



HARPY AEROSPACE INTERNSHIP

AIoT PROJECT
RECOMMENDATION SYSTEM

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Recommendation System 1

GATED RECURRENT UNIT NETWORK MODEL(RNN)

OUTPUTS

```
Downloading and preparing dataset 4.70 MiB (download: 4.70 MiB, generated: 32.41 MiB, total: 37.10 MiB) to /root/tensorflow_datasets/movielens/100k-ratings/0.1.1...
DL Completed... 100% [██████████] 1/1 [00:01<00:00, 1.13s/ url]
DL Size... 100% [██████████] 4/4 [00:01<00:00, 3.60 MiB/s]
Extraction completed... 100% [██████████] 23/23 [00:01<00:00, 1.03s/ file]
Dataset movielens downloaded and prepared to /root/tensorflow_datasets/movielens/100k-ratings/0.1.1. Subsequent calls will reuse this data.
Downloading and preparing dataset 4.70 MiB (download: 4.70 MiB, generated: 150.35 KiB, total: 4.84 MiB) to /root/tensorflow_datasets/movielens/100k-movies/0.1.1...
DL Completed... 100% [██████████] 1/1 [00:00<00:00, 12.98 MiB/s]
DL Size... 100% [██████████] 4924029/4924029 [00:00<00:00, 83164709.77 MiB/s]
Extraction completed... 0/0 [00:00<?, ? file/s]
Dataset movielens downloaded and prepared to /root/tensorflow_datasets/movielens/100k-movies/0.1.1. Subsequent calls will reuse this data.
```

```
Ratings Dataset:
User ID: b'138'
Movie Title: b"One Flew Over the Cuckoo's Nest (1975)"
---
User ID: b'92'
Movie Title: b'Strictly Ballroom (1992)'
---
User ID: b'301'
Movie Title: b'Very Brady Sequel, A (1996)'
---
User ID: b'60'
Movie Title: b'Pulp Fiction (1994)'
---
User ID: b'197'
Movie Title: b'Scream 2 (1997)'
---
```

```
Epoch 1/10
20/20 [=====] - 40s 1s/step - factorized_top_k/top_1_categorical_accuracy: 2.1250e-04 - factorized_top_k/top_5_categorical_accuracy: 0.0023
Epoch 2/10
20/20 [=====] - 27s 1s/step - factorized_top_k/top_1_categorical_accuracy: 6.2500e-05 - factorized_top_k/top_5_categorical_accuracy: 0.0054
Epoch 3/10
20/20 [=====] - 23s 1s/step - factorized_top_k/top_1_categorical_accuracy: 3.7500e-05 - factorized_top_k/top_5_categorical_accuracy: 0.0024
Epoch 4/10
20/20 [=====] - 26s 1s/step - factorized_top_k/top_1_categorical_accuracy: 0.0011 - factorized_top_k/top_5_categorical_accuracy: 0.0087 - fa
Epoch 5/10
20/20 [=====] - 23s 1s/step - factorized_top_k/top_1_categorical_accuracy: 1.7500e-04 - factorized_top_k/top_5_categorical_accuracy: 0.0026
Epoch 6/10
20/20 [=====] - 23s 1s/step - factorized_top_k/top_1_categorical_accuracy: 3.7500e-05 - factorized_top_k/top_5_categorical_accuracy: 0.0027
Epoch 7/10
20/20 [=====] - 27s 1s/step - factorized_top_k/top_1_categorical_accuracy: 3.7500e-05 - factorized_top_k/top_5_categorical_accuracy: 0.0054
Epoch 8/10
20/20 [=====] - 24s 1s/step - factorized_top_k/top_1_categorical_accuracy: 5.0000e-05 - factorized_top_k/top_5_categorical_accuracy: 0.0082
Epoch 9/10
20/20 [=====] - 28s 1s/step - factorized_top_k/top_1_categorical_accuracy: 2.8750e-04 - factorized_top_k/top_5_categorical_accuracy: 0.0073
Epoch 10/10
20/20 [=====] - 24s 1s/step - factorized_top_k/top_1_categorical_accuracy: 1.3750e-04 - factorized_top_k/top_5_categorical_accuracy: 0.0055
<tensorflow_recommenders.layers.factorized_top_k.BruteForce at 0x7b2122066770>
```

```
Top 3 recommendations for user 42: [b'Cliffhanger (1993)' b'Getaway, The (1994)'  
b'Conan the Barbarian (1981)' b'Indian in the Cupboard, The (1995)'  
b'Secret Adventures of Tom Thumb, The (1993)' b'Sliver (1993)'  
b'Star Trek VI: The Undiscovered Country (1991)' b'Under Siege (1992)'  
b'Speed (1994)' b'Blue Chips (1994)']
```

A Gated Recurrent Unit (GRU) network can be effectively used in a movie recommendation system, especially when dealing with sequential data such as a user's movie-watching history. Here's an explanation of how a GRU-based model can be applied to such a system:

Model Components

1. Input Data:

- User Sequences: A sequence of movies watched by each user.
- Movie Features: Embeddings or feature vectors representing each movie, which can include genre, director, cast, etc.

2. GRU Layers:

- These layers process the sequence of movies and capture the temporal dependencies and patterns in the user's viewing history.

3. Dense Layers:

- Fully connected layers that map the GRU's output to the final prediction space.

4. Output Layer:

- Produces a list of movie recommendations or predicts the next movie the user is likely to watch.

Recommendation System 2

NEURAL COLLABORATIVE FILTERING(NCF) MODEL

OUTPUTS

```
Epoch 1/5
WARNING:tensorflow:Gradients do not exist for variables ['dense/kernel:0', 'dense/bias:0', 'dense_1/kernel:0', 'dense_1/bias:0']
WARNING:tensorflow:Gradients do not exist for variables ['dense/kernel:0', 'dense/bias:0', 'dense_1/kernel:0', 'dense_1/bias:0']
WARNING:tensorflow:Gradients do not exist for variables ['dense/kernel:0', 'dense/bias:0', 'dense_1/kernel:0', 'dense_1/bias:0']
WARNING:tensorflow:Gradients do not exist for variables ['dense/kernel:0', 'dense/bias:0', 'dense_1/kernel:0', 'dense_1/bias:0']
25/25 [=====] - 18s 674ms/step - factorized_top_k/top_1_categorical_accuracy: 1.0000e-04 - fact
Epoch 2/5
25/25 [=====] - 15s 581ms/step - factorized_top_k/top_1_categorical_accuracy: 1.1000e-04 - fact
Epoch 3/5
25/25 [=====] - 15s 591ms/step - factorized_top_k/top_1_categorical_accuracy: 2.7000e-04 - fact
Epoch 4/5
25/25 [=====] - 15s 592ms/step - factorized_top_k/top_1_categorical_accuracy: 4.1000e-04 - fact
Epoch 5/5
25/25 [=====] - 15s 593ms/step - factorized_top_k/top_1_categorical_accuracy: 4.1000e-04 - fact
<keras.src.callbacks.History at 0x7b2122f33bb0>
```

Top 3 recommendations for user 100: [b'Big Bang Theory, The (1994)' b'N\xc3\xa9nette et Boni (1996)' b'Other Voices, Other Rooms (1997)']

Neural Collaborative Filtering (NCF) is a deep learning-based method for creating recommendation systems, such as movie recommendations. It uses neural networks to capture complex, non-linear interactions between users and items. Here's a concise breakdown:

1. Embedding Layers: Users and items are represented by dense vectors (embeddings) that capture their latent features.

2. Hidden Layers: These embeddings are passed through multiple non-linear layers (e.g., ReLU) to model intricate user-item interactions.

3. Output Layer: The final layer predicts the interaction (e.g., rating or like/dislike) between a user and an item, often using a sigmoid function for binary interactions.

Thank you!