Technical Report:

Credit Decision Screening System (ADK)

A Multi-Agent Vector Search Approach to Credit Risk Assessment

Team B

Dhia Eddine Louati
Eya Bargouth
Sarra Ayadi
Wejden Hosni

Date: January 26, 2026

Version: 1.0.0

Contents

1   Project Idea & Problem Statement

1.1   The Problem

Traditional credit scoring methods often rely on fixed formulas and numeric thresholds that miss the deeper financial patterns behind borrower behavior. To improve accuracy, lenders need to assess how similar a new applicant is to historical borrowers who either repaid successfully or defaulted.

1.2   The Solution

Credit Decision ADK is an intelligent loan screening system that breaks down applications into meaningful semantic components (e.g., Income Stability, Credit Behavior) and uses Qdrant's vector similarity search to find historical cases with similar profiles. This enables a dynamic, context-aware risk assessment beyond traditional credit scores.

2   System Architecture & Qdrant Integration

2.1   Modular Multi-Agent Pipeline

The system uses specialized agents for each stage, as illustrated in Figure 1.

Agent	Responsibility
Ingestion Agent	Validates and normalizes raw loan application data
Chunking Agent	Applies semantic chunking to group related features
Retrieval Agent	Queries Qdrant for nearest neighbor loan cases
Risk Agent	Aggregates similarity results into a risk profile
Decision Agent	Compares risk against lending criteria
Explanation Agent	Generates natural language explanations using LLMs

Table 1: Multi-Agent System Components

2.2   Why Qdrant?

Qdrant is the core vector search engine powering similarity retrieval. Its strengths:

- **Named Vectors Support**: Enables simultaneous similarity search across multiple semantic dimensions.

- **High Performance**: HNSW indexing for millisecond latency on thousands of loan vectors.

- **Flexible Deployment**: Runs locally or on cloud infrastructure, suitable for hackathon setups.

- **Rich API**: Simplifies complex queries and retrieval.

3   Data Pipeline Overview

The transformation from raw data to actionable intelligence follows the process shown in Figure 2.
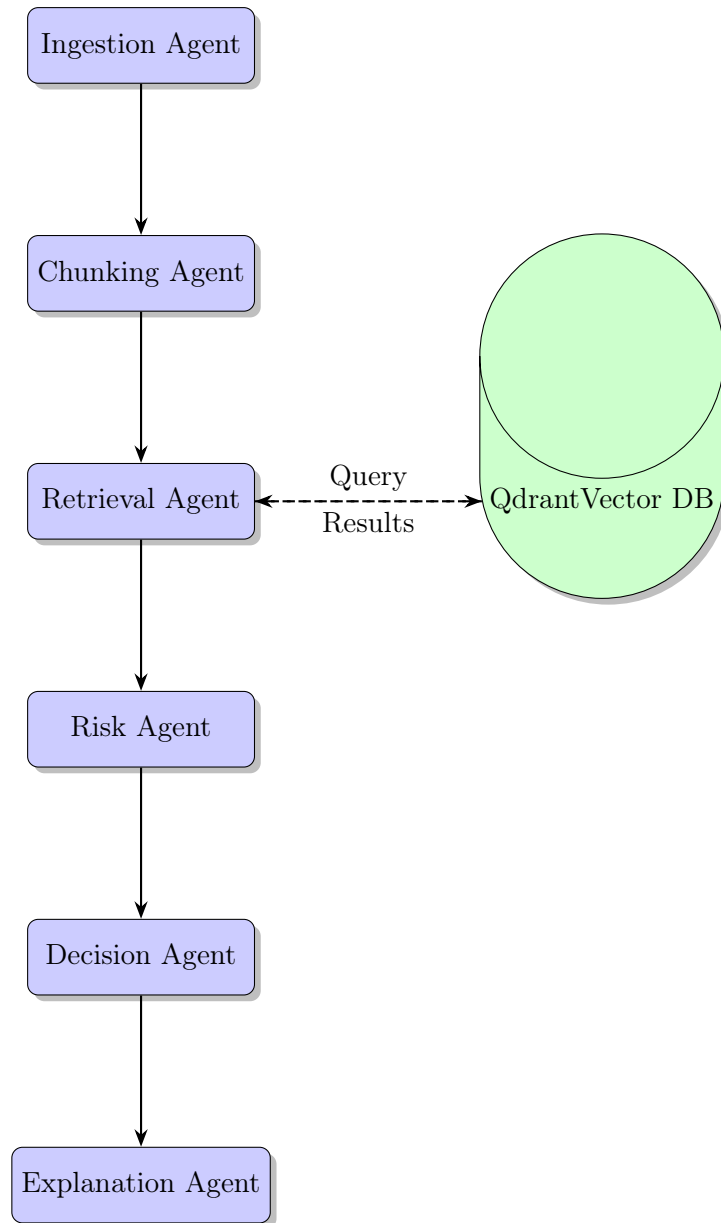
Figure 1: Multi-Agent Pipeline Architecture

The detailed steps are:

1. **Load Historical Data**: Import raw loan data (CSV/JSON).

2. **Schema Alignment**: Map features into standard credit categories.

3. **Semantic Chunking**: Group attributes into logical chunks (e.g., Loan Context, Credit Behavior).

4. **Embedding Generation**: Use FastEmbed (BAAI/bge-small-en-v1.5) to convert chunks into 384-dimensional vectors.

5. **Vector Upsert**: Store embeddings in Qdrant with loan metadata payload.

6. **Similarity Search**: Embed new applications and query Qdrant for nearest neighbors in each chunk dimension.
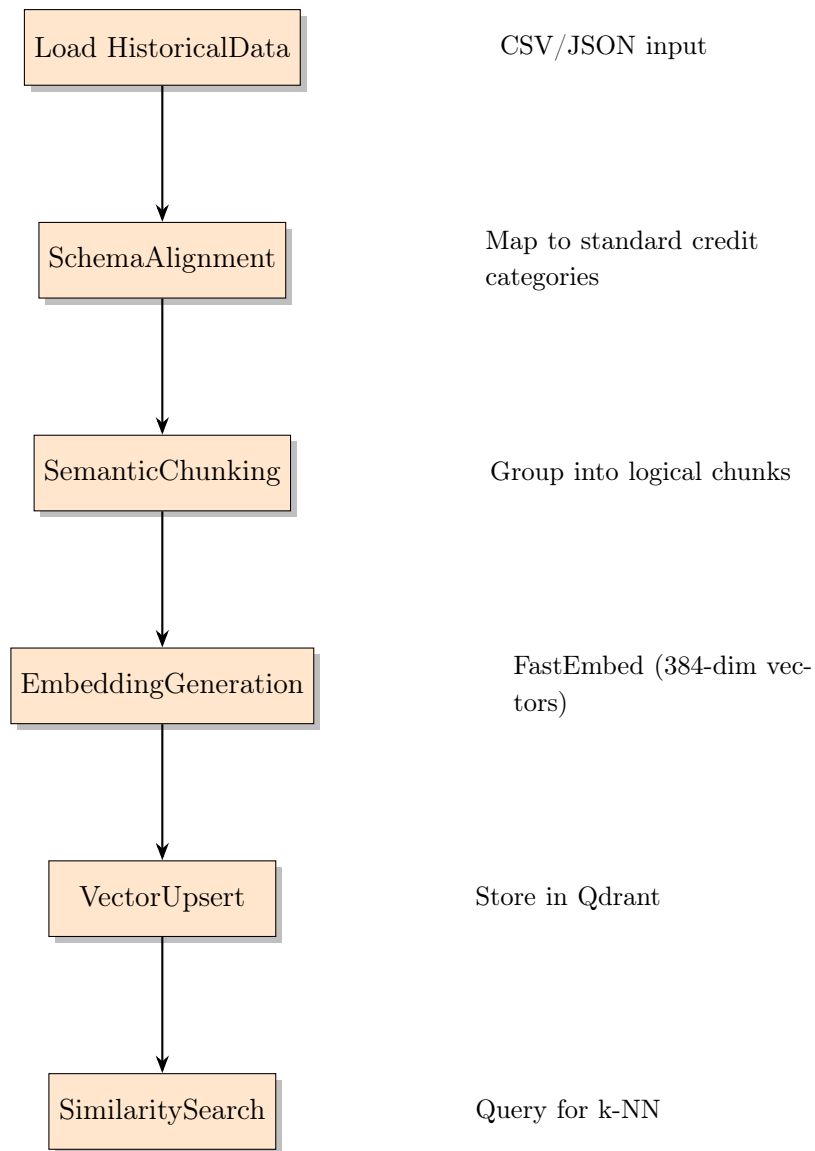
Load HistoricalData	CSV/JSON input
SchemaAlignment	Map to standard credit categories
SemanticChunking	Group into logical chunks
EmbeddingGeneration	FastEmbed (384-dim vectors)
VectorUpsert	Store in Qdrant
SimilaritySearch	Query for k-NN

Figure 2: Data Processing Pipeline

4 Vector Similarity Concept

Figure 3 illustrates how loan applications are represented in the vector space, with similar profiles clustering together.

5 Achievements & Next Steps

5.1 Completed

✓ Multi-agent orchestration framework implemented.

✓ Full Qdrant integration with named vector support.

✓ Local, low-latency embedding generation via FastEmbed.

✓ Interactive CLI for data processing and testing.

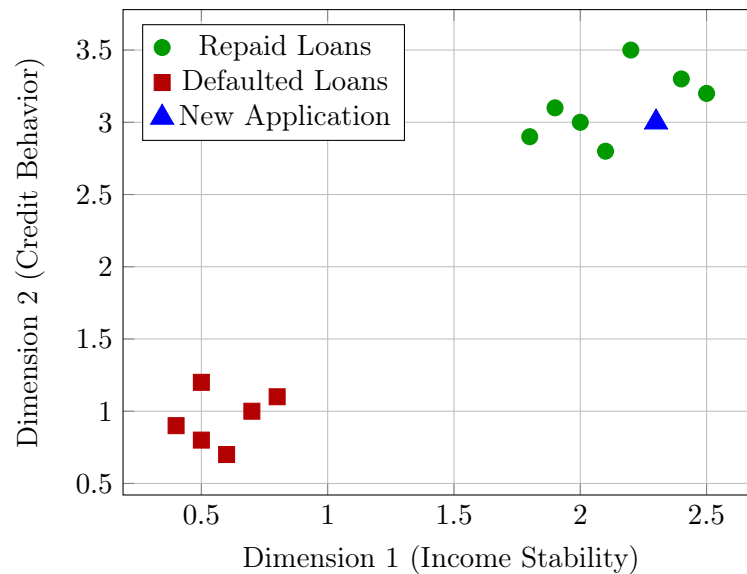✓ Explanation layer built using LLMs for risk interpretation.

Figure 3: Vector Space Representation of Loan Profiles

5.2   Next Focus for Hackathon

- Optimize Qdrant queries for speed and accuracy.

- Enhance error handling and fallback logic.

- Fine-tune semantic chunking and embedding consistency.

- Build concise, user-friendly explanations of similarity-based risk.

- **Develop web interface for loan officers** to visualize risk assessments, similarity clusters, and decision explanations in an intuitive dashboard.

5.3   Planned Web Interface

The upcoming web interface will provide:

- Interactive loan application submission forms

- Real-time risk assessment visualization

- Similarity cluster exploration with historical case comparisons

- Natural language explanation displays

- Batch processing capabilities for multiple applications

- Administrative dashboard for system monitoring and configuration