Machine Learning for Trading
Financial Investing
Part 3 of Course
Overview and Introduction
So you want to be a Portfolio Manager?

• What is Computational Investing?
  – Types of funds
  – Liquidity and Capitalization
  – Fund Managers
  – The Investors
  – Goals and Metrics
Landscape

• Retail Investors.
  – Individual who purchases securities for his or her own personal account
  – 50 Million US households [Investment Company Institute and the Securities Association]
  – Round lot trades. (lot=100 stocks), typically interested in investing in larger companies.

• Institutional Investors.
  – (Large) Organization, rather than individual that invest on behalf of the member.
  – Block trades - 10,000 or more shares traded at a time, invest in larger companies (stocks are >> $10 share) Swaps and forwards market (later)

6 Types of Institutional Investors

• Organization, rather than individual that invest on behalf of the member.

Institutional Investor Types:
• Pension Funds
• Endowment funds
• Insurance Companies
• Commercial Bands
• Mutual Funds
• Hedge Funds
• We will focus on Retail Investing.
Module Content.

- So you want to be a hedge fund manager?
- Market mechanics
- What is a company worth?
- The Capital Assets Pricing Model (CAPM)
- How hedge funds use the CAPM
- Technical Analysis
- Dealing with data
- Efficient Markets Hypothesis
- The Fundamental Law of active portfolio management
- Portfolio optimization and the efficient frontier

Core Projects: Market Simulator & Strategy Learner
## Classes of Fund Types

<table>
<thead>
<tr>
<th>ETF</th>
<th>Mutual Funds</th>
<th>Hedge Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Buy/Sell like stocks</td>
<td>• Buy/Sell at end of day</td>
<td>• Buy/Sell by agreement</td>
</tr>
<tr>
<td>• Basket of Stocks</td>
<td>• Quarterly disclosure</td>
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- **ETF**
  - Buy & Sell – how liquid is the fund?
  - Fees of exchange
- **Mutual Funds**
  - Buy/Sell at end of day
  - Quarterly disclosure
  - Less Transparent
- **Hedge Funds**
  - Buy/Sell by agreement
  - No disclosure
  - Not Transparent

- **Buy & Sell** – how liquid is the fund?
- **Fees of exchange**
- **Disclosure** – what is in the fund, how often is it disclosed
- **Transparency** – in addition to what is in the fund, what are the goals of the fund.
Exchange Traded Funds

• Tracks either:
  – Index, commodity, bonds, basket of assets like an index fund, some utilize gearing/leverage – tracking opposite returns of assets.

• Liquid
  – Easy to buy and sell ETFs, trades like a to common stock
    • But you buy multiple stocks with an ETF.
  – Quickly converts into cash at a reasonable price.
    • Maturity tends to be less than a year.
    • Carries more interest than cash.

• ETF price: value is close to fair value.

• Advantages:
  – Higher daily liquidity, and lower fees than mutual funds.
  – Diversification
  – Sell short, buy on margin
  – Tax advantages on capital gains not passed to shareholders like mutual funds.

• Examples:
  – SPDR –ticker SPY tracks SP500, IWM tracks Russell 2000, QQQ tracks Nasdaq 100,
  – Foreign markets both indices and currency.
Mutual Fund

- Pool of money – from many investors that are operated by professional money managers using an investment objective stated in a prospectus.
- Regulated by the SEC (hedge funds are not)
  - Disclosure, prospectus, less aggressive, an advertise.
- Liquid: Daily bases (less liquid that ETF, more liquid than hedge funds).
- Disclosure: regulated – must disclose it quarterly.
- Strategies: Mostly long, some short the market – hedge funds are more aggressive.
  - More likely to outperform hedge funds in a down market (bear market).
- Price/Value: less expensive than hedge funds. Mutual Funds generally charge 2% in total fees, while hedge funds – commonly have a 2/20 structure – 2% management fee skimmed on top, and 20% on all profits.
- **Advantages**: Low cost with a professional fun manager, diverse, liquidity, explicit goals.
- **Disadvantages**: Lower overall returns, underperform benchmark averages, only once per day. Tax inefficient,
- **Examples**: Pimco, Vanguard (Several)), Fidelity Contrafund, American Funds

Hedge Funds.

- Alternate to Mutual Funds.
- Only accessible to accredited investors. Not SEC regulated.
What type of fund is this?

• Use Google for a few minutes for these and fill the boxes in with E, M or H.
  – **E** – ETF
  – **M** – Mutual fund
  – **H** – Hedge fund.

- VTINX
- DSUM
- FAGIX
- Bridgewater Pure Alpha
- SPLV
Activity: What type of fund is this?

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Last Name, First Name: Notes: Include – what does the acronym mean, and is it a good investment? Or not?
Activity: What type of fund is this?

• Use Google for a few minutes for these and fill the boxes in with E, M or H.
  – E  – ETF
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Hedge fund: No symbol acronym, don’t need to be traded readily, only 100 investors
Incentives: How are portfolio managers compensated?

• ETF
• Mutual Funds
• Hedge Funds

-- Assets Under Management (AUM) – typically earn a % of the AUM.
-- What is the formula?
Incentives: How are they compensated?

What is the Expense Ratio? For each type of fund:

- **ETF**: 0.01% AUM --- 1.00% AUM
- **Mutual Funds**: 0.50% AUM --- 3.00% AUM
- **Hedge Funds**: Two & Twenty (2% AUM & 20% Profit)

- ETF managers – stocks are tied to the index.
- Mutual funds – paid for research what goes in to the fund, and tying these stocks to the fund.
Incentives

Managed Fund Example:

• January 1, 2017
  – $100,000,000 ($100 million!)

• December 31, 2017
  – $115,000,000

Two and Twenty: 2% AUM, 20% of profit.

“Two” = $100M * 0.02 → $2M - $2.3M (0.02*115M)

“Twenty” = $15M * 0.20 → $3M

= $5M - $5.3M
Incentives

Managed Fund Example:

- January 1, 2017
  - $100,000,000 ($100 million!)

- December 31, 2017
  - $115,000,000

Two and Twenty: 2% AUM, 20% of profit.
Incentives

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= $5M

Two & Twenty

popular approach in 90s – early 2000s

Today typically lower

Exception:

ASC Capital – (not a public fund) 4 and 20.
Quiz: Incentives

- AUM accumulation
- Profits
- Risk Taking

Accumulating assets under management -> not profit.
Quiz: Incentives

• AUM accumulation ✔ ✔ ✔
• Profits ✔ ✔ ✔
• Risk Taking ✔ ✔ ✔

Expense Ratio  Two Twenty
How funds attract Investors

• Who are the investors?
  – Individuals
  – Institutions
  – Funds of funds

• Why?
  – Track Records
  – Simulation and Story
  – Good portfolio fit
Hedge Funds goals and metrics

• Goals:
  – Beat a benchmark
  – Absolute Return
    • Long/Short
      – **Long (+bets)**: Buying first, selling at [a profit hopefully]
      – **Short (-bets)**: Reverse order. Borrow stocks - immediately sell, then buy back when it drops in price.

• Metrics (recap)
  – Cumulative Return
  – Volatility
  – Risk/Reward (SR)
Computations inside a Hedge Fund

- A Computational Framework
  - database -> scale up.
  - Network connectivity
  - Low latency, high bandwidth
  - Real time processing.
Inside a Hedge Fund

- How to get to a target portfolio without perturbing the market.
- Small incremental steps.
Inside a Hedge Fund

- Create a forecasting algorithm, tied to the stock market (information feed).
Market Mechanics.

– Buy stocks by issuing orders
– Sent to a stock broker
What is an order?

- Buy or Sell
- Symbol
- #Share
- Limit (price) or Market Order
- Price

**Market** – willing to accept a good price, the price that the market is currently bearing.

**Limit** – constraints on buying or selling.

Examples:
- Selling: not to sell it below a certain price.
- Buying: not buy at a price above a certain amount
Order Book

- List of orders recording buyers and sellers interests, organized by price level.
- One order book for every stock sold or bought:

**Example:**
- **BB: BUY, IBM, 100, LIMIT, 99.95**
  - (no seller yet)
  - Buy 100 shares for no more than 99.95
- **BID**
- **SA: SELL IBM, 1000, LIMIT, 100**
  - **ASK** does not match any of the bids.
Market Mechanics.

Example:
• **BB: BUY**, IBM, 100, LIMIT, 99.95
  • (no seller yet)
  • **BID**
• **SA: SELL** IBM, 1000, LIMIT, 100
  • **ASK** does not match any of the bids.

• Market order
  – **BB: BUY**, IBM, 100, Market
  – Exchange must give client the lowest price – so deduct 100 stocks from the ‘ASK 100’ row.
Quiz: Order book

- Is the Price of stock going up or down?
  - [ ] Up
  - [ ] Down
Market Mechanics.

• Price going up or down?
  – Probably price is going **down**, there is more selling pressure
    • 1600 stocks to sell
    • 100 stocks to buy
  – Example what will happened if:
    • SELL 500, market.
      – Price immediately goes down.
      – First 100 sell @99.95
      – Second 50 sell @99.90
      – … and so on.
    • BUY 500, market
      – Price is not budging much (there are plenty of sell orders.)
**Example:**
- **BUY, 100, Market**
- **BUY, 100, Limit, 100.02**
  - Executed at **100.00**
- **SELL, 175, Market**
  - Executed at
    - **100 @ 99.95**
    - **50 @ 99.90**
    - **25 @ 99.85**
  - (average price)

**Note:** Price is going down.
• Live Order book example.
  – Udacity: How orders affect the order book \(\{155, 2:49\}\)
Market Mechanics.

• How orders get to the exchange
Market Mechanics.

- How orders get to the exchange
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Market Mechanics.

- How orders get to the exchange

- Handle trade internally
- Eventually register trade at ‘host’ exchange.
Market Mechanics.

- How orders get to the exchange
Exploiting Market Mechanics

- Order from far away
- Order at exchange
- Value fluctuates
- Co-located
- .3 usec vs. 12 msec.
- Co-located could get the stock at lower price.
Exploiting Market Mechanics

- Order from far away
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Additional Order Types

• Exchanges
  – Buy
  – Sell
  – Market
  – Limit

• Broker
  – Stop Loss – when stock drops to a certain price sell it.
  – Stop Gain – when stock gains to a certain price sell it.
  – Trailing Stop
  – Sell Sort
Market Mechanics.

- Hedge funds & co-location of computers on the exchanges “floor” space.