

Homework 3

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Recommendation

We recommend using the ReRanker model. The ReRanker has the highest recall @1 result and Mean Reciprocal Rank (MRR) results, which means that compared to the ground truth movie, it has the highest probability of matching the search results with the ground truth movie item. The Semantic Search Model Results did list some movie items based on the query, but the recall@1 and MRR equaled 0. The RAG did perform well and generated similar results to the ReRanker Model, however, from what it generated, we believe that their outputs with additional contexts and dialogue may cause information overload, and it's harder for the users to retrieve the movie titles that they need. Moreover, from the runtime, we can tell that the Semantic Search Model and ReRanker both took around 1s to give the results, but RAG took around 11s to generate the results for five queries. Based on the precision, accuracy, and runtime, we decided to recommend the ReRanker model.

Production

The ReRanker model did have such cons: a) There were cases where the results were fewer than 5, even though we have set five as a goal; however, if the similarity is not sufficient, the model will automatically ignore it. For example, in the results for query 1 and query 3, we only saw three results. b) In the model, we gave the results only based on the similarity rank and query input, without the consideration of reviews and movie quality. Therefore, if the boss hopes to regulate that every query should generate five results or include the movie quality in the model, future work should be done. However, it didn't sway our recommendation that the ReRanker model should be the best. Because it gives accurate results with sufficient similarity to the ground truth and the short run time.

RAG/LLM's

Unlike the Semantic Search Model, BM25, or ReRanker, we cannot calculate the recall@1 and MRR score for the RAG output. As it is a generative model, we decided to evaluate the outputs based on three standards: relevance, coherence, and accuracy. From the outputs, the RAG model did give relevant results based on the query, and one of the six outputs matched the ground truth title, in the first order. For coherence, the model acts more like a human, compared to the Semantic Search, BM 25, and ReRanker. The RAG output started with the illustration of the contexts, then continued with the titles (some of them going with details), and ended with a polite concluding remark like "I hope this helps!" For accuracy, it's less convincing than the BM25 and ReRanker, especially when we focus on the match between the ground truth title and

the RAG outputs. Also, another factor is domain specificity. We developed the notebook based on a recipe-domain RAG model, which might affect its effectiveness.

Fine Tuning

If we are going to take the fine-tuning, we need to select the pre-model that we are going to use. In this case, we may choose to use [nq-distilbert-base-v1](#), as suggested by the boss. Then we may prepare a training dataset (200), by selecting some valid queries online and matching them with the movie results. Then we will manually verify if they match the movie titles provided under the query. Then we will apply the Parameter Efficient Fine-Tuning (PEFT) like the [LoRA model](#) to set the parameters and fine-tune the pre-model. Then we will apply the model after being fine-tuned and retest the ReRanker results with the wikipedia-movie dataset, and recalculate the recall@1 and Mean Reciprocal Rank, to see how much it improved the results. However, we don't think this is a necessary process, as a) the ReRanker model already has a high score of recall@1 (0.83) and also a high score of Mean Reciprocal Rank (0.83), and b) collecting the queries and manually verifying the results may take a lot of time, and the results cannot be promised to be improved.

Appendix

Table 1. Three Parts' Results

Query	Ground Truth Movie	Semantic Search Model Results	BM25 Results	ReRanker Results
"Documentaries showcasing indigenous peoples' survival and daily life in Arctic regions"	'Nanook of the North'	1. Ben-Hur: A Tale of the Christ 2. The Frozen North 3. Adventure 4. Midnight Mystery 5. The Runaway Bride	1. I do 2. Uncharted Seas 3. Powers that Prey 4. Rough Waters	1. Nanook of the North 2. Uncharted Seas 3. The Frozen North
"Western romance"	'The Lucky Horseshoe'	1. Romance 2. Romance 3. The Road to Romance 4. A Rogue's Romance 5. A Romance of Happy Valley	1. The Call of the Wild 2. Romance 3. A Man's Fight 4. Gun Smoke	1. Romance 2. The Road to Romance 3. The Call of the Wild 4. A Romance of Happy Valley
"Silent film about a Parisian star moving to Egypt, leaving her husband for a baron, and later reconciling after finding her family in poverty in Cairo."	'Sahara'	1. A Woman of Paris 2. So This Is Paris 3. Caught in a Cabaret 4. A Rogue's Romance 5. Fox Movietone Follies of 1929	1. Sahara 2. Inspiration 3. A Lad from Old Ireland 4. The Maltese Falcon	1. Sahara 2. Inspiration 3. Blind Youth
"Comedy film, office disguises, boss's daughter, elopement."	'Ask Father'	1. Bad Girl 2. Street Girl 3. Caught Cheating 4. Romance 5. Romance	1. Mabel's Blunder 2. Bucking Broadway 3. Ask Father 4. The Front Page 5. His Wedding Night	1. Ask Father 2. Bucking Broadway 3. Mabel's Blunder 4. His Wedding Night
"Lost film, Cleopatra"	'Cleopatra'	1. Near the Rainbow's End	1. Cleopatra 2. Fair Lady	1. Cleopatra 2. Youth's Endearing

charms Caesar, plots world rule, treasures from mummy, revels with Antony, tragic end with serpent in Alexandria."		2. The Lost World 3. Journey's End 4. River's End 5. One Night in Rome	3.Reaching for the Moon 4. Tom Sawyer	Charm 3. 4 Devils 4. The Love of Sunya 5. The Lost World
"Denis Gage Deane-Tanner"	'Captain Alvarez'	1. Kathleen Mavourneen 2. The Property Man 3. The Man from Blankley's 4. Lady Rose's Daughter 5. Alias French Gertie	1.Captain Alvarez 2. Hangman's House 3. Red Courage 4. The Sea Lion	1.Captain Alvarez 2.Caught Plastered 3. Hangman's House 4. The General

Table 2. RAG Results

Query	Ground Truth Movie	RAG Output
"Documentaries showcasing indigenous peoples' survival and daily life in Arctic regions"	'Nanook of the North'	Based on your query, here are some suggested movies and shows that showcase indigenous peoples' survival and daily life in Arctic regions: <ul style="list-style-type: none"> - "The Frozen North" (1922) - "From Leadville to Aspen: A Hold-Up in the Rockies" (1923) - "The Ghost of Slumber Mountain" (1923) - "The Viking" (1924) - "The Call of the Wild" (1923) These movies and shows are all available on the SUGGESTIONS list provided.
"Western romance"	'The Lucky Horseshoe'	Based on the provided QUERY and SUGGESTIONS, the suggested movies are: <ul style="list-style-type: none"> 1. The Road to Romance 2. Song of the West 3. Romance 4. Romance 5. A Romance of Happy Valley

<p>"Silent film about a Parisian star moving to Egypt, leaving her husband for a baron, and later reconciling after finding her family in poverty in Cairo."</p>	<p>'Sahara'</p>	<p>Based on the query "A silent film about a Parisian star moving to Egypt, leaving her husband for a baron, and later reconciling after finding her family in poverty in Cairo", the following movies from the SUGGESTIONS list could be suggested:</p> <ul style="list-style-type: none"> - "Married in Hollywood" - "A Woman of Paris" - "Show Girl in Hollywood" - "Broken Hearts of Hollywood" - "The Runaway Bride" <p>These movies all have similar themes of love, loss, and family, and feature characters who move to new places and encounter challenges in their relationships.</p>
<p>"Comedy film, office disguises, boss's daughter, elopement."</p>	<p>'Ask Father'</p>	<p>Based on your query and the suggestions provided, here are some suggested movies and shows that you may enjoy:</p> <ul style="list-style-type: none"> - "A Rogue's Romance" (1926) - A romantic comedy about a thief who falls in love with a wealthy woman. - "Beauty and the Rogue" (1926) - A romantic comedy about a woman who hires a gardener and falls in love with him. - "The Runaway Bride" (1926) - A romantic comedy about a woman who elopes with a man and gets caught up in a series of misunderstandings. - "Annabelle's Affairs" (1926) - A romantic comedy about a woman who falls in love with her husband without realizing that they are already married. - "The Exquisite Thief" (1926) - A romantic comedy about a thief who falls in love with a wealthy woman and must navigate the dangerous world of high society. <p>I hope you find these suggestions helpful!</p>
<p>"Lost film, Cleopatra charms Caesar, plots world rule, treasures from mummy, revels with Antony, tragic end with serpent in Alexandria."</p>	<p>'Cleopatra'</p>	<p>Based on the QUERY provided, here are some suggested movies and shows that might interest you:</p> <ul style="list-style-type: none"> - "Cleopatra" (1963) - A historical drama film directed by Joseph L. Mankiewicz, starring Elizabeth Taylor as Cleopatra. - "The Lost World" (1925) - A classic adventure film directed by Sir Arthur Conan Doyle, starring Charlie Chaplin and Lon Chaney. - "Little Caesar" (1931) - A crime drama film directed by Mervyn LeRoy, starring Edward G. Robinson as Rico Bandello. - "The Eyes of Mystery" (1941) - A mystery film directed by John Braunstein, starring Lon Chaney Jr. and Ann Sheridan. - "Beauty and the Rogue" (1946) - A romance film directed by Henry Hathaway, starring Joan Fontaine

		<p>and Henry Fonda.</p> <p>These movies and shows are all related to the themes of lost civilizations, ancient history, crime, mystery, and romance, which are present in the QUERY.</p>
"Denis Gage Deane-Tanner"	'Captain Alvarez'	<p>Based on the query "Denis Gage Deane-Tanner", here are some suggested movies and shows that you may enjoy:</p> <ul style="list-style-type: none"> - "Beau Geste" (1926) - directed by Cecil B. DeMille, starring Ronald Colman, Buster Keaton, and Anna May Wong - "Knockout Reilly" (1929) - directed by John Ford, starring George Arliss Bolger, Pat Malone, and Mary Astor - "Beau Brummel" (1924) - directed by George Arliss Bolger, starring George Arliss Bolger, Mary Astor, and Pat Malone - "The Bondman" (1925) - directed by George Arliss Bolger, starring George Arliss Bolger, Mary Astor, and Pat Malone - "Gentlemen of Nerve" (1926) - directed by George Arliss Bolger, starring George Arliss Bolger, Mary Astor, and Pat Malone <p>These movies and shows are all directed by George Arliss Bolger and star some of the same actors, including George Arliss Bolger, Pat Malone, and Mary Astor. They are all classics of early cinema and are sure to provide hours of entertainment.</p>

Table 3. Experiment Results

	Recall @ 1	Mean Reciprocal Rank
Semantic Search	0.00	0.00
BM25	0.50	0.56
ReRanker	0.83	0.83