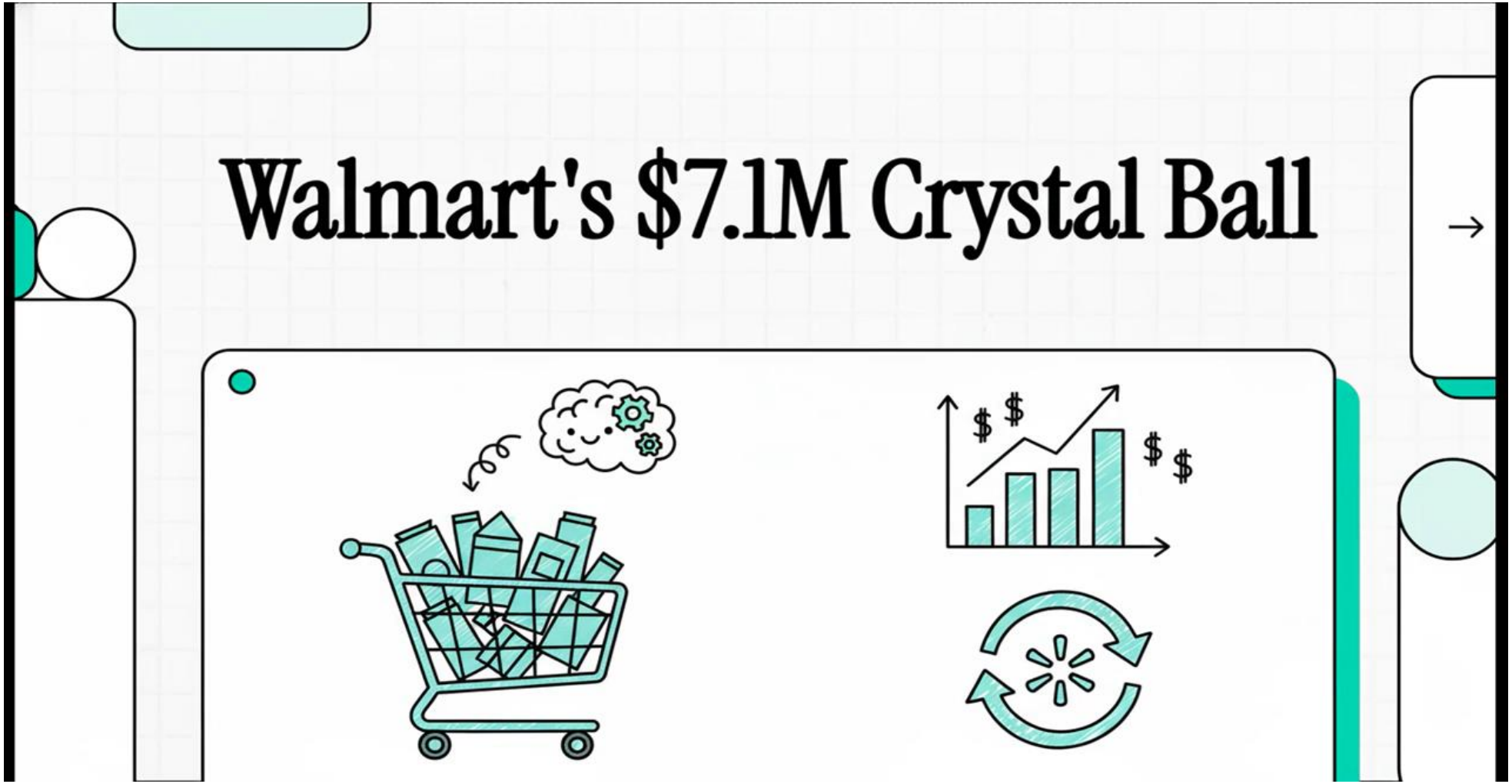
Walmart Sales Forecasting and Optimization

LEVERAGING MACHINE LEARNING
FOR $7.1M PROJECTED ROI

Video



Executive Summary

The Problem: Inaccurate sales forecasts causing stockouts/overstocking.

The Solution: End-to-End ML Pipeline (Random Forest).

The Result: 99.96% Accuracy / $106.77 MAE.

The Value: Production Ready and Scalable.

Business Challenge

- **Before ML:** High operational costs, manual planning, inventory waste.
- **Objectives:** Achieve a $R^2 > 0.95$ to drive **35% reduction in stockouts**.
- **Scope:** Predicting weekly sales for 45 stores/99 departments.

Data Strategy at Scale

421K

Training Records

Cleaned & Merged

91

Engineered Features

From 10 Original Features

100%

Data Completeness

Zero Missing Values

Key Business Insights

Seasonality

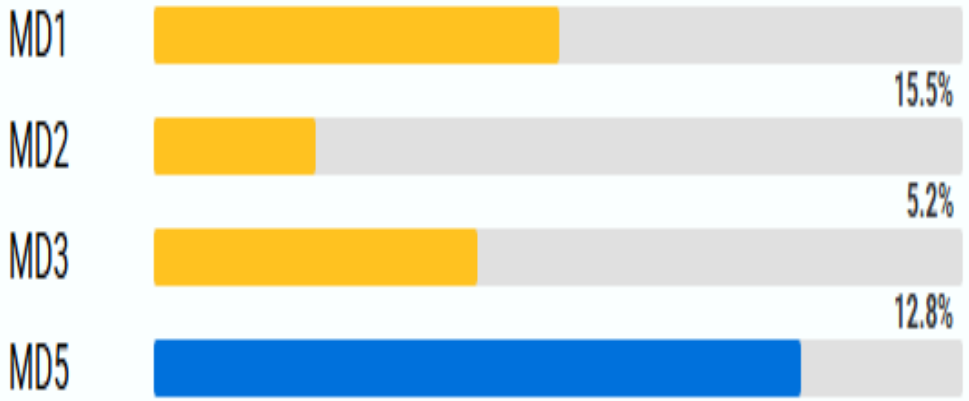
- Q4 sales are 35-40% higher than Q1

Holiday Impact

- Sales are +7.13% higher on average during holiday weeks.

Promotion

- Markdown effects are highly variable and key to prediction



Model Selection and Performance

Model Tested	· Random Forest, XGBoost, LightGBM.
Champion	· Random Forest Regressor.
Key Matrics	• $R^2 = \frac{0.9996}{MAE} = \$106.77$
Why it Works	· Captures complex integrations (e.g. Promotion + Holiday).

MLOps and Deployment (Production Readiness)

Tracking: MLflow for robust experiment management.

Serving: FastAPI API (fast inference <10ms).

User Interface: Interactive Streamlit Dashboard for business users.

Containerization: Docker for easy, one-command deployment.

Live Demo

- **Action:** Show the Streamlit Dashboard/API output.
- **Focus:** Demonstrate prediction capability by inputting new data (e.g., a holiday week vs. a regular week) and showing the quick, accurate result.
- **Link:** walmart-sales-forecasting-ml.streamlit.app

Business Value & ROI

Inventory Savings: $2.4M annual savings projected.

Staff Efficiency: 20% optimization in labor costs.

Net Value: Projected $7.1 Million ROI.

Future Roadmap

Data: Integrate social media/sentiment analysis.

Model: Explore advanced **LSTM/Transformer** models.

Scaling: Move to enterprise-grade **Cloud MLOps Platform** (AWS/Azure).

Project Leadership & Team

Development Team (DEPI Initiative)





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Thank You & Q&A

Summary: We delivered a high-impact, production-ready solution.

Open for questions.