

Topic: Data and AI - SAP and Data Warehouse Recommendation Engine

“In the next two to three years, consumer data will be the most important differentiator. Whoever is able to unlock the reams of data and strategically use it, will win.”

-Eric McGee

In today's data-driven world, businesses are constantly seeking innovative ways to leverage their data for strategic decision-making. The integration of Artificial Intelligence (AI) and Data Warehouses has emerged as a powerful combination to drive business insights and recommendations. As a former SAP-ABAP intern, I have come to realize that SAP is a leader in enterprise software and has been at the forefront of this revolution, offering robust solutions that enable organizations to build recommendation engines using their data warehouses. This blog will explore the convergence of SAP and data warehouses in the context of recommendation engines, shedding light on the technical and creative aspects of this dynamic partnership.

Recommendation engines are software applications that provide personalized suggestions to users.

Data warehouses are central repositories that store and manage an organization's data. SAP, a key player in the BI and data management space, offers a suite of tools and solutions to optimize data warehousing and analytics.

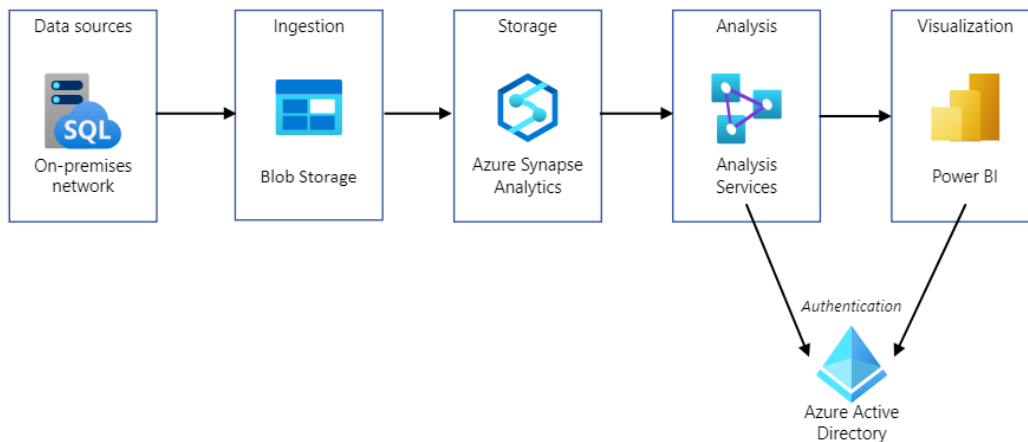
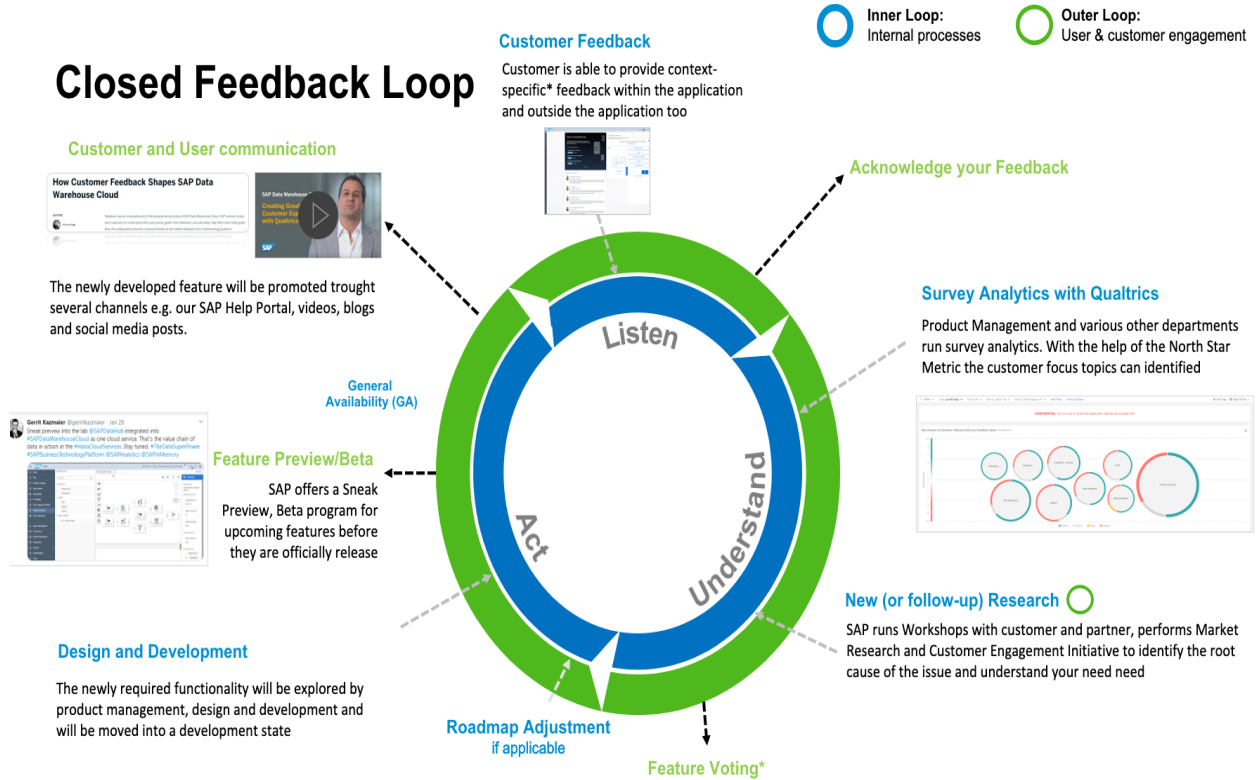
Problem Statement 1 Definition: Inefficient User Feedback Loop for SAP Data Warehouse Recommendation Engine

"We are surrounded by data, but starved for insights."

-Jay Baer

Challenge: Many organizations face the problem of limited or inefficient user feedback loops in their SAP Data Warehouse Recommendation Engines. Without robust feedback mechanisms, it's challenging to refine and improve recommendation algorithms, resulting in less accurate and relevant suggestions.

Closed Feedback Loop



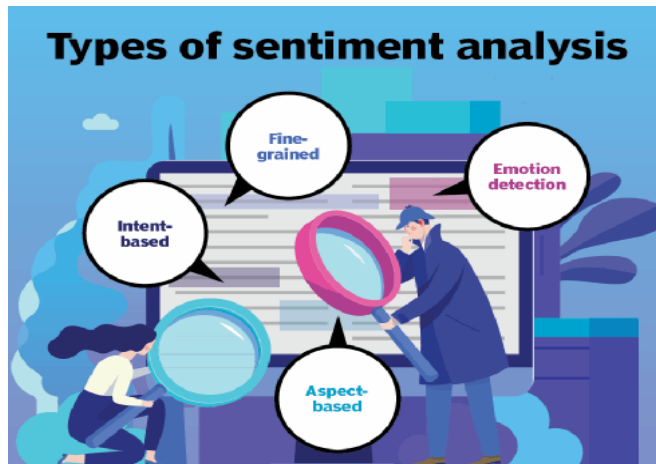
Solution:

1. Implement Seamless Feedback Mechanisms: Integrate feedback options directly into the user interface of your recommendation engine. Allow users to rate recommendations, mark items as liked or disliked, or provide written feedback easily. This ensures a continuous flow of data for algorithm refinement.

Example of such system is the Microsoft Feedback Client:

The **Visual Studio Microsoft Feedback client** is a downloadable tool that can be installed on desktop. It supports similar features for capturing findings to those provided by the Test & Feedback extension.

2. **Sentiment Analysis:** Apply sentiment analysis to user-provided feedback. By automatically analyzing user comments, one can gain deeper insights into their preferences and sentiments which allows for fine-tuning recommendations based on emotional cues.



Sample Code (Python in Azure) for maintaining Feedback Loop Using Sentiment Analysis:

```
%%pyspark
df =
spark.read.load('abfss://default@azuresynapsesa.dfs.core.windows.net/data/FabrikamComments.csv', format='csv'
## If a header exists, uncomment the line below
, header=True
)
df.write.mode("overwrite").saveAsTable("default.YourTableName")
```

Code written in Azure Notebook:

```
from mmlspark.cognitive import *
from notebookutils import mssparkutils
from pyspark.sql.functions import explode
#Load the data into a Spark DataFrame
Df = spark.sql("SELECT FROM default.fabrikamcomments")
sentiment=(TextSentiment ()
    .setLinkedService("TextAnalytics")
    .setOutputCol("output")
    .setErrorCol("error")
    .setLanguage("en")
    .setTextCol("comment"))
results=sentiment.transform(df)
# Show the results
```

```

display(results\
  .select("comment", explode("output").alias("exploded"), "error")\
  .select("comment", "exploded.", "error")\
  limit(10))

```

Output of given example:

View Table Chart Export results ▼

comment	sentiment	statistics	confidenceScores	sentences	warnings
I ordered three widgets last week...	mixed	undefined	▶ {"positive":0.26,"neutral":0.01,"neg	▶ [{"sentiment":"neutral","confidenc	[""]
Can't believe you fools shipped ...	negative	undefined	▶ {"positive":0.03,"neutral":0.05,"neg	▶ [{"sentiment":"negative","confider	[""]
Wow! I had NO IDEA that recipro...	mixed	undefined	▶ {"positive":0.5,"neutral":0.04,"neg	▶ [{"sentiment":"positive","confiden	[""]
Jake, I've had similar problems tr...	mixed	undefined	▶ {"positive":0.44,"neutral":0.03,"neg	▶ [{"sentiment":"negative","confider	[""]
That hand model needs a manic...	neutral	undefined	▶ {"positive":0.01,"neutral":0.99,"neg	▶ [{"sentiment":"neutral","confidenc	[""]
I put my wedding ring in a Bag o...	negative	undefined	▶ {"positive":0,"neutral":0.02,"negati	▶ [{"sentiment":"neutral","confidenc	[""]
David, sorry, it's whatchamacallit...	negative	undefined	▶ {"positive":0,"neutral":0,"negative'	▶ [{"sentiment":"negative","confider	[""]
Hi folks. According to your encab...	negative	undefined	▶ {"positive":0,"neutral":0,"negative'	▶ [{"sentiment":"neutral","confidenc	[""]
Jake, it's probably none of my bu...	positive	undefined	▶ {"positive":0.99,"neutral":0,"negati	▶ [{"sentiment":"positive","confiden	[""]
Maria, I'm pretty sure the folks at...	positive	undefined	▶ {"positive":1,"neutral":0,"negative'	▶ [{"sentiment":"neutral","confidenc	[""]

- A/B Testing with Feedback Loops:** Conduct A/B tests with different recommendation algorithms and collect feedback from users assigned to each group. This helps in comparing the effectiveness of various algorithms and selecting the one that resonates best with the audience.
- Dynamic Recommendation Updates:** Use user feedback to dynamically update recommendations in real-time. When a user provides feedback, adjust their recommendations immediately, ensuring they receive a better experience based on their preferences.
- Periodic Algorithm Re-evaluation:** Regularly re-evaluate and update recommendation algorithms using accumulated feedback data. This ensures that the engine evolves with changing user preferences and trends.

Benefits:

Implementing an efficient feedback loop for SAP Data Warehouse Recommendation Engine empowers the organization to enhance user satisfaction and engagement significantly. By continually refining recommendations based on user input, one can provide more accurate and personalized suggestions, leading to increased customer retention, sales, and overall business success.

Problem Statement 2 Definition: Inadequate User Engagement in SAP Data Warehouse Recommendation Engine

Challenge: Many businesses struggle with low user engagement in their SAP Data Warehouse Recommendation Engines. Users may not interact as frequently or extensively as desired, leading to underutilization of the recommendation system.

Solution:

1. **Enhanced User Profiling:** Implement advanced user profiling techniques to better understand individual preferences. Analyze historical user data and interactions to create detailed user profiles. This allows for more accurate recommendations aligned with users' interests.
2. **Contextual Recommendations:** Incorporate contextual information such as user location, device, and time of day into recommendations. This increases relevance and encourages users to engage with recommendations in different scenarios.
3. **Gamification Elements / Incentive based Architecture:** Introduce gamification elements like badges, rewards, or leaderboards to incentivize users to explore recommendations actively. Gamification can turn the recommendation process into an engaging and enjoyable experience.
4. **Dynamic Content Personalization:** Use real-time data to personalize content recommendations. Continuously adapt recommendations based on user behavior during their current session, increasing the likelihood of user engagement.
5. **Interactive User Interface:** Design an interactive user interface that encourages exploration. Implement features like "More Like This" or "Explore Similar Items" to keep users engaged and curious.
6. **User Education:** Provide users with educational content about how the recommendation system works and how it can benefit them. Users who understand the value of recommendations are more likely to engage with them.
7. **Feedback Integration:** Allow users to provide feedback on recommendations easily. Positive and negative feedback can help fine-tune the system and improve future suggestions.

Benefits:

By addressing the challenge of low user engagement in your SAP Data Warehouse Recommendation Engine, you can unlock its full potential. Implementing advanced user profiling, contextual recommendations, gamification, and interactive interfaces will not only increase user engagement but also drive higher conversion rates, revenue, and customer satisfaction. This solution transforms your recommendation engine into a valuable tool that actively enhances the user experience and drives business growth.

SAP and Data Warehouses dynamic PARTNERSHIP!

The fusion of SAP and data warehouses in the context of recommendation engines represents a powerful alliance between data management and AI-driven insights. Organizations can harness the capabilities of SAP Data Intelligence, SAP HANA, and SAP Analytics Cloud to collect, process, and present personalized recommendations to their users. By combining technical expertise in data modeling and real-time processing with creative approaches to personalization and user interface design, businesses can create recommendation engines that drive engagement, increase sales, and enhance user satisfaction. In this data-driven era, SAP

and data warehouses are leading the way in delivering intelligent and creative recommendations that shape the future of customer experiences.

I would like to conclude this blog with yet another quote!

**“Machine intelligence is the last invention that humanity will ever need to make”
-Nick Bostrom**

Acknowledgment

The dynamic partnership which exists between data warehousing and the world’s best ERP Tool-SAP (System Application Products in Data Processing) can yield not just one but multiple solutions to the problems that exist in the real world.

My time as an intern (ABAP Intern) at one of India’s largest construction companies (MEIL) has made me gain abundant knowledge in the field of SAP. The combination of Data Warehousing and SAP not just gives solutions on how to build a recommendation engine but also customize it according to various businesses/enterprises.

This blog has also given me the opportunity to explore one of the many domains of Azure. As a Microsoft Student Ambassador, working on this blog exposed me to many interesting and impactful features that Microsoft Azure provides to students like me.

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