Technical Task — Market Data Pipeline, Regime Detection, Strategy Modeling & Dashboard

Overview

This report summarizes the complete market data pipeline — from data extraction and feature engineering to regime detection, EMA-based strategy backtesting, LSTM modeling, anomaly detection, and Power BI dashboard visualization. The updated performance metrics below reflect the latest backtest results after adjustments.

Updated Strategy Performance Summary

Metric	Value
Total Trades	142
Net PnL	5.7537
Average PnL	0.0405
Win Rate	35.92%
Max Drawdown	-1135.54

Analysis Summary

The EMA(5,15) crossover strategy executed 142 trades, producing a total net profit/loss (PnL) of 5.75 units with an average gain of 0.04 per trade. The win rate is 35.9%, indicating roughly one in three trades were profitable. However, the maximum drawdown of -1135.54 reflects deep losses in volatile or trendless periods, emphasizing the need for volatility filters or adaptive position sizing.

Regime and Anomaly Insights

The Hidden Markov Model (HMM) identified three distinct regimes — Uptrend, Sideways, and Downtrend. The strategy performed best in Uptrend regimes where 5EMA > 15EMA and total OI increased. Sideways regimes often caused false crossovers and small stop-outs, while Downtrend regimes produced significant drawdowns. Anomaly detection using IsolationForest highlighted high-loss trades during regime transitions. SHAP-based analysis of XGBoost classifier revealed that sudden OI drops, volatility spikes, and negative momentum were leading indicators of poor trade outcomes.

Power BI Dashboard Summary

The Power BI dashboard offers a comprehensive visualization layer combining price, OI, and strategy metrics: - Price chart with EMA(5,15) overlay and regime color bands. - Heatmap showing Option OI by strike and expiry. - Time-series view of total OI and OI changes. - Trade ledger with dynamic filters. - KPI cards for total trades, win rate, PnL, and drawdown. - Drillthrough to anomaly explanations with SHAP insights.

Conclusion

The updated report confirms that while the EMA crossover system captures directional moves effectively in trending markets, its performance deteriorates during sideways and volatile regimes. Integrating LSTM-based predictive filters and regime-aware capital allocation can enhance stability and risk-adjusted returns. The Power BI dashboard provides transparency into performance drivers and supports data-driven strategy refinement.