Interactive Web Interface for Korea's Statute Network Using Community-Aware Layout

Keywords: Statute network, Visualization, Community-aware layout, Network analysis, Interactive network

Extended Abstract

Statutes (laws) regulate core domains of daily life, yet their complexity can create information gaps, generating costs for individuals and society. This complexity stems from dense interconnections and cross-citations among statutes, which produce dynamic networks that are challenging to analyze, particularly at the national level [1, 2]. Network analysis and visualization can improve comprehension, efficiency, and user engagement by presenting statute structures, citation flow, and central statutes in a more accessible way ([1], [3], [4]). Accordingly, effective network visualization is required to control visual clutter, preserve global and local structure, and facilitate navigation, given that target users include both legal professionals and the general public who lack network analysis expertise. Recent research has proposed promising visualization layout methods for node-link diagrams [5][6][7]. However, these methods have not been fully evaluated against the requirements of statute networks nor widely applied in this domain. We study the statute collection of the Republic of Korea (civil-law system). From the national legal corpus (late 2023), we compiled the active statutes and parsed explicit citations among them. Each statute is internally hierarchical (chapters → sections → articles → content items). Fig. 1a shows the data model and relationships among these components. The corpus contained 4 006 statutes, 83 146 articles, 373 314 content items, and 27 313 citations between the statutes. We present an interactive web interface to visualize the structure of the Korean statute network. First, we develop a Layered Community-aware Layout (LCGraph) that models citations at the statute level to create a statute-to-statute graph. This abstraction retains the global citation structure while remaining tractable for interactive exploration. LCGraph recursively identifies communities and sub-communities, packs community regions on a non-overlapping grid, orders communities via Tabu search to minimize inter-community crossings, and places nodes within community bounds using a constrained force-directed layout. This yields a community-preserving map that enforces containment, strengthens separability, reduces long cross-cluster clutter, and maintains a stable global scaffold for navigation. Second, we implement the interactive web interface to support interaction with and navigation of LCGraph. The system provides (1) community-aware visualization via a level-of-detail (LOD) rendering technique (Fig. 1b); (2) keyword search over statute titles and content (Fig. 1c); (3) direct node interaction (hover/focus for local neighborhoods; click-through to metadata, and article-level content and intra-/inter-statute references) (Fig. 1c); and (4) an article-level network visualization for a selected statute using the Fruchterman–Reingold (F–R) layout [8] (Fig. 1d). Formative feedback from two lawyers and three network scientists emphasized that the system provides overview-plus-detail. The layered, community-aware layout exposes communities and citation paths, enabling users to understand the global and local structure of the Korean statute network; article-level access supports smooth navigation between levels; keyword search and direct node interaction enable citation-driven navigation with minimal context switching, and the sidebar complements the graph by presenting article-level text and metadata. They suggested future enhancements, including improved network interactivity, clearer UI affordances, graph-distance navigation, and better rendering performance.

References

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(a) Data schema of the corpus (Statute, Section, Article, Content, Citation)

(b) LCGraph: community-aware layout of statutes and inter-community links.

(c) Keyword-search panel with the interactive network view
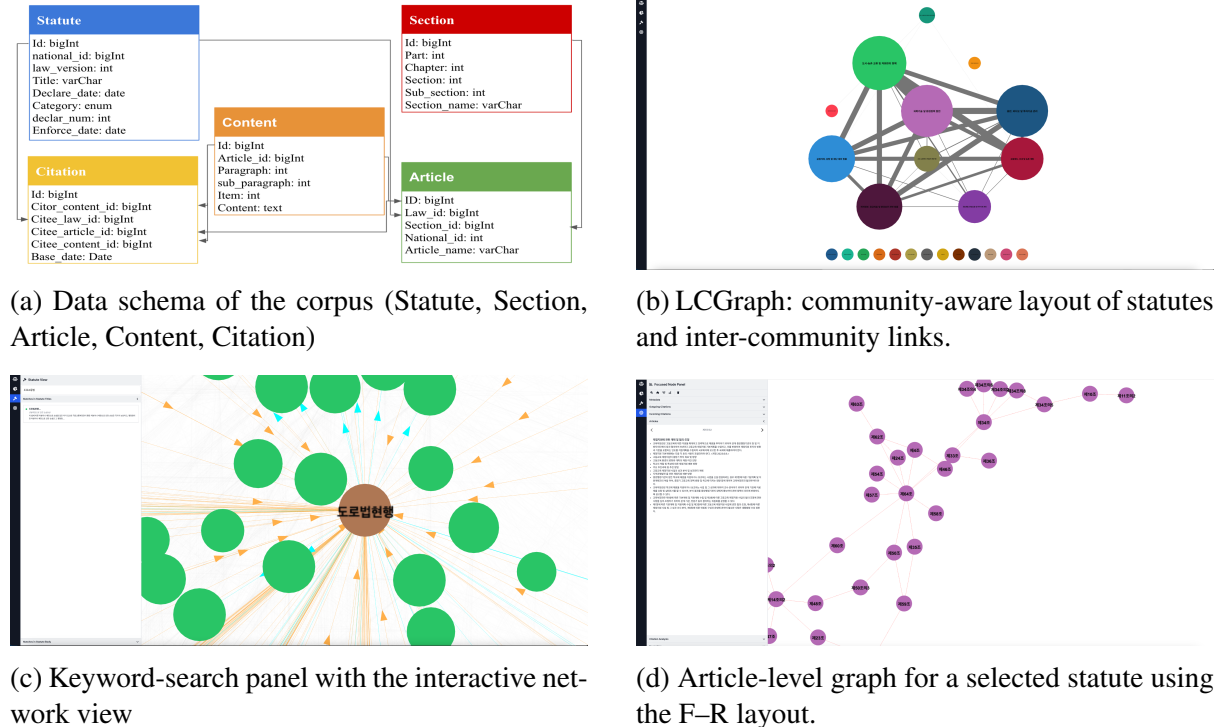

(d) Article-level graph for a selected statute using the F–R layout.

Figure 1: Korea's Statute Network and Interface.