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REVIEWER'S REPORT

Manuscript No.: IJAR-59668

Title: Sequential Optimization of Real-Time Revenue Using Adaptive Online Learning

Recommendation:

Accept as it is .....

Accept after minor revision.....

Accept after major revision .....yes.....

Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality			Y	
Techn. Quality			Y	
Clarity			Y	
Significance			Y	

Reviewer's ID: JPR-Dr.Shaweta Sachdeva

Detailed Reviewer's Report

1. The manuscript addresses a relevant research problem; however, the novelty and specific research contribution of the proposed approach need to be clearly highlighted in comparison with existing Thompson Sampling-based revenue optimization techniques.
2. The authors should provide a more detailed description of the experimental dataset containing 10,000 users. In particular, the source of the dataset, data generation methodology, distribution of conversion rates, and preprocessing procedures should be explained.
3. The nine marketing strategies are described conceptually, but their actual configurations and differences are not sufficiently explained. A detailed description of each strategy would improve the reproducibility of the study.
4. The manuscript assumes fixed but unknown conversion probabilities for the nine strategies. However, the discussion claims that the proposed approach can respond effectively to non-stationary environments. The authors should clarify this inconsistency and provide experimental evidence under changing reward distributions.
5. The methodology section requires further clarification regarding the implementation of Thompson Sampling, including the initialization process, posterior updates, stopping criteria, and convergence conditions.
6. Algorithm 1 presents a Deep Q-Learning procedure, whereas the proposed methodology is based on Thompson Sampling. The authors should clarify the relevance of Deep Q-Learning in this study or replace the algorithm with the actual implementation of the proposed approach.
7. There are inconsistencies in the experimental results. For example, Table 1 and Table 2 report different cumulative rewards and detection times for Thompson Sampling. These differences should be explained, and the experimental results should be made consistent throughout the manuscript.
8. The statistical evaluation should be strengthened by reporting the exact p-values, standard deviations, confidence intervals, and effect sizes obtained from the 100 independent simulation runs.
9. The authors should provide a clear explanation of how the 100 independent simulations were conducted and whether different random seeds and identical experimental conditions were maintained across all algorithms.
10. The comparison with Random Selection and UCB is useful; however, additional comparisons with relevant recent online learning or contextual multi-armed bandit approaches would strengthen the experimental evaluation.

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11. The economic analysis estimates revenue based on 100 million users and a 20% conversion rate. However, the assumptions regarding subscription costs, operational expenses, customer acquisition costs, and promotional discounts should be incorporated to establish the actual profitability of the proposed approach.
12. The claim of achieving faster convergence and minimizing exploration costs should be supported by more detailed quantitative evidence, including convergence curves and comparative performance metrics.
13. Figures and tables should be reviewed carefully. The numbering and references to figures appear inconsistent in different sections. Ensure that all figures and tables are properly numbered, captioned, and discussed in the main text.
14. The discussion section should provide a deeper interpretation of the experimental findings rather than primarily repeating the numerical results. The authors should also explain the practical implications of the observed performance differences.
15. The manuscript claims that deployment costs, advertising fatigue, and user experience preservation are incorporated as contributions. However, these factors are not explicitly modeled in the mathematical formulation or experimental evaluation. The authors should either provide supporting implementation details or revise these claims.
16. The literature review should be strengthened with more recent and directly relevant studies on Bayesian online learning, multi-armed bandits, and adaptive revenue optimization.
17. The conclusion should clearly distinguish between experimentally demonstrated findings and projected economic benefits. The large-scale revenue estimates should be presented with appropriate assumptions and limitations.
18. The manuscript requires thorough English language editing to improve grammatical accuracy, sentence structure, technical clarity, and consistency of terminology.
19. Overall Recommendation
20. Major Revision
21. The manuscript investigates a promising application of Bayesian online learning for real-time revenue optimization. However, significant improvements are required in the experimental methodology, consistency of reported results, algorithmic presentation, statistical validation, and justification of economic claims. In particular, the discrepancy between the two result tables and the inclusion of a Deep Q-Learning algorithm in a Thompson Sampling-based study need careful attention. The authors should address these concerns comprehensively to improve the scientific rigor, reproducibility, and overall quality of the manuscript.