Paper Summary

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Title: Opportunity Map: A Visualization Framework for Fast Identification of Actionable Knowledge

Authors: Kaidi Zhao, Bing Liu, Thomas M. Tirpak, Weimin Xiao

DOI: 10.1145/1099554.1099684

Year: 2005

Publication Type: Conference

Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Data Mining, Visualization, Actionable Knowledge Discovery

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit and explicit elements)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Yes

Contains Framework/Model: Yes (Opportunity Map)

Operationalization Present: Yes

Primary Methodology: Conceptual with applied case study

Study Context: Post-mining analysis of large rule sets from data mining to identify actionable patterns

Geographic/Institutional Context: University of Illinois at Chicago; Motorola Labs (USA)

Target Users/Stakeholders: Data analysts, product designers, decision-makers in industrial contexts

Primary Contribution Type: Visualization framework and interactive analysis method

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

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Year: 2005

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Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Data Mining, Visualization, Actionable Knowledge Discovery

Contextual Background: This work addresses the challenge of sifting through large volumes of mined

Geographic/Institutional Context: University of Illinois at Chicago; Motorola Labs, USA

Target Users/Stakeholders: Data analysts, product engineers, product managers, decision-makers in

Primary Methodology: Conceptual development with real-world industrial case study

Primary Contribution Type: Framework/methodology (Opportunity Map) with interactive visualization f

General Summary of the Paper

The paper proposes the **Opportunity Map**, a visual data mining framework designed to quickly identify

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the ability of a rule or pattern to guide concrete interventions within the user's d

> "An attribute is actionable if the user is able to do something with that attribute to achieve some desired

> "Actionability is the key… It depends on the task that the user wants to perform." (p. 1)

What Makes Something Actionable

- The attribute must be controllable within the user's context.
- The class or problem addressed must be important to the user's goals.
- The relationship between attribute and class should be clear, strong (support/confidence), and interpreta
- Patterns must be applicable to real-world decision-making, not just surprising.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Opportunity Map
- **Methods/Levers:** Visual prioritization matrix; user-driven sorting by importance and actionability; drill-
- **Operational Steps / Workflow:**
  1. Mine rules (e.g., with class association rule miner CBA).
  2. Visualize as attribute–class matrix.
  3. Arrange classes (by importance) and attributes (by actionability).
  4. Focus on top-left priority sector (important + actionable).

5. Drill down into attribute–class pairs to find finer-grained actionable rules.
6. Compare rule sets across subsets (e.g., product versions).

- **Data & Measures:** Support and confidence of rules; number of rules per cell; coverage of data points
- **Implementation Context:** Post-mining analysis in industrial product design/failure diagnosis.

> “This isolates a small area in the matrix… that may contain actionable rules.” (p. 2)

> “The insights from these rules are immediately actionable, as engineers can… identify/propose possible

Dimensions and Attributes of Actionability (Authors’ Perspective)

- **CL (Clarity):** Yes — visualization aids interpretation and explicit linking of attributes to classes.
- **CR (Contextual Relevance):** Yes — prioritization is based on user/application importance.
- **FE (Feasibility):** Yes — actionable attributes are defined as those under user control.
- **TI (Timeliness):** Partial — focuses on efficiency in identification, but not time-to-implementation.
- **EX (Explainability):** Partial — interpretability via visualization; not formal model explainability.
- **GA (Goal Alignment):** Yes — prioritization matrix directly aligns with application objectives.
- **Other Dimensions Named by Authors:** Unexpectedness (as contrast with actionability).

Theoretical or Conceptual Foundations

- Quality Function Deployment (House of Quality)
- Rule interestingness measures (objective vs. subjective) from data mining literature

Indicators or Metrics for Actionability

- Support and confidence of rules in priority sectors
- Number of rules covering key attribute–class intersections
- Coverage percentage of rules over relevant data points

Barriers and Enablers to Actionability

- **Barriers:** Imbalanced datasets, non-actionable attributes, overwhelming number of rules
- **Enablers:** Visualization of priorities, interactive drill-down, comparative analysis

Relation to Existing Literature

The framework integrates subjective interestingness with visual analytics, diverging from existing visualiz

Summary

The **Opportunity Map** framework offers a systematic and interactive way to identify actionable knowle

Scores

- **Overall Relevance Score:** 88 — Strong conceptualization of actionability linked to operational needs
- **Operationalization Score:** 90 — Detailed, step-by-step framework with tooling, workflow, and industr

Supporting Quotes from the Paper

- “Actionability is the key… It depends on the task that the user wants to perform.” (p. 1)
- “An attribute is actionable if the user is able to do something with that attribute to achieve some desired
- “This isolates a small area in the matrix… that may contain actionable rules.” (p. 2)
- “The insights from these rules are immediately actionable…” (p. 8)

Actionability References to Other Papers

- [1] Adomavicius & Tuzhilin (1997) — Action hierarchy approach.
- [17] Liu et al. (2001) — Identifying non-actionable association rules.
- [22] Piatesky-Shapiro & Matheus (1994) — Interestingness of deviations.
- [26] Silberschatz & Tuzhilin (1996) — Patterns interestingness framework.