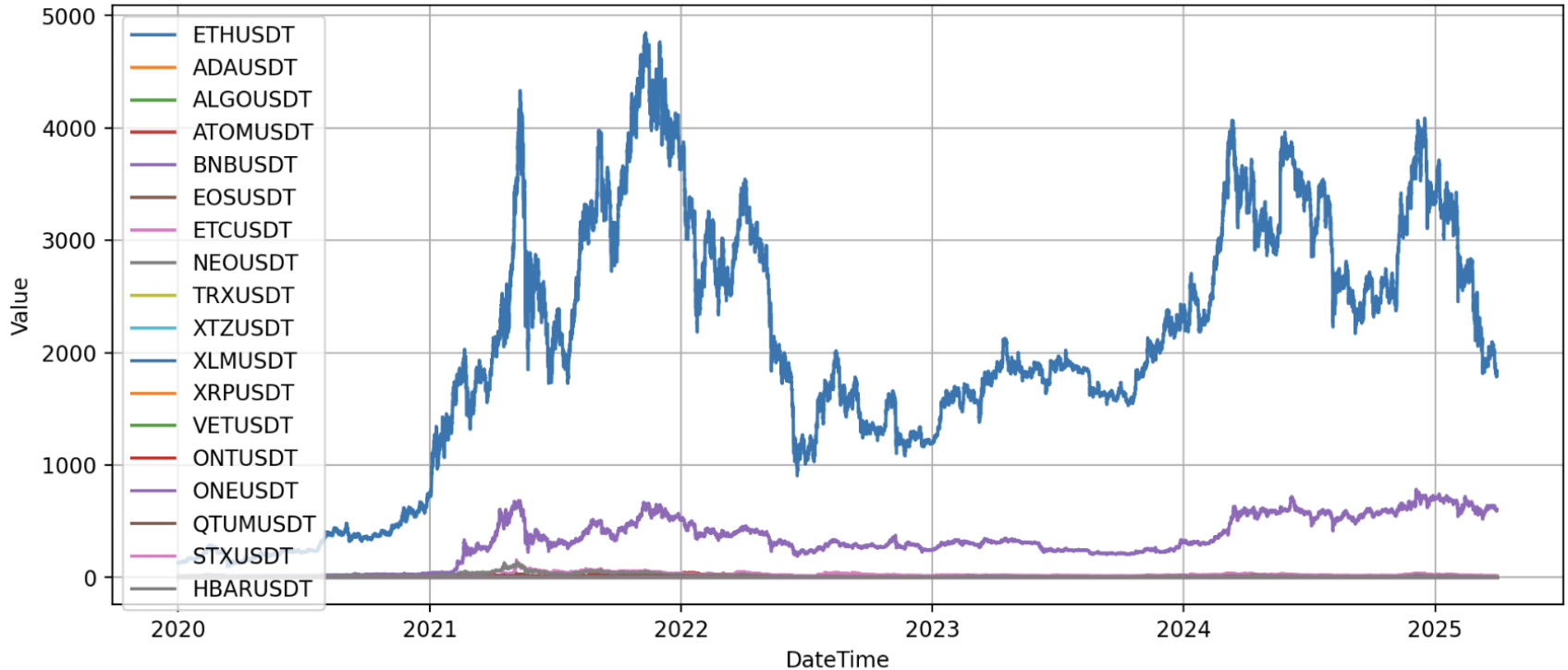# CRYPTO HEDGE FUND MVP

Structure

1. Hedge Fund Model:

Vision and components

2. Risk management

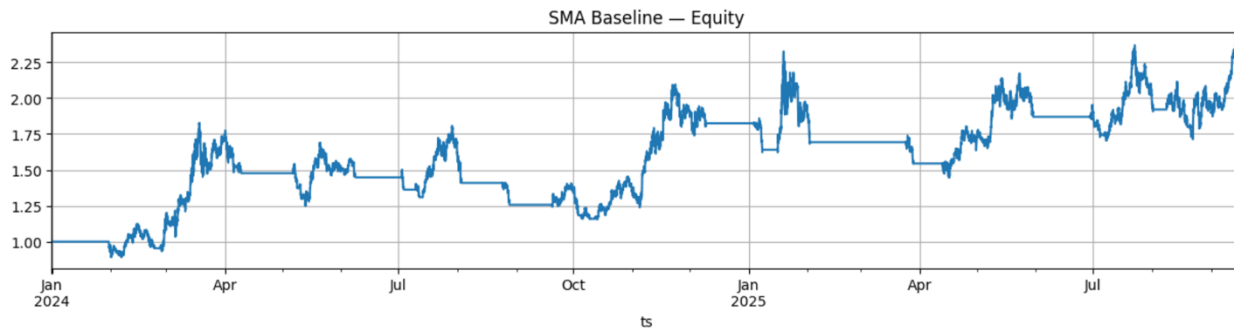*Main concepts and metrics*

3. Portfolio management
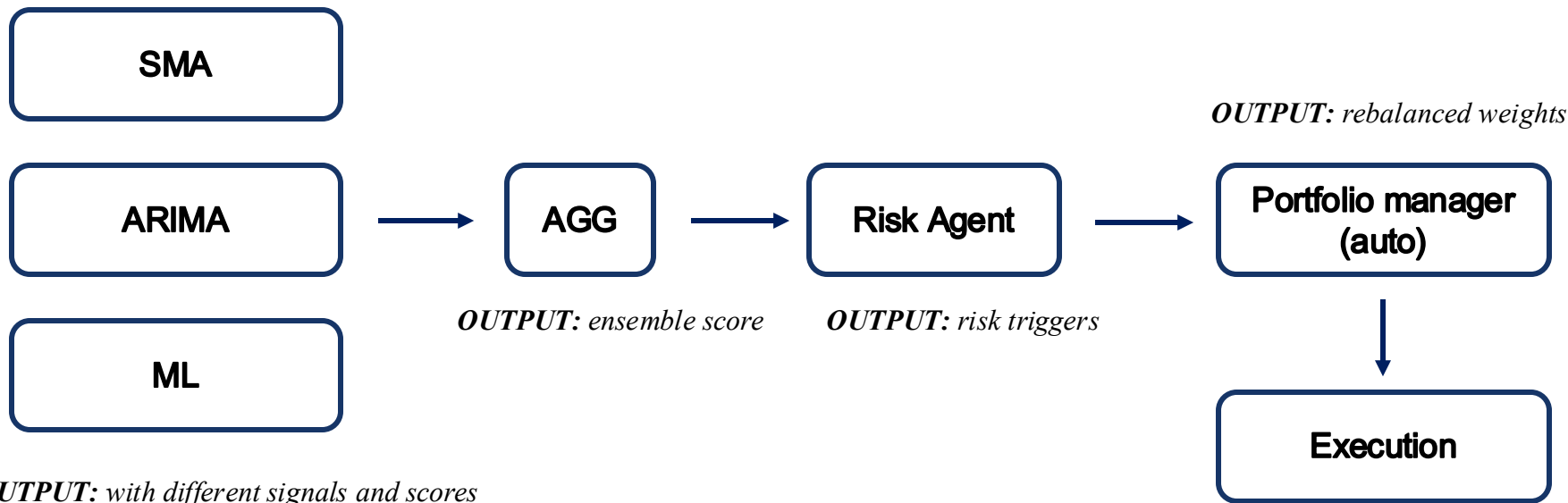
Main concepts and metrics

4. System Architecture

Architecture example

SMA Baseline — Equity

Price & SMAs

Hedge Fund Model

AI Role

Optimization in decision making, calculate and graduate market risk metric: forecasting models and trading agents

SMA

ARIMA

ML

OUTPUT: *with different signals and scores*

AGG

OUTPUT: *ensemble score*

Risk Agent

OUTPUT: *risk triggers*

Portfolio manager (auto)

OUTPUT: *rebalanced weights*

Execution

Model	Pros	Cons	Possible Role
SMA	Easy to implement and interpretate Captures medium/long-term trends	Lags behind price (slow reaction to regime shifts)	Serves as a **baseline** strategy and benchmark; useful for long-term trend detection
ARIMA	Captures autocorrelation and mean-reversion patterns	Struggles with non-linear dynamics and regime shifts	Used to model short-term **statistical dependencies** in returns
GARCH	Captures volatility clustering (common in crypto)	Focused only on **variance**, not mean returns	Incorporated into the **risk management module**: volatility forecasts to reduce leverage or scale down positions
Logistic Regression	Simple, fast, and interpretable classification model	Linear decision boundary Sensitive to feature scaling and correlation	Serves as a **baseline ML classifier** for directional forecasts; useful for interpretability
Boosting	Handles **non-linearities** and feature interactions	Risk of overfitting without careful tuning	Provides the core predictive agent for signal generation;
Aggregation (Ensemble / Voting / Weighted)	Diversifies across models → reduces overfitting	Requires monitoring of model correlations and weights	Acts as the **meta-agent** in architecture: combines outputs from different models into one unified trading signal, balancing simplicity with robustness.

Risk management

Role of Risk Management in a Hedge Fund

Capital Preservation: protects the fund against catastrophic losses.

Stability: ensures smoother equity curves, less volatility in returns.

Position Sizing: adjusts exposure according to market risk levels.

Regime Adaptation: reduces leverage or exits during high-volatility or illiquid periods.

Investor Confidence: provides transparency and discipline for stakeholders.

Core Metrics:
- Volatility
- Drawdowns
- VaR
- Sharp Ratio

Risk management

AI Role

*AI-driven agents monitor **volatility**, **liquidity**, and tail risks in real time, dynamically adjusting exposure, enforcing stop signals, and protecting capital during turbulent periods.*

Volatility Estimation:

Historical volatility
GARCH models for conditional variance
ML-based forecasting

Liquidity Estimation:

Bid-ask spread and *Amihud liquidity ratio*
Order book depth analysis (volume at top levels).
Slippage simulation based on order size vs. market depth.

Portfolio management
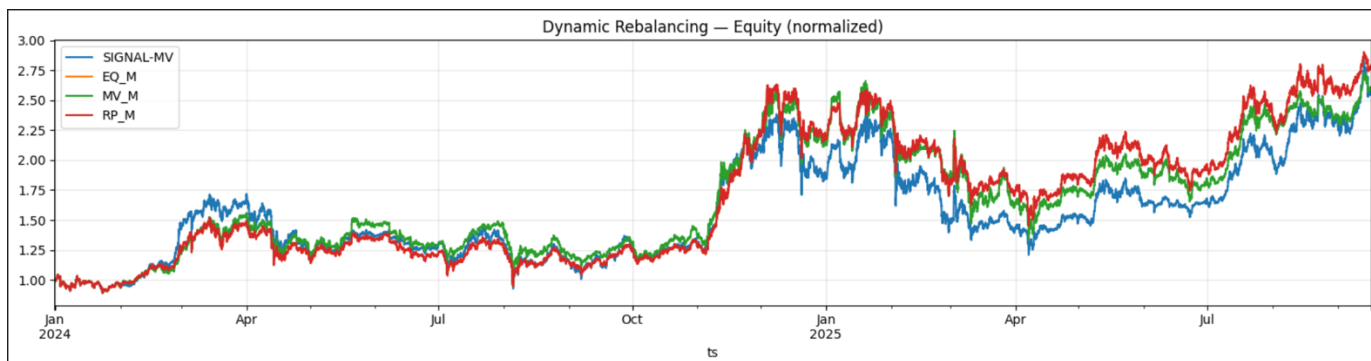
Popular **theories** of portfolio management:

- Modern Portfolio Theory (Markowitz)

- Risk Parity

- Black–Litterman

- Factor Models

Optimal portfolio:

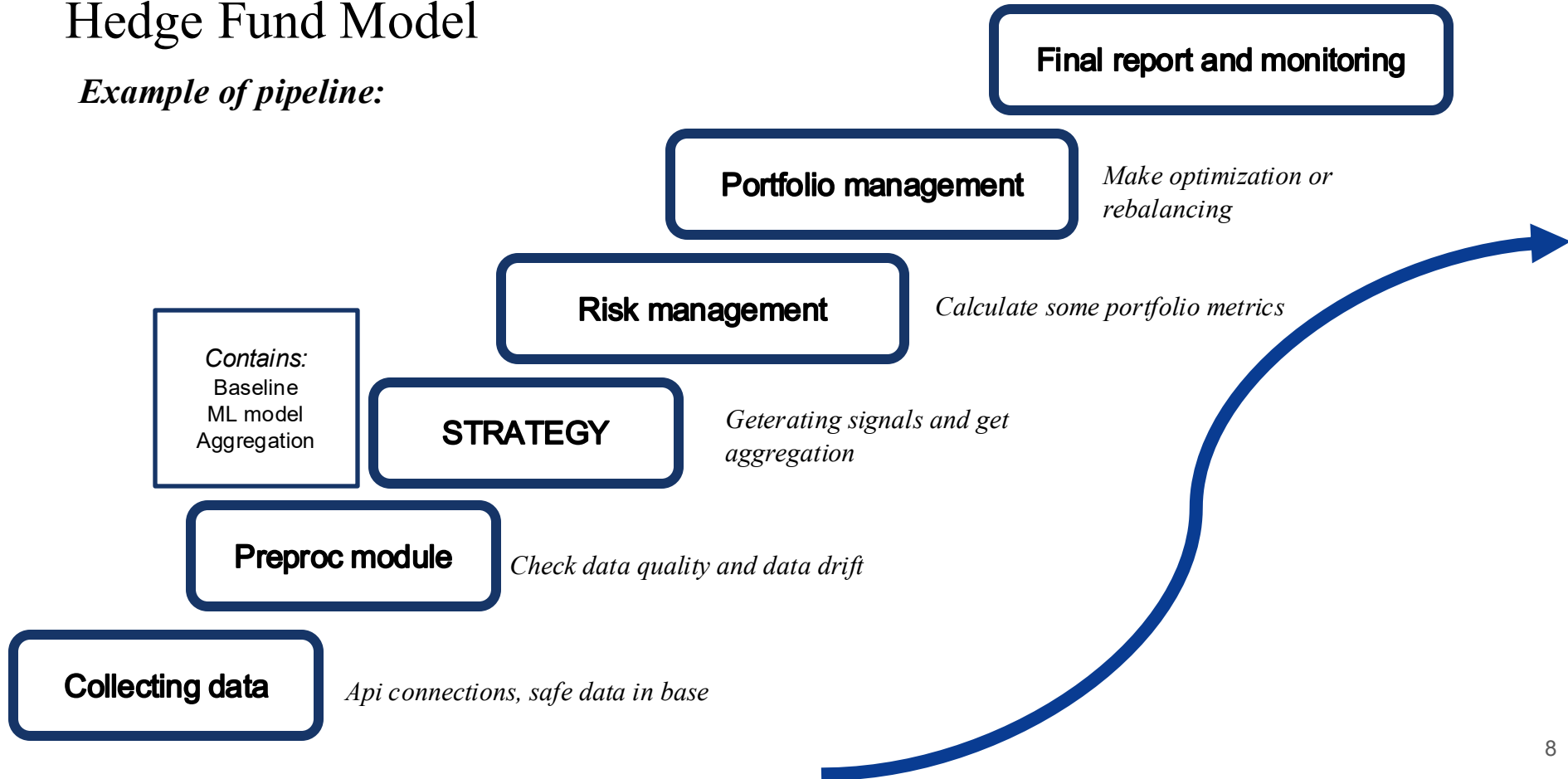Balanced **return, volatility, drawdown and liquidity constraints**.

Avoid over-concentration by accounting for **correlations** between assets.

Evaluated using **risk-adjusted performance metrics.**

Hedge Fund Model

Example of pipeline:

Final report and monitoring

Portfolio management

Make optimization or rebalancing

Risk management

Calculate some portfolio metrics

Contains:
Baseline
ML model
Aggregation

STRATEGY

Geterating signals and get aggregation

Preproc module

Check data quality and data drift

Collecting data

Api connections, safe data in base

Key Takeaways:

- The AI-based hedge fund model combines **classical theory** with **ML** for adaptive, real-time decision-making.
- **Risk management** is central to portfolio stability, with **AI agents** dynamically adjusting for volatility and liquidity.
- **Portfolio management** leverages theories to optimize risk-adjusted returns.

Next Steps:

- *Expand* the library of signals using strong, complementary models
- *Enhance* the aggregation process and define clear risk-adjusted performance ranges
- *Fast Scalability*
- *Incorporate bot* for live monitoring and manual adjustments.
- Set *monitoring system*