BUDGE-IT: PERSONAL EXPENSE AND SAVINGS OPTIMIZER WITH CHATBOT INTEGRATION

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***Abstract*** *– Sample text.*

*Keywords – Sample text, Sample text.*

1. INTRODUCTION

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1. REVIEW OF RELATED LITERATURE

The integration of chatbots into personal finance applications has been explored in various studies. Thong [[1]](#_REFERENCES) developed a mobile application that combines personal finance management with chatbot functionality, enhancing user engagement and financial tracking. Talasila [[2]](#_REFERENCES) introduced an AI-driven system, MyFinanceAI, which utilizes machine learning for real-time financial analysis and personalized budgeting recommendations. Alenazi and Sas [[3]](#_REFERENCES) evaluated 45 budgeting apps, revealing that many focus more on tracking expenses than on proactive budgeting features. A case study [[4]](#_REFERENCES) discussed the design and implementation of a budget tracker app aimed at promoting healthy financial habits through visualization tools. Doherty [[5]](#_REFERENCES) explored the development of a web-based chatbot for online banking, utilizing natural language understanding to assist users in financial transactions.

The integration of Natural Language Processing (NLP) into financial applications has markedly enhanced user interactions within fintech platforms. Favour et al. [[6]](#_REFERENCES) highlighted that NLP-powered chatbots and virtual assistants are revolutionizing customer engagement by delivering instant, accurate, and personalized financial services. These intelligent systems are capable of handling user queries, providing spending insights, and offering tailored financial guidance, thereby proving invaluable in personal finance tracking tools like Budge-IT.

1. METHODOLOGY

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1. RESULTS AND DISCUSSION

**Key Findings**

* Distinct clusters of condom sales were identified across different regions, influenced by demographic and economic factors.
* Urban regions showed higher demand, with spikes during public awareness campaigns.
* Outliers detected by DBSCAN suggested anomalies in sales, possibly due to government interventions or external factors.

**Model Evaluation**

* Silhouette Scores indicated that K-Means with K=4 provided the best segmentation.
* DBSCAN unsuccessfully identified outliers in low-sales regions.

**Baseline Comparison**

* Compared to random clustering, our optimized models demonstrated a 30% improvement in clustering cohesion.
* Prior studies relied on market segment definitions, whereas our approach dynamically identified emerging trends.

**Statistical Significance**

* Cluster compactness differences were validated using statistical tests.
* P-values < 0.05 indicated significant differences between clusters.

**Meaning of Results**

* The clustering results align with market reports on urban-rural sales disparities.
* Seasonal trends in condom sales were identified, linking demand fluctuations to public health campaigns.

**Patterns and Trends**

* Higher sales in metropolitan areas correlated with higher awareness and accessibility.
* Sales dropped in certain conservative regions, indicating cultural influence.

**Consistency with Expectations**

* Findings largely matched predictions but revealed unexpected trends in certain rural areas with high but seasonal sales.

**Comparison with Previous Research**

* Previous studies relied on survey data; our data-driven approach offered greater granularity and predictive capability.

**Advantages and Limitations:**

* **Advantages:** Scalability, real-time analysis, robust to noise.
* **Limitations:** Model sensitivity to hyperparameters, potential biases in dataset coverage.

**Insights from Model Errors:**

* DBSCAN struggled with varying densities, leading to not finding the significant clusters.
* K-Means assigned some points to inappropriate clusters due to assumptions of spherical clusters.

1. CONCLUSION

Using clustering methods, this research sought to determine the demographic and geographical factors influencing condom sales trends in India. We were able to effectively segment several markets and identify important elements impacting sales patterns by conducting a thorough examination of sales data. The results show that although more conservative locations often have lower sales, metropolitan areas usually have high sales, with substantial jumps during public health campaigns. A better comprehension of these patterns was made possible by the use of K-Means and DBSCAN clustering, which revealed both predicted and unexpected sales distributions.

This study's main contribution is the advancement of conventional market research methodology via the application of machine learning-based clustering for market segmentation analysis. These findings provide practical suggestions for public health professionals, merchants, and legislators to maximize condom distribution and awareness initiatives. This research also emphasizes the benefits of using machine learning to market analysis, providing a data-driven, scalable, and trend-adaptable method.

Despite our method's advantages, drawbacks were noted, including model susceptibility to hyperparameters and dataset biases. These restrictions could have made it more difficult to fully capture certain trends. In order to improve prediction capacities, future research may concentrate on extending dataset coverage and using deep learning approaches. Further understanding of long-term patterns may also be gained by researching cultural changes across time.

In summary, this study shows how effective data-driven decision-making can be in comprehending Indian condom sales patterns. We have offered significant insights that may direct public health and commercial agendas by using clustering techniques. The study highlights the potential of machine learning in market research and provides opportunities for more investigation into the dynamics of customer behavior.

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