

## **Engaging Minds: Boosting Brand Awareness with AI-Powered Content Recommendations**

### **Overview**

Our capstone project, "Engaging Minds: Enhancing Brand Awareness through AI-Driven Content Recommendations," aims to boost digital engagement and Aramco's global brand visibility. Personalization is essential for developing meaningful connections and company image in the digital age. This project is intended to develop an AI-driven content recommendations platform to offer personalized content to engage people and build loyalty. The system provides relevant and tailored experiences through a unique approach that focuses on the accurate representation of content, allowing for a simple model to make inferences. This approach avoids complexity while delivering highly accurate results and able to scale efficiently. It also tackles the "cold start" problem, ensuring that new users with no prior tracked usage behavior receive useful and engaging content, attracting a wider audience and strengthening Aramco's image as a global company with innovation at its core.

Owned channels play a critical role in communication strategies. For example, Aramco utilizes platforms like AramcoLife, Elements Magazine, and Raceteq to showcase its values, achievements, and leadership in the energy sector and beyond. These channels allow Aramco to craft and deliver narratives that deeply resonate with its target audience, offering control and authenticity that paid or third-party platforms cannot match. By providing effective content across these platforms, Aramco can enhance user engagement, build brand awareness, and establish trust. The recommendation engine developed in this project further empowers Aramco to optimize its owned media strategy, ensuring that content reaches the right audience at the right time, fostering deeper user engagement, and strengthening brand loyalty.

Without access to usage behavior data, it can be challenging to provide tailored content recommendations to users. This is known as the "cold start" problem. This project addresses this issue by delivering accurate, tailored news recommendations to users, by providing customized content that aligns with individual preferences, the system encourages users to stay engaged longer, creating a more relevant and personalized experience that strengthens their connection to the platform.

The project utilized the Microsoft News Dataset (MIND), comprising over one million users and 160,000 articles, to learn user behaviors, extract significant patterns, and develop a recommendation engine that delivers real-time, personalized content.

### **Data Preparation and Analysis**

The MIND dataset was preprocessed to clean and structure user interaction data with article information. Specifically, we dropped unnecessary features and kept only those that would positively impact model performance. We created new features within the behavior dataset to analyze users' engagement, specifically whether they clicked or did not click on an article.

### **Model Selection and Development**

We initially explored different recommendation techniques, such as content-based filtering, collaborative filtering, and hybrid approaches. However, we found that these methods did not yield optimal results. To address this, we decided to improve how we represent news articles by fine-tuning the BERT model to be

more specific to the news domain. We also incorporated pre-trained models to analyze sentiment and emotion in news articles, which helped us capture additional features for model training.

We created two types of representations, or embeddings, for each news article. The first focuses on the details and context within the article itself (micro-level), while the second looks at broader metadata, such as categories, subcategories, sentiment, and emotion (macro-level). We used k-means and one-hot encoding clustering techniques to generate the macro-level embedding. These two embeddings were combined to create a rich representation of user preferences and non-preferences.

To predict whether a user will click on a news article, we used a cosine similarity function. This compares the user's profile based on their preferences with the news article's embedding to see how well they match. By pre-calculating these embeddings, we made the process efficient and scalable.

### **Metrics and deployment**

The model achieved an 87% accuracy score during validation. Having achieved good accuracy, we developed a Streamlit application to demonstrate the model's power in a real-life context. The deployment utilized Docker, Google Artifact Registry, and Google Cloud Run. Having migrated our model and its data to a cloud environment, we were also able to utilize Big Query for data storage and connect this database with Tableau for data visualization. This enables multiple users to access and work with the model, thus allowing scalability and efficiency.

### **Sustainability**

Sustainability is an integral part of our personalized news recommendation system. As of November 2024, the average website produces as much as 1.76 of CO<sub>2</sub> per page view. The average user spends around 10 minutes daily reading 10-20 articles to find relevant content. This produces approximately 17-35 g of CO<sub>2</sub> per user per day from inefficient news browsing. Users can find relevant content faster and more efficiently using our personalized content recommendation system. This could reduce CO<sub>2</sub> emissions by approximately 60% (7-14)g of CO<sub>2</sub>.

### **In conclusion**

This project exemplifies the team's resolve, collaboration, dedication, and mastery of advanced machine-learning techniques. Despite many obstacles, the solutions outlined in our project report exemplify the revolutionary potential of AI-driven customization in enriching user experiences and promoting brand loyalty.

With this AI-driven content recommendation platform, Aramco is well-positioned to spearhead digital innovation and establish new benchmarks for engagement and communication. This project reflects the team's academic journey, resulting in a sense of achievement and anticipation for the future. The competencies, knowledge, and experiences acquired up to this point will undoubtedly propel ongoing success and innovation, creating a lasting influence on both Aramco and the team's professional development.