The 2nd International Conference on Multidisciplinary Engineering (2nd ICOMDEN 2024)

The 2nd International Conference on Multidisciplinary Engineering: 00062 (2024) https://doi.org/10.29103/icomden.v2.xxxx
Volume 2, 2024
eISSN: xxxx-xxxx
Research Original Article

Development of a Decision Support System for Movie Recommendations Using the Evaluation Based on Distance from Average Solution

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Abstract
Digital transformation has changed how people enjoy media content, including films, through digital platforms like YouTube. Recommendation systems play a vital role in helping viewers find movies that match their preferences, utilizing methods such as Simple Additive Weighting and Collaborative Filtering to enhance recommendation accuracy and relevance. In this study, the Evaluation Based on Distance From Average Solution (EDAS) method is applied to provide more independent and user-focused movie recommendations. EDAS works by analyzing user profiles, which contain keywords or features related to films of interest. Based on an analysis of 300 film alternatives, the results show that Dune: Part Two (A199) ranks highest with a qualitative utility score of 1, followed by Spider-Man: Across the Spider-Verse (A182) with a score of 0.932194, and Furiosa: A Mad Max Saga (A201) with a score of 0.853523. The lowest-ranked alternative is Cobweb (A158) with a qualitative utility score of 0. Through the EDAS approach, this movie recommendation system offers a more relevant and satisfying viewing experience for users.
Keywords : Digital Transformation; Recommendation System; EDAS; Movie Preferences

Introduction
Digital transformation has advanced rapidly in recent years, significantly impacting many aspects of human life, including how people access and consume video content. The swift evolution of media technology, exemplified by platforms like YouTube, has reshaped the ways individuals interact with and consume digital media. This shift has created a growing need for effective recommendation systems, especially in fields such as film, where an abundance of content makes it challenging for users to find selections that align with their unique preferences.

Recommendation systems predict user preferences and suggest items based on the predicted ratings, applicable across books, music, films, and more. Commonly used methods include Simple Additive Weighting and Collaborative Filtering, as well as the Apriori algorithm, which leverages user-item interactions to improve recommendation accuracy. Despite notable successes, these systems still face challenges in enhancing recommendation relevance and alignment with user expectations.

This study proposes the Evaluation Based on Distance from Average Solution (EDAS) method as a robust approach to address these challenges in film recommendation systems. EDAS, designed to offer independent recommendations, evaluates user profiles and item attributes through a comparison that prioritizes items most likely to align with individual user interests. By integrating keywords and relevant features from user profiles, the EDAS method aims to create a more accurate, personalized recommendation experience.

Literature Review
1. Film
According to [1], film serves as an effective educational medium by capturing children's attention and offering advantages over other media. Films are presented in a sequence of fast-moving images, creating the illusion of continuous motion and spanning various genres, both fiction and non-fiction.

Meanwhile [2] notes that each film has unique qualities shaped by its director, contributing to competitive dynamics within the film industry. This highlights the need for accurate film recommendations based on viewer preferences, directors, and popularity.

2. Decision Support System

According to [3], a Decision Support System (DSS) is a system that processes alternative actions to achieve specific goals by systematically approaching problems, gathering data, and incorporating essential factors to inform decision-making.

Khadir (2023) further highlights that DSS can be applied across various fields, including business, government, healthcare, and education, with common applications in credit eligibility assessments, employee performance evaluations, inventory management, and strategic planning.

3. Characteristics of a Decision Support System

According to [4], there are several characteristics of a Decision Support System (DSS), which include the following:

a. Supports all organizational activities
b. Assists in multiple interacting decisions
c. Can be reused repeatedly and remains constant
d. Comprises two main components: data and model
e. Utilizes both external and internal data
f. Capable of performing what-if and goal-seeking analyses
g. Employs various quantitative models

4. Evaluation Based on Distance Average Solution

According to [5], the EDAS (Evaluation Based on Distance from Average Solution) method is used to generate ranking values from multiple options by calculating each criterion attribute's values. Developed by Mehdi Keshavarz-Ghorabaee in 2015, EDAS supports decision-making processes by analyzing problems and calculating the positive and negative ideal distances based on averages, resulting in ranked values that guide final decision-making. This method is commonly used within decision support systems (DSS).

The EDAS calculation process, as outlined by [6], includes the following steps:

1. Create a Decision Matrix

$$X = [X_{ij}]_{nxm} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1m} \\ X_{21} & X_{22} & \cdots & X_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{n2} & \dots & X_{nm} \end{bmatrix} \quad \text{.....(1)}$$

2. Determine Average Solution (AV)

$$AV_j = \frac{\sum_{i=1}^{m} X_{ij}}{m} \quad \text{.....(2)}$$

3. Calculate Positive and Negative Distances (PDA and NDA)

$$PDA_{ij} = \frac{\max(0(X_{ij} - AV_j))}{AV_j} \quad \text{.....(3)}$$

$$NDA_{ij} = \frac{\max(0(AV_j - X_{ij}))}{AV_j} \quad \text{.....(4)}$$

for cost criteria, use formulas

$$PDA_{ij} = \frac{\max(0(AV_j - X_{ij}))}{AV_j} \quad \text{.....(5)}$$

$$NDA_{ij} = \frac{\max(0(X_{ij} - AV_j))}{AV_j} \quad \text{.....(6)}$$

4. Compute Weighted Positive and Negative Distances

$$SP_i = \sum_{j=1}^{m} W_j * PDA_j \quad \text{.....(7)}$$

$$SN_i = \sum_{j=1}^{m} W_j * NDA_j \quad \text{.....(8)}$$

5. Normalize Positive and Negative Scores (NSP and NSN)

$$NSP_i = \frac{SP_i}{\max_i(SP_i)} \quad \text{.....(9)}$$

$$NSN_i = 1 - \frac{SN_i}{Max_i(SN_i)} \quad \text{.....(10)}$$

6. Determine Final Alternative Score (AS)

$$AS_i = \frac{1}{2}(NSP_i + NSN_i) \quad \text{.....(11)}$$

5. Recommendation System

According to [7] a recommendation system is software designed to suggest items of interest to users, personalized according to their preferences. The design phase is crucial for mapping the specifications and requirements of the application being developed.

[8] highlight that recommendation systems are widely used to make predictions across various domains, including books, music, films, and tourist attractions. For instance, in film selection, a well-structured recommendation model is essential to ensure that suggestions align with user preferences, thereby facilitating informed decision-making in choosing which film to watch.

Materials & Methods

1. Data Collection

In this study, the film data samples were sourced from two credible platforms: Kaggle and MovieLens. By combining data from these two sources, the research achieves a more diverse and representative sample. MovieLens facilitates user behavior analysis, while Kaggle provides technical information about films. Utilizing the Evaluation Based on Distance From Average Solution (EDAS) method, this combination aims to create a more accurate and relevant recommendation model for film ranking processes.

Below are the alternative data from the decision support system for film recommendations:

Table 1. Film Data

Code	Title	IMdb Rating	Year	Genre	Metascore	Duration
A1	Talk to Me	7.1	2022	Horror	76.0	95.0
A2	Barbarian	7.0	2022	Horror	78.0	102.0
A3	The Coffee Table	6.8	2022	Comedy	72.0	91.0
A4	Pearl	7.0	2022	Drama	76.0	103.0
A5	The Invitation	5.3	2022	Horror	45.0	105.0
A6	X	6.5	2022	Horror	80.0	105.0
A7	Arthur the King	7.0	2024	Adventure	54.0	107.0
A8	Where the Crawdads Sing	7.2	2022	Drama	43.0	125.0
…	…	…	…	…	…	…
A300	Fantastic Beasts: The Secrets of Dumbledore	6.2	2022	Adventure	47.0	142.0

2. Method

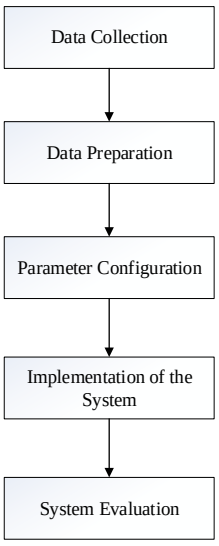

Figure 1. Research Methodology

a. Data Collection
In this data collection phase, it is essential to gather a dataset that includes user ratings for a number of films. This data must encompass information about user ratings for relevant criteria such as Genre, Year, Duration, etc.

b. Data Preparation
In this stage, data cleaning and organization of the dataset are necessary, including handling missing values or inconsistent data and normalizing the data to ensure all criteria have a uniform scale.

c. Parameter Configuration
After preparing the data, the next step is to determine the criteria that will be used in the recommendation system (e.g., Genre, Year, Duration).

d. Implementation of the System
System implementation involves creating an application using programming languages. PHP, HTML, and Bootstrap are the programming languages utilized. The author also organizes the database according to the system's needs to support system functionality, ensuring it operates smoothly. MySQL is used as the database server for storing the necessary data.

e. System Evaluation
In the final stage, system evaluation, the testing process is conducted. The goal of this testing is to identify system errors and then correct them based on the analysis.

3. System Scheme

Below is the scheme for the development of a decision support system for film recommendations using the EDAS method:

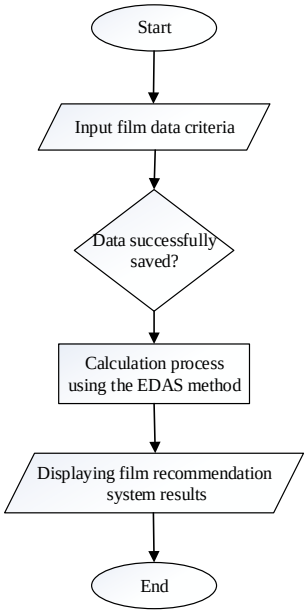

Figure 2. System Scheme

The calculation process of the EDAS method begins by inputting the film data to be identified. Next, the EDAS method starts the calculations using the alternative data to compute the normalized criterion weights. Then, it calculates the utility values based on the alternative data, and finally computes the final scores, which result in the rankings for the film recommendations.

Results and Discussion

1. Determining Criteria

Table 2. Film Criteria

Code	Name Criteria	Types of Criteria	Criterion Weights
C1	Title	Benefit	0.30
C2	Year	Benefit	0.15
C3	IMdb Rating	Benefit	0.25
C4	Metascore	Benefit	0.20
C5	Duration	Cost	0.10

Based on the table above, it can be concluded that the first, second, third, and fourth criteria are classified as benefit criteria, as they all provide positive added value to the quality or appeal of a film. In contrast, the fifth criterion is classified as a cost criterion, because the longer the duration of a film, the greater the fatigue or discomfort that viewers may experience.

2. Manual Calculation of the EDAS Method

Below is the alternative film data that has been modified based on the weighted subcriteria values.

Table 2. Decision Matrix

Alternative	C1	C2	C3	C4	C5
A1	3	3	2	4	4
A2	3	3	2	4	4
A3	3	3	3	4	4
A4	3	3	4	4	4

A5	2	3	3	2	4
A6	3	3	3	4	4
A7	3	3	2	4	4
A8	3	3	2	4	4
…	…	…	…	…	…
A300	2	3	5	2	3
Nmax	5	5	5	5	5

a. Matrix Normalization
The next step is to calculate the normalization of the matrix. The goal is to ensure that the values used are greater than zero and less than one. The results are as follows:

Table 3. Matrix Normalization

Alternative	C1	C2	C3	C4	C5
A1	0,6	0,6	0,4	0,8	0,8
A2	0,6	0,6	0,4	0,8	0,8
A3	0,6	0,6	0,6	0,8	0,8
A4	0,6	0,6	0,8	0,8	0,8
A5	0,4	0,6	0,6	0,4	0,8
A6	0,6	0,6	0,6	0,8	0,8
A7	0,6	1	1	0,4	0,8
A8	0,6	0,6	0,8	0,4	0,6
…	…	…	…	…	…
A300	0,4	0,6	1	0,4	0,6

b. Determining the Average Solution (AV)
In the EDAS method, the average solution (AV) for each criterion is calculated by summing the values associated with each alternative and dividing by the total number of alternatives. This is the initial stage of the process.

Table 4. Average Solution

Alternative	C1	C2	C3	C4	C5
A1	0,6	0,6	0,4	0,8	0,8
A2	0,6	0,6	0,4	0,8	0,8
A3	0,6	0,6	0,6	0,8	0,8
A4	0,6	0,6	0,8	0,8	0,8
A5	0,4	0,6	0,6	0,4	0,8
A6	0,6	0,6	0,6	0,8	0,8
A7	0,6	1	1	0,4	0,8
A8	0,6	0,6	0,8	0,4	0,6
…	…	…	…	…	…
A300	0,4	0,6	1	0,4	0,6
AV	0,551333	0,81	0,78	0,60866	0,76666
Total	165,4	243	234	182,6	230

c. Finding Postive Distance from Average Solution (PDAS)
This step involves calculating the Positive Distance from the Average Solution (PDAS) for each alternative. PDAS measures how far each alternative is from the average solution, helping to evaluate their relative performance.

Table 5. PDAS

Alternative	C1	C2	C3	C4	C5
A1	0,088271	0	0	0,314348	0
A2	0,088271	0	0	0,314348	0
A3	0,088271	0	0	0,314348	0
A4	0,088271	0	0,025641	0,314348	0
A5	0	0	0	0	0
A6	0,088271	0	0	0,314348	0
A7	0,088271	0,234568	0,282051	0	0
A8	0,088271	0	0,025641	0	0,217391
…	…	…	…	…	…
A300	0	0	0,282051	0	0,217391

d. Finding Negative Distance from Average Solution (NDAS)
In this step, we calculate the Negative Distance from the Average Solution (NDAS) for each alternative. NDAS assesses how close each alternative is to the average solution, providing insight into their relative shortcomings.

Table 6. NDAS

Alternative	C1	C2	C3	C4	C5
A1	0	0,259259	0,487179	0	0,043478
A2	0	0,259259	0,487179	0	0,043478
A3	0	0,259259	0,230769	0	0,043478
A4	0	0,259259	0	0	0,043478
A5	0,274486	0,259259	0,230769	0,342826	0,043478
A6	0	0,259259	0,230769	0	0,043478
A7	0	0	0	0,342826	0,043478
A8	0	0,259259	0	0,342826	0
…	…	…	…	…	…
A300	0,274486	0,259259	0	0,342826	0

a. Determining the Weighted Sum of Positive and Negative Values (SP/SN)
In this step, we calculate the Weighted Sum of Positive Values (SP) and Negative Values (SN) for each alternative. This helps to evaluate the overall performance by balancing the contributions of both positive and negative distances.

Table 7. SP/SN

Alternative	SP	SN
A1	0,08935092	0,165032
A2	0,08935092	0,165032
A3	0,08935092	0,100929
A4	0,09576117	0,043237
A5	0	0,25184
A6	0,08935092	0,100929
A7	0,13217926	0,072913
A8	0,05463064	0,107454
…	…	…
A300	0,09225195	0,1898
Max	0,46052918	0,304993

b. Normalizing the Positive and Negative Distances of Alternatives (NSP/NSN)
In this step, we normalize the Positive Distances (NSP) and Negative Distances (NSN) for each alternative. This ensures that the distances are scaled appropriately, facilitating a fair comparison among the alternatives.

Table 8. NSP/NSN

Alternative	NSP	NSN
A1	0,194018	0,4589
A2	0,194018	0,4589
A3	0,194018	0,66908
A4	0,207937	0,85824
A5	0	0,17427
A6	0,194018	0,66908
A7	0,287016	0,76094
A8	0,118626	0,64768
…	…	…
A300	0,200317	0,37769

c. Determining the Score for Each Alternatives(AS)
In this step, we calculate the score for each alternative (AS). This score is derived from the normalized positive and negative distances, providing a comprehensive measure of each alternative's performance.

Table 9. AS Result

Alternative	AS
A1	0,326459
A2	0,326459
A3	0,431547
A4	0,533087
A5	0,087137
A6	0,431547
A7	0,523976
A8	0,383154
…	…
A300	0,289004

After obtaining the final score for each alternative (AS), the values can be ranked from highest to lowest. The ranking results can be found in the following table:

Table 10. Ranking Result

Alternative	Score	Rank
A199	1	1
A182	0,932194	2
A201	0,853523	3
A131	0,842362	4
A50	0,840609	5
A183	0,840609	5
A159	0,826784	7
A29	0,824546	8
…	…	…
A158	0	300

Conclusions

This research successfully developed a movie recommendation system using the *Evaluation Based on Distance from Average Solution* (EDAS) method, effectively processing user rating data to generate recommendations aligned with user preferences. The EDAS method ranks movies by analyzing the distance from both positive and negative ideal solutions, allowing the system to recommend movies that best meet criteria such as genre, IMDB rating, duration, release year, and metascore.

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