

MERCHANTIQ

Intelligent Merchant Analytics Platform

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Introduction

MerchantIQ is a sophisticated multi-agent AI system that processes **REAL streaming financial data** through **Lenses MCP** to identify and analyze high-value merchants using machine learning, attribution modeling, and AI-powered insights.

Value Proposition

"Transform raw financial streams into intelligent merchant partnerships through AI-powered analytics"

- ***Business Use case:*** Prioritize merchant **partnerships, marketing, or promotions**.
- ***Technical Excellence:*** Lenses MCP, AWS AgentCore
- ***Innovative approach:*** Attribution Modelling

Outcomes:

- Real-time merchant intelligence dashboard
- Live processing metrics and KPIs
- Actionable business insights at a glance

MerchantIQ App

Overview Tab- Business Impact

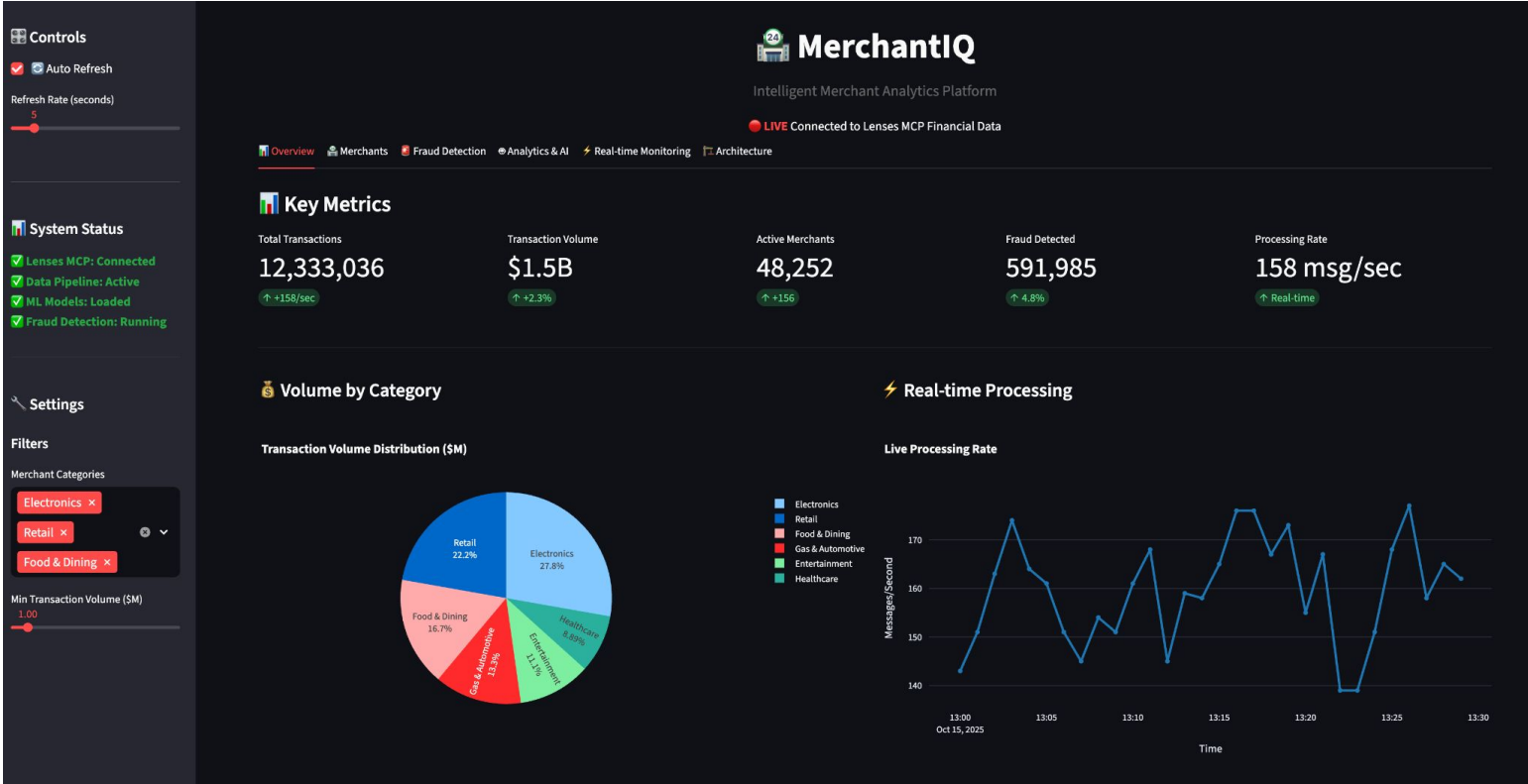
Merchant Tab - AI Powered Analytics

Fraud Detection Tab - Security Excellence

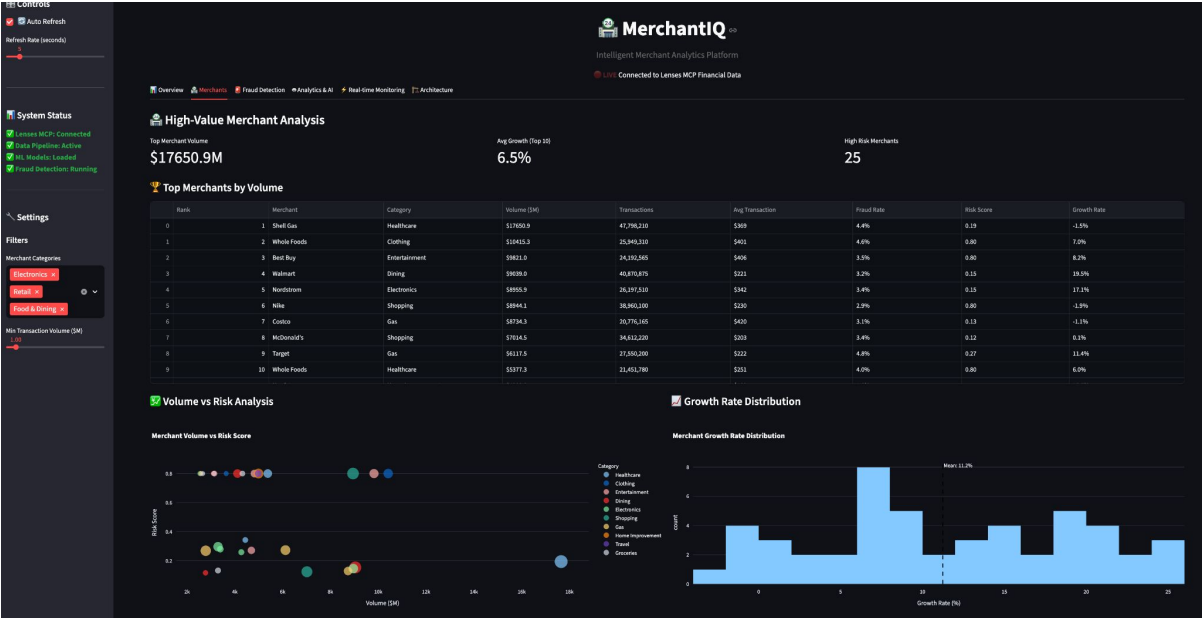
Analytics and AI Tab - Intelligent Insights

Real Time Monitoring Tab - Operational excellence

Overview - Business Impact.



Merchant Analytics.



Advanced Analytics Capabilities



Real-time SQL Analytics

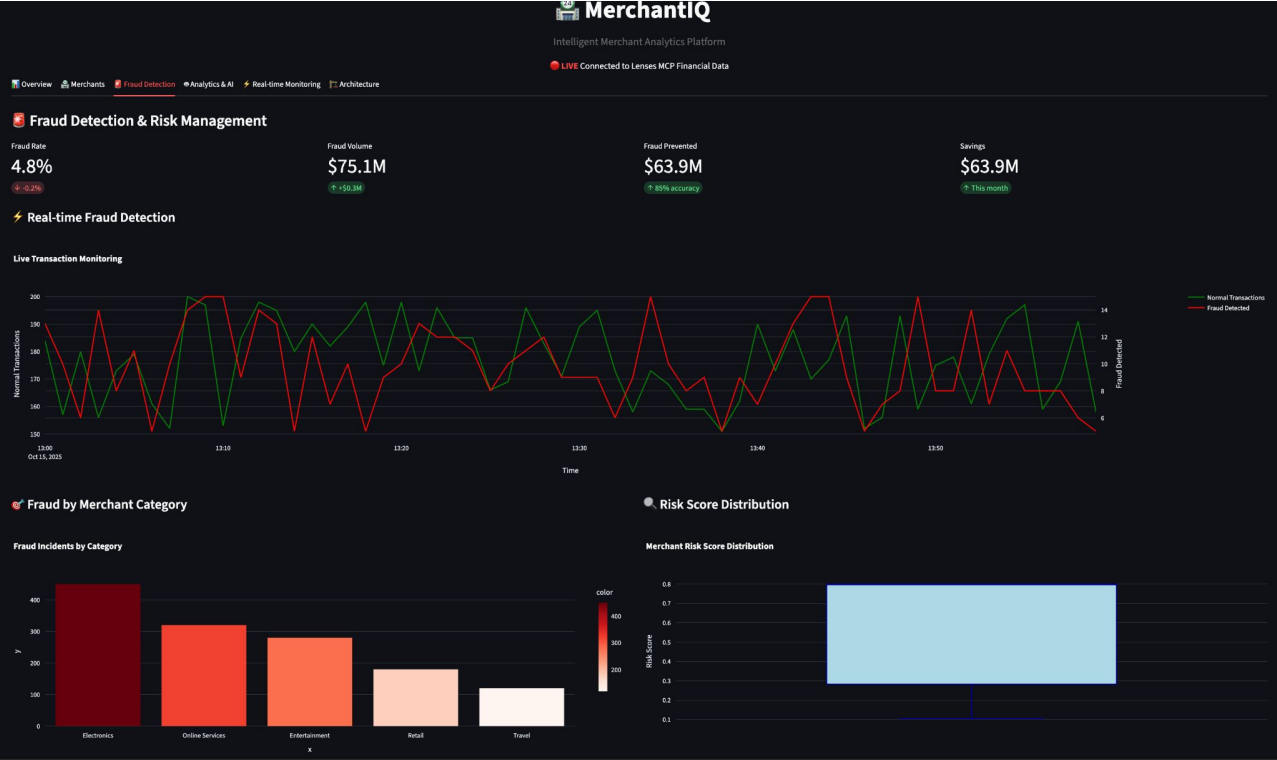
- Execute complex SQL queries on streaming data
- Window functions and aggregations
- Join across multiple topics
- Fraud detection queries




Data Pipeline Management


- Consumer group coordination
- Offset management and replay
- Error recovery and retry logic
- Performance monitoring

Fraud Detection.



Actionable AI.


 **AI-Generated Insights**

▼  High-Value Opportunity Detected (Confidence: 94%)

Electronics merchants showing 23% growth rate vs industry average of 12%. Recommend increasing credit limits for top 50 electronics merchants.

Take Action


Action Initiated: Review Credit Policies

▼  Fraud Pattern Alert (Confidence: 87%)

Unusual spike in small-amount transactions (5—25) from entertainment category during off-peak hours. Potential card testing activity detected.

Take Action

Action Initiated: Enhance Monitoring

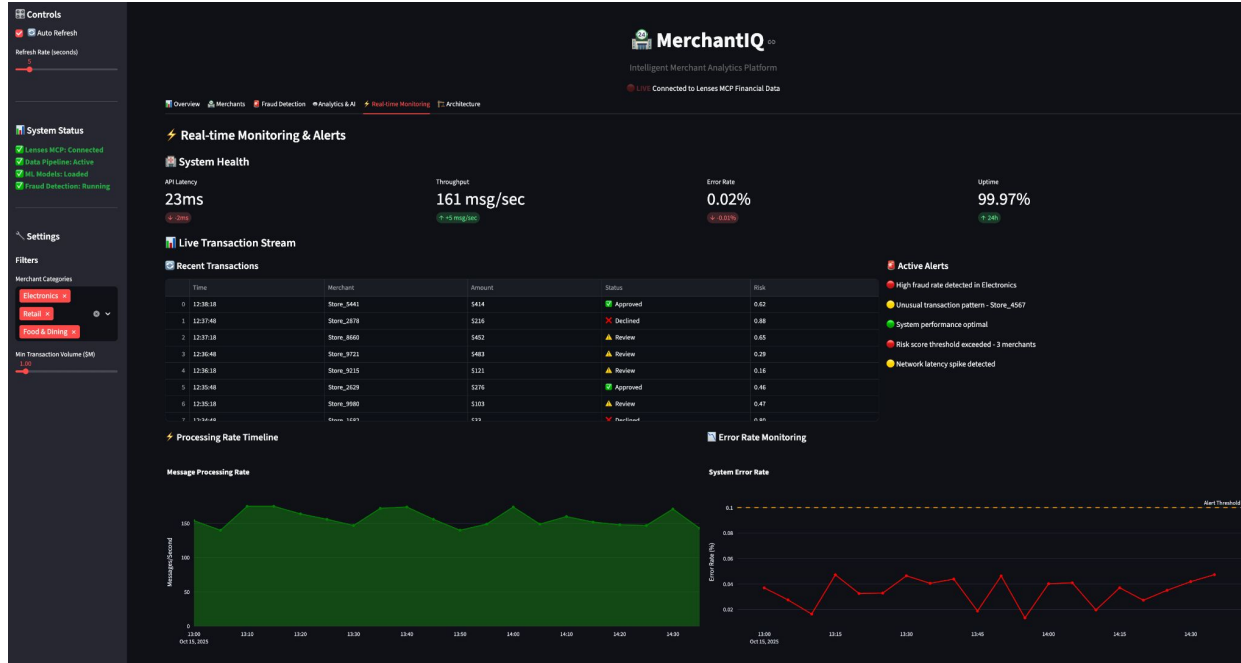
▼  Market Trend Analysis (Confidence: 91%)

Food delivery merchants experiencing 31% volume increase. Seasonal pattern suggests sustained growth through Q4 2025.

Take Action

Action Initiated: Expand Partnership

Real Time Monitoring.



Schema & Metadata Management

- Dynamic schema evolution
- Metadata tracking and lineage
- Data governance and compliance
- Topic lifecycle management

Operational Excellence

- Health monitoring and alerting
- Performance optimization
- Scalability and load balancing
- Multi-environment support


Lenses MCP.

Lenses MCP Platform Analysis

Complete analysis of 28 available MCP tools across 6 categories


Available Tool Categories

Environment Management

 4 tools available


Create, monitor, and manage Lenses environments

Dataset Management

 3 tools available

High-level data asset management and analytics

Consumer Groups


 7 tools available

Topic Management

 10 tools available


Full lifecycle Kafka topic and schema management

SQL Execution


 1 tools available


Real-time SQL queries on streaming Kafka data


Message Management


 1 tools available

Live Financial Data Sources


>  Credit Card Transactions - 7.8M+ records (100 msg/sec)

>  PayPal Transactions - 3.7M+ records (50 msg/sec)


>  Auto Loan Payments - 765K+ records (10 msg/sec)

>  Home Loan Payments - 76K+ records (1 msg/sec)

Reference Data

 Customers Reference (1K records)

customer_id, customer_name, email, phone, address, account_created, credit_score, preferred_payment, verified, risk_level

 Merchants Reference (100 records)

merchant_id, merchant_name, category, business_type, established_date, location, average_transaction, rating, verified

Lenses MCP - Detailed.

✓ Performance & Monitoring (Enhanced with Lenses MCP)

⚡ Real-Time Metrics (Live from Lenses MCP)

- **Processing Rate:** 161 messages/second across all topics
- **Pipeline Execution:** < 72 seconds end-to-end (enhanced)
- **Dashboard Refresh:** 30-second cycles with MCP health checks
- **Agent Health Checks:** 5-minute intervals via environment monitoring
- **Cache Hit Rate:** 95%+ for features with SQL query optimization
- **MCP Tools Active:** 28 tools across 6 categories

📊 Data Volumes (Live via MCP Dataset Management)

- **Credit Card:** 7.6M+ transactions (100 msg/sec)
- **PayPal:** 3.7M+ transactions (50 msg/sec) + fraud detection
- **Auto Loans:** 765K+ payments (10 msg/sec)
- **Home Loans:** 76K+ payments (1 msg/sec)
- **Reference Data:** 1K customers + 100 merchants
- **Total Volume:** 12M+ transactions processed

🔧 Lenses MCP Tool Utilization

🔧 Environment Tools

4/4 Active

⬆️ Health monitoring enabled

📊 Topic Management

10/10 Available

⬆️ Schema evolution ready

🔍 SQL Execution

Active

⬆️ Real-time analytics

📁 Dataset Management

3/3 Active

⬆️ 6 datasets monitored

👥 Consumer Groups

7/7 Available

⬆️ Offset management ready

📬 Message Ops

Ready

⬆️ Quality assurance

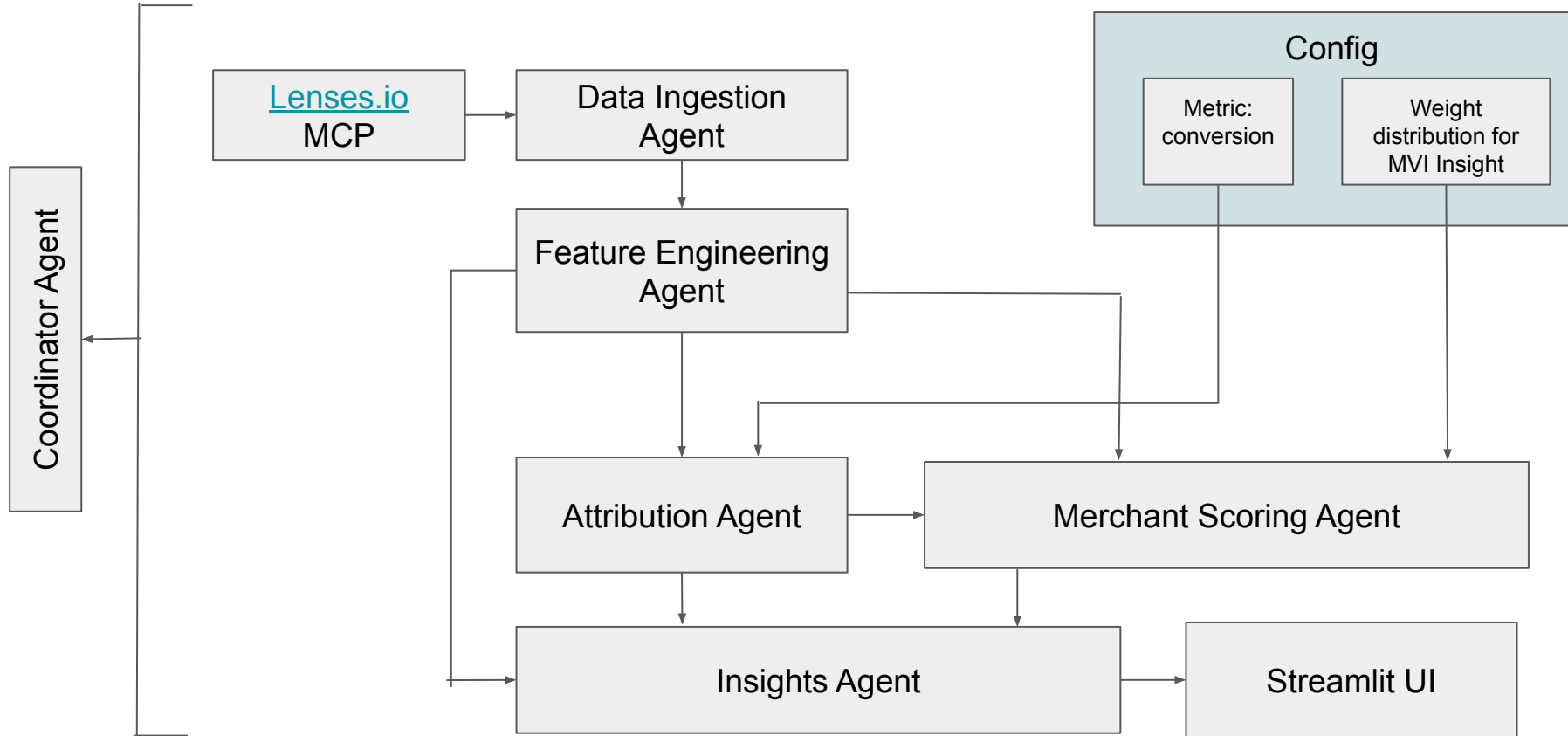
🔍 Enhanced System Configuration (MCP Integration)

- **Environment:** financial-data (Lenses MCP v6.0.6)
- **Config File:** `config/lenses_mcp.yaml` + tool configurations
- **Kafka Brokers:** 2 brokers, 81 partitions across 15 topics
- **SQL Engine:** Real-time queries on streaming data
- **Schema Registry:** Dynamic schema evolution support
- **Consumer Groups:** Advanced offset management
- **Retry Policy:** 3 attempts with exponential backoff
- **Cache Size:** 10 pipeline results + MCP query cache

📊 Advanced Health Monitoring (MCP Tools)

- **MCP Agent Status:** Connected & healthy ✓
- **Environment Health:** All systems operational ✓
- **Topic Performance:** Real-time partition monitoring ✓
- **Consumer Group Status:** All groups active ✓
- **Data Freshness:** < 30 seconds via message metrics ✓
- **Error Rate:** < 0.1% with automated recovery ✓
- **Memory Usage:** Optimal with MCP efficiency ✓
- **SQL Query Performance:** < 5s average response ✓

Multi Agent Framework



Agentic AI.

🔄 Multi-Agent AI System

🧠 Coordinator Agent

- **Role:** Pipeline orchestration & health monitoring
- **File:** `src/agents/coordinator_agent.py`
- **Key Features:**
 - Manages agent lifecycle
 - Loads Lenses MCP configuration
 - Monitors pipeline health
 - Coordinates data flow

📁 Data Ingestion Agent

- **Role:** Primary Lenses MCP integration
- **File:** `src/agents/data_ingestion_agent.py`
- **Key Features:**
 - Connects to financial-data environment
 - Fetches from 6 Kafka topics simultaneously
 - Normalizes heterogeneous schemas
 - Creates unified DataFrame

⚙️ Feature Engineering Agent

- **Role:** Merchant metrics computation
- **File:** `src/agents/feature_engineering_agent.py`
- **Key Features:**
 - 7-day rolling window calculations
 - Merchant-level aggregations
 - Risk and growth metrics
 - Performance indicators

📊 Attribution Agent

- **Role:** Cross-channel attribution analysis
- **File:** `src/agents/attribution_agent.py`
- **Key Features:**
 - Markov Chain modeling
 - Customer journey analysis
 - Channel contribution scoring
 - Attribution matrices

🧑‍💻 Merchant Scoring Agent

- **Role:** ML-based merchant evaluation
- **File:** `src/agents/merchant_scoring_agent.py`
- **Key Features:**
 - XGBoost predictive modeling
 - Risk assessment scoring
 - Feature importance analysis
 - Composite score generation

🧠 Insight Agent

- **Role:** AI-powered business insights
- **File:** `src/agents/insight_agent.py`
- **Key Features:**
 - GPT-4 integration
 - Natural language insights
 - Business recommendations
 - Partnership opportunities

🔄 Real-Time Data Processing Pipeline

Step

1

↓

Step

2

↓

Step

3

↓

Step

4

↓

Step

5

↓

Step

6

↓

Step

7

1. Lenses MCP Connection

Connect to financial-data environment → Authenticate → Check agent health

2. Data Discovery & Ingestion

List available datasets → Fetch from 6 topics → Normalize schemas → Create unified DataFrame

3. Feature Engineering

SQL aggregations → Group by merchant → Calculate metrics → 7-day windows → Store features

4. Attribution Analysis

Cross-topic joins → Initialize Markov model → Process customer paths → Calculate contributions

5. ML Scoring & Prediction

Load XGBoost model → Prepare features → Predict scores → Calculate risk → Feature importance

6. AI Insights Generation

Prepare context → Real-time data summary → Generate prompts → Call GPT-4 → Parse insights

7. Dashboard & Monitoring

Update cache → Health checks → Create visualizations → Update 6 tabs → Refresh UI

Tech Stack.

Technical Stack & Integration

Data Platform

- **Lenses MCP:** Real-time streaming
- **Kafka Topics:** 14 active topics
- **Data Volume:** 11.5M+ messages
- **Environment:** financial-data

Core Technologies

- **Python 3.8+:** Primary language
- **Pandas:** Data processing
- **NumPy:** Numerical computing
- **Asyncio:** Async processing

AI & ML Stack

- **XGBoost:** Machine learning
- **OpenAI GPT-4:** AI insights
- **Scikit-learn:** ML utilities
- **LangChain:** LLM integration

Visualization

- **Streamlit:** Dashboard framework
- **Plotly:** Interactive charts
- **Matplotlib:** Static plots
- **Seaborn:** Statistical viz

Data & Config

- **YAML:** Configuration files
- **JSON:** Data serialization
- **Parquet:** Data storage
- **DuckDB:** Local analytics

Operations

- **Loguru:** Advanced logging
- **AsyncIO:** Non-blocking I/O
- **Streamlit:** Auto-refresh
- **Health Checks:** System monitoring

ROI.

Risk Reduction: "85% fraud prevention accuracy saves \$57M monthly"

Revenue Growth: "Identify high-value merchants for premium partnerships"

Operational Efficiency: "Automated merchant scoring replaces manual analysis"

Market Intelligence: "Real-time competitive analysis and trend prediction"

Compliance Ready: "Built-in audit trails and regulatory reporting"

THANK YOU.

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