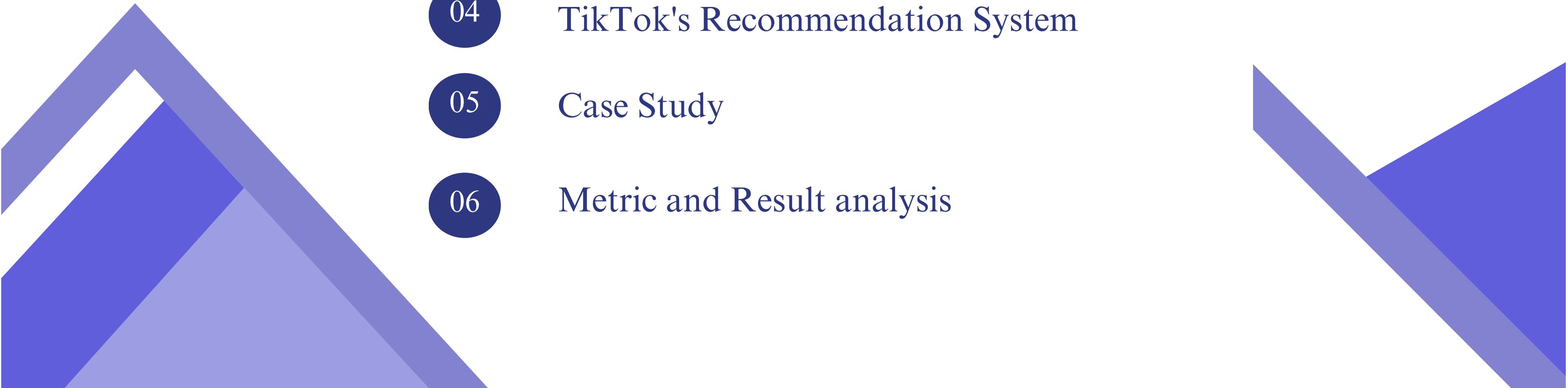


Recommender Systems

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Recommender Systems

Recommender systems are algorithms designed to suggest relevant items or content to users based on their preferences, behavior, or profile. They help users discover products, media, or information tailored to their interests, often enhancing user experience.



Types of Recommender Systems

There are several types of recommender systems, each with unique methods to personalize content:

01

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Content-Based Filtering :

- Recommends items similar to what a user has previously liked by analyzing item features.

Collaborative Filtering :

- Suggests items based on the preferences of similar users or items, using patterns in user behavior.
- Two main types: **User-based and Item-based Collaborative Filtering.**

Hybrid Recommender Systems :

- Combines content-based and collaborative approaches to improve accuracy and overcome limitations of individual methods.

Overview of TikTok as a Case Study

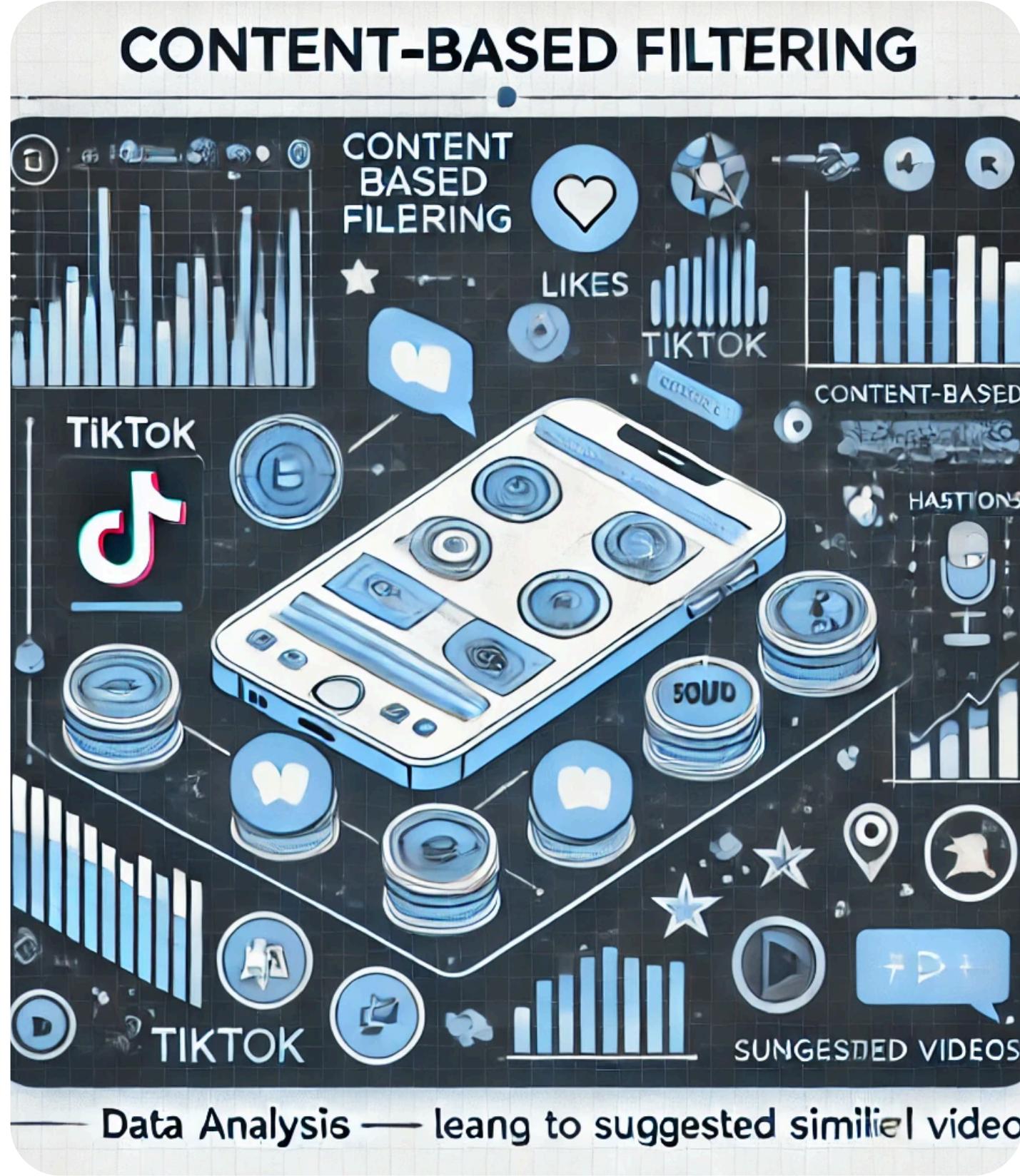
Overview

TikTok is a social media platform designed for creating, sharing, and discovering short-form videos. TikTok quickly gained global popularity, amassing billions of users worldwide.

TikTok uses a powerful recommendation algorithm to tailor content based on each user's interests and behavior. This feature plays a significant role in its success.



TikTok's Recommendation System



TikTok uses a combination of recommendation system types to create a personalized and engaging experience for its users:

Content-Based Filtering:

- TikTok recommends videos similar to those a user has previously liked or interacted with.
- It analyzes video features like hashtags, captions, audio, and visual elements to match content to user preferences.

Collaborative Filtering



It also uses Collaborative Filtering to recommend videos based on similarities in user behaviour and interests. Here's how it works:

- **User Interaction Data:** TikTok collects data on user actions like likes, shares, comments, and repeat views.
- **Pattern Identification:** Collaborative Filtering analyzes these interactions to find patterns among users with similar behaviors, inferring shared interests.
- **Content Recommendation:** Using these patterns, TikTok suggests videos enjoyed by similar users, even if the individual hasn't engaged with that content, enhancing personalization on the "For You" page.

Case Study:-How does collaborative Filtering help tiktok

It also employs Collaborative Filtering to suggest videos by examining user behavior and interests. Here's the process:

- User Interaction Data: TikTok gathers information on user activities such as likes, shares, comments, and repeated views.
- Pattern Identification: Collaborative Filtering evaluates these interactions to uncover patterns among users with comparable behaviors, identifying mutual interests.

Content Recommendation: Leveraging these patterns, TikTok recommends videos that other similar users have enjoyed, even if the individual has not interacted with that content, thereby enhancing personalization on the "For You" page.

What are problems without Collaborative Filtering :

Without a collaborative filtering system, TikTok would encounter multiple challenges:

1. Limited Personalization: Users would be exposed to generic content, leading to decreased engagement.
2. Hindered Content Discovery: Finding new creators and trends would become difficult, as recommendations would depend solely on follows and searches.
3. Decreased User Engagement: Irrelevant content could result in less time spent on the platform.
4. Cold Start Challenges: New users and videos would face difficulties in gaining visibility due to ineffective recommendations.

Implementation of Collaborative filtering in tiktok

Step 1: Data Collection

Data Collection

TikTok collects a wealth of user interaction data, which includes:

- User Engagement: Metrics like likes, shares, comments, and video watch time.
- User Profiles: Details regarding users' demographics and interests.
- Content Metadata: Data about the videos, including hashtags and the audio utilized.

Step 2: Create User-Item Interaction Matrix

TikTok structures interaction data into a user-item matrix, where:

- Rows signify users.
- Columns signify videos.
- Cells hold engagement metrics, such as likes or watch time.

Step 3: Calculate Cosine Similarity

Cosine similarity is used to determine how similar users are based on their interaction vectors. This metric calculates the cosine of the angle between two vectors, allowing TikTok to identify users with similar preferences.

Cosine Similarity Formula:

$$\frac{A \cdot B}{\|A\| \|B\|}$$

Where AAA and BBB are vectors representing user interactions.

Step 4: Implementing Cosine Similarity

In practice, TikTok would compute the cosine similarity for user pairs based on their interaction vectors (likes, watch time) using a process similar to this:

Steps:

- Normalize the user interaction vectors.
- Compute cosine similarity scores for all pairs of users.
- Create a similarity matrix.

Step 5: Generate Recommendations

Using the similarity scores, TikTok can recommend videos to a user based on what similar users have engaged with:

- Identify users similar to the target user.
- Aggregate the engagement of those similar users for videos the target user has not interacted with.
- Recommend the top videos based on this aggregated data.

Metrics and Result analysis used

Error Metrics used:

- Mean Absolute Error (MAE)
- Precision K and Recall K
- F1 Score
- Mean Squared Error (MSE)

Result analysis used:

After calculating error metrics, TikTok evaluates the results through the following methods:

1. Data Visualization: Utilizing graphs and charts to illustrate trends in error metrics over time, which aids in spotting patterns and anomalies.
2. Segmentation Analysis: Examining error metrics across various user segments (e.g., new versus returning users) to gain insights into differing reactions to recommendations.
3. A/B Testing: Conducting controlled experiments to determine how various recommendation algorithms influence error metrics and user engagement.
4. Continuous Feedback Loop: TikTok actively monitors user interactions, adjusting algorithms based on the real-time performance of error metrics.



Thank You