

```
In [1]: import pandas as pd
df = pd.read_csv('intern_task.csv', header=0)
```

```
In [19]: !pip install --upgrade nbconvert jupyter
```

```
Requirement already satisfied: nbconvert in /home/anastasiia/anaconda3/lib/python3.11/site-packages (6.5.4)
Collecting nbconvert
  Obtaining dependency information for nbconvert from https://files.pythonhosted.org/packages/b8/bb/bb5b6a515d1584aa2fd89965b11db6632e4bdc69495a52374bcc36e56cfa/nbconvert-7.16.4-py3-none-any.whl.metadata
  Downloading nbconvert-7.16.4-py3-none-any.whl.metadata (8.5 kB)
Requirement already satisfied: jupyter in /home/anastasiia/anaconda3/lib/python3.11/site-packages (1.0.0)
Requirement already satisfied: beautifulsoup4 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (4.12.2)
Requirement already satisfied: bleach!=5.0.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (4.1.0)
Requirement already satisfied: defusedxml in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (0.7.1)
Requirement already satisfied: Jinja2>=3.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (3.1.2)
Requirement already satisfied: jupyter-core>=4.7 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (5.3.0)
Requirement already satisfied: jupyterlab-pygments in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (0.1.2)
Requirement already satisfied: MarkupSafe>=2.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (2.1.1)
Collecting mistune<4,>=2.0.3 (from nbconvert)
  Obtaining dependency information for mistune<4,>=2.0.3 from https://files.pythonhosted.org/packages/f0/74/c95adcdf032956d9ef6c89a9b8a5152bf73915f8c633f3e3d88d06bd699c/mistune-3.0.2-py3-none-any.whl.metadata
  Downloading mistune-3.0.2-py3-none-any.whl.metadata (1.7 kB)
Requirement already satisfied: nbclient>=0.5.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (0.5.13)
Requirement already satisfied: nbformat>=5.7 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (5.9.2)
Requirement already satisfied: packaging in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (23.1)
Requirement already satisfied: pandocfilters>=1.4.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (1.5.0)
Requirement already satisfied: pygments>=2.4.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (2.15.1)
Requirement already satisfied: tinycss2 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (1.2.1)
Requirement already satisfied: traitlets>=5.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbconvert) (5.7.1)
Requirement already satisfied: notebook in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter) (6.5.4)
Requirement already satisfied: QtConsole in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter) (5.4.2)
Requirement already satisfied: jupyter-console in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter) (6.6.3)
Requirement already satisfied: IPykernel in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter) (6.25.0)
Requirement already satisfied: IPywidgets in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter) (8.0.4)
Requirement already satisfied: six>=1.9.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from bleach!=5.0.0->nbconvert) (1.16.0)
Requirement already satisfied: webencodings in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from bleach!=5.0.0->nbconvert) (0.5.1)
Requirement already satisfied: platformdirs>=2.5 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter-core>=4.7->nbconvert) (3.10.0)
Requirement already satisfied: jupyter-client>=6.1.5 in /home/anastasiia/anaconda3/lib/p
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python3.11/site-packages (from nbclient>=0.5.0->nbconvert) (7.4.9)
Requirement already satisfied: nest-asyncio in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbclient>=0.5.0->nbconvert) (1.5.6)
Requirement already satisfied: fastjsonschema in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbformat>=5.7->nbconvert) (2.16.2)
Requirement already satisfied: jsonschema>=2.6 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbformat>=5.7->nbconvert) (4.17.3)
Requirement already satisfied: soupsieve>1.2 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from beautifulsoup4->nbconvert) (2.4)
Requirement already satisfied: comm>=0.1.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (0.1.2)
Requirement already satisfied: debugpy>=1.6.5 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (1.6.7)
Requirement already satisfied: ipython>=7.23.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (8.15.0)
Requirement already satisfied: matplotlib-inline>=0.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (0.1.6)
Requirement already satisfied: psutil in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (5.9.0)
Requirement already satisfied: pyzmq>=20 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (23.2.0)
Requirement already satisfied: tornado>=6.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipykernel->jupyter) (6.3.2)
Requirement already satisfied: widgetsnbextension~=4.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipywidgets->jupyter) (4.0.5)
Requirement already satisfied: jupyterlab-widgets~=3.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipywidgets->jupyter) (3.0.5)
Requirement already satisfied: prompt-toolkit>=3.0.30 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter-console->jupyter) (3.0.36)
Requirement already satisfied: argon2-cffi in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from notebook->jupyter) (21.3.0)
Requirement already satisfied: ipython-genutils in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from notebook->jupyter) (0.2.0)
Requirement already satisfied: Send2Trash>=1.8.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from notebook->jupyter) (1.8.0)
Requirement already satisfied: terminado>=0.8.3 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from notebook->jupyter) (0.17.1)
Requirement already satisfied: prometheus-client in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from notebook->jupyter) (0.14.1)
Requirement already satisfied: nbclassic>=0.4.7 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from notebook->jupyter) (0.5.5)
Requirement already satisfied: qtpy>=2.0.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from qtconsole->jupyter) (2.2.0)
Requirement already satisfied: backcall in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipython>=7.23.1->ipykernel->jupyter) (0.2.0)
Requirement already satisfied: decorator in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipython>=7.23.1->ipykernel->jupyter) (5.1.1)
Requirement already satisfied: jedi>=0.16 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipython>=7.23.1->ipykernel->jupyter) (0.18.1)
Requirement already satisfied: pickleshare in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipython>=7.23.1->ipykernel->jupyter) (0.7.5)
Requirement already satisfied: stack-data in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipython>=7.23.1->ipykernel->jupyter) (0.2.0)
Requirement already satisfied: pexpect>4.3 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from ipython>=7.23.1->ipykernel->jupyter) (4.8.0)
Requirement already satisfied: attrs>=17.4.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jsonschema>=2.6->nbformat>=5.7->nbconvert) (22.1.0)
Requirement already satisfied: pyparsing!=0.17.0,!=0.17.1,!=0.17.2,>=0.14.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jsonschema>=2.6->nbformat>=5.7->nbconvert) (0.18.0)
Requirement already satisfied: entrypoints in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (0.4)
Requirement already satisfied: python-dateutil>=2.8.2 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (2.8.2)
Requirement already satisfied: jupyter-server>=1.8 in /home/anastasiia/anaconda3/lib/pyt

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hon3.11/site-packages (from nbclassic>=0.4.7->notebook->jupyter) (1.23.4)
Requirement already satisfied: notebook-shim>=0.1.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from nbclassic>=0.4.7->notebook->jupyter) (0.2.2)
Requirement already satisfied: wcwidth in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from prompt-toolkit>=3.0.30->jupyter-console->jupyter) (0.2.5)
Requirement already satisfied: ptyprocess in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from terminado>=0.8.3->notebook->jupyter) (0.7.0)
Requirement already satisfied: argon2-cffi-bindings in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from argon2-cffi->notebook->jupyter) (21.2.0)
Requirement already satisfied: parso<0.9.0,>=0.8.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jedi>=0.16->ipython>=7.23.1->ipykernel->jupyter) (0.8.3)
Requirement already satisfied: anyio<4,>=3.1.0 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter-server>=1.8->nbclassic>=0.4.7->notebook->jupyter) (3.5.0)
Requirement already satisfied: websocket-client in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from jupyter-server>=1.8->nbclassic>=0.4.7->notebook->jupyter) (0.58.0)
Requirement already satisfied: cffi>=1.0.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from argon2-cffi-bindings->argon2-cffi->notebook->jupyter) (1.15.1)
Requirement already satisfied: executing in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from stack-data->ipython>=7.23.1->ipykernel->jupyter) (0.8.3)
Requirement already satisfied: asttokens in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from stack-data->ipython>=7.23.1->ipykernel->jupyter) (2.0.5)
Requirement already satisfied: pure-eval in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from stack-data->ipython>=7.23.1->ipykernel->jupyter) (0.2.2)
Requirement already satisfied: idna>=2.8 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from anyio<4,>=3.1.0->jupyter-server>=1.8->nbclassic>=0.4.7->notebook->jupyter) (3.4)
Requirement already satisfied: sniffio>=1.1 in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from anyio<4,>=3.1.0->jupyter-server>=1.8->nbclassic>=0.4.7->notebook->jupyter) (1.2.0)
Requirement already satisfied: pycparser in /home/anastasiia/anaconda3/lib/python3.11/site-packages (from cffi>=1.0.1->argon2-cffi-bindings->argon2-cffi->notebook->jupyter) (2.21)
Downloading nbconvert-7.16.4-py3-none-any.whl (257 kB)
  257.4/257.4 kB 991.8 kB/s eta 0:00:00 eta 0:00:01
0:01:01
Using cached mistune-3.0.2-py3-none-any.whl (47 kB)
Installing collected packages: mistune, nbconvert
  Attempting uninstall: mistune
    Found existing installation: mistune 0.8.4
    Uninstalling mistune-0.8.4:
      Successfully uninstalled mistune-0.8.4
  Attempting uninstall: nbconvert
    Found existing installation: nbconvert 6.5.4
    Uninstalling nbconvert-6.5.4:
      Successfully uninstalled nbconvert-6.5.4
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.
spyder 5.4.3 requires pyqt5<5.16, which is not installed.
spyder 5.4.3 requires pyqtwebengine<5.16, which is not installed.
Successfully installed mistune-3.0.2 nbconvert-7.16.4

```

In [2]: `df.head()`

Out[2]:

	rank	query_id	feature_0	feature_1	feature_2	feature_3	feature_4	feature_5	feature_6	feature_7	...	fea
0	0	10	1.0	0.0	1.0	3.0	3.0	0.333333	0.0	0.333333	...	
1	1	10	3.0	0.0	3.0	0.0	3.0	1.000000	0.0	1.000000	...	
2	0	10	3.0	0.0	2.0	0.0	3.0	1.000000	0.0	0.666667	...	
3	1	10	3.0	0.0	3.0	0.0	3.0	1.000000	0.0	1.000000	...	
4	2	10	3.0	0.0	3.0	1.0	3.0	1.000000	0.0	1.000000	...	

5 rows × 146 columns

```
In [3]: unique_count = df['rank'].nunique()
print("Количество уникальных значений:", unique_count)
```

Количество уникальных значений: 5

```
In [4]: unique_count = df['query_id'].nunique()
print("Количество уникальных значений:", unique_count)
```

Количество уникальных значений: 2000

```
In [5]: null_check = df.isnull().any()
print("Наличие отсутствующих значений в столбцах:")
print(null_check)
```

Наличие отсутствующих значений в столбцах:

```
rank          False
query_id      False
feature_0     False
feature_1     False
feature_2     False
...
feature_139   False
feature_140   False
feature_141   False
feature_142   False
feature_143   False
Length: 146, dtype: bool
```

```
In [6]: # обучаем модель ранжированию внутри сессии, где query_id= 10
data = df[df['query_id'] == 10]
```

```
In [7]: data.drop('query_id', axis=1, inplace=True)
data
```

/tmp/ipykernel_35582/2628678927.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
data.drop('query_id', axis=1, inplace=True)

```
Out[7]:
```

	rank	feature_0	feature_1	feature_2	feature_3	feature_4	feature_5	feature_6	feature_7	feature_8	...	ft
0	0	1.0	0.0	1.0	3.0	3.0	0.333333	0.0	0.333333	0.000000	...	
1	1	3.0	0.0	3.0	0.0	3.0	1.000000	0.0	1.000000	0.004251	...	
2	0	3.0	0.0	2.0	0.0	3.0	1.000000	0.0	0.666667	0.008501	...	
3	1	3.0	0.0	3.0	0.0	3.0	1.000000	0.0	1.000000	0.012752	...	
4	2	3.0	0.0	3.0	1.0	3.0	1.000000	0.0	1.000000	0.017003	...	
...	
87	1	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.000000	0.369808	...	
88	0	2.0	0.0	0.0	0.0	2.0	0.666667	0.0	0.000000	0.374059	...	
89	1	2.0	0.0	2.0	1.0	2.0	0.666667	0.0	0.666667	0.378310	...	
90	1	3.0	3.0	3.0	1.0	3.0	1.000000	1.0	1.000000	0.382560	...	
91	0	3.0	0.0	3.0	1.0	3.0	1.000000	0.0	1.000000	0.386811	...	

92 rows × 145 columns

```
In [8]: size = df.shape
size
```

```
Out[8]: (235258, 146)
```

```
In [9]: size = data.shape
size
```

```
Out[9]: (92, 145)
```

```
In [10]: y = data['rank']#y- ранк
```

```
In [11]: y
```

```
Out[11]: 0      0
1      1
2      0
3      1
4      2
..
87     1
88     0
89     1
90     1
91     0
Name: rank, Length: 92, dtype: int64
```

```
In [12]: data.drop('rank', axis=1, inplace=True)
```

```
/tmp/ipykernel_35582/799740295.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
data.drop('rank', axis=1, inplace=True)
```

```
In [13]: X = data.values#векторы фичей
```

```
In [14]: import numpy as np
num_classes = 5
from keras.utils import to_categorical
```

```
2024-04-29 22:42:32.301022: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-T
RT Warning: Could not find TensorRT
```

```
In [15]: y_one_hot =pd.get_dummies(y)
print(y_one_hot)
```

```
      0      1      2      3      4
0  True False False False False
1 False  True False False False
2  True False False False False
3 False  True False False False
4 False False  True False False
..    ...    ...    ...    ...    ...
87 False  True False False False
88  True False False False False
89 False  True False False False
90 False  True False False False
91  True False False False False
```

```
[92 rows x 5 columns]
```

```
In [16]: from sklearn.model_selection import train_test_split
```

```

from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

X_train, X_test, y_train, y_test = train_test_split(X, y_one_hot, test_size=0.3, random_

```

```

In [17]: import tensorflow as tf
from tensorflow.keras import layers, models

input_dim = X_train.shape[1] # Получаем количество признаков из обучающих данных

# Создание модели нейронной сети
model = models.Sequential([
    layers.Dense(128, activation='relu', input_shape=(input_dim,)),
    layers.Dense(128, activation='relu'),
    layers.Dense(64, activation='relu'),
    layers.Dense(32, activation='relu'),
    layers.Dense(16, activation='relu'),
    layers.Dense(5, activation='softmax')
])

# Компиляция модели
model.compile(optimizer='adam',
              loss='categorical_crossentropy',
              metrics=['accuracy'])

# Обучение модели
history = model.fit(X_train, y_train, epochs=30, batch_size=32, validation_split=0.2)
scores = model.predict(X_test)
# Оценка модели на тестовых данных
test_loss, test_acc = model.evaluate(X_test, y_test)
print('Test accuracy:', test_acc)

```

/home/anastasiia/anaconda3/lib/python3.11/site-packages/keras/src/layers/core/dense.py:8
8: 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__(activity_regularizer=activity_regularizer, **kwargs)
2024-04-29 22:42:34.541065: I external/local_xla/xla/stream_executor/cuda/cuda_executor.
cc:998] successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at https://github.com/torv
alds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-pci#L344-L355
2024-04-29 22:42:34.849813: W tensorflow/core/common_runtime/gpu/gpu_device.cc:2251] Can
not dlopen some GPU libraries. Please make sure the missing libraries mentioned above ar
e installed properly if you would like to use GPU. Follow the guide at https://www.tenso
rflow.org/install/gpu for how to download and setup the required libraries for your plat
form.
Skipping registering GPU devices...

```

```

Epoch 1/30
2/2 000000000000000000000000 2s 195ms/step - accuracy: 0.0862 - loss: 2143.8467 - val_accuracy:
0.4615 - val_loss: 94.3918
Epoch 2/30
2/2 000000000000000000000000 0s 28ms/step - accuracy: 0.1254 - loss: 1463.7280 - val_accuracy:
0.0769 - val_loss: 162.5208
Epoch 3/30
2/2 000000000000000000000000 0s 27ms/step - accuracy: 0.2351 - loss: 922.1891 - val_accuracy:
0.3077 - val_loss: 67.7868
Epoch 4/30
2/2 000000000000000000000000 0s 28ms/step - accuracy: 0.3264 - loss: 319.0905 - val_accuracy:
0.2308 - val_loss: 95.5331
Epoch 5/30
2/2 000000000000000000000000 0s 27ms/step - accuracy: 0.1332 - loss: 590.8842 - val_accuracy:
0.2308 - val_loss: 69.5720
Epoch 6/30
2/2 000000000000000000000000 0s 26ms/step - accuracy: 0.1201 - loss: 59.8819 - val_accuracy: 0.
0000e+00 - val_loss: 74.9424

```

Epoch 7/30
2/2 00000000000000000000 0s 25ms/step - accuracy: 0.1801 - loss: 63.6104 - val_accuracy: 0.2308 - val_loss: 22.5055
Epoch 8/30
2/2 00000000000000000000 0s 28ms/step - accuracy: 0.2063 - loss: 28.3412 - val_accuracy: 0.2308 - val_loss: 23.8244
Epoch 9/30
2/2 00000000000000000000 0s 27ms/step - accuracy: 0.2898 - loss: 27.0941 - val_accuracy: 0.2308 - val_loss: 24.2365
Epoch 10/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.2324 - loss: 23.0938 - val_accuracy: 0.3077 - val_loss: 13.8647
Epoch 11/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.2533 - loss: 13.8711 - val_accuracy: 0.3846 - val_loss: 8.6125
Epoch 12/30
2/2 00000000000000000000 0s 28ms/step - accuracy: 0.3656 - loss: 9.5452 - val_accuracy: 0.4615 - val_loss: 5.9021
Epoch 13/30
2/2 00000000000000000000 0s 27ms/step - accuracy: 0.3603 - loss: 7.2803 - val_accuracy: 0.3846 - val_loss: 4.2545
Epoch 14/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.3525 - loss: 5.5020 - val_accuracy: 0.3077 - val_loss: 2.7486
Epoch 15/30
2/2 00000000000000000000 0s 28ms/step - accuracy: 0.5378 - loss: 1.9866 - val_accuracy: 0.3077 - val_loss: 2.0069
Epoch 16/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.4700 - loss: 6.6706 - val_accuracy: 0.3077 - val_loss: 1.9640
Epoch 17/30
2/2 00000000000000000000 0s 25ms/step - accuracy: 0.4465 - loss: 25.2542 - val_accuracy: 0.3077 - val_loss: 3.1780
Epoch 18/30
2/2 00000000000000000000 0s 25ms/step - accuracy: 0.5143 - loss: 2.8443 - val_accuracy: 0.3077 - val_loss: 3.6135
Epoch 19/30
2/2 00000000000000000000 0s 25ms/step - accuracy: 0.4935 - loss: 3.2468 - val_accuracy: 0.3077 - val_loss: 3.5561
Epoch 20/30
2/2 00000000000000000000 0s 29ms/step - accuracy: 0.5247 - loss: 3.3611 - val_accuracy: 0.3077 - val_loss: 3.2271
Epoch 21/30
2/2 00000000000000000000 0s 28ms/step - accuracy: 0.5143 - loss: 2.9572 - val_accuracy: 0.3077 - val_loss: 2.7766
Epoch 22/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.4700 - loss: 2.3560 - val_accuracy: 0.3077 - val_loss: 2.3150
Epoch 23/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.5196 - loss: 1.9394 - val_accuracy: 0.3077 - val_loss: 1.8775
Epoch 24/30
2/2 00000000000000000000 0s 25ms/step - accuracy: 0.5300 - loss: 1.7453 - val_accuracy: 0.3846 - val_loss: 1.5824
Epoch 25/30
2/2 00000000000000000000 0s 25ms/step - accuracy: 0.5404 - loss: 1.7746 - val_accuracy: 0.3846 - val_loss: 1.5810
Epoch 26/30
2/2 00000000000000000000 0s 27ms/step - accuracy: 0.5196 - loss: 1.9346 - val_accuracy: 0.3846 - val_loss: 1.5795
Epoch 27/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.5196 - loss: 1.9735 - val_accuracy: 0.3846 - val_loss: 1.5780
Epoch 28/30
2/2 00000000000000000000 0s 26ms/step - accuracy: 0.5300 - loss: 1.9090 - val_accuracy: 0.3846 - val_loss: 1.5765

Epoch 29/30
2/2 00000000000000000000 0s 28ms/step - accuracy: 0.4988 - loss: 1.7432 - val_accuracy: 0.3846 - val_loss: 1.5750
Epoch 30/30
2/2 00000000000000000000 0s 29ms/step - accuracy: 0.5404 - loss: 1.5231 - val_accuracy: 0.3846 - val_loss: 1.5735
1/1 00000000000000000000 0s 69ms/step
1/1 00000000000000000000 0s 22ms/step - accuracy: 0.4286 - loss: 3.5237
Test accuracy: 0.4285714328289032

In [18]: `from sklearn.metrics import ndcg_score`

```
ndcg_score(y_test, scores)
#подсчет метрики ранжирования
```

Out[18]: 0.7234267563628052

In []:

In []: