Enhanced Forecasting Models, Knowledge Requirements & Recommendations

1. Trend-Level (Price Band) Forecasting

Definition: Short-horizon estimation of a plausible price range rather than exact next price.

Models (ARIMA, ETS, Prophet)

ARIMA handles autoregression, differencing, MA structure.

ETS decomposes trend & seasonality through smoothing.

Prophet uses additive trend + seasonality + holiday components.

Knowledge Required

Stationarity tests, ACF/PACF interpretation.

Forecast error metrics and residual diagnostics.

Difficulty: Low–Medium

Recommended as MVP; intuitive and visually clean.

2. Return Forecasting

Definition: Prediction of the next numerical return, highly noisy.

Models (Linear Regression, Ridge, RF, XGBoost)

Linear models capture weighted lagged effects.

Tree ensembles capture nonlinear interactions.

Ridge stabilizes coefficients under noise.

Knowledge Required

Feature engineering, leakage control.

Regularization & cross-validation.

Difficulty: Medium

Good pedagogical example; poor real-world predictability.

3. Volatility Forecasting

Definition: Prediction of future return variability, very forecastable.

Models (EWMA, GARCH, EGARCH)

EWMA uses decay-weighted squared returns.

GARCH models volatility clustering & mean reversion.

EGARCH captures asymmetric response to shocks.

Knowledge Required

Conditional variance modeling.

MLE fitting, residual checks.

Difficulty: Medium

Highly practical and recommended for quant dashboards.

4. Direction Forecasting (Up/Down)

Definition: Binary classification of next move direction.

Models (Logistic, SVM, XGBoost)

Logistic outputs upward-move probability.

SVM maximizes margin for classification.

Boosting captures nonlinear boundaries.

Knowledge Required

ROC, AUC, class imbalance handling.

Normalization and indicator features.

Difficulty: Low–Medium

Accuracy rarely exceeds 55%; still useful to showcase ML.

5. Market Regime Forecasting

Definition: Identifying hidden structural states (bull/bear, vol regimes).

Models (HMM, K-Means, GMM)

HMM models hidden state transitions over time.

K-Means clusters regimes via Euclidean distances.

GMM provides soft probabilistic clustering.

Knowledge Required

State transitions, time-series segmentation.

Unsupervised models interpretation.

Difficulty: Medium–High

More advanced; very insightful.

6. Volume Forecasting

Definition: Predicting future traded volume (liquidity indicator).

Models (ARIMA, LSTM, Gradient Boosting)

ARIMA exploits autocorrelated volume.

LSTM models sequential variation.

Boosting detects nonlinear drivers.

Knowledge Required

Volume seasonality, normalization.

Handling intraday cycles.

Difficulty: Medium

Useful for microstructure or event-driven contexts.

7. Volatility-of-Volatility (VoV)

Definition: Prediction of how unstable volatility itself will be.

Models (HARCH, GARCH-of-GARCH)

HARCH uses multi-horizon squared returns.

Higher-order GARCH models vol instability.

Knowledge Required

Advanced vol modeling.

Long-memory processes.

Difficulty: High

Only for advanced quant extensions.

8. Risk Metrics Forecasting (VaR / ES)

Definition: Prediction of tail-risk thresholds and expected losses beyond VaR.

Models (Historical, Monte Carlo, GARCH-VaR)

Historical VaR uses empirical quantiles.

Monte Carlo simulates future price paths.

GARCH-VaR adjusts for conditional volatility.

Knowledge Required

Tail distributions, EVT basics.

Backtesting risk violations.

Difficulty: High

Great for institutional-style dashboards.

9. Momentum / Mean Reversion Strength

Definition: Prediction of trend persistence or reversal intensity.

Models (Regression, HMM segmentation)

Regression estimates continuation strength.

HMM separates trending vs reverting states.

Knowledge Required

Momentum indicators and filters.

Cycle detection & state behaviors.

Difficulty: Medium

Very useful for strategy design.

10. Breakout Probability

Definition: Likelihood that price exits a consolidation range.

Models (Logistic, Tree Models)

Logistic predicts breakout odds.

Trees capture nonlinear range-volatility effects.

Knowledge Required

Range compression metrics.

Support/resistance concepts.

Difficulty: Medium

Great for traders; very intuitive visually.

11. Intraday Pattern Forecasting

Definition: Predicting intraday drift, reversals, or volatility spikes.

Models (LSTM, CNN)

LSTM captures sequential microstructure.

CNN extracts shape patterns from price curves.

Knowledge Required

Intraday microstructure.

Resampling, denoising.

Difficulty: High

High impact but high complexity.

12. Correlation Forecasting

Definition: Predicting how relationships between assets evolve.

Models (DCC-GARCH, Rolling Regression)

DCC models dynamic covariance matrices.

Rolling windows track shifts in correlation.

Knowledge Required

Covariance matrix dynamics.

Cross-asset statistical dependencies.

Difficulty: Medium–High

Excellent for multi-asset portfolios.

13. Beta Forecasting

Definition: Prediction of future market sensitivity (beta) of a stock.

Models (Kalman Filter, Rolling Regression)

Kalman updates beta recursively over time.

Rolling regression estimates dynamic factor exposure.

Knowledge Required

State-space models.

Factor modeling concepts.

Difficulty: Medium

Strong addition for portfolio analytics.

14. Drawdown Probability Forecasting

Definition: Estimating probability of future losses exceeding a threshold.

Models (Monte Carlo, Markov Chains)

Monte Carlo simulates many stochastic return paths.

Markov chains model transition probabilities to loss states.

Knowledge Required

Path dependency & tail risks.

Stochastic state modeling.

Difficulty: High

Very valuable for risk management.

15. Overnight Gap Forecasting

Definition: Predicting difference between today's close and tomorrow's open.

Models (Boosted Classifiers/Regressors)

Models use volatility, late-session returns, after-hours signals.

Regression predicts magnitude; classification predicts direction.

Knowledge Required

Open-close microstructure.

Handling noisy distributions.

Difficulty: Medium

Nice addition for equity-focused apps.