```python
import numpy as np
import tensorflow as tf
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split

def generate_temperature_data(n_samples=1000):
    x = np.linspace(0, 10, n_samples)
    y = np.sin(x) + np.random.normal(0, 0.2, size=n_samples)
    return y.reshape(-1, 1)

data = generate_temperature_data()
scaler = MinMaxScaler()
data_scaled = scaler.fit_transform(data)

def create_sequences(dataset, look_back=10):
    X, Y = [], []
    for i in range(len(dataset) - look_back):
        X.append(dataset[i:i+look_back, 0])
        Y.append(dataset[i+look_back, 0])
    return np.array(X), np.array(Y)

X, y = create_sequences(data_scaled, look_back=10)
X = X.reshape(X.shape[0], X.shape[1], 1)

model_temp = tf.keras.Sequential([
    tf.keras.layers.LSTM(64, input_shape=(X.shape[1], 1)),
    tf.keras.layers.Dense(1)
])

model_temp.compile(optimizer='adam', loss='mse')
model_temp.fit(X, y, epochs=20, batch_size=32)

predicted = model_temp.predict(X)
predicted = scaler.inverse_transform(predicted)

plt.plot(scaler.inverse_transform(y.reshape(-1, 1)),
label="Rzeczywiste")
plt.plot(predicted, label="Prognozowane")
plt.legend()
plt.title("Prognozowanie temperatury - LSTM")
plt.show()
```

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Epoch 1/20

c:\Users\szymo\AppData\Local\Programs\Python\Python312\Lib\site-
packages\keras\src\layers\rnn\rnn.py:199: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
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the model instead.
  super().__init__(**kwargs)

31/31 ━━━━━━━━━━━━━━━━━━━━ 1s 1ms/step - loss: 0.2134
Epoch 2/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0116
Epoch 3/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0065
Epoch 4/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0058
Epoch 5/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0055
Epoch 6/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0053
Epoch 7/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0056
Epoch 8/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0054
Epoch 9/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0056
Epoch 10/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0051
Epoch 11/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0054
Epoch 12/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0053
Epoch 13/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0054
Epoch 14/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0050
Epoch 15/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0054
Epoch 16/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0051
Epoch 17/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0055
Epoch 18/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0055
Epoch 19/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0053
Epoch 20/20
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 1ms/step - loss: 0.0053
31/31 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step
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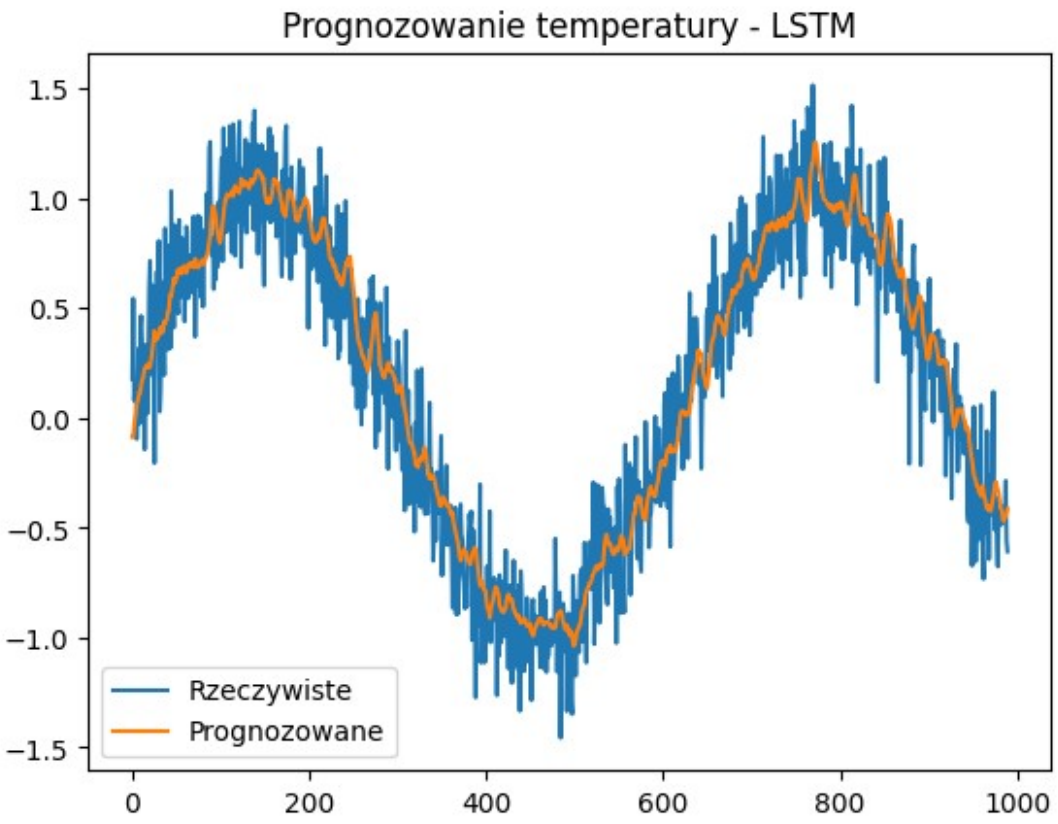


```
def generate_sensor_data(n_samples=1000, timesteps=10):
    X = np.random.normal(0, 1, (n_samples, timesteps))
    y = np.zeros(n_samples)

    anomaly_indices = np.random.choice(n_samples, size=n_samples //
10, replace=False)
    X[anomaly_indices] += np.random.normal(5, 1,
(len(anomaly_indices), timesteps))
    y[anomaly_indices] = 1
    return X.reshape((n_samples, timesteps, 1)), y

X_anomaly, y_anomaly = generate_sensor_data()
X_train, X_test, y_train, y_test = train_test_split(X_anomaly,
y_anomaly, test_size=0.2)

model_anomaly = tf.keras.Sequential([
    tf.keras.layers.LSTM(32, input_shape=(X_anomaly.shape[1], 1)),
    tf.keras.layers.Dense(1, activation='sigmoid')
])

model_anomaly.compile(optimizer='adam', loss='binary_crossentropy',
metrics=['accuracy'])
model_anomaly.fit(X_train, y_train, epochs=10, batch_size=32,
validation_data=(X_test, y_test))
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loss, accuracy = model_anomaly.evaluate(X_test, y_test)
print(f"Dokładność wykrywania anomalii: {accuracy:.2f}")
```

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Epoch 1/10

c:\Users\szymo\AppData\Local\Programs\Python\Python312\Lib\site-
packages\keras\src\layers\rnn\rnn.py:199: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
the model instead.
  super().__init__(**kwargs)

25/25 ━━━━━━━━━━━━━━━━━━━━ 1s 6ms/step - accuracy: 0.7408 - loss:
0.6484 - val_accuracy: 0.9300 - val_loss: 0.5517
Epoch 2/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 0.9776 - loss:
0.4794 - val_accuracy: 1.0000 - val_loss: 0.1590
Epoch 3/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0801 - val_accuracy: 1.0000 - val_loss: 0.0127
Epoch 4/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0102 - val_accuracy: 1.0000 - val_loss: 0.0074
Epoch 5/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0065 - val_accuracy: 1.0000 - val_loss: 0.0054
Epoch 6/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0051 - val_accuracy: 1.0000 - val_loss: 0.0042
Epoch 7/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0040 - val_accuracy: 1.0000 - val_loss: 0.0035
Epoch 8/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0036 - val_accuracy: 1.0000 - val_loss: 0.0030
Epoch 9/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0026 - val_accuracy: 1.0000 - val_loss: 0.0026
Epoch 10/10
25/25 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
0.0022 - val_accuracy: 1.0000 - val_loss: 0.0022
7/7 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss: 0.0022

Dokładność wykrywania anomalii: 1.00
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```
def generate_activity_data(n_samples=1500, timesteps=20):
    X, y = [], []
    for label in range(3):
        for _ in range(n_samples // 3):
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            if label == 0:
                sequence = np.random.normal(0, 0.2, (timesteps,))
            elif label == 1:
                sequence = np.sin(np.linspace(0, 3*np.pi, timesteps))
+ np.random.normal(0, 0.1, (timesteps,))
            else:
                sequence = np.sin(np.linspace(0, 6*np.pi, timesteps))
+ np.random.normal(0, 0.2, (timesteps,))
            X.append(sequence)
            y.append(label)
    return np.array(X).reshape(-1, timesteps, 1), np.array(y)

X_activity, y_activity = generate_activity_data()
y_activity = tf.keras.utils.to_categorical(y_activity, num_classes=3)
X_train, X_test, y_train, y_test = train_test_split(X_activity,
y_activity, test_size=0.2)

model_activity = tf.keras.Sequential([
    tf.keras.layers.LSTM(64, input_shape=(X_activity.shape[1], 1)),
    tf.keras.layers.Dense(3, activation='softmax')
])

model_activity.compile(optimizer='adam',
loss='categorical_crossentropy', metrics=['accuracy'])
model_activity.fit(X_train, y_train, epochs=15, batch_size=32,
validation_data=(X_test, y_test))

loss, accuracy = model_activity.evaluate(X_test, y_test)
print(f"Dokładność klasyfikacji aktywności użytkownika:
{accuracy:.2f}")
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Epoch 1/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 1s 5ms/step - accuracy: 0.6797 - loss:
1.0246 - val_accuracy: 0.7333 - val_loss: 0.7105
Epoch 2/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.8298 - loss:
0.5060 - val_accuracy: 0.9733 - val_loss: 0.1383
Epoch 3/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.9568 - loss:
0.1333 - val_accuracy: 0.9867 - val_loss: 0.0390
Epoch 4/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.9862 - loss:
0.0522 - val_accuracy: 0.9933 - val_loss: 0.0287
Epoch 5/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.9927 - loss:
0.0331 - val_accuracy: 1.0000 - val_loss: 0.0034
Epoch 6/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.9988 - loss:
0.0073 - val_accuracy: 1.0000 - val_loss: 0.0016
Epoch 7/15
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38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
0.0015 - val_accuracy: 1.0000 - val_loss: 0.0021
Epoch 8/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.9989 - loss:
0.0034 - val_accuracy: 0.9933 - val_loss: 0.0163
Epoch 9/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
0.0048 - val_accuracy: 1.0000 - val_loss: 6.0632e-04
Epoch 10/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
5.5991e-04 - val_accuracy: 1.0000 - val_loss: 4.2900e-04
Epoch 11/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
4.0311e-04 - val_accuracy: 1.0000 - val_loss: 3.5401e-04
Epoch 12/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
3.3330e-04 - val_accuracy: 1.0000 - val_loss: 3.0292e-04
Epoch 13/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
2.8701e-04 - val_accuracy: 1.0000 - val_loss: 2.6579e-04
Epoch 14/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
2.5880e-04 - val_accuracy: 1.0000 - val_loss: 2.3693e-04
Epoch 15/15
38/38 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 1.0000 - loss:
2.2504e-04 - val_accuracy: 1.0000 - val_loss: 2.1273e-04
10/10 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 1.0000 - loss:
2.1978e-04
Dokładność klasyfikacji aktywności użytkownika: 1.00
```