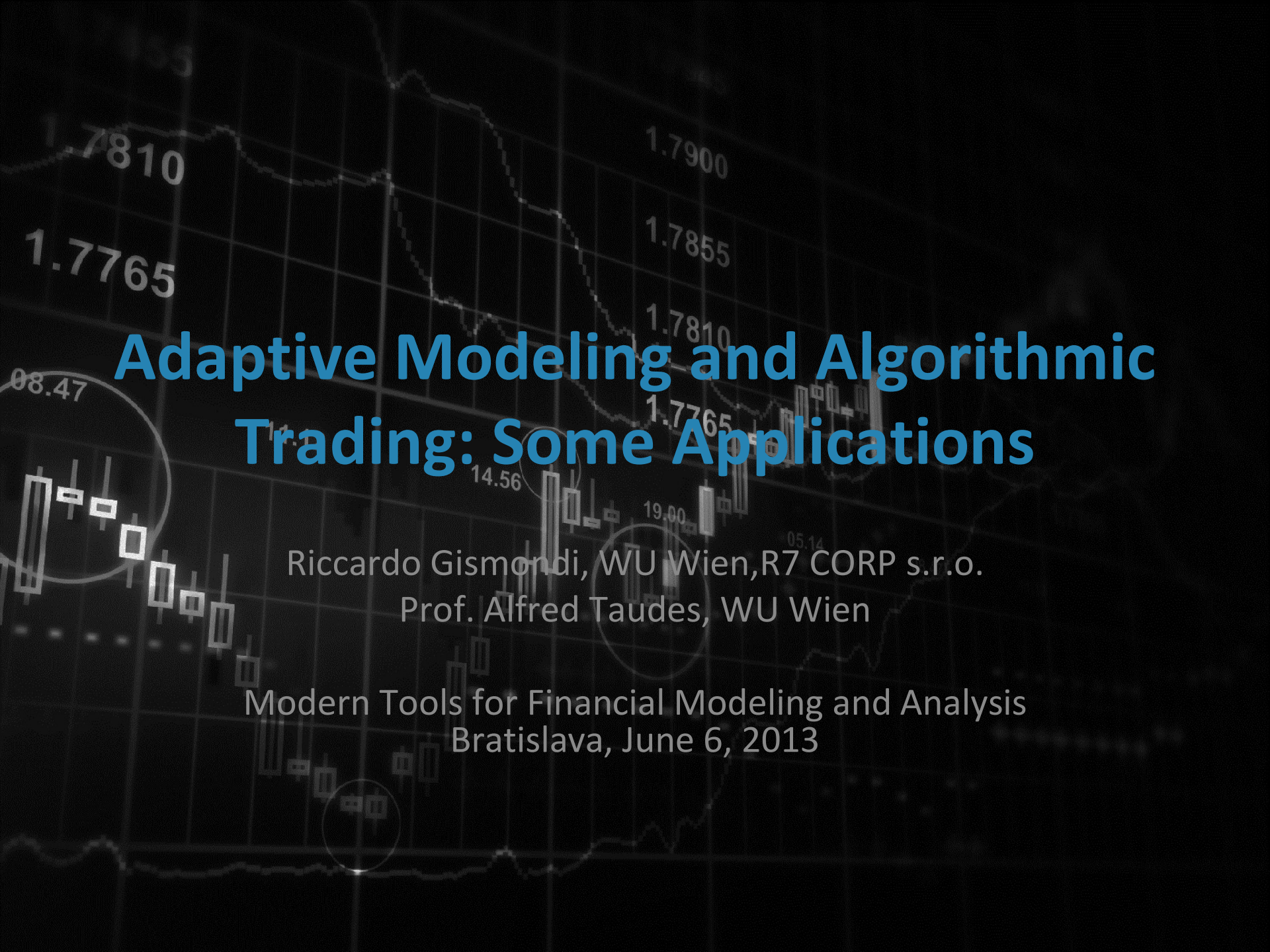

Adaptive Modeling and Algorithmic Trading: Some Applications

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Outline of the presentation

- Motivation
- Various fields of uses
- Adaptive modeling in finance
- Adaptive trading
  - Technical indicators
  - Applications

Motivation

- Typically, in non-adaptive experiments, decisions such as how to sample during an experiment are made and fixed in advance
- Adaptive modelling, adaptive sampling designs for statistical experiments, or response-adaptive designs, are ones where the accruing data (i.e., the observations) are used to adjust the experiment as it is being run
- Adaptive modeling allows to quickly adapt to various influences, structural changes, preferences, etc.

Examples of use of adaptive modeling

- Clinical tests
  - in a classical clinical trial comparing two different treatments, patients are assigned to the two treatments with half being assigned to each therapy. At the end of the experiment an evaluation is made as to which treatment is more effective
  - in contrast, in an adaptive clinical trial, patient outcomes can be used as they become available to adjust the assignment of future patients, assigning more of them to the better treatment

- Data compression resource - process of entropy coding
  - modelling (1st part) assigns probabilities to the symbols, and coding (2nd part) produces a bit sequence from these probabilities
  - adaptive model changes the symbol probabilities during the compression process in order to adapt to the changing contexts during the process

Adaptive modeling in finance

- Agent based models – with heterogeneous agents and trading strategies
  - Modeling of stylized facts (fat tails, volatility clustering, etc.)
  - Modeling of asset pricing and wealth dynamics resulting in adaptive rational equilibrium dynamics
- Adaptive trading, i.e. adapting to changes in price of the asset being traded, either by accelerating execution when the price moves in the trader's favour, or conversely

Adaptive modeling and algorithmic trading

- Algorithmic trading is the use of electronic platforms for entering trading orders based on pattern recognition algorithms.
- Algorithms follow the strategies based on different technical indicators.
- This approach is widely used nowadays by hedge funds, mutual funds, and other institutional traders.
- Modern trading decisions should be based on non-discretionary attempts. Therefore, the use of computational decision-making is highly preferred.
- Efficient implementation of trading algorithms is crucial, because vast amount of data have to be processed in very short time.

Algorithmic Trading

- The use of algorithmic trading methods can be beneficial in any kind of investment strategies or stages (arbitrage, risk management, position management, timing, etc.).
- These algorithms can be implemented as information systems, semi-automatic, or full-automatic trading systems.

Technical indicators

- A technical indicator is a series of data points that are derived by applying a formula to the price data of a security
- A technical indicator offers a different perspective from which to analyze the price action
  - indicators could work differently for different assets
  - attempts to cover more than five indicators are usually futile

- Most popular indicators
  - Commodity Channel Index (identifies a new trend or warns of extreme conditions)
  - Momentum (measures the rate-of-change of a security's price)
  - Relative Strength Index (compares the average price change of the advancing periods with the average change of the declining periods)
  - Stochastic Oscillator (measures the price of a security relative to the high/low range over a set period of time)
  - Williams %R (much like Stochastic Oscillator)

Lagging indicators

- **Lagging indicators** follow the price action and are commonly referred to as trend-following indicators
- Moving averages (exponential, simple, weighted, variable)

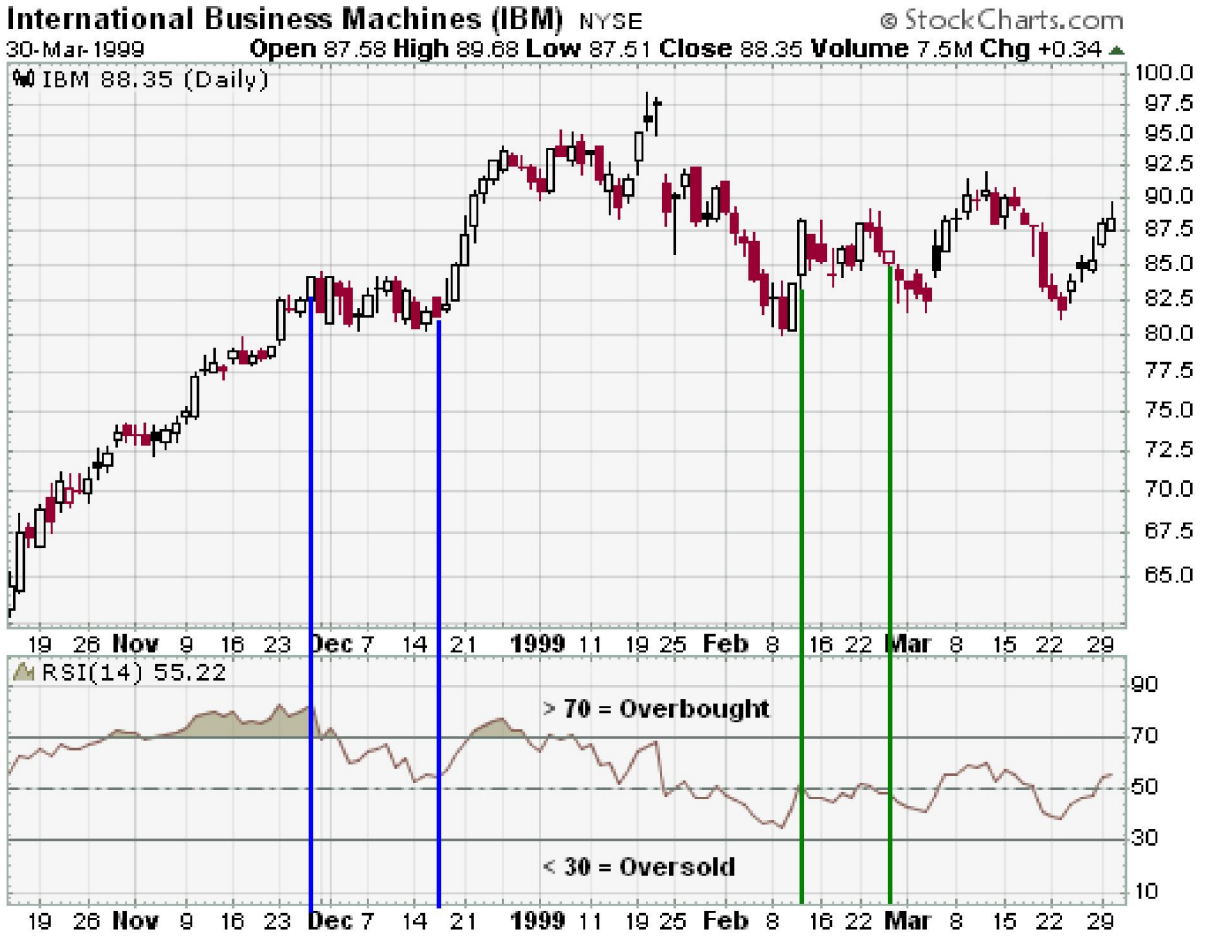
Relative Strength Index

- Momentum indicator
- Measures the speed and change of price movements

- RSI ∈ [0,100]

$$RSI = 100 - \frac{100}{1 - RS},$$

$$RS = \frac{average\ (gain)}{average\ (loss)}$$



Oscillator signals

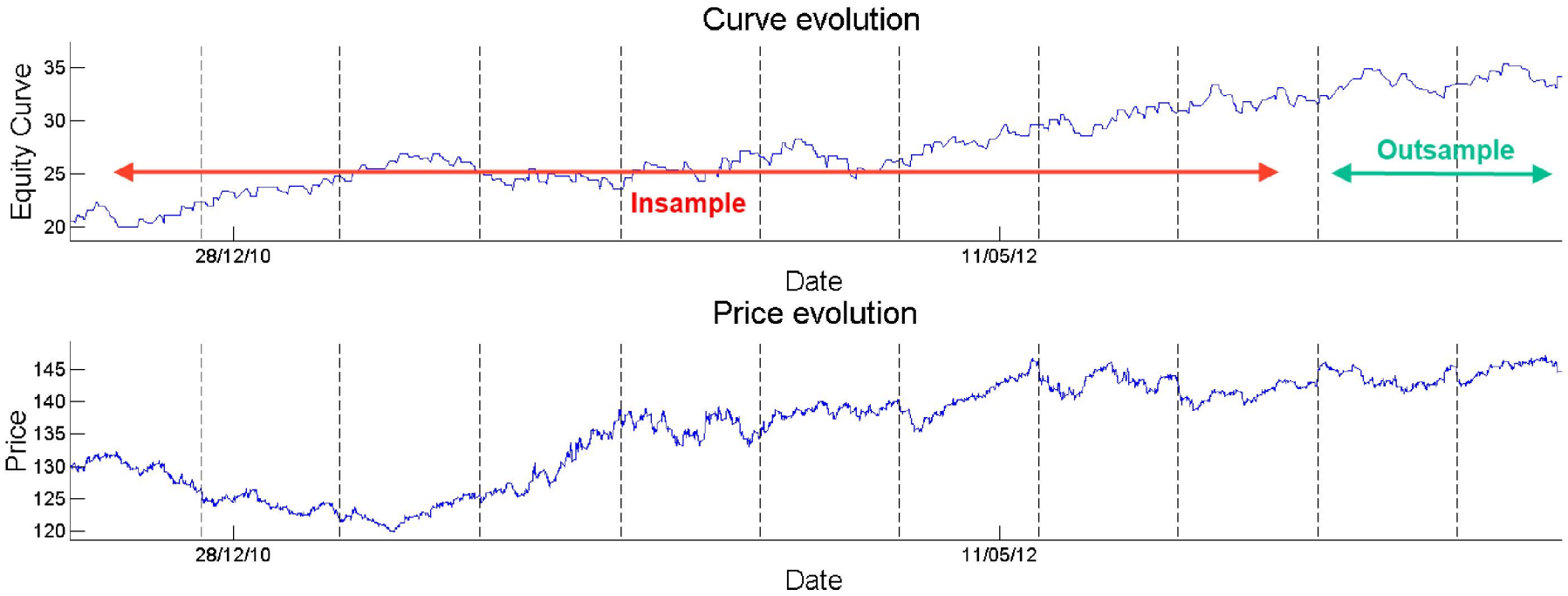
- OS reflect one characteristic of a security's price action
- Key concept is:
  - **positive divergence** occurs when the indicator advances and the underlying security declines
  - **negative divergence** occurs when an indicator declines and the underlying security advances

Adaptive modeling in trading

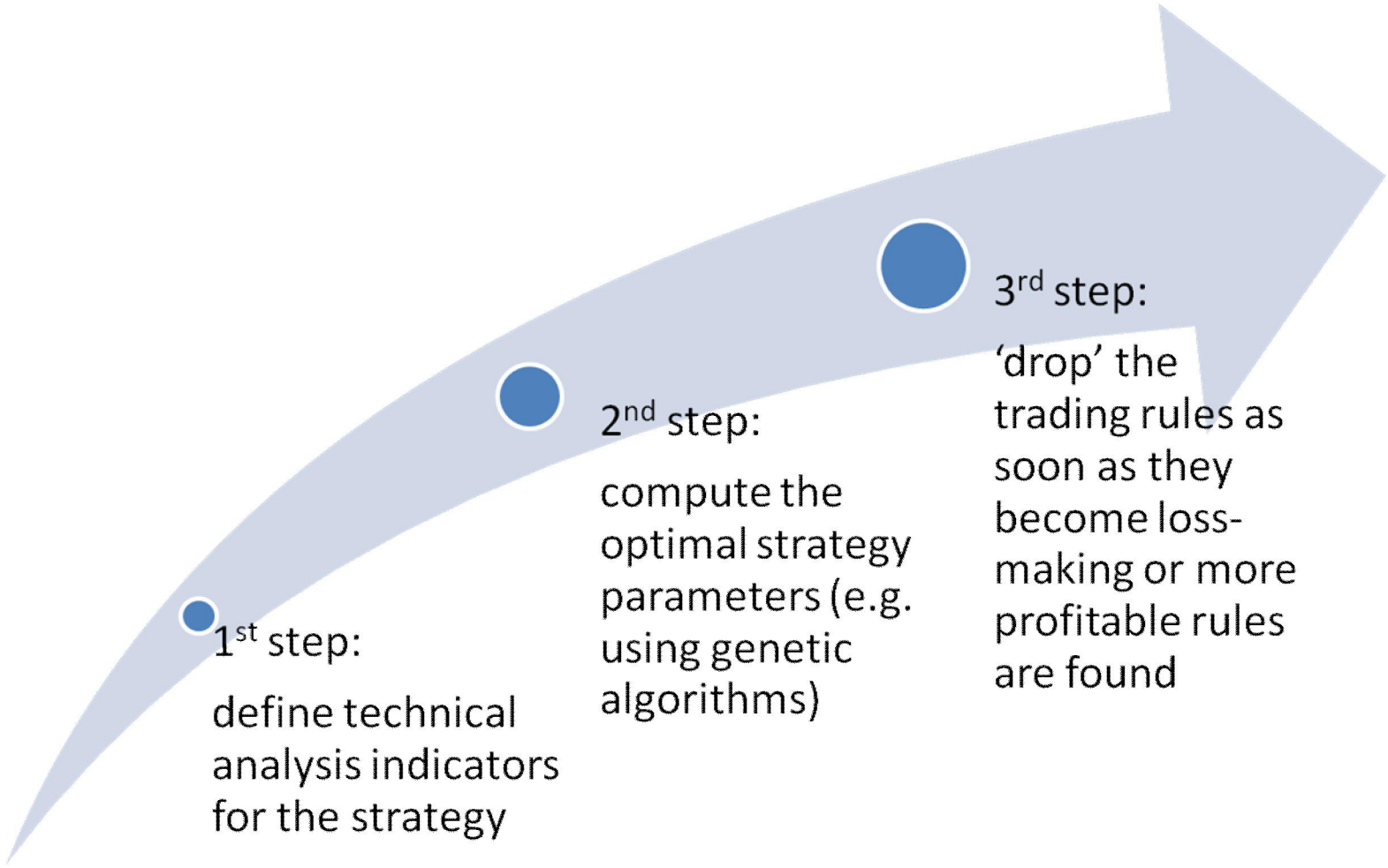
- First step is to find the right strategy for current market conditions – define the efficient indicators with their parameters (e.g. by using the optimization methods – GA – on the historical data)

- Second step is to evaluate the strategy with respect to its performance and set the right moment to change the parameters or the strategy -> adapt to changes on the market (e.g. structural changes, trends, etc.)

Adaptive trading - some application



Adaptive trading



Thank you for your attention.

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