```python
print("Hello world")
```

```
Hello world
```

Практическая работа №1

Выполни Егоров Ю.А. Студент группы ББМО-01-23

```python
!pip install tensorflow
```

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```python
!pip install torch torchvision
!pip install foolbox
!pip install cleverhans
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```

```python
import tensorflow as tf
import torch
import foolbox
import cleverhans
# Проверка версии TensorFlow
print(f"TensorFlow version: {tf.__version__}")
# Проверка версии PyTorch
print(f"PyTorch version: {torch.__version__}")
# Проверка версии Foolbox
print(f"Foolbox version: {foolbox.__version__}")
# Проверка версии CleverHans
print(f"CleverHans version: {cleverhans.__version__}")
```

```
TensorFlow version: 2.17.0
PyTorch version: 2.4.1
Foolbox version: 3.3.4
CleverHans version: 4.0.0-edc15c6ec93c96562523dc42ae33c9e7
```

```
from tensorflow.keras.datasets import mnist
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.utils import to_categorical
# Загрузка датасета MNIST
(train_images, train_labels), (test_images, test_labels) = mnist.load_data()
# Нормализация данных
train_images = train_images / 255.0
test_images = test_images / 255.0
# Преобразование меток в one-hot encoding
train_labels = to_categorical(train_labels)
test_labels = to_categorical(test_labels)
# Создание модели
model = Sequential([
    Flatten(input_shape=(28, 28)),
    Dense(128, activation='relu'),
    Dense(10, activation='softmax')
])
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=
['accuracy'])
# Обучение модели
model.fit(train_images, train_labels, epochs=5)
# Оценка модели на тестовых данных
test_loss, test_acc = model.evaluate(test_images, test_labels)
print(f"Test accuracy: {test_acc}")
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz
11490434/11490434 ───────────────── 9s 1us/step
/opt/homebrew/lib/python3.11/site-packages/keras/src/layers/reshaping/flatten.py:37: UserWarning: Do not pass an `input_:
  super().__init__(**kwargs)
Epoch 1/5
1875/1875 ───────────────── 3s 1ms/step - accuracy: 0.8799 - loss: 0.4245
Epoch 2/5
1875/1875 ───────────────── 2s 1ms/step - accuracy: 0.9654 - loss: 0.1178
Epoch 3/5
1875/1875 ───────────────── 3s 1ms/step - accuracy: 0.9771 - loss: 0.0741
Epoch 4/5
1875/1875 ───────────────── 2s 1ms/step - accuracy: 0.9827 - loss: 0.0562
Epoch 5/5
1875/1875 ───────────────── 2s 1ms/step - accuracy: 0.9865 - loss: 0.0423
313/313 ───────────────── 0s 491us/step - accuracy: 0.9702 - loss: 0.0946
Test accuracy: 0.9746999740600586
```

```
model.save('mnist_model.h5')
```

```
WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save_model(model)`. This file
```