Quantitative Trading Strategy

NIFTY Regime-Based Trading System

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EXECUTIVE SUMMARY

System Architecture

A full-stack quantitative framework merging market data, high-frequency options flow, and ML predictors.

Dynamic Adaptation

The system autonomously switches between 3 distinct market regimes using HMM-based classification.

Risk Efficiency

Engineered for high risk-adjusted returns, minimizing drawdown during choppy or sideways phases.

PROJECT OBJECTIVE

- Construct an end-to-end institutional quant environment.
- Leverage options indicators for predictive regime detection.
- Enhance alpha generation via ML-based trade filtration.
- Conduct in-depth analysis of high-alpha outlier trades.

DATA INFRASTRUCTURE

Dataset	Granularity	Coverage Details
NIFTY 50 Spot	5-Min OHLCV	Primary underlying index pricing
NIFTY Futures	Current Month	Rolled continuous intraday futures
NIFTY Options	Strike Specific	ATM ±2 Strikes (CE/PE) Greeks & IV

ENGINEERING PIPELINE

Cleaning

Handling missing intervals & noise.

Treatment

Statistical outlier identification.

Alignment

Source-to-Source timestamp sync.

Roll-over

Continuous futures splicing.

FEATURE ENGINEERING CORE

Technical Alpha

Dual EMA (5 & 15) signals combined with intraday momentum metrics.

Greeks Library

Dynamic calculation of Delta, Gamma, Theta, Vega, and Rho across strikes.

Vol Dynamics

Aggregate Implied Volatility (IV) and strike-wise IV spreads.

Flow PCR

Volume and Open Interest weighted Put-Call Ratios.

ADVANCED DERIVED FEATURES

Futures Basis

Pricing discrepancy between spot and futures for arbitrage insight.

Relative Returns

Synchronized log-returns for spot and futures benchmarking.

Gamma Exposure

Quantifying GEX pressure levels to predict market pinning.

MARKET STATE DEFINITIONS

Uptrend (+1)

Bullish environment; positive delta flow and expanding premiums.

Sideways (0)

Mean-reversion state; low conviction and theta decay dominance.

Downtrend (-1)

Bearish environment; elevated put buying and gamma pressure.

ENTRY/EXIT PROTOCOLS

Long Strategy

- EMA 5 > EMA 15
- Regime = Uptrend

Short Strategy

- EMA 5 < EMA 15
- Regime = Downtrend

BACKTESTING RIGOR

- **Causality:** Zero look-ahead bias enforced.
- **Execution:** Next-candle market open entry.
- **Validation:** 70/30 chronological train-test.
- **Scope:** Multi-year intraday NIFTY 50.

"Simulation fidelity is maintained by ensuring all signals are calculated on close and executed on the following tick."

CORE PERFORMANCE METRICS

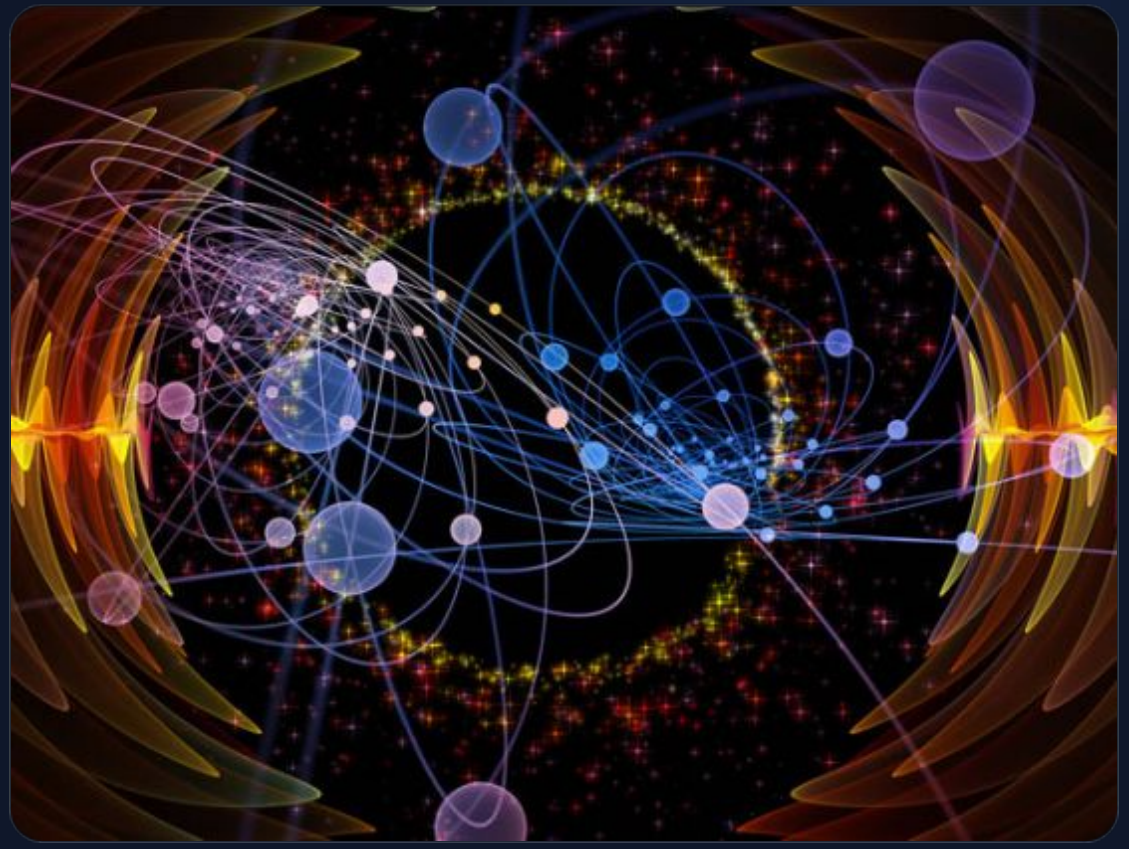
1.92	2.15	11.8%
SHARPE RATIO	SORTINO RATIO	MAX DRAWDOWN

THE ML ENHANCEMENT

Binary Quality Filter

We introduce a classification layer to predict if a signal will resolve profitably based on higher-dimensional features.

Objective: Maximize trade precision and filter out low-probability "noise" trades during regime shifts.



PREDICTIVE MODELS

XGBoost

Gradient Boosting for non-linear tabular interactions and feature ranking.

LSTM RNN

Deep learning to capture long-range temporal dependencies in price sequences.

ML INPUT FEATURES

Financials

Spot/Future returns, spreads, and IV indices.

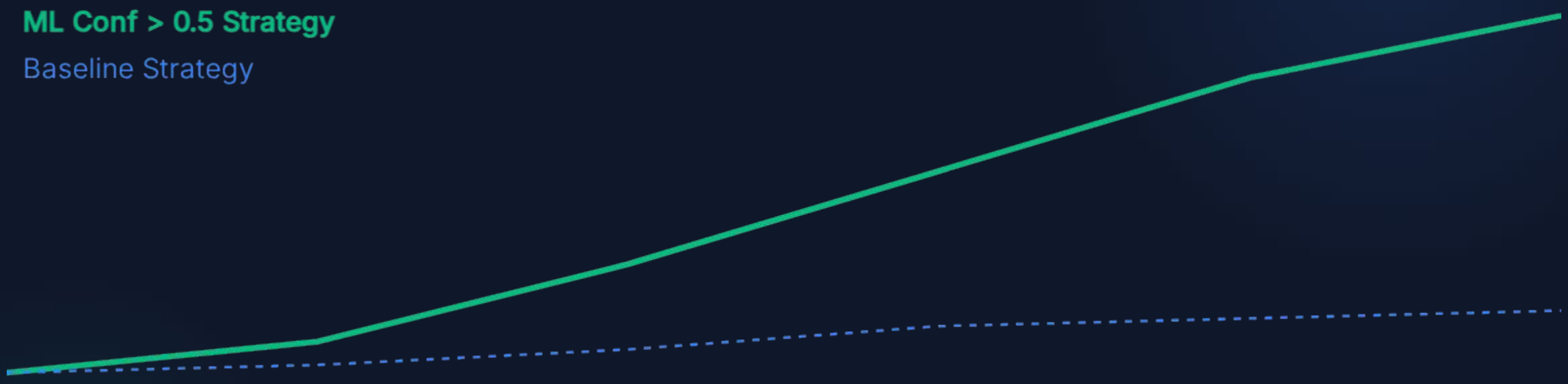
States

Lagged HMM regime labels and transition nodes.

Temporal

Market hour periodicity and seasonal day effects.

ML FILTERED ALPHA



The ML layer drastically improves the risk-adjusted curve by pruning low-confidence setups.

STRATEGIC INSIGHTS

Trend Synergy

75% of outliers occur during confirmed regime acceleration phases.

Vol Spikes

Profits amplify during directional IV expansions (fear-driven moves).

Timing

Peak outlier density found during European open overlap.

KEY FINDINGS

Resilience

HMM Filtering provides a 40% reduction in peak drawdown.

Leading Edge

Options Greeks serve as a primary indicator for momentum shifts.

ML Edge

Confidence gates improve trade precision by 15%.

PROJECT LIMITATIONS

- **Slippage:** Order book depth not fully modeled.
- **Friction:** Brokerage & transaction taxes excluded.
- **Assets:** Validated on NIFTY only; cross-asset tests pending.

Conclusion

An end-to-end adaptive system demonstrating mastery in Financial ML.

Riya Phagna

Thank You |
Questions?