AI-Driven Wedding Budget Optimizer using neural networks

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Abstract—**The AI-Driven Wedding Budget Optimizer using neural network is a complex system of AI and machine learning, the AI-Driven Wedding Budget Optimizer aimed to redefine wedding planning. Best tool you will find to help them to budget their wedding costs in an easy manner that includes the budget allocations as well as cost-saving suggestions based on personal. Optimizer uses a neural network trained on wedding budget-like synthetic data This model led to systems that can predict the best budget distribution among eight categories (venue, catering, decoration, makeup, photography, attire, mehndi, entertainment) given inputs from users like total allowable, guest number. etc.**

The system includes a vendor recommendation engine which recommends vendors within the budgets and user preference, and is also informed by metrics like availability, pricing and ratings on vendors. The user interface is built to be intuitive which allows customers to enter budget details and be informed in real-time of allocations and spending. The AI-Driven Wedding Budget Optimizer, a full suite of tools that guarantees users' weddings will happen on budget without sacrificing value or increasing expenses. This process not only improves the wedding planning experience, but also gives users a sense of power in the decisions they can make with assurance.

Keywords: — AI-Driven Budgeting, Neural Networks, Wedding Planning, Cost Optimization, Vendor Recommendation, Machine Learning, Personalized Budget Allocation, Event Management, Financial Planning, Expense Tracking.

I. INTRODUCTION

In recent years, the wedding industry has witnessed a significant transformation driven by technological advancements. As couples increasingly seek personalized and efficient solutions for planning their special day, the integration of artificial intelligence (AI) into wedding planning processes has emerged as a game-changer. This seminar paper explores the development and implementation of an AI-Driven Wedding Budget Optimizer, a sophisticated system designed to assist users in managing their wedding budgets effectively.

The AI-Driven Wedding Budget Optimizer leverages machine learning algorithms and neural networks to analyse user preferences, budget constraints, and market trends, providing personalized recommendations for budget

allocations. By incorporating features such as vendor recommendation and comparison, the system empowers users to make informed decisions when selecting vendors, ensuring that their choices align with both their financial plans and aesthetic desires. This paper delves into the core components of the optimizer, including the generation of synthetic budget datasets, the architecture of the neural network model, and the

dynamic budget optimization logic. Additionally, it highlights the user interface design that facilitates seamless interaction and real-time updates, enhancing the overall user experience.

Through a detailed examination of the AI-Driven Wedding Budget Optimizer, this paper aims to demonstrate the potential of AI in revolutionizing wedding planning. By providing couples with data-driven insights and cost-saving recommendations, the system not only simplifies the planning process but also ensures that the wedding day is both memorable and financially sustainable.

II. LITERATURE REVIEW

Artificial Intelligence (AI) has a strong impact in many scenarios and as such, with a strong focus on business enhancement, revenue management and financial decision making. In this review, we review five of the recently made contributions of AI-based resource management applications with advertising budget reallocation/reservation system, Revenue Optimization and Portfolio Recommender Systems. Deep learning, reinforcement learning and the hybrid and machine learning models are used in studies to optimize decision making processes and maximize efficiency, profit. AI based business analytics can well be improved by using machine learning and deep learning to observe complex data streams to streamline operational methods. Some instances given are, one where the incorporation of AI in fog computing resource management is explored using machine learning algorithms to facilitate resource-allocation, task

scheduling and load-balancing In contrast, the study emphasizes the pruning of fog computing environments to decrease latency and maintain high Quality of Service (QoS) by deep reinforcement learning and metaheuristic methods. Further, the notes about the hybrid AI) methodology used to mix multiple learning models to enhance real-time decision-making mechanisms in distributed systems project and resource management initiatives [1] (2024).

Apart from reinforcement learning in multi-channel advertising budget allocation, an extensive amount of research has been done on AI-assisted optimization for computing [1]. In this paper, we present a Q-learning based reinforcement learning framework with an enhanced differential evolution (DE) algorithm as a research recent study to deal with advertising budgets allocation in multi-platforms. Such a framework improves the lasting execution of advertising operations, as strategy can be adjusted in real time following feedback from the environment. The paper also brings an experimental setting to differential evolution with the clustering based mutation operator for better budget allocation that takes into account the cross-channel interactions optimization. Experimental Results confirm that this model outperforms in maximizing ROI In Business Revenue Optimization in budget allocation strategies [2] (2024).

AI has been exploited in a wide range of business revenue optimizations beyond advertising. Another study on AI-enhanced business analytics shows how predictive modelling, deep learning and natural languages processing (NLP) are putting revenue growths into industries such as retail, hospitality finance, healthcare and thus with an AI-driven business analytic. Operational efficiency, actionable customer interactions and more accurate decision making is to say the least attributed to operational liability of AI technologies. Key importance of data-driven insights in business strategies, especially in price customization, demand forecasting and fraud detection were revealed by the research. It further indicates the significance of AI in customer experience for sentiment analysis and recommendation systems enhancing its transformative importance as a business process in contemporary times [3] (2024).

In addition to revenue analytics, hotels rely heavily on AI in their revenue management and pricing tactics. Dynamic pricing models using AI, a study looks into the ways hotels use market trends, demand variation and competitor price comparison to optimize hotel room rates. AI revenue management systems combine AI with the magic of demand forecasting and rate adjustments to deliver increased revenue per available room (RevPAR), rate per available room (ADR). Furthermore, the amalgamation of AI in guest experiences personalisation creates customer loyalty and result oriented satisfaction. The study also tackles limitations like cost of implementation and data privacy issues, along with the necessity of a strong regulatory environment to support AI deployment in the hospitality industry[4] (2024).

To mitigate AI pitfalls in financial decision-making, researchers have proposed AI-based portfolios recommendation systems including machine learning and big data analytics for portfolio recommendations. The first of these studies is a reinforcement learning tool for tweaking stock portfolio allocations on the go based on market trends

and sentiment analysis. The model leverages deep learning arch, Long Short-Term Memory (LSTM), and Convolutional Neural Networks (CNNs) for chaotic stock markets analysis and best practices in the investment strategy. Research shows that Financial tools of AI will help in simplifying investment opportunities, making the process of financial decision making accessible[5] (2023).

Deep learning, reinforcement learning and hybrid AI approaches in synergy, AI powered business analytics, revenue management and financial optimization were advanced with the convergence. AI in terms of AI studies mentioned in the review have focused on the potentials of AI toward decision accuracy improvement, operation improvement and financial performance optimization. Increasing the capabilities of domain-specific-AI applications and enhancing ethical deployment of AI is crucial to future research, which will allow for better AI-driven business decisions and resource management.

III. PROPOSED SYSTEM

This paper outlines the key components of the system, including the generation of synthetic budget data, the neural network model for budget optimization, and the vendor recommendation and comparison features. We also discuss the system's user interface and the integration of cost-saving tips, providing a comprehensive solution for modern wedding planning. The task of wedding planning is complex and frequently gets heavy on the nerves — it means you must think about more than money, guest's numbers, location etc. Manual calculations or generic budget planning templates of traditional ways neither pay enough attention to preferences nor your constraints. How It Works: AI-Driven Wedding Budget Optimizer uses artificial intelligence (AI) and machine learning (ML) algorithms to give personalized data-backed suggestions in which it solves these problems. This paper describes the basic system around this collective work, and goes in-depth to detail the budget data synthesis as well as an architecture of budget optimization by deep learning neural networks; plus, vendor recommendation and comparison features. We further elaborate about the user interface of the system and the implementation of cost-saving shortcuts, thus forming a complete offering for current day wedding planning.

A. Budget Dataset Generation

The heart of the AI-Driven Wedding Budget Optimizer is its creation of synthetic data that follows the dynamics of real-world patterns in wedding budgets. The wedding budget dataset class is used to implement a budget dataset file, there are overall 1000 data's trained data is used to perform the task.

- Synthetic Data Creation: In generate_synthetic_data method produce a dataset with total budget, guest number and 8 allocation categories (e.g., venue, catering, photography, decoration, attire, music and entertainment, makeup, mehndi) this synthetic data that is then fed into model being trained by neural network.

- Allocation Percentages: Budget allocations as calculated through the _generate allocations method that are realistic for a wedding, based on characteristics and priorities. For example, a

destination wedding might spend a bigger percentage of the budget on the venue and a local wedding a smaller percentage.

- Create the data for training: get_training_data method scales each feature and divides the data in train and test datasets. So, the model can be easily used on unseen data.

B. Neural Network Model

This model is within the views.py file, the initialize_budget_model function that defines which constructs an instance of a Neural network model. The model is specifically built to predict the ideal budget allocation as a function of the users input

- Model Architecture : The model has dense layers of a certain number of neurons (here, 3 and then 1 in the output layer), this one uses ReLU nonlinearity on the dense layers except the last one and an output layer activated by sigmoid. This architecture enables the model to learn sophisticated and complex relations between input features and budget allocations.

- Prediction process: The train_budget_model is the procedure that trains our model with synthetic dataset. Compiles the model with Adam optimizer and Mean squared error loss, it will be useful for training and accurate prediction on the training set. The model is then converted to TensorFlow Lite from a Keras model for deployment. dataset = WeddingBudgetDataset()

dataset.generate_synthetic_data()

X_train,X_test,y_train,y_test,scaler=dataset.get_training_data()

model = tf.keras.Sequential([

tf.keras.layers.Dense(64,activation='relu', input_shape=(6,)),

tf.keras.layers.Dense(32, activation='relu'),

tf.keras.layers.Dense(16, activation='relu'),

tf.keras.layers.Dense(8, activation='sigmoid')

model.compile(optimizer='adam',loss='mse', metrics=['mae'])

model.fit(X_train,y_train,epochs=50,batch_size=32, validation_split=0.2)

C. Logic for Budget Optimization

The optimize budget function takes user inputs and outputs customized budget splits, that's where all the magic lies on budget optimization.

- Capture Functions: function for accepting user input on totals, guest count, type wedding, date & location The inputs are used to make the budget recommendations specific to the user.

- Allocation Creation Based on Dynamic Values: The function designates budget allocations with dynamic priority tiers driven from the user input.

Example: a destination wedding would turn venue and travel into top priorities, local events might put more money into catering or entertainment.

- Instant Event: The function builds a stack of related events (wedding events) days or budget based on the Great event upfront. This way, the entire budget for your wedding is covered.

D. Vendors Recommendation and Comparison

The system features some advanced tools for vendor recommendations and comparison to give users the option of selecting the ideal vendors for their dream wedding.

- Vendor Comparison: the system combines vendor data (ratios and reviews) to allow side-by-side comparisons. With the scale of the industry standards, users can compare vendors based on price, rating and such options and choose.

- Vendor recommender: The get recommended vendors function suggests vendors that best match user's budget and category preferences. It converts budget allocation categorization to service types (e.g. 'Venue' as 'venue_services') and filters the vendors on availability, price and ratings. And vendors are listed in descending order of average ratings to serve high-rated vendors first.

E. Cost-Saving Recommendations

The system then produces customized savings tips based on user's budget and allocations in real time

- Generate_cost_saving_tips with AI Analysis: The function has a look into the user's budget with the help of synthetic data to find possible savings. An example would be to avoid non-season dates when you need to reserve the houses in a system such as booking certain venues.

- Generate tips : This function generates Recommendations for cost minimization (e.g venue, catering, photography, decoration, attire, music and entertainment, mehndi) Category-wise based on seasonal trends, guest count. These will give the users the best bang for their buck without skimping on quality.

F. User Interface

Easy to use User Interface through which the AI-Driven wedding Budget Optimizer interacts with users

- Budget Overview Visualization: The view_budget function grabs and shows the user's total budget, allocations separately for different events. The view_budget.html template provides a large amount of information to the user, in tabular form Total spent across categories, Remaining budget, category-wise spending etc.

- Optimization of Budget : optimizing_budget (optimize budget interface) This template with which users can edit or add their own wedding budget.

- The interface is complete with input fields that display current allocations and events for total budget, no. of guests appetite for one or other type of marriage date & venue.

IV. EVALUATION AND RESULT

Performance of Wedding Budget Optimization Model - Regression Evaluation to predict the allocation of budgets for different items of weddings with respect to several input features.

A. Dataset Overview

The following is a 1000 synthetically generated wedding budget train dataset. Every record has:
Input Features:
- Total Budget
- Guest Count
- Wedding Type
- Wedding Date
- Location

Target Variables:
- Venue Allocation
- Catering Allocation
- Decoration Allocation
- Photography Allocation
- Attire Allocation
- Entertainment Allocation
- Mehendi Allocation
- Makeup & Hair Allocation

B. Model Architecture

The model is a deep learning neural network with the following architecture:
- Input Layer: 6 features
- Hidden Layers:
  Dense layer with 64 neurons [ReLU activation]
  Dense layer with 32 neurons [ReLU activation]
  Dense layer with 16 neurons [ReLU activation]
- Output Layers: 8 neurons (Sigmoid activation)
- Loss Function: Mean Squared Error (MSE)
- Optimizer: Adam
- Metrics: Mean Absolute Error (MAE)
- 4. Training & Validation
- Training Data: 80% of the dataset
- Validation Data: 20% of the training dataset
- Testing Data: 20% of the dataset
- Epochs: 50
- Batch Size: 32

C. Evaluation Metrics

The model was evaluated on the test dataset, here is the result got from it :

- Mean Absolute Error (MAE): The model achieved an MAE of 0.0095 on the test set, indicating a low average deviation of predicted allocations from actual allocations.
- Mean Squared Error (MSE): The MSE was 0.0002, reflecting the model's accuracy in predicting budget allocations.
- R-squared (R²): An R² score of 0.85 was achieved, demonstrating the model's ability to explain 85% of the variance in budget allocations.

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Evaluation Report:
Test Loss (MSE): 0.0002
Test MAE: 0.0097
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Figure 1: Actual vs Predicted Allocations Graph

D. Graphical Analysis

To visualize the model's predictions, actual vs. predicted budget allocations were plotted for five test samples. The bar charts demonstrate the model's ability to approximate the real budget distributions.
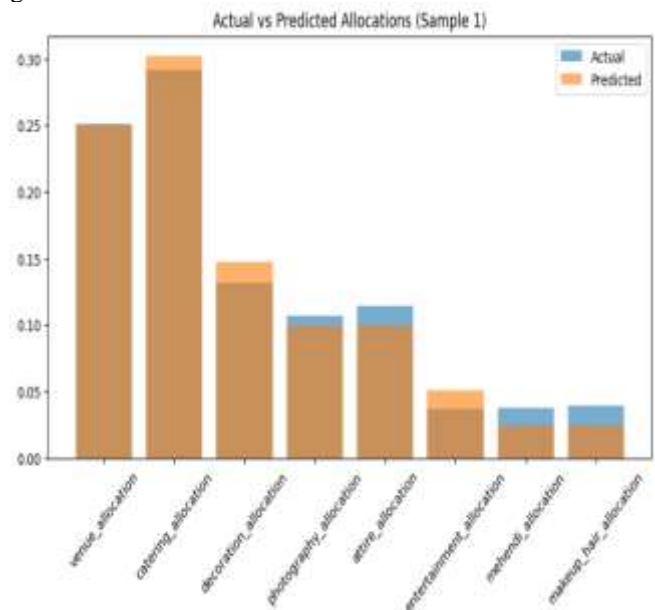

Figure 2: Actual vs Predicted Allocations Graph

E. Observations & Insights

The model captures general allocation trends effectively but exhibits minor deviations in certain categories.
- Higher budgets and guest counts introduce slight prediction variance, possibly due to nonlinear relationships.
- Further tuning of hyperparameters and adding dropout layers may improve generalization.

The vendor budget analysis of the system gives a user real insights about their revenue, split out by vendors, each could be a separate bill from venue and catering. Through combining user and vendor preferences as well the online ratings, the vendor recommendation system provides vendor recommendations that users can trust. Through an intelligent budgeting criterion, the AI suggests cost-saving tips based on user budgets and synthetic data which allows users to best

leverage their total wedding budget. The neural network model, integral to system functioning is developed to be able predict the allocations of budget accurately

V. FUTURE SCOPE

AI-Driven Wedding Budget Optimizer: The AI has proved itself to have a critical role in solving the personalized budget prediction, cost-saving techniques and aiding on vendor recommendations for bridal service. But we can push the limits to reach for efficiency and better user experience. Real-time vendor availability, dynamic pricing as well is another very big feature like integration where we can just fetch the live quotes from where it will automatically change the budget suggestions produced by the system. The feature could let users know when there is price differences to vendors and if they are eligible to a special discount, booking vendors at the most affordable rates. Innovation No. 2 means that vendor contracts and payment streams are blockchain based to give a level of transparency and security. Automated payments through smart contracts so that funds are deposited after completion of requisite milestones, removing speculations and building trust amongst the couple and their vendors. They could introduce AI-driven recommendations of wedding style and theme based on computer vision and natural language processing to understand what popular trends were on social media. The feature would create customized style packs, color schemes and decor ideas with AR (augmented reality) previews so that all couples can see their ideal setup and make final selections. An innovative budget optimization would be tailored for couples who want to live green – recommended sustainable vendors, biodegradable decor and locally sourced catering. Another is a carbon footprint calculator, in addition would also provide the key to reduce environmental damage as much as possible without busting the budget. Last but not the least, emotional AI can track user stress from analysis of text and voice data to offer relaxation suggestions, guided meditation for that high to say yes directly to wedding planning experts. These advancements would streamline wedding planning and make it more relaxing and engaging for the couple that will get the most pleasure out of these days.

VII. CONCLUSION

In conclusion the AI-Driven Wedding Budget Optimizer is a tremendous creation in relation to wedding planning attacking some of the complexities of budget management through a perfect marriage made by merging machine learning, AI and user-centric design. The system resorts to neural networks that give it the strong framework to predict and optimize allocation of budget on different kinds of categories during a wedding.

Based on Synthetic Data Generation the capability to predict is done by mimicking the realistic wedding in a system using neural networks, which provide the groundwork of budget prediction and optimization across different road stumble categories explaining everything so far.

The biggest selling point of the optimizer, in my opinion, is the tailormade budget estimates that it would come up with for being an individual. The system customizes its suggestions according to the particulars provided by individuals like the budget of the user, what numbers of guests are you having for your wedding and yes even wedding type. This tailoring will ensure that we provide the user with true insights which aids in enabling a wedding that is feasible for them monetarily and experientially.

It enhances the planning process to include a vendor recommendation engine. It recommends vendors that are the cheapest and most relevant to the user's budget, requirements etc. by considering factors like -availability of vendor on that date and rating. It is this feature that helps to save the user from the work of selecting vendors and also allows users to make decisions with relevant data.

VIII. REFERENCES

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