Lesson 29: Algorithmic Trading

Mini-Lecture Version (30 min)

Digital Finance

Learning Objectives: Classify different types of algorithmic trading strategies — Design and execute backtesting frameworks — Identify and avoid common backtesting pitfalls — Understand overfitting in trading models

What is Algorithmic Trading?

Definition:

- Automated execution based on rules
- No human intervention
- Computer algorithms make decisions
- Processes data faster than humans

Market Share:

- US equities: 70-80% of volume
- Futures: 60-70% 92

Key Advantages:

- Speed (microseconds)
- Consistency (no emotions)
- Backtesting capability
- Scalability

Challenges:

- Overfitting to historical data
- Model decay (regime changes)
- Technology costs
- Regulatory scrutiny

Understanding this definition is foundational for Algorithmic Trading.

Types of Strategies

Execution Algorithms:

- VWAP, TWAP
- Minimize market impact
- Cost minimization

Market Making:

- Provide liquidity
- Profit from spread
- High-frequency trading

Statistical Arbitrage:

- Mean reversion
- Pair trading
- Market-neutral

Momentum:

- Follow trends
- Breakout strategies
- Moving averages

ML-Based:

- Prediction models
- Alternative data
- Classification/regression

HFT:

- Ultra-short holding
- Latency arbitrage
- Co-location required

This concept is fundamental to understanding Algorithmic Trading.

Backtesting Framework

Steps:

1. Define strategy rules
2. Acquire historical data
3. Simulate trades
4. Calculate returns (net of costs)
5. (See full lecture for details)

Key Metrics:

- Total return
- Sharpe ratio (risk-adjusted)
- Maximum drawdown
- Win rate
- (See full lecture for details)

Realistic Targets:

- Sharpe ¿ 1.5: Good
- Sharpe ¿ 2.0: Very good
- Sharpe ¿ 3.0: Exceptional (or overfitting?)

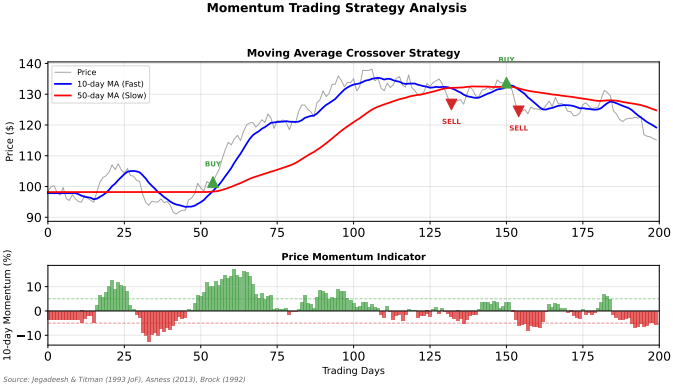
Common Pitfalls:

- Look-ahead bias
- Survivorship bias
- Data snooping
- Ignoring costs
- (See full lecture for details)

Warning: Backtest performance usually overstates live performance.

This concept is fundamental to understanding Algorithmic Trading.

Momentum Strategy Performance



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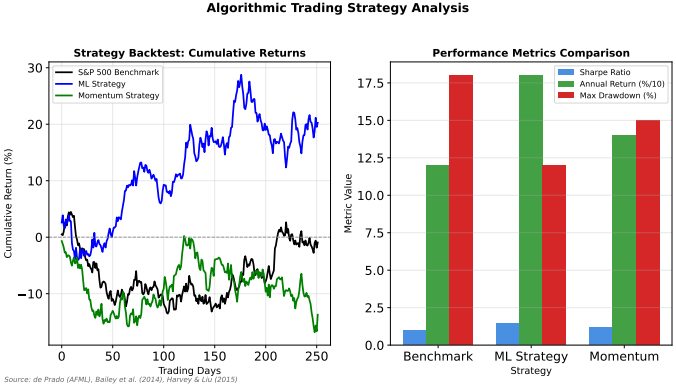
Trading Strategy Backtest Results



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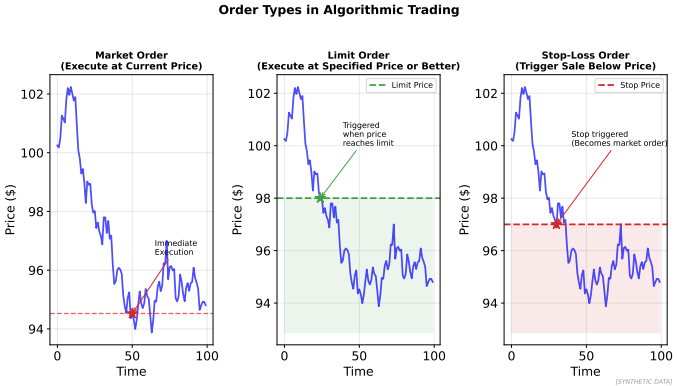
Order Types and Execution



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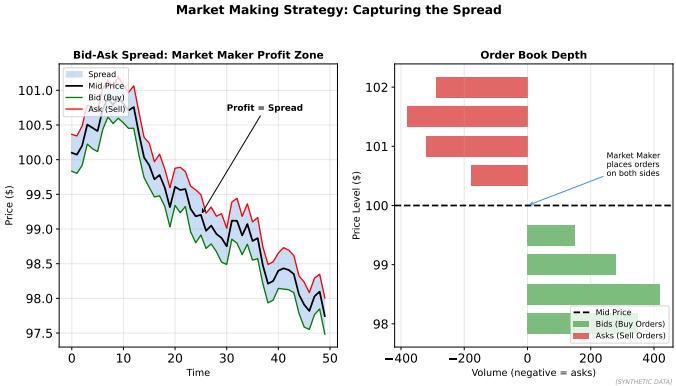
Market Making Spread Dynamics



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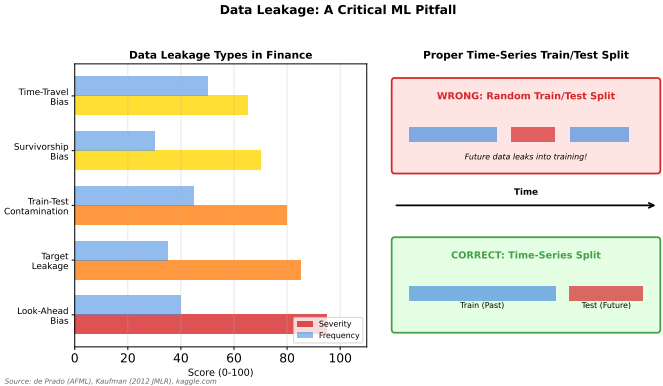
Data Leakage in Backtesting



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Key Takeaways

1. Classify different types of algorithmic trading strategies
2. Design and execute backtesting frameworks
3. Identify and avoid common backtesting pitfalls
4. Understand overfitting in trading models

Bottom Line: Algorithmic Trading is transforming how financial services operate and compete.

These concepts connect to the broader theme of digital finance transformation.

Algorithmic Trading in Visual Perspective

Technology view

Application view

Future view

Visual representations help reinforce key concepts of algorithmic trading.

Concrete Examples: Making It Real

Technical Examples

- Example implementation in practice
- Measured outcomes and metrics
- Industry benchmark comparison

Case Study

- Real-world deployment scenario
- Quantifiable results achieved

Industry Leaders

- Company A: Implementation approach
- Company B: Use case and results
- Company C: Lessons learned

Market Data

- Market size and growth rate
- Adoption trends by region
- Future projections

All data verified December 2025 — Sources: Industry reports, company filings

Quiz Questions (1–5)

Q1. What is the primary purpose of algorithmic trading?
A) Increase efficiency B) Reduce costs C) Improve access D) All of the above

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Q10. What is a key takeaway about algorithmic trading?
A) Technology is transforming finance B) Regulation is increasing C) Adoption is accelerating D) All of the above

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Q10. What is a key takeaway about algorithmic trading?
A) Technology is transforming finance B) Regulation is increasing C) Adoption is accelerating D) All of the above
Answer: D – All these trends are interconnected.