Algorithmic Identification of Chart Patterns

step-by-step identification procedures which can be coded in a computer program

Algorithmic Identification of Chart Patterns

Key Benefits

- Instant scan innumerous charts
- Objective statistical analyses
- Powerful research means on combinations of chart patterns with other analysis methods

Algorithmic Identification of Chart Patterns

Major Obstacles

- **Pattern Variation**

  endless ways for a textbook pattern to manifest itself in a real chart.

- **Scale**

  Almost all chart patterns of classic technical analysis are scale-free

Outline of the Talk

- Brief review of methods used in academic literature (finance and computer science)
- Ideas I have used in my articles
- A detailed example

Academic Approaches (Finance)

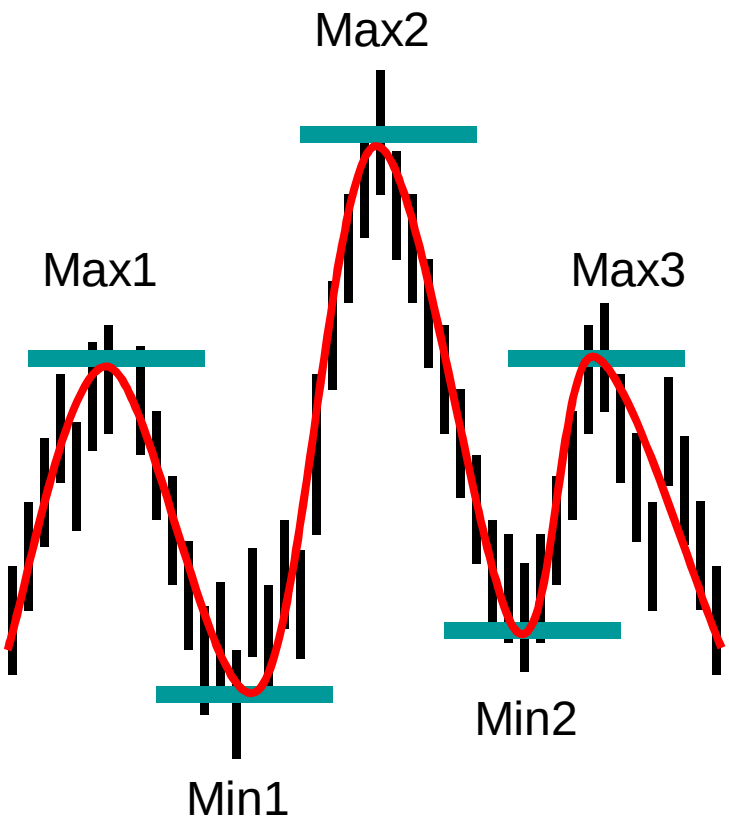
Three major identification methods in academic financial literature.

- Smoothing price data
- Zigzag-ing
- Matrix template

Academic Approaches (Finance)

1st Method (Smoothing Price)

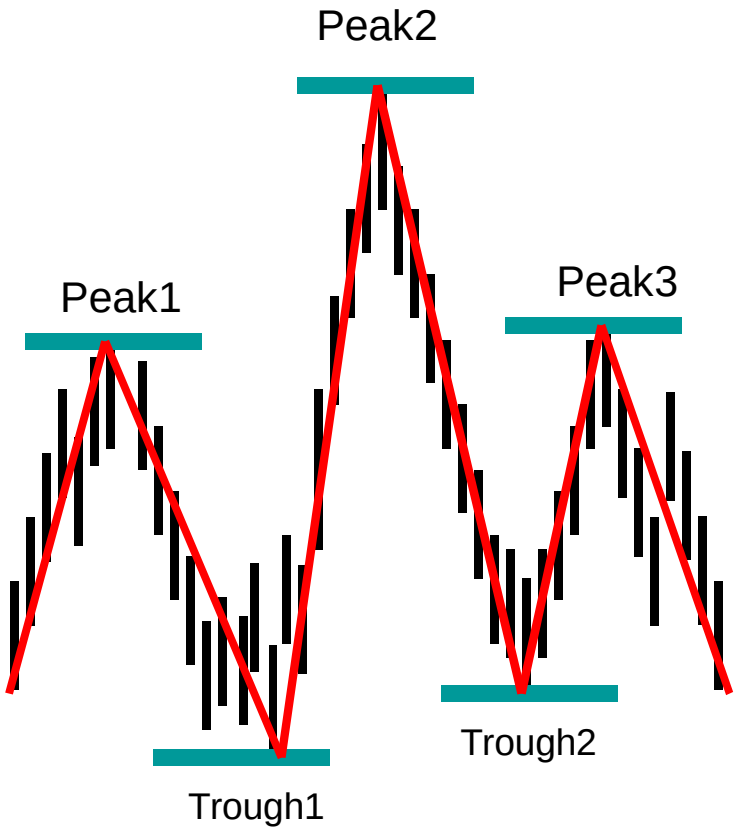
- smooth price data in a time span and identify local extrema
- Define the pattern via conditions for these extrema
- Repeat the procedure using different time spans.



Academic Approaches (Finance)

2nd Method ("Zigzag-ing")

- Apply a "Zigzag" swing indicator to filter noise (disregard changes below x% cutoff threshold) and identify peaks and troughs
- Define the pattern via conditions for the peaks and troughs
- Repeat using different cutoff threshold x%



Academic Approaches (Finance)

3rd Method (Matrix Templates)

A matrix template models the desired pattern using weights

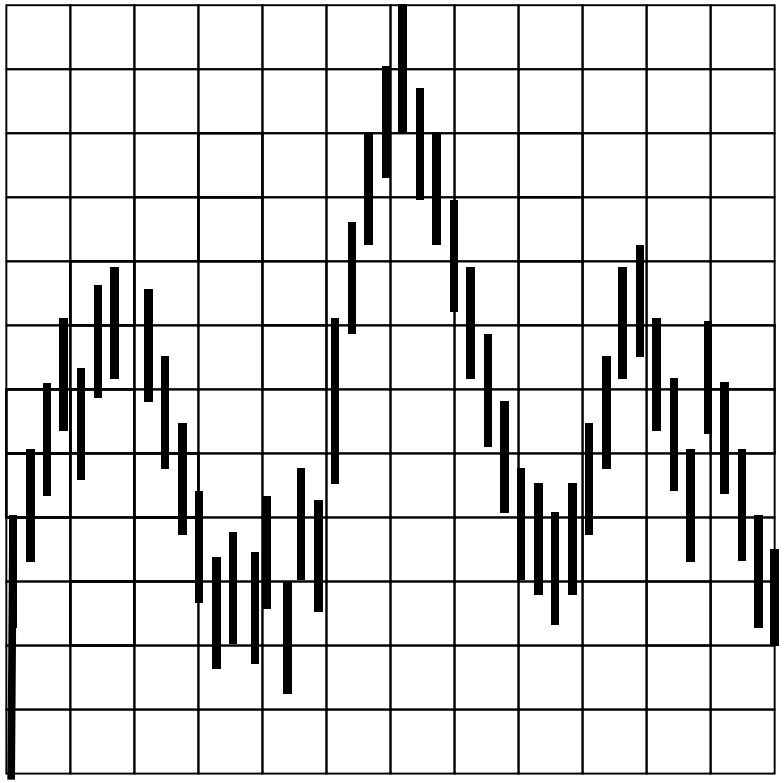
-1	-1	-1	-1	-1	+2	+2	-1	-1	-1	-1	-1
-1	-1	-1	-1	-1	+2	+2	-1	-1	-1	-1	-1
-1	-1	+1	0	-1	+2	+2	-1	0	+1	-1	-1
-1	-1	+2	+1	-1	+2	+2	-1	+1	+2	-1	-1
-1	+1	+2	+2	0	+2	+2	0	+2	+2	+1	-1
0	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	0
+1	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+1
+2	+2	+2	+2	+2	0	0	+2	+2	+2	+2	+2
+2	+2	+1	+2	+1	-1	-1	+1	+2	+1	+2	+2
+2	+2	0	+1	-1	-1	-1	-1	+1	0	+2	+2
+2	0	-1	-1	-1	-1	-1	-1	-1	-1	0	+2
+2	0	-1	-1	-1	-1	-1	-1	-1	-1	0	+2

An iconic 12x12 matrix template for H&S

Academic Approaches (Finance)

3rd Method (Matrix Templates)

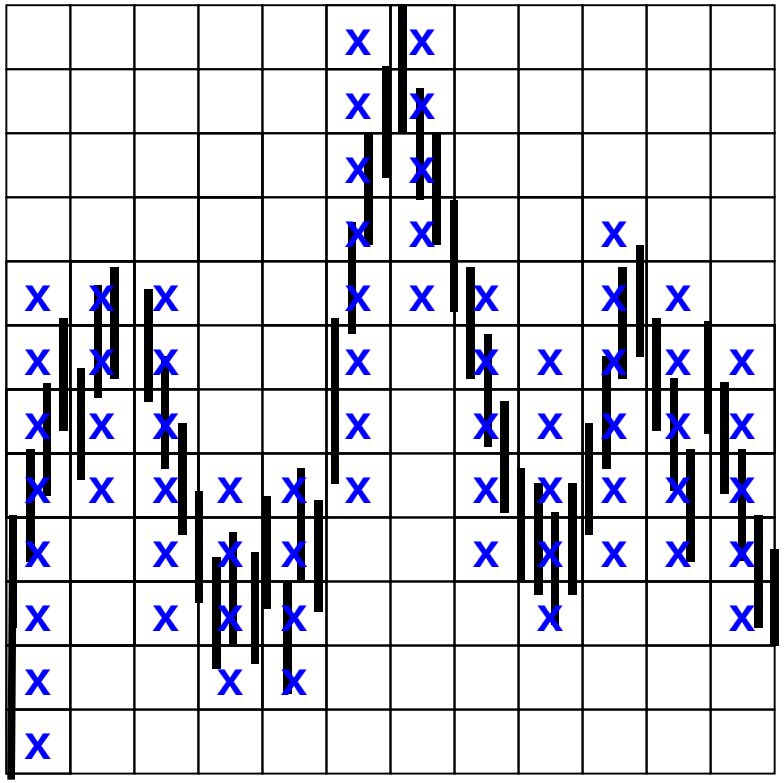
Superimpose a grid (having the same dimensions as the matrix template) in the actual price chart



Academic Approaches (Finance)

3rd Method (Matrix Templates)

The price action is then converted into matrix form

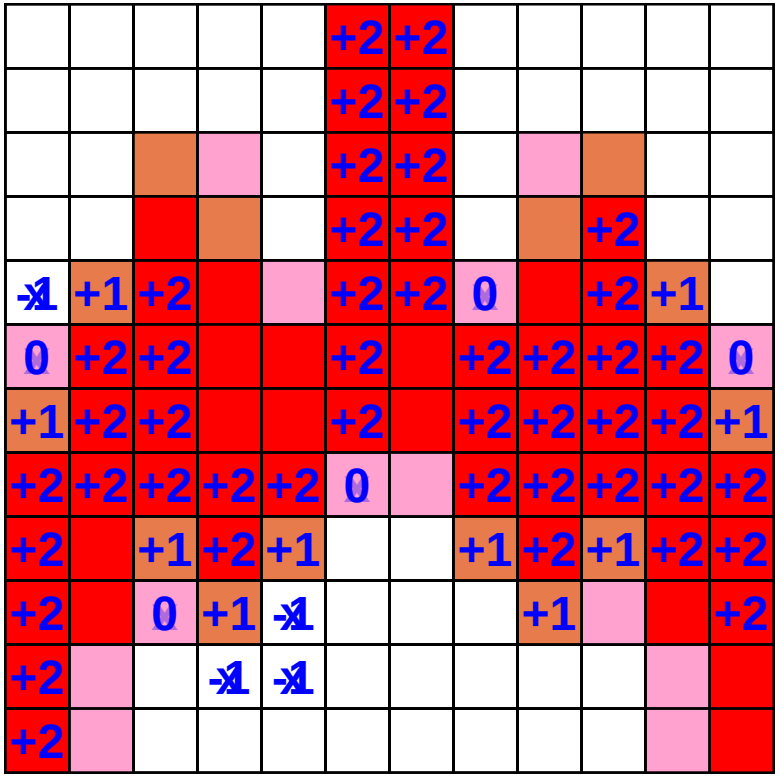


Academic Approaches (Finance)

3rd Method (Matrix Templates)

Sum up all weights for the price action

The higher the sum, the better the price action fits the pattern model



Academic Approaches (Computer Science)

- **Perceptually Important Points (PIP)**

  A smart modification of the zigzag-ing method: no use of % thresholds; you a-priori define the number of swings you want instead.

- **Symbolic Aggregate Approximation (SAX)**

  Uses alphabetic symbolic representation of segmented data series and applies methods from bioinformatics and text data mining

- **Support Vector Machines (SVM)**

  Sophisticated classification method which makes use of learning algorithms in high-dimensional feature spaces

My Published Algorithms on Chart Pattern Identification

Focus on:

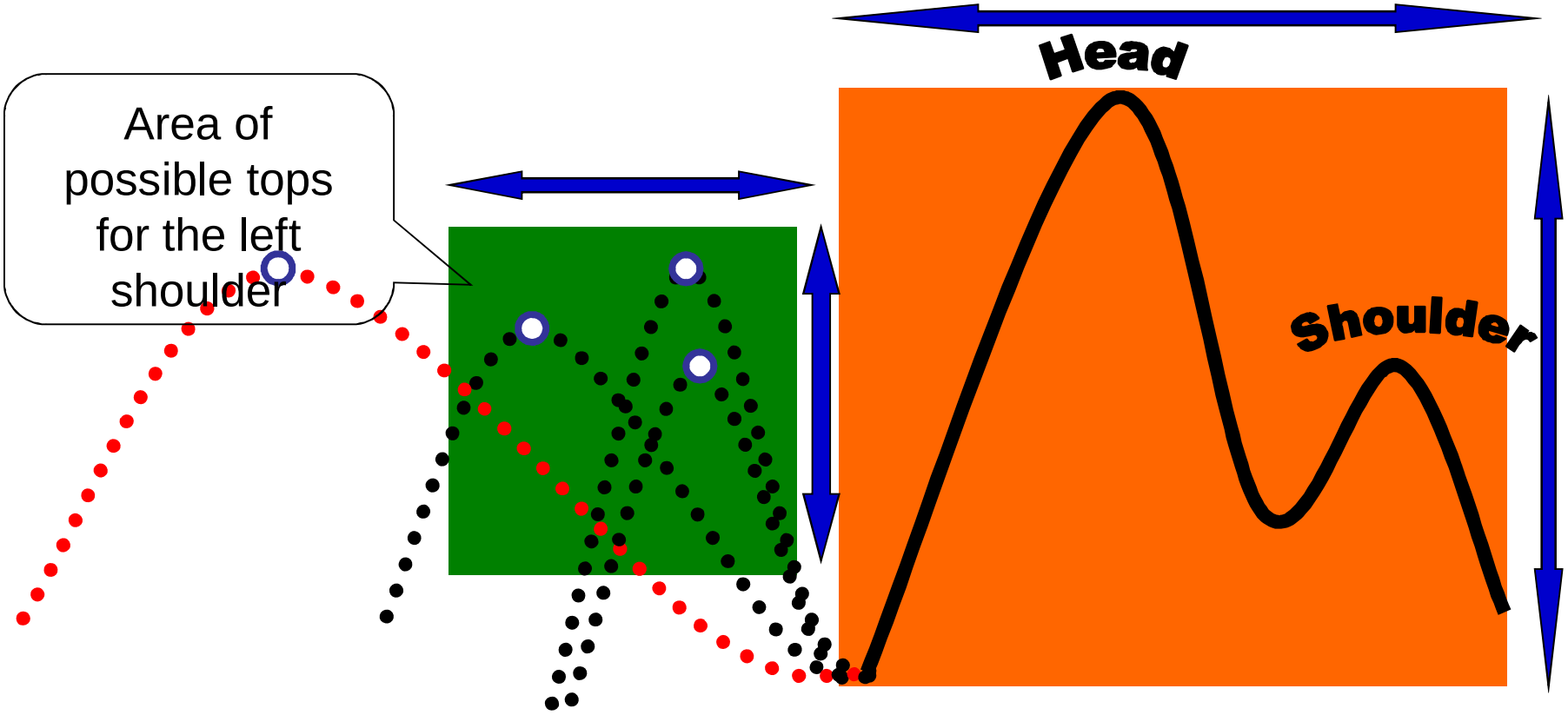
- Perception of Technical Analysts in mind
- Elimination of Variation and Scale obstacles
- Implementation in almost any technical analysis software (Simplicity)
- Execution Speed

To accomplish the above:
I created different algorithms per case (pattern)

Simple ideas I have Used (I)

- Chart patterns usually consist of branches
- These branches have some dimensional restrictions with respect to one another
- If we identify even just one of these branches, then we can usually identify the whole pattern

Example:
Identifying the top of the left shoulder in H&S



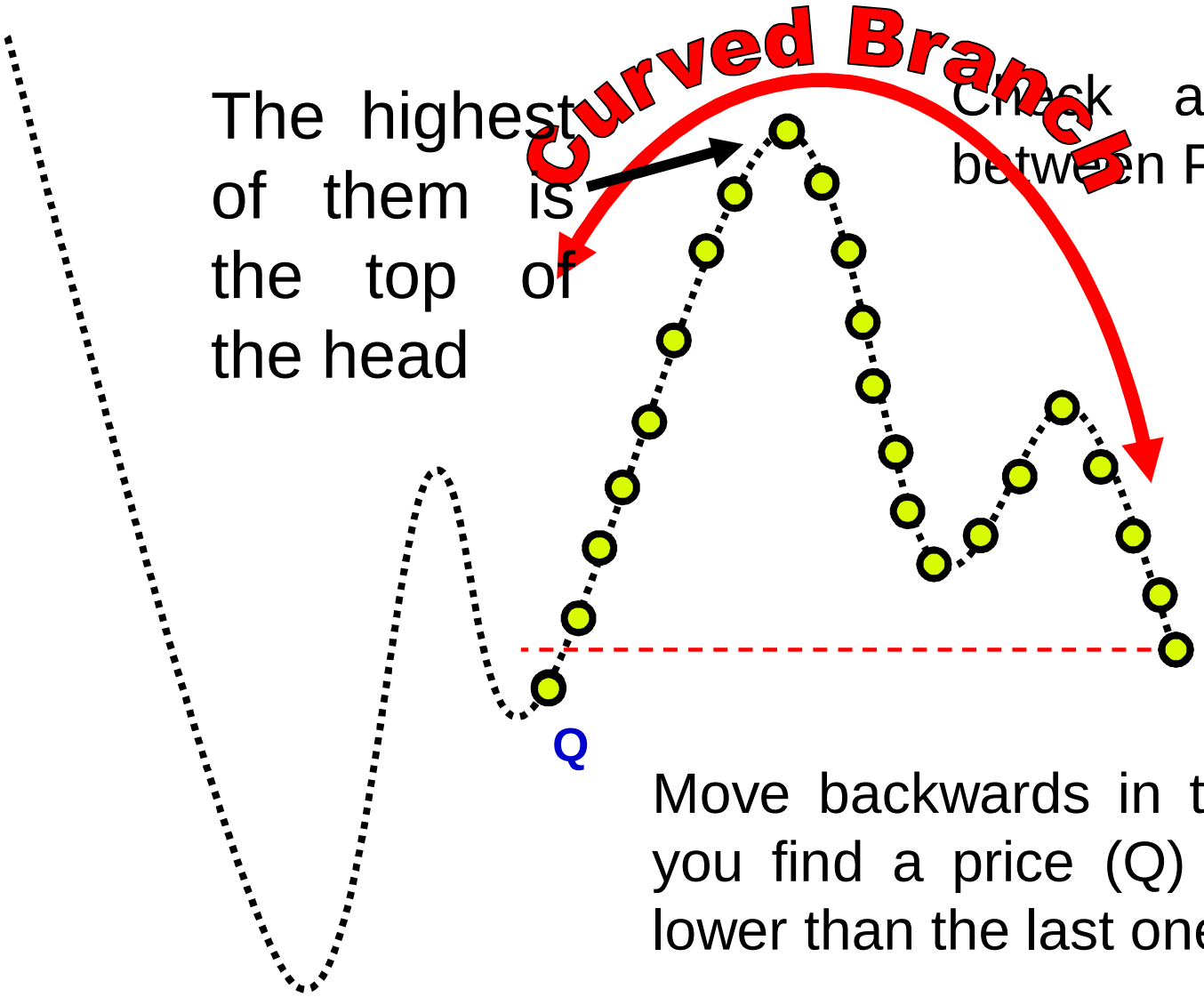
The dimensions of the green area are related to the dimensions of the orange one

Simple ideas I have Used (II)

When a branch of a chart pattern is more or less curved, you can usually identify its important points

(no matter the scale)

Example:
Identifying the top of the head in H&S



The highest of them is the top of the head

Check all prices between P and Q.

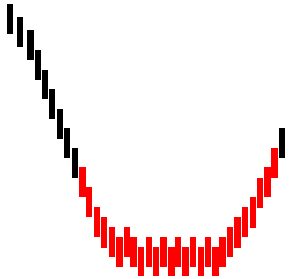
Move backwards in time until you find a price (Q) which is lower than the last one (P)

A Detailed Example

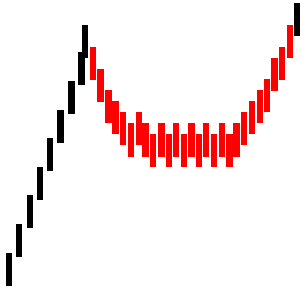
Identifying the cup pattern

A modification of a simple algorithm presented in my February 2006 article “Identifying The Cup” in the Technical Analysis of Stocks and Commodities magazine

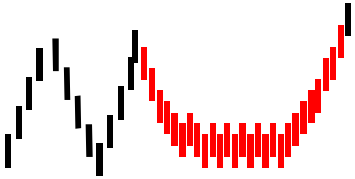
What is a Cup pattern?



Rounding Bottom
after a downtrend



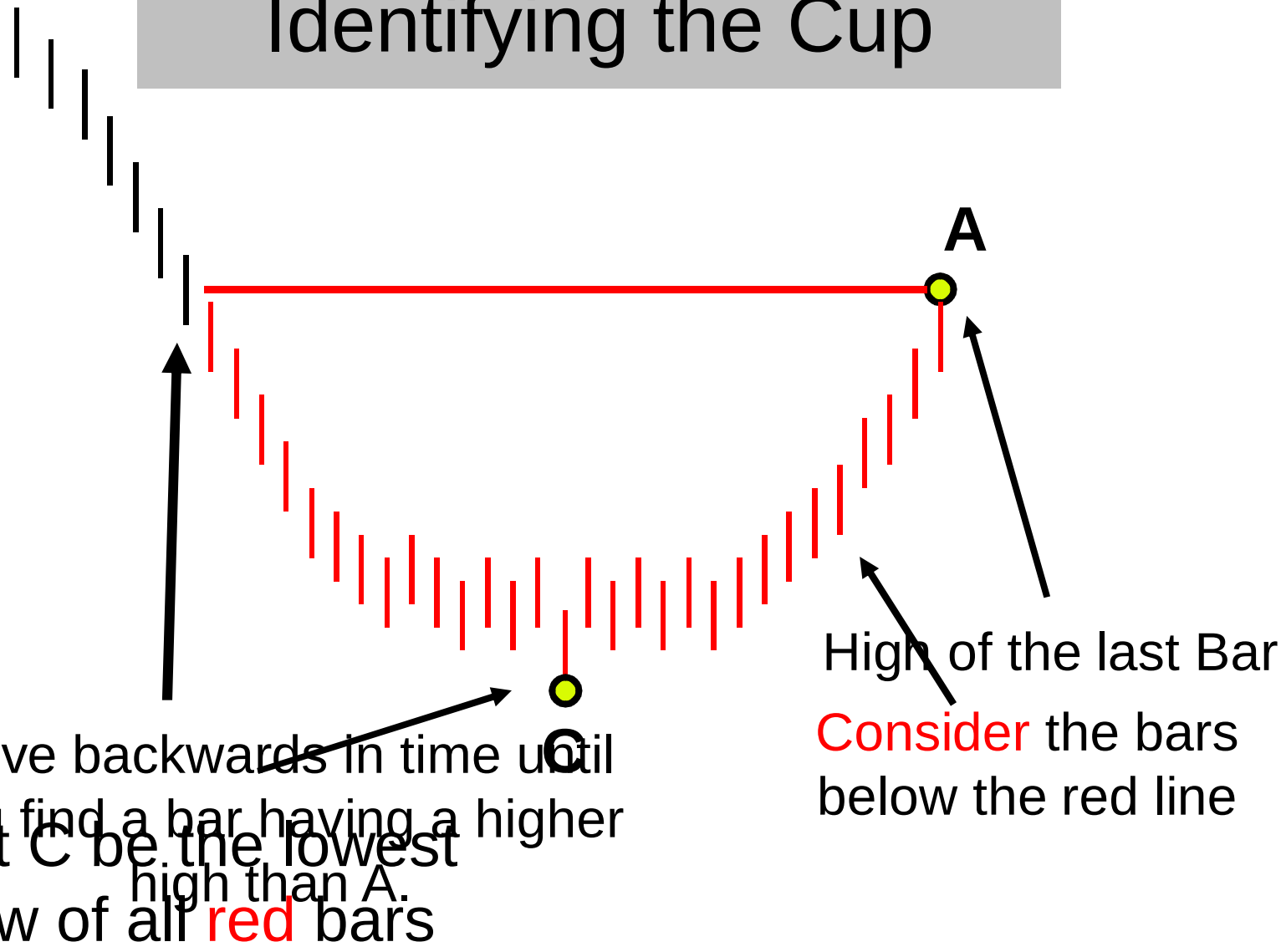
Rounding "Bottom"
after an uptrend



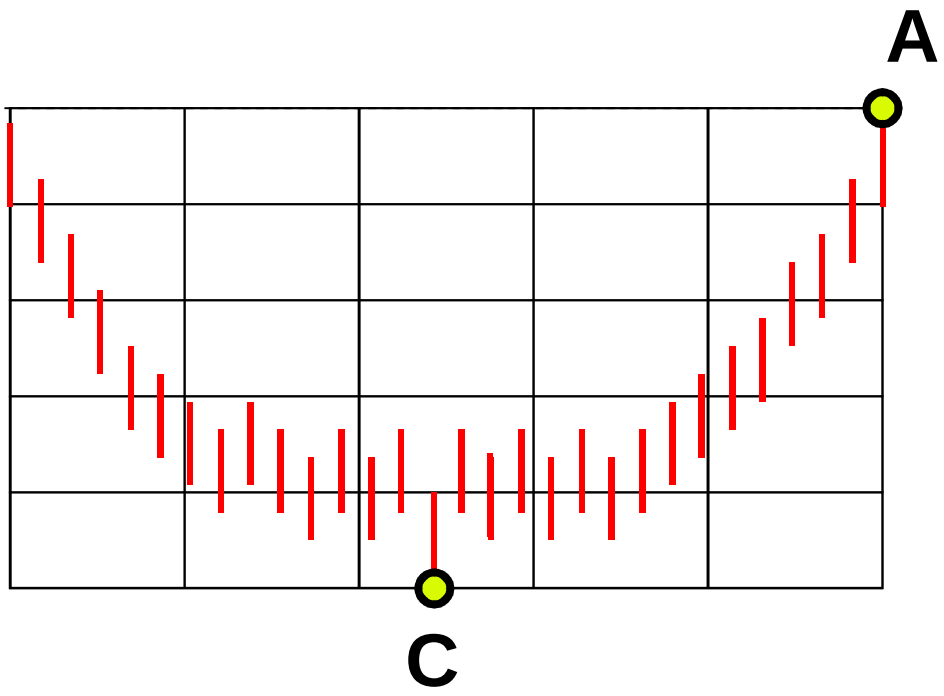
Rounding "Bottom"
after a sideways market

All these different types of rounding "bottoms" are called **cups** and they are generally considered bullish patterns

Identifying the Cup



Identifying the Cup



“Imprison” the red bars behind a 5x5 grid of equal rectangular cells using A and C as milestones

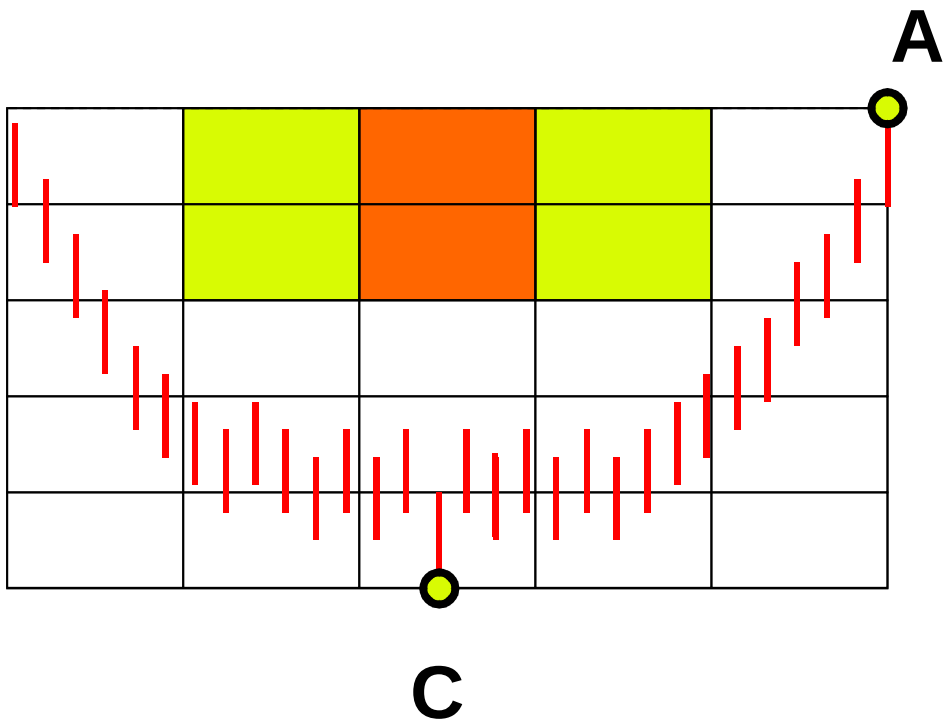
Identifying the Cup

1st Condition:

No Closing price inside the yellow cells

AND

No High price inside the orange cells



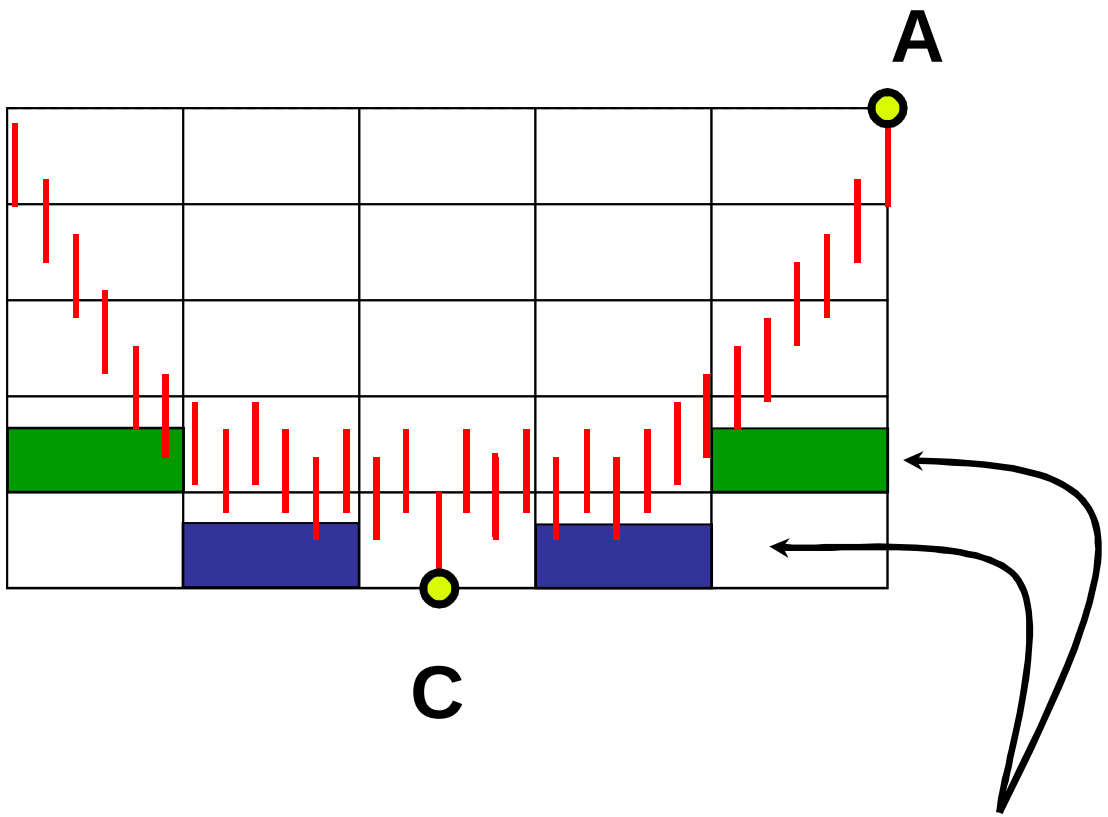
Identifying the Cup

2nd Condition:

Bar lows exist inside **both** green boxes

OR

bar lows exist inside **both** blue boxes

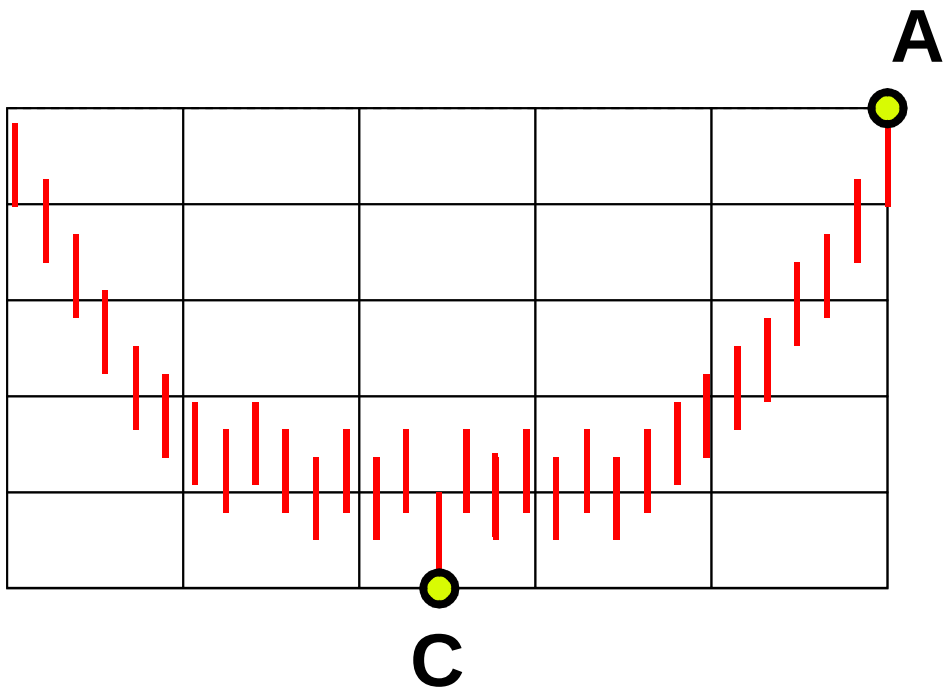


Height of blue and green boxes = 2/3 of the height of cells

Identifying the Cup

3rd Condition:

There are at least 20 red bars



Application

Application of the algorithm in the daily charts of all S&P500 stocks from 1982 to 2014 reveals a total of 3,991 distinctive* cups of various durations.

Scan took less than 20 seconds

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distinctive*

No time overlap of more than 70% between any two cups in the same chart

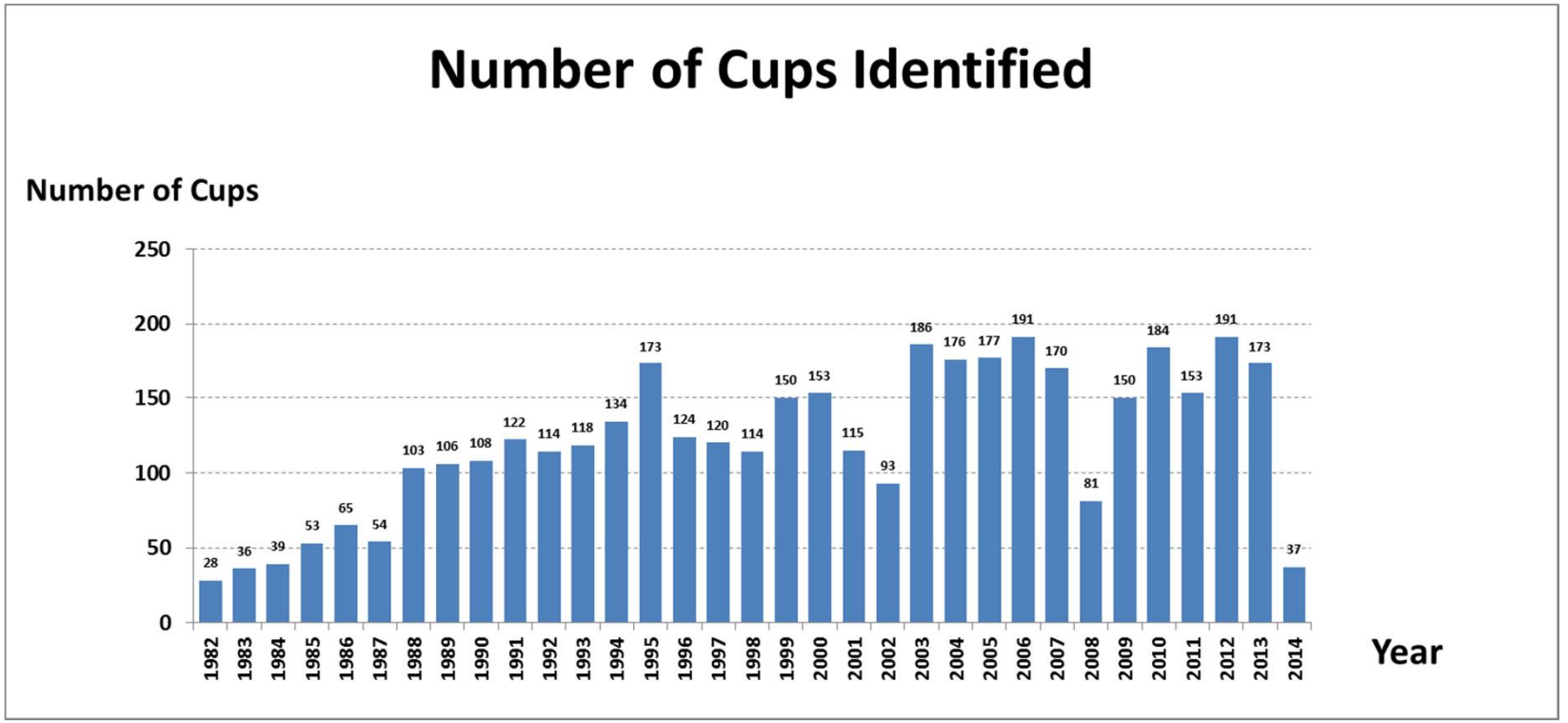
Algorithm in Action [Example 1]

Algorithm in Action [Example 2]

Algorithm in Action [Example 3]

Statistics for the S&P500 Stocks

(Daily Charts 1982-2014)



- Total number of cups: 3,991
- Minimum duration: 20 bars
- Maximum duration: 1,162 bars
- Median duration: 32 bars
- 80% of all cups were less than 3-months long (75 trading days)

Evaluation of Chart Patterns

Algorithmic identification gives us the means to evaluate the effectiveness and efficiency of a chart pattern

Because: it gives us detailed info about innumerous manifestations of the pattern in actual charts

Example: Evaluating of Cup

Questions:

Does the cup pattern actually produce uptrends?

Are these trends exploitable?

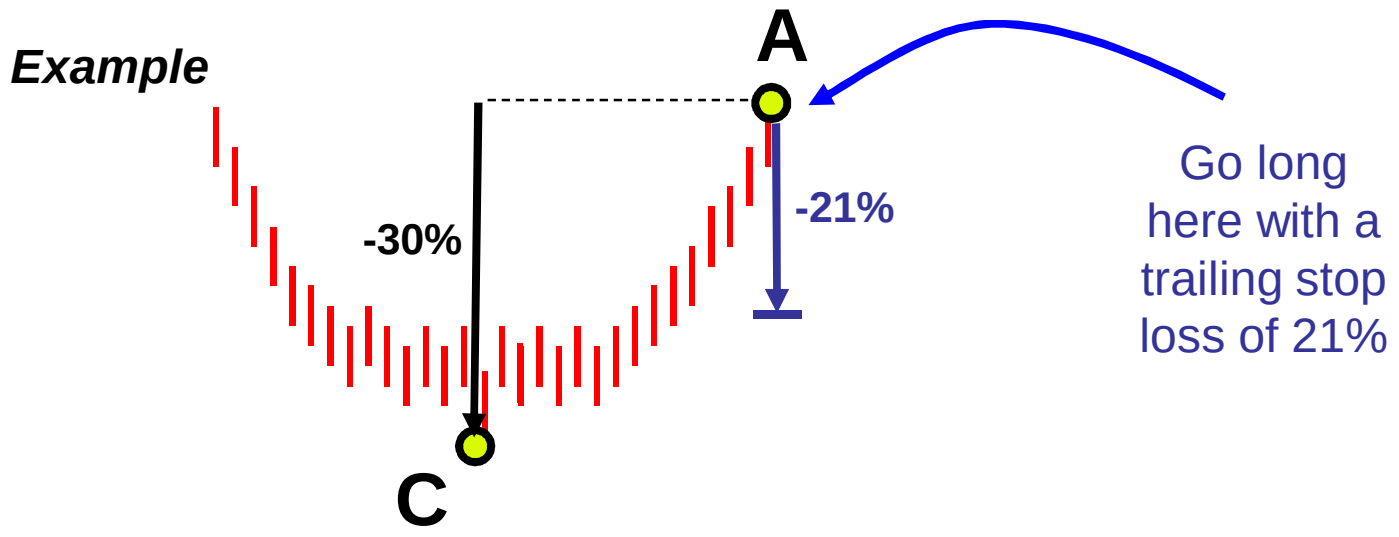
What is the historical edge of the cup?

How confident we are that this edge is statistically significant?

Example: Evaluating the Cup

A simple buy-only system was applied in the previous data

- Go long at the high of the identification bar when a cup is identified
- Exit when the price falls below a % trailing stop-loss of 0.7 times the % distance from A to C



Example: Evaluating the Cup

A Profit Factor (PF) was calculated for every hypothetical trade :

$$PF = \frac{\text{Profit (\%)}}{\text{Trailing Stop (\%)}}$$

So, all cups are treated under equal terms (no matter their height) allowing us to determine the "edge" of cup pattern from this system's point of view

Example: Evaluating the Cup

Results for S&P500 stocks from 1982 to 2014:

Statistical Values	Translation
• Mean PF = 0.166	Edge of cup (1982-2014) = 16.6%
• Profitable trades (%) = 39%	Most trades produced loses
• CV = 1,105%	PF's vary too much in relation to the edge of the system
• 99% confidence levels for Mean PF : 9.1% - 24.0%	We can be 99% sure that the [9% , 24%] interval captures the all-time edge of the cup pattern

Epilogue

Algorithmic identification of classic TA patterns is feasible and provides important benefits for the chartists

Thank you