

A062 · The Genomic Interval Query Language (GIQL): A declarative, engine-agnostic grammar for genomic analysis

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Genomic interval operations, e.g., intersection, overlap, proximity, and related computations, are foundational to functional genomics, yet the dominant tooling (bedtools, samtools, and similar utilities) expresses these operations as chains of command-line invocations that exchange data through intermediate files. This pattern is brittle, difficult to compose with general-purpose data infrastructure, and resistant to agentic automation. To address these limitations, we introduce the Genomic Interval Query Language (GIQL), an extended SQL dialect and transpiler that allows genomic interval operations to be expressed declaratively. Inspired by the adoption of SQL in geospatial analysis, GIQL transpiles a small, focused genomic grammar into standard SQL, enabling genomic operations to compose with larger analytical queries and execute wherever the user's data already lives. Consequently, GIQL can target modern analytical engines like DuckDB and DataFusion, which are increasingly adopted for streaming, distributed, and cloud-native genomics workloads; however, it does not prescribe any particular query engine. The grammar integrates with any tabular encoding of genomic ranges by mapping the user's existing representation to a pseudo-column at transpile time. SQL's precise, well-documented semantics and exceptional representation in LLM training data make GIQL a reliable target for AI-assisted analysis, and a bundled Model Context Protocol (MCP) server exposes the language's operator reference, documentation, and transpiler directly to LLM-powered coding agents, enabling verified query authoring without out-of-band reference material. GIQL is freely available and open-source (<https://github.com/abdenlab/giql>), with ongoing work focusing on a versioned grammar specification, community engagement, and expanded support for multi-step AI-assisted workflows.