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From Quality Notifications to Root Causes: A Practical LLM-Based Approach for Scalable Analysis

Quality notifications (QNs) often include detailed free-text descriptions that are difficult to analyze at scale. As a result, many lower-priority notifications are resolved operationally without a structured root cause analysis, even though they may represent recurring problems and non-negligible quality costs. This work presents a practical methodology for using large language models (LLMs) to extract structured insights from unstructured quality notification text.

The approach is applied to quality notifications related to different issues, including packaging defects and logistics-related deviations. Free-text fields such as notification descriptions and internal communication notes are processed using an LLM to generate concise summaries and identify potential causes. These causes are then grouped into a small number of data-driven "cause buckets,"which are further refined into subcategories when repeated patterns are observed. Each notification is automatically assigned one or more cause categories, enabling consistent analysis across large datasets.

Once categorized, the QNs can be analyzed quantitatively, for example by comparing frequencies and aggregating quality-related costs per cause category. This converts previously unstructured QN data into measurable information that can support both operational decision-making and longer-term improvement initiatives.

The proposed methodology demonstrates how LLMs can complement traditional quality and process analytics by reducing manual effort, improving consistency, and enabling scalable root cause analysis.

Special/ Invited session

Classification

Both methodology and application

Keywords

Generative AI, Root cause analysis, Text analysis

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