

*Data Science Practicum Project · 2026*

# Amazon Competitor Analysis Platform

*AI-Powered E-Commerce Competitive Intelligence*

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FastAPI · React 18 · Groq LLM · MongoDB · Oxylabs

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# Problem Statement & Objectives

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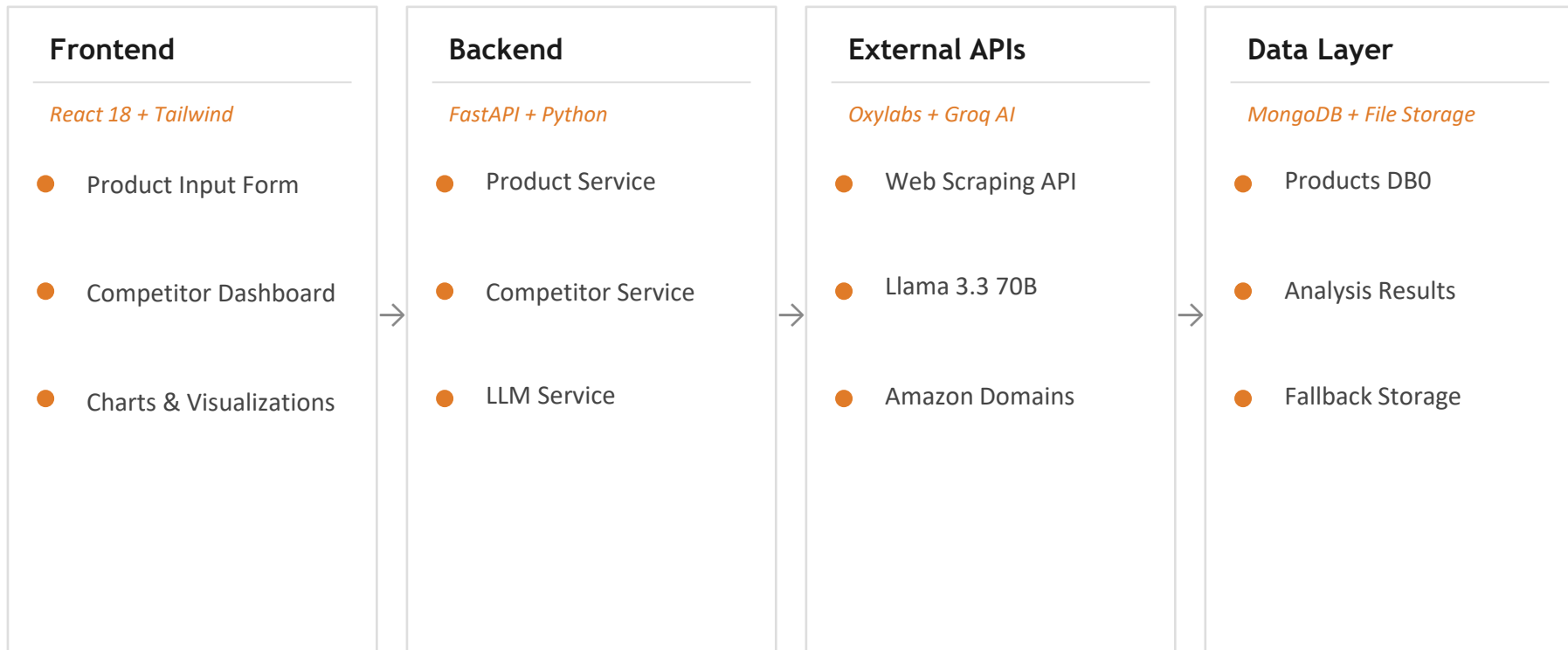
## THE PROBLEM

- No real-time visibility into competitor activity
- Manual price & feature tracking takes hours per week
- No integrated AI to turn data into actionable advice
- Tools are scattered no single platform does everything

## OBJECTIVES

- 1 Automate competitor discovery via web scraping
- 2 Use an LLM to generate intelligent market insights
- 3 Build rich visualisations & comparison dashboards
- 4 Persist data in MongoDB for ongoing trend tracking

# System Architecture



# How It Works: Step-by-Step

## 01 Product Input

Enter ASIN, URL or product name. Select Amazon domain and ZIP code.

## 02 Primary Scraping

Oxylabs fetches full product details from Amazon (2–5 seconds).

## 03 Multi-Strategy Search

Title-based, category-based and brand-based searches run simultaneously.

## 04 Filter & Validate

Dedup, ASIN check, price range  $0.5\times - 3\times$  of main product.

## 05 Batch Enrichment

Up to 10 competitors scraped in parallel. Results cached for 24h.

## ACTUAL PLATFORM UI

The screenshot shows the 'Amazon Competitor Analysis' web interface. At the top, there's a header with the logo, the title 'Amazon Competitor Analysis', a subtitle 'AI-powered competitive intelligence for Amazon products', and buttons for 'Reset' and 'API Docs'. Below the header is an 'Analysis Workflow' section with four steps: 'Product Input' (In Progress), 'Scrape Product' (Pending), 'Find Competitors' (Pending), and 'AI Analysis' (Pending). The 'Product Information' section below contains a form with fields for 'Product Identifier Type' (ASIN, Product URL, Product Name), 'Product ASIN' (with an example 'e.g., B0BNSWRWNW'), 'ZIP Code' (with '10001' and an example for US), and 'Amazon Domain' (with 'amazon.com (US)' and a dropdown arrow). A large orange button at the bottom says 'Scrape Product Details'.

# AI Analysis Engine: Groq LLM Integration

## MODEL CONFIGURATION

Model **Llama 3.3 70B Versatile**

Provider **Groq AI**

Temperature **0.3 (balanced / factual)**

Max Tokens **2,000 per request**

Timeout **2 minutes + fallback**

## 15+ ANALYSIS CATEGORIES

- Market Positioning
- Pricing Strategy
- Feature Comparison
- Brand Strength
- Customer Satisfaction
- Market Trends
- Competitive Threats
- Action Plans
- Review Analysis
- Geo Insights
- Seasonal Trends
- Quality Assessment
- Value Proposition
- Risk Assessment
- Growth Opportunities

# Data Model: MongoDB Collections

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## products

---

asin (unique key)

---

title, brand, price

---

rating, review\_count

---

categories, features

---

geo\_location, domain

---

scraped\_at, last\_updated

## competitor\_analysis

---

main\_product\_asin

---

competitors[ ]

---

competitive\_score

---

price\_difference

---

feature\_similarity

---

analysis\_metadata

## ai\_analysis\_results

---

main\_product\_asin

---

analysis\_type

---

insights { }

---

market\_position { }

---

groq\_model + tokens

---

processing\_time

# Performance Metrics & Scalability

**30-45s**

**Product Scraping**

*per product*

**60-80s**

**Competitor Discovery**

*avg · 3 strategies*

**5-10s**

**AI Analysis**

*15+ categories*

**10+**

**Concurrent Users**

*FastAPI async*

## Key Optimisations

- **Async Processing:** Non-blocking I/O, backend never sits idle waiting
- **Smart Caching:** MongoDB result caching with 24-hour TTL
- **Batch Processing:** Up to 10 competitors scraped simultaneously
- **Connection Pooling:** Reused HTTP connections to external APIs
- **Rate Limiting:** 0.5s delays between Oxylabs scraping calls
- **Fallback System:** Pre-generated insights when external APIs fail

# Platform in Action – Live Results

## PRODUCT DETAILS & WORKFLOW

**Amazon Competitor Analysis**  
AI-powered competitive intelligence for Amazon products

**Analysis Workflow**

- Product Input: Enter product details (Pending)
- Scrape Product: Get product information (Complete)
- Find Competitors: Discover competing products (In Progress)
- AI Analysis: Generate market insights (Pending)

**Product Details**

**Main Product**

**PlayStation®5 Digital Edition – 825GB**

**\$583.94** ⭐ 4.8 363 reviews

**In Stock**

The PS5 Digital Edition unleashes new gaming possibilities that you never anticipated. Experience lightning fast loading with an ultra-high speed SSD, deeper immersion with support for haptic feedback, adaptive triggers, and 3D Audio, and an all-new generation of Incredible PlayStation...

ASIN: B0FRGMJ3MG [View on Amazon](#)

## COMPETITOR ANALYSIS RESULTS

**Amazon Competitor Analysis**  
AI-powered competitive intelligence for Amazon products

**Analysis Workflow**

- Product Input: Enter product details (Complete)
- Scrape Product: Get product information (Complete)
- Find Competitors: Discover competing products (Complete)
- AI Analysis: Generate market insights (Complete)

**Product Details**

**PlayStation®5 Digital Edition – 825GB**

**\$583.94**

**Competitor Analysis**

**Price Analysis Summary**

Price Range: **\$275.00 - \$699.99**

Market Price: **\$522**

**Competitor Analysis (10 products)**

PRODUCT	PRICE	STATUS	REVIEWS	SELLER RATING
Sony PlayStation 5 DualSense Wireless Controller	\$59.99	Available	4.8	98%
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Sony PlayStation 5 DualSense Wireless Controller	\$59.99	Available	4.8	98%
PlayStation 5 DualSense Wireless Controller	\$59.99	Available	4.8	98%
Sony PlayStation 5 DualSense Wireless Controller	\$59.99	Available	4.8	98%

10

competitors found

3

cheaper options

7

premium options

\$522

avg market price

# Project Results & Key Features

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## Multi-Domain Support

Amazon.com, .in, .co.uk, .de, .fr + 5 more geo-location ZIP targeting

## AI-Powered Insights

Groq Llama 3.3 70B: 15+ insight categories, 100% uptime via fallback

## Rich Visualisations

Price comparison charts, market position radar, score cards & tables

## Persistent Storage

MongoDB collections for products, analyses & AI results; file fallback

## Fast API Backend

FastAPI async endpoints, Pydantic v2 validation, full OpenAPI at /docs

## Test Coverage

Pytest suite: CRUD, search, integration, connection & postal code tests

# Challenges & Learnings

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## Challenges Faced

### API Rate Limiting

Oxylabs limits required careful batch management and retry logic

### LLM Reliability

Groq timeouts needed a comprehensive fallback analysis system

### Data Consistency

Multi-strategy search produced duplicates & dedup pipeline required

### Geo-Location Validation

Postal codes vary by country & custom regex patterns per domain

## Key Learnings

### Async Architecture

FastAPI async patterns dramatically improve I/O-heavy throughput

### Prompt Engineering

Structured JSON prompts with Pydantic models reduce LLM errors

### Defensive Coding

Graceful fallbacks are critical for external API dependencies

### Data Normalisation

Early Pydantic v2 validation prevents downstream data quality issues

# Live deployment

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- **Frontend (Netlify)** <https://amazon-competitor-analysis.netlify.app/>
- **Backend API (Render)** <https://amazon-competitor-analysis.onrender.com>
- **Database** MongoDB Atlas, cloud-hosted, no local setup required
- No local setup, accounts, or API keys required to access the demo

## Key Takeaways

# What We Built & Learned

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- End-to-end pipeline: scraping → storage → AI analysis → visualization
- 15+ AI categories from Groq Llama 3.3 70B with a robust fallback system
- Multi-strategy competitor discovery with smart deduplication
- Production-ready FastAPI + MongoDB stack with fully async design
- Geo-aware, multi-domain Amazon support across 10 countries