 0s - loss: 10.3803 - mae: 2.6428 - 76ms/epoch - 3ms/step
Epoch 14/100
30/30 - 0s - loss: 9.4318 - mae: 2.5083 - 65ms/epoch - 2ms/step
Epoch 15/100
30/30 - 0s - loss: 8.5976 - mae: 2.3891 - 63ms/epoch - 2ms/step
Epoch 16/100
30/30 - 0s - loss: 7.9876 - mae: 2.3231 - 63ms/epoch - 2ms/step
Epoch 17/100
30/30 - 0s - loss: 7.4713 - mae: 2.2495 - 62ms/epoch - 2ms/step
Epoch 18/100
30/30 - 0s - loss: 7.0550 - mae: 2.1969 - 61ms/epoch - 2ms/step
Epoch 19/100
30/30 - 0s - loss: 6.7587 - mae: 2.1557 - 63ms/epoch - 2ms/step
Epoch 20/100
30/30 - 0s - loss: 6.5131 - mae: 2.1184 - 65ms/epoch - 2ms/step
Epoch 21/100
30/30 - 0s - loss: 6.3523 - mae: 2.0884 - 77ms/epoch - 3ms/step
Epoch 22/100
30/30 - 0s - loss: 6.1263 - mae: 2.0373 - 71ms/epoch - 2ms/step
Epoch 23/100
30/30 - 0s - loss: 6.0127 - mae: 2.0232 - 71ms/epoch - 2ms/step
Epoch 24/100
30/30 - 0s - loss: 5.9468 - mae: 2.0199 - 65ms/epoch - 2ms/step
Epoch 25/100
30/30 - 0s - loss: 5.8526 - mae: 2.0027 - 67ms/epoch - 2ms/step
Epoch 26/100
30/30 - 0s - loss: 5.8038 - mae: 1.9956 - 70ms/epoch - 2ms/step
Epoch 27/100
30/30 - 0s - loss: 5.7589 - mae: 1.9896 - 67ms/epoch - 2ms/step
Epoch 28/100
```

30/30 - 0s - loss: 5.7391 - mae: 1.9836 - 63ms/epoch - 2ms/step
Epoch 29/100
30/30 - 0s - loss: 5.7072 - mae: 1.9764 - 61ms/epoch - 2ms/step
Epoch 30/100
30/30 - 0s - loss: 5.6884 - mae: 1.9727 - 61ms/epoch - 2ms/step
Epoch 31/100
30/30 - 0s - loss: 5.6772 - mae: 1.9698 - 64ms/epoch - 2ms/step
Epoch 32/100
30/30 - 0s - loss: 5.6663 - mae: 1.9655 - 62ms/epoch - 2ms/step
Epoch 33/100
30/30 - 0s - loss: 5.6576 - mae: 1.9610 - 62ms/epoch - 2ms/step
Epoch 34/100
30/30 - 0s - loss: 5.6789 - mae: 1.9660 - 62ms/epoch - 2ms/step
Epoch 35/100
30/30 - 0s - loss: 5.6539 - mae: 1.9585 - 60ms/epoch - 2ms/step
Epoch 36/100
30/30 - 0s - loss: 5.6756 - mae: 1.9576 - 65ms/epoch - 2ms/step
Epoch 37/100
30/30 - 0s - loss: 5.6597 - mae: 1.9563 - 60ms/epoch - 2ms/step
Epoch 38/100
30/30 - 0s - loss: 5.6458 - mae: 1.9502 - 67ms/epoch - 2ms/step
Epoch 39/100
30/30 - 0s - loss: 5.6423 - mae: 1.9496 - 63ms/epoch - 2ms/step
Epoch 40/100
30/30 - 0s - loss: 5.6438 - mae: 1.9509 - 64ms/epoch - 2ms/step
Epoch 41/100
30/30 - 0s - loss: 5.6451 - mae: 1.9465 - 62ms/epoch - 2ms/step
Epoch 42/100
30/30 - 0s - loss: 5.6324 - mae: 1.9462 - 61ms/epoch - 2ms/step
Epoch 43/100
30/30 - 0s - loss: 5.6333 - mae: 1.9460 - 66ms/epoch - 2ms/step
Epoch 44/100
30/30 - 0s - loss: 5.6581 - mae: 1.9471 - 64ms/epoch - 2ms/step
Epoch 45/100
30/30 - 0s - loss: 5.6408 - mae: 1.9462 - 64ms/epoch - 2ms/step
Epoch 46/100
30/30 - 0s - loss: 5.6394 - mae: 1.9477 - 62ms/epoch - 2ms/step
Epoch 47/100
30/30 - 0s - loss: 5.6396 - mae: 1.9478 - 63ms/epoch - 2ms/step
Epoch 48/100
30/30 - 0s - loss: 5.6300 - mae: 1.9448 - 61ms/epoch - 2ms/step
Epoch 49/100
30/30 - 0s - loss: 5.6257 - mae: 1.9443 - 60ms/epoch - 2ms/step
Epoch 50/100
30/30 - 0s - loss: 5.6275 - mae: 1.9438 - 62ms/epoch - 2ms/step
Epoch 51/100
30/30 - 0s - loss: 5.6404 - mae: 1.9423 - 60ms/epoch - 2ms/step
Epoch 52/100
30/30 - 0s - loss: 5.6296 - mae: 1.9464 - 68ms/epoch - 2ms/step

```
Epoch 53/100
30/30 - 0s - loss: 5.6224 - mae: 1.9434 - 64ms/epoch - 2ms/step
Epoch 54/100
30/30 - 0s - loss: 5.6328 - mae: 1.9480 - 62ms/epoch - 2ms/step
Epoch 55/100
30/30 - 0s - loss: 5.6362 - mae: 1.9432 - 62ms/epoch - 2ms/step
Epoch 56/100
30/30 - 0s - loss: 5.6263 - mae: 1.9432 - 60ms/epoch - 2ms/step
Epoch 57/100
30/30 - 0s - loss: 5.6220 - mae: 1.9409 - 61ms/epoch - 2ms/step
Epoch 58/100
30/30 - 0s - loss: 5.6143 - mae: 1.9419 - 63ms/epoch - 2ms/step
Epoch 59/100
30/30 - 0s - loss: 5.6214 - mae: 1.9432 - 68ms/epoch - 2ms/step
Epoch 60/100
30/30 - 0s - loss: 5.6163 - mae: 1.9430 - 64ms/epoch - 2ms/step
Epoch 61/100
30/30 - 0s - loss: 5.6152 - mae: 1.9425 - 63ms/epoch - 2ms/step
Epoch 62/100
30/30 - 0s - loss: 5.6120 - mae: 1.9401 - 60ms/epoch - 2ms/step
Epoch 63/100
30/30 - 0s - loss: 5.6150 - mae: 1.9437 - 63ms/epoch - 2ms/step
Epoch 64/100
30/30 - 0s - loss: 5.6091 - mae: 1.9445 - 63ms/epoch - 2ms/step
Epoch 65/100
30/30 - 0s - loss: 5.6297 - mae: 1.9458 - 95ms/epoch - 3ms/step
Epoch 66/100
30/30 - 0s - loss: 5.6163 - mae: 1.9444 - 72ms/epoch - 2ms/step
Epoch 67/100
30/30 - 0s - loss: 5.6082 - mae: 1.9416 - 63ms/epoch - 2ms/step
Epoch 68/100
30/30 - 0s - loss: 5.6165 - mae: 1.9461 - 65ms/epoch - 2ms/step
Epoch 69/100
30/30 - 0s - loss: 5.6447 - mae: 1.9470 - 63ms/epoch - 2ms/step
Epoch 70/100
30/30 - 0s - loss: 5.6000 - mae: 1.9380 - 61ms/epoch - 2ms/step
Epoch 71/100
30/30 - 0s - loss: 5.6253 - mae: 1.9501 - 61ms/epoch - 2ms/step
Epoch 72/100
30/30 - 0s - loss: 5.6154 - mae: 1.9411 - 63ms/epoch - 2ms/step
Epoch 73/100
30/30 - 0s - loss: 5.6020 - mae: 1.9433 - 61ms/epoch - 2ms/step
Epoch 74/100
30/30 - 0s - loss: 5.6210 - mae: 1.9423 - 62ms/epoch - 2ms/step
Epoch 75/100
30/30 - 0s - loss: 5.5892 - mae: 1.9348 - 65ms/epoch - 2ms/step
Epoch 76/100
30/30 - 0s - loss: 5.6002 - mae: 1.9419 - 64ms/epoch - 2ms/step
Epoch 77/100
```

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30/30 - 0s - loss: 5.6089 - mae: 1.9449 - 62ms/epoch - 2ms/step
Epoch 78/100
30/30 - 0s - loss: 5.5872 - mae: 1.9390 - 63ms/epoch - 2ms/step
Epoch 79/100
30/30 - 0s - loss: 5.5857 - mae: 1.9379 - 62ms/epoch - 2ms/step
Epoch 80/100
30/30 - 0s - loss: 5.5794 - mae: 1.9375 - 61ms/epoch - 2ms/step
Epoch 81/100
30/30 - 0s - loss: 5.6163 - mae: 1.9412 - 66ms/epoch - 2ms/step
Epoch 82/100
30/30 - 0s - loss: 5.5730 - mae: 1.9356 - 64ms/epoch - 2ms/step
Epoch 83/100
30/30 - 0s - loss: 5.5921 - mae: 1.9394 - 62ms/epoch - 2ms/step
Epoch 84/100
30/30 - 0s - loss: 5.5832 - mae: 1.9408 - 64ms/epoch - 2ms/step
Epoch 85/100
30/30 - 0s - loss: 5.5807 - mae: 1.9422 - 63ms/epoch - 2ms/step
Epoch 86/100
30/30 - 0s - loss: 5.5888 - mae: 1.9363 - 62ms/epoch - 2ms/step
Epoch 87/100
30/30 - 0s - loss: 5.5734 - mae: 1.9366 - 61ms/epoch - 2ms/step
Epoch 88/100
30/30 - 0s - loss: 5.5696 - mae: 1.9344 - 62ms/epoch - 2ms/step
Epoch 89/100
30/30 - 0s - loss: 5.5664 - mae: 1.9337 - 62ms/epoch - 2ms/step
Epoch 90/100
30/30 - 0s - loss: 5.5844 - mae: 1.9441 - 63ms/epoch - 2ms/step
Epoch 91/100
30/30 - 0s - loss: 5.5910 - mae: 1.9383 - 67ms/epoch - 2ms/step
Epoch 92/100
30/30 - 0s - loss: 5.5600 - mae: 1.9349 - 64ms/epoch - 2ms/step
Epoch 93/100
30/30 - 0s - loss: 5.5616 - mae: 1.9357 - 68ms/epoch - 2ms/step
Epoch 94/100
30/30 - 0s - loss: 5.5614 - mae: 1.9368 - 70ms/epoch - 2ms/step
Epoch 95/100
30/30 - 0s - loss: 5.5510 - mae: 1.9344 - 63ms/epoch - 2ms/step
Epoch 96/100
30/30 - 0s - loss: 5.5651 - mae: 1.9367 - 62ms/epoch - 2ms/step
Epoch 97/100
30/30 - 0s - loss: 5.5540 - mae: 1.9334 - 62ms/epoch - 2ms/step
Epoch 98/100
30/30 - 0s - loss: 5.5682 - mae: 1.9334 - 63ms/epoch - 2ms/step
Epoch 99/100
30/30 - 0s - loss: 5.5517 - mae: 1.9381 - 64ms/epoch - 2ms/step
Epoch 100/100
30/30 - 0s - loss: 5.5544 - mae: 1.9375 - 70ms/epoch - 2ms/step
1/1 [=====] - 0s 129ms/step
Input: [0. 1. 1. 0. 0. 0. 1. 1. 0.5 0.5 1. 1. 0. 0. 1.]
```

```
0.5 0.5 1.  
0.5 0. ]  
True Output: [5]  
Predicted Output: 6.7791743
```

```
Input: [0.5 0. 0. 0.5 0.5 0.5 0.5 1. 0. 0. 0.5 1. 1. 0.5 0. 0.  
0. 1.  
0. 0.5]  
True Output: [8]  
Predicted Output: 6.366035
```

```
Input: [1. 0.5 0.5 1. 1. 1. 0. 1. 0. 0.5 0. 1. 0. 0.5 0. 1.  
0.5 1.  
1. 0. ]  
True Output: [5]  
Predicted Output: 6.8030972
```