

Paper Summary

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Title: Why-Not Explainable Graph Recommender

Authors: Herve-Madelein Attolou, Katerina Tzompanaki, Kostas Stefanidis, Dimitris Kotzinos

DOI: 10.1109/ICDE60146.2024.00178

Year: 2024

Publication Type: Conference

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Explainable Recommender Systems, Counterfactual Explanations, Graph-based Reco

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and explicit through actionable explanation design)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (EMiGRe)

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental Evaluation

Study Context: Graph-based recommendation systems with user–item interaction data

Geographic/Institutional Context: CY Cergy Paris University, Tampere University

Target Users/Stakeholders: End-users of RS, system developers/debuggers

Primary Contribution Type: Algorithm/Framework Proposal with Evaluation

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

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Why-Not Explainable Graph Recommender

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Computer Science / Artificial Intelligence

****Subdomain/Topic:****

Explainable Recommender Systems, Counterfactual Explanations, Graph-based Recommendations

****Contextual Background:****

The work is situated in the area of explainable AI for recommendation systems, particularly in addressing

****Geographic/Institutional Context:****

CY Cergy Paris University (France), Tampere University (Finland)

****Target Users/Stakeholders:****

End-users seeking transparency; system developers for debugging and improving recommender perform

****Primary Methodology:****

Conceptual framework development + algorithm design + experimental evaluation on Amazon product re

****Primary Contribution Type:****

Algorithm/Framework (EMiGRe) and empirical validation

General Summary of the Paper

This paper introduces ****EMiGRe****, a framework for generating **Why-Not explanations** in graph-based r

Eligibility

Eligible for inclusion: ****Yes****

How Actionability is Understood

Actionability is framed as providing explanations that **suggest concrete, feasible actions a user can take*

> “We opt for a form of Counterfactual Explanations... proposing a possible world that could have led to t

> “...provides... actionable insights on the source data and their interrelations” (p. 1)

What Makes Something Actionable

- Directly modifiable by the user (edges rooted at the user node)
- Feasibility within privacy constraints (only user's own actions)
- Causally linked to producing the desired recommendation (must result in WNI being top-1)
- Specificity (identifies exact edges to add or remove)
- Adaptability to system constraints and user preferences

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** EMiGRe (Explainable Missing Graph Recommendation)
 - **Methods/Lever(s):** Counterfactual graph modifications via edge addition (Add Mode) or removal (Removal Mode)
 - **Operational Steps / Workflow:**
 1. Define Why-Not item (WNI)
 2. Identify candidate edges (user-rooted) influencing WNI ranking using Personalized PageRank contribution
 3. Search for minimal modification set (Incremental, Powerset, Exhaustive Comparison)
 4. Validate candidate explanations against top-1 constraint
 - **Data & Measures:** Personalized PageRank scores, contribution metrics, runtime, success rate, explainability
 - **Implementation Context:** Post-hoc explanation for graph-based RS, tested on Amazon product review
- > “...set of edges rooted at the user u node... to replace rec by WNI as the recommendation” (p. 5)
- > “...propose... missing pertinent edges to be added... or existing edges to be removed” (p. 5)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — explicitly identifies specific, understandable actions (edges)
- **CR (Contextual Relevance):** Yes — actions are user-specific and relevant to target item
- **FE (Feasibility):** Yes — constrained to actions the user can perform
- **TI (Timeliness):** No — no explicit discussion of time sensitivity
- **EX (Explainability):** Yes — method provides causal reasoning via counterfactuals
- **GA (Goal Alignment):** Yes — directly tied to achieving WNI recommendation
- **Other Dimensions Named by Authors:** Privacy-preserving scope

Theoretical or Conceptual Foundations

- Counterfactual explanations (AI interpretability literature)
- Graph-based recommendation and Personalized PageRank
- Why-Not questions in databases and ranking functions

Indicators or Metrics for Actionability

- Success rate (ability to achieve WNI in top-1)
- Size of explanation (fewer edges preferred)
- Runtime efficiency (practicality of producing the explanation)

Barriers and Enablers to Actionability

- **Barriers:**
 - Cold start/low activity users (few modifiable edges)
 - Highly popular competing items (structurally difficult to displace)
 - Out-of-scope cases where only edge additions or removals are insufficient
- **Enablers:**
 - Availability of rich user–item interaction data
 - Graph-based structure allowing edge-level manipulation
 - Efficient PPR computation methods

Relation to Existing Literature

Extends explainable RS literature from *Why* to *Why-Not* scenarios, differing from PRINCE by:

1. Focusing on missing recommendations
2. Providing both past-action and future-action explanations

Builds on prior Why-Not work in databases and adapts it to graph RS with privacy-preserving constraints.

Summary

The paper introduces EMiGRe, a novel framework for producing actionable Why-Not explanations in graph

Scores

- **Overall Relevance Score:** 90 — Strong conceptualization of actionability with explicit operational features
- **Operationalization Score:** 95 — Detailed algorithms, heuristics, and evaluation directly tied to production

Supporting Quotes from the Paper

- “We opt for a form of Counterfactual Explanations... proposing a possible world that could have led to the recommendation” (p. 5)
- “...set of edges rooted at the user u node... to replace rec by WNI as the recommendation” (p. 5)
- “We provide more actionable explanations, by proposing not only existing actions... but also new actions” (p. 5)
- “This form of explanation provides user-comprehensible and actionable evidence of the trustworthiness of the recommendation” (p. 5)

Actionability References to Other Papers

- Ghazimatin et al. (2020) — PRINCE: Provider-side Interpretability with Counterfactual Explanations in Recommendation Systems
- Miller (2017, 2021) — Contrastive explanation theory
- Database and IR Why-Not literature (e.g., Bidoit et al. 2014, Chapman & Jagadish 2009)