Spike-Aware Local Music Recommendation: Detecting Event-Driven Anomalies for Secure Streaming *

Tae-Han Kim and Sang-Min Choi*

Gyeongsang National University, Jinju, Republic of Korea
rhdiddl9406@gnu.ac.kr, jerassi@gnu.ac.kr
*Corresponding author

Abstract

Music recommender systems often rely on long-term popularity metrics, making it difficult to reflect short-term local trends. This paper proposes a lightweight methodology, realized through the SpikeDecay model, which enhances a POP-based baseline by incorporating short-term event signals detected through an EWMA (Exponentially Weighted Moving Average). Using the MMTD (Million Musical Tweets Dataset) from the Los Angeles region, we show that SpikeDecay consistently improves Recall, Hit, NDCG, and MAP metrics. While the model maintains high similarity with the baseline during regular periods, it locally adjusts rankings during event-driven spikes. These results demonstrate not only improved recommendation quality but also a potential application in detecting abnormal surges for security purposes.

1 Introduction

With the rapid growth of streaming services, research on music recommender systems has become increasingly active [**?**]. However, existing recommender systems have the limitation of relying heavily on long-term popularity metrics, making it difficult to adequately reflect short-term local trends [**?**]. To address this limitation, we propose a lightweight methodology that maintains the structure of the POP baseline while incorporating city-level short-term events (e.g., concerts, meme diffusion), thereby enabling more localized recommendations.

2 Methodology & Experiment

This paper propose a lightweight methodology that extends the POP-based recommendation by incorporating short-term event signals detected through EWMA (Exponentially Weighted Moving Average) [**?**]. The procedure consists of three steps: (1) generate the baseline ranking using POP scores, (2) detect sudden spikes and re-rank items within a predefined EventWindow (a temporary time window defined around detected spikes), and (3) revert to the original POP ranking once the window ends. Figure **??** provides a high-level overview of the proposed workflow, from POP ranking to spike detection and event-driven re-ranking. This figure allows readers to grasp the entire process at a glance.

Experiments were conducted using the MMTD [**?**] focusing on the Los Angeles region. We compared POP and SpikeDecay using evaluation metrics Recall@K, Hit@K, NDCG@K, and MAP [**?**]. SpikeDecay consistently outperformed POP, with Recall +2.20%, Hit +0.81%, NDCG +4.23%, and MAP +7.22%. Jaccard Similarity analysis further showed that, while similarity remained above 0.95 during regular periods, it dropped to 0.82 during event days, confirming that the proposed approach effectively reflects short-term local trends.

*Proceedings of the 9th International Conference on Mobile Internet Security (MobiSec'25), Article No. P-15, December 16-18, 2025, Sapporo, Japan.

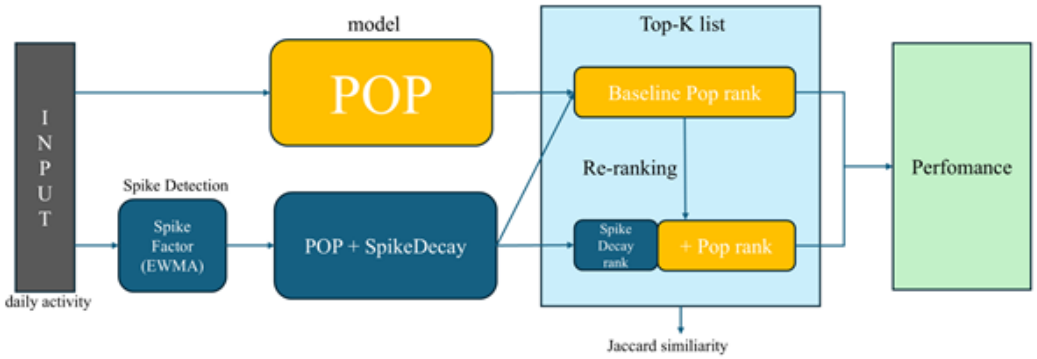

Figure 1: Processing flow of the baseline POP model and the proposed SpikeDecay model.

3 Conclusion

This study presents SpikeDecay, a lightweight enhancement to POP-based recommenders, incorporating short-term event signals to overcome limitations associated with long-term popularity reliance. Experiments with MMTD from the Los Angeles region confirmed consistent improvements in Recall, Hit, NDCG, and MAP. The model maintains stable performance during regular periods while dynamically adjusting recommendations during event-driven spikes. Moreover, by comparing detected surges with actual local event data, our approach can distinguish genuine trends from abnormal activity, suggesting potential use in detecting and mitigating DDoS-like attacks on streaming services. Future work will focus on refining spike detection thresholds and enhancing data quality for broader real-world applicability.

Acknowledgement

This research was supported by the Regional Innovation System & Education(RISE) program through the RISE Center, Gyeongsangnam-do, funded by the Ministry of Education(MOE) and the Gyeongsangnam-do Provincial Government, Republic of Korea.(2025-RISE-16-001)