

## Pixie Algorithm Explanation

Pixie-inspired recommendation algorithms are graph-based methods designed to distribute fast, real-time, and personal recommendations in particularly large-scale systems. Pixie, which dates from Pinterest's internal recommended engine, takes advantage of the structure of a large-scale graph representing users, items (such as pins or products), and their interaction to provide personal suggestions. These systems are called "Pixie-inspired" because they adopt the basic ideas behind Pinterest's Pixie engine, which depends on partial random trips over a heterogeneous graph to effectively surface content relevant to a user's previous behavior or current query.

The main idea behind Pixie-inspired algorithms is using random walkers to explore a graph that encodes the relationship between entities such as users, pins, boards, and subjects. In a random walk, an algorithm begins on one or more source nodes (for example, the user recently interacted with pins), and moves iteratively to neighboring nodes according to some probability. These possibilities can be biased based on node types, edge weight, or other relevant information (eg, preference for more recent or popular materials). As the algorithm moves through the graph, it creates a visits count or heat map that indicates how many times different nodes are visited, which serves as a vested score for relevance. Nodes with high visit scores are then recommended to the user.

The strength of this approach lies in its ability to naturally incorporate both collaborative and content-based filtration methods. Since the graph structure captures different types of interactions (e.g., user-user,

element-element, user-element), random trips can detect non-open conditions that other models may miss, such as shared interests between users who have not interacted directly, but who share overlapping web interactions. In addition, these trips can be calculated incredibly quickly and iteratively, making the method very suitable for real-time systems where latency and scalability are critical features.

In the industry, Pixie-inspired random walking algorithms have found broad adoption beyond Pinterest. For example, Spotify uses a graph-based recommendation system that conditions random trips to suggest songs and playlists based on user activity and music similarity. Additionally, LinkedIn uses similar techniques to recommend jobs, connections, or groups by navigating through a professional network graph. E-commerce platforms like Amazon can also use variations of this method to recommend products by going through graphs built from CO purchases and surfer data. The success of Pixie-inspired systems demonstrated the power of graph-based modeling and stochastic traverse methods for delivering scalable, high-quality personal recommendations in different domains.