GeniusTrader Manual

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1 What is *GeniusTrader*?

GeniusTrader is a open source software suite to develop and test trading systems. A trading system is a set of rules that determines when to buy or sell a stock. This can be combined with moneymanagement rules, close-strategies and all the other stuff you may know from propietary systems.

The decision to open or close a position depends on a Signal. A Signal is a simple boolean function. A signal (normally) indicates a situation in which it is reasonable that the value of the stock will rise or fall.

Signals can be based on any kind of data (e.g. a candlestick pattern) but they are mostly based on an indicator. An Indicator is calculated on the values of the stock. It can be a simple moving average or a complex formula covering several sheets of paper.

All these informations can be displayed graphically using the script `graphic.pl`. More important than a nice picture is the performance of the system. The performance and many other factors that are useful for the evaluation of a system can be calculated using the `backtest.pl`-script.

All these features are available from the commandline – but we plan to build a webinterface for the future. The great advantage of the commandline is that the extensive perl-features of code-evaluation at runtime are used so that it is easy to build complex systems at the commandline.

1 What is GeniusTrader?

2 Installing *GeniusTrader*

At the moment (October 20, 2003) *GeniusTrader* is still under development and heavy changes appear very often. Therefore it is not reasonable to build a rpm- or deb-package. You have to install the libraries on which *GeniusTrader* depends and then add the GT-directory to the library-path of perl.

Once you downloaded both GT.tar.gz and Scripts.tar.gz from the main page, you can extract them in a new directory :

```
> mkdir geniustrader
> cd geniustrader
> tar zxf ~/GT.tar.gz
> tar zxf ~/Scripts.tar.gz
```

Before you continue to install *GeniusTrader* you have to fulfill the needed dependencies.

2.1 Install the dependencies

GeniusTrader uses several external perl modules. You have to install them. You can do this by hand, or you can use the CPAN perl module or you can use the corresponding packages of your linux distribution. Take care, some of those modules depend on other modules.

- Carp::Datum (debian package: libcarp-datum-perl)

- Date::Calc (debian package: libdate-calc-perl)

- Getargs::Long (debian package: libgetargs-long-perl)

- XML::LibXML (debian package: libxml-libxml-perl)

If you want to use the CPAN-shell, you can simply use the following commands. Before installing the perl modules you should check if the libxml-library is properly installed.

```
> perl -MCPAN -eshell
cpan> install Carp::Datum
cpan> install Date::Calc
cpan> install Getargs::Long
cpan> install XML::LibXML
```

2.2 Setup your source of data

In order to do something useful, you have to setup a source of data (prices). Various modules are available for that (check GT::DB::*). Since you may not have any data, *GeniusTrader* provides some sample data. Extract this archive near the two other archives that you already extracted:

```
> tar zxf ~/data.tar.gz
```

Now, you have to create the GT configuration file:

```
> mkdir ~/.gt
> vim ~/.gt/options or
> xemacs ~/.gt/options :-)
```

Copy and paste the following text in your configuration file, and edit the directories so that they match your real directories of course:

```
DB::module Text
DB::text::directory /home/rhertzog/geniustrader/data

Brokers::module SelfTrade

Path::Font::Arial /usr/X11R6/lib/X11/fonts/TrueType/arial.ttf
Path::Font::Courier /usr/X11R6/lib/X11/fonts/TrueType/couri.ttf
Path::Font::Times /usr/X11R6/lib/X11/fonts/TrueType/times.ttf

Analysis::ReferenceTimeFrame year

#Graphic::BackgroundColor black
#Graphic::ForegroundColor white

Aliases::Global::TFS    SY:TFS 50 10|CS:SY:TFS
Aliases::Global::TFS[]  SY:TFS #1 #2|CS:SY:TFS #1|CS:Stop:Fixed #3
```

Now you are ready to test *GeniusTrader*. If you want to use the scripts systemwide you should copy them to `/usr/local/bin` or any other directory in your path.

You can now start to use *GeniusTrader* by following the instructions in the following chapter.

3 Generating Charts

As introduction to the possiblities of *GeniusTrader* we'll create some graphics. The program `graphic.pl` in the `Scripts`-subfolder is capable of creating (nearly) all those nifty charts you know from commercial packages. Even if the chart-generation is not the main purpose of *GeniusTrader* we start with this topic because it is more intuitive to understand an indicator or a system when you can draw it on a chart.

In all the examples, we use the example-data provided by the *GeniusTrader*-Website, so make sure, you copied those files and added the right `DB::text::directory`-variable to your options-file.

The command

```
./graphic.pl 13000 > test.png
```

produces a chart of the 13000-stock using the default-parameters. The output is a png-file, which is redirected to `test.png`. This should look similar to the graphic in fig. 3.1.

Figure 3.1: A simple graph using the default parameters of `graphic.pl`

The graphic can be view by one of the various image viewers. You can use ee, xv or display. I have some good experiences in using the display-Program because you can easily scroll larger graphics or I start a GIMP-session and use gimp-remote to view the images (see man gimp-remote for further explanations).

3.1 Formatting the Chart

The program provides several commandline-options:

```
./graphic.pl [ --timeframe=day|week|month ] [ --nb-item=120 ] \
             [ --start=1999-02-01 ] [ --end=2001-03-23 ] \
             [ --type=candle|barchart|line|none ] [ --volume ]
             [ --volume-height=150 ] [ --title="Daily Chart" ] \
             [ --width=200 ] [ --height=230 ] [ --logarithmic ] \
             [ additionnal graphical elements ] \
             [ --file=conf ]
             <code>
```

All of these options can be written in a file – one parameter per line. If the program is called with the `file`-parameter and the filename, the options out of the file are loaded. Each line in this file corresponds to a command line parameter. Lines starting with # are ignored. As an example, place these lines in a file `sma.conf`:

```
# A sample configuration-file
--title=Stock of %c
--add=Switch-Zone(0)
--add=Curve(Indicators::SMA 200, [255,0,0])
--add=Curve(Indicators::SMA 38, [0,0,255])
```

Be aware that you have to omit the quotation marks that you use normally to tell the bash not to care about the arguments. If you call now the program with the configuration-file as parameter, the coresponding modifications take place:

```
./graphic.pl --file=sma.conf 13000 > test.png
```

To understand what these parameters do, see below.

3.1.1 Adjusting the timeframe

Using the `timeframe`-parameter, the timeframe can be adjusted. To create a chart on a weekly basis you can use the following command:

```
./graphic.pl --timeframe=week 13000 > test.png
```

The start and the end of the displayed period can be defined by the parameters `start` and `end`. By default the program displays the last 120 days. You can change this behaviour by using either the two parameters mentioned above or the `nb-item`-parameter. The following command produces a chart of the last 30 days.

```
./graphic.pl --nb-item=30 13000 > test.png
```

To produce a chart of year 2001 you have to use the following command:

```
./graphic.pl --start=2001-01-01 --end=2001-12-31 13000 > test.png
```

3.1.2 Changing the look of the chart

To change the look of the chart you can use the `~/.gt/options`-file and several commandline-options. In the configuration-file you can specify the default colors as in the following example:

```
Graphic::Histogram::Color lightblue
Graphic::BackgroundColor black
Graphic::ForegroundColor white
```

This produces the histograms by default in a lightblue and uses white as foreground and black as background color. By looking at the sources of the GT::Graphics-folder you'll find an option for nearly all colors used in a chart.

The following graphical options are available:

- `Graphic::BackgroundColor`: Color of the background

- `Graphic::BarChart::DownColor`: Color of the Bars where the stock moves down

- `Graphic::BarChart::UpColor`: Color of the Bar where the stock moves up

- `Graphic::BarChart::Width`: Widht of one Bar

- `Graphic::BuySellArrows::BuyColor`: Color of the "Buy"-BuysellArrow

- `Graphic::BuySellArrows::Distance`: Distance between Candle and arrow

- `Graphic::BuySellArrows::SellColor`: Color of the "Sell"-BuysellArrow

- `Graphic::Candle::DownColor`: Color of the Candles where the close is lower that the open

- `Graphic::Candle::Height`:

- `Graphic::Candle::UpColor`: Color of the Candles where the close is higher that the open

- `Graphic::Candle::Width`: Width of onw Candle

- `Graphic::ForegroundColor`: Default foreground-color

- `Graphic::Grid::Color`: Color of the grid

- `Graphic::Histogram::Color`: Color of the Histogram (e.g. the volume)

- `Graphic::Marks::Color`: Color of the Marks

- `Graphic::Marks::Width`: Width of the Marks

- `Graphic::Mountain::Color`: Color of the Mountain

- `Graphic::PointAndFigure::DownColor`: Color of the P&F-Circles

- `Graphic::PointAndFigure::UpColor`: Color of the P&F Crosses

- `Graphic::PricesColor::Down`:

- `Graphic::PricesColor::Equal`:

- `Graphic::PricesColor::Up`:

- `Graphic::Text::Color`: Color of the Text

- `Graphic::VotingLine::BuyColor`: Color of the Voting-Line for a long-position

- `Graphic::VotingLine::Height`: Height of the Voring-Line

- `Graphic::VotingLine::SellColor`: Color of the Voting-Line for a short-position

- `Graphic::VotingLine::Width`:

3.1.3 Changing title and type of display

By using the commandline-parameter `title`, you can change the title. If the string contains a `%c`, this part is replaced by the code of the stock.

The type of the chart can be changed by the parameter `type`. The possibilities are candlestick (`candle`) which is the default, barchart (`bar`), linechart (`line`) or no chart (`none`).

To disable the display of the volume-chart use the parameter `--novolume`. The height of the volume-chart is adjusted by the `volume-height`-parameter.

The width and height of the hole chart is normally automatically adjusted (Hint: if the chart is getting very large, the display-program from the ImageMagick-toolkit is very useful because it allows to select in a panel the part of the image to be displayed. If you want to edit th chart you should start GIMP and open the charts using the command `gimp-remote`). To specify the width and height manually, you have to use the `width`- and `height`-parameter:

```
./graphic.pl --title="Graph of %c" --start=2001-12-01 \
     --end=2001-12-31 \--width=600 13000 > test.png
```

The parameter `logarithmic` creates a logarithmic axis for the stock value.

3.2 Additionnal graphical elements

The possibility to place additional graphical elements in the chart is the most important feature of the graphical frontend.

In *GeniusTrader* the chart is composed of zones. The fist zone (no. 0) is the main zone, 1 is the volume zone if it exists. To create a new zone you have to use the command

```
New-Zone(height, [left, right, top, bottom])
```

After applying this command, a new zone with the height `height` is created and using the parameters above, below, right or left you can specify the border of the graphic.

While adding more graphical elements, you can switch the zone using the command

```
Switch-Zone(zoneid)
```

This changes the current display zone, which is particular useful if you want to add indicators (like moving averages) to the main-zone.

All the commands described later are applied for the current display zone.

3.2.1 Formatting the zone

Not only the main zone, but every zone can be formated using the corresponding `add`-commands:

`Set-Scale(min,max,[logarithmic])` or `Set-scale(auto,[logarithmic])`

This defines the scale for the currently selected zone (by default the last zone created or the main zone if no zone has been created).

`Set-Special-Scale(min,max,[log])` or `Set-Special-Scale(auto,[log])`

The last created object will be displayed with its own scale (and not the default one of the zone). The scale may be given or it may be calculated to fit the full zone.

`Set-Axis(tick1,tick2,tick3...)`

Define the ticks for the main axis of the current zone.

`set-title-{left,right,top,bottom}(title,font\_size)`

This adds a title to the currently selected zone. The title will be displayed in the given size (size can be tiny, small, medium, large and giant). If the title contains a %c, this is replaced by the code-number.

3.2.2 Adding Graphical Elemnts

Using the `--add=" "`-parameters, you can insert additional graphical elements in your charts.

Using the command

```
Text(text, x, y, [halign, valign, font_size, color, font_face])
```

you can add Text to your graph. The given coordinate are expressed in percent of the width/height of the zone.

halign can be one of `left`, `center` or `right`. valign can be one of `top`, `bottom` or `center`. font_size can be one of `tiny`, `small`, `medium`, `large` or `giant`. font_face can be one of `arial`, `times` or `fixed`.

The command

```
./graphic.pl --add="New-Zone(100)" \
   --add="Text("MACD", 50, 50, center, center, giant, [200,200,200])" \
   --add="Curve(Indicators::MACD, [0,0,255])" 13000 > test.png
```

creates a new zone and inserts a kind of background text before it displays the indicator. This is IMO a nice alternative for the "normal" titles.

More important than all the formatting is the question how to insert indicators, buy/sell-arrows, etc. First you have to chose how to display the data. *GeniusTrader* provides four different possibilities to display data:

- `Histogram(<datasource>, [color])`

- `Curve(<datasource>, [color])`

- `Marks(<datasource>, [color])`

- `Mountain(<datasource>, [color])`

`Histogram` displays a histogram as you mabe know it from the MACD-Difference. It is identical to the volume histogram. The Curve is a simple line – the most usable form. Using the `Marks` you can place a line of crosses and by using the `Mountain` it is possible to add a area.

Using these commands, one can add a new graphical object in the current zone. The datasource explains what data has to be displayed. The color is an array of the R, G and B value ([0,0,0] is black, [255,0,0] red and so one. . .).

Indicators

If the datasource is an indicator, it is important to know how to provide parameters to the datasource. The parameters of an indicator are separated by blanks. So you can for example add three moving averages to the main zone by the following command:

```
./graphic.pl --add="Switch-Zone(0)" \
--add="Curve(Indicators::SMA  38, [0,0,255])" \
--add="Curve(Indicators::SMA 100, [0,255,0])" \
--add="Curve(Indicators::SMA 200, [255,0,0])" 13000 > test.png
```

Some indicators like Bollinger Bands create multiple data rows. these rows can be accessed using a slash after the indicator-name:

```
./graphic.pl --add="Switch-Zone(0)" \
--add="Switch-Zone(0)" \
--add="Curve(Indicators::BOL/2 25 3, [0,0,255])" \
--add="Curve(Indicators::BOL/3 25 3, [0,0,255])" 13000 > test.png
```

This command would create a graph with the upper and lower Bollinger Band included.
More informations about indicators you find in chapter 5.

Buy-/Sell-Arrows and VotingLine

By adding BuySellArrows or a VotingLine you can show the buy- and sell-decisions of a system
in a chart.

The following command would create two moving averages and display a buy or a sell arrow
where the short one crosses the log one.

```
./graphic.pl --add="Curve(Indicators::EMA 5,[255,0,0])" \
            --add="Curve(Indicators::EMA 20,[0,0,255])"\
--add="BuySellArrows(Systems::Generic Signals::Generic::CrossOverUp \
    {I:EMA 5} {I:EMA 20}  Signals::Generic::CrossOverUp {I:EMA 5} \
    {I:EMA 20} )"  13000 > test.png
```

If you us the Voting-Line as in OmniTrader it is nearly the same:

```
./graphic.pl --add="Curve(Indicators::EMA 5,[255,0,0])" \
            --add="Curve(Indicators::EMA 20,[0,0,255])"\
--add="VotingLine(Systems::Generic Signals::Generic::CrossOverUp \
    {I:EMA 5} {I:EMA 20}  Signals::Generic::CrossOverUp {I:EMA 5} \
    {I:EMA 20},5.5)"  13000 > test.png
```

You can indicate the y at which the line should be displayed. In this example the line is
displayed in the height of 5.5.

**The objects PortfolioEvaluation(<portfolio>) and BackTestPortfolio(<systemname>,
[directory]) should be described . . .**

4 Trading-Systems

In *GeniusTrader* a Trading-System consists of the following components:

- *GT::Indicators* as discussed in the last chapter are the basis of every trading system.

- *GT::Signals* are Signals that occur when an indicator crosses a specific level, two indicators cross each other, etc. A *GT::Signal* is not an indication to buy or sell.

- *GT::Systems* are Systems that provide two functions, e.g. two signals, one signal to go long and an other to go short.

- *GT::Tradefilters* are used to decide whether or not a trade is accepted. It can for example refuse trade going against the current trend.

- *GT::MoneyManagement* decides how much money is spent for a trade.

- *GT::Brokers* calculates the annual account charge as well as the commissions for each order.

- *GT::CloseStrategy* manages the opened positions. The CloseStrategy decides when to close the position.
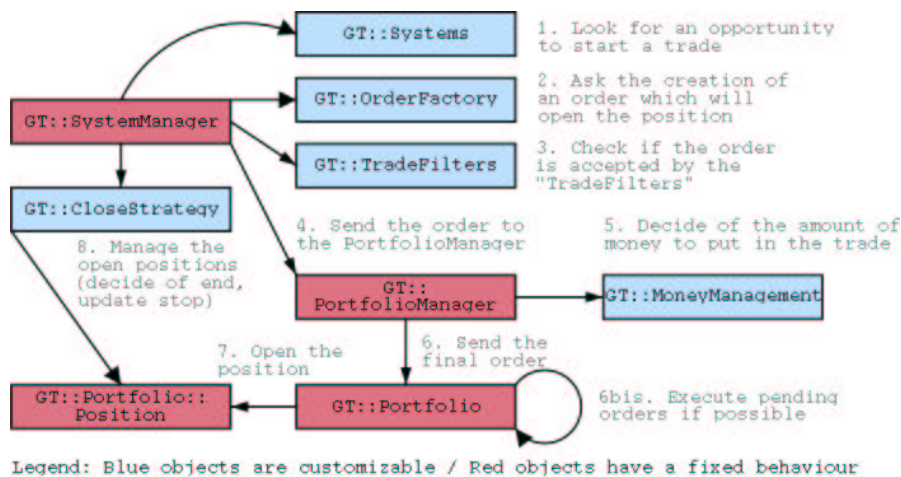

Figure 4.1: The internal structure of *GeniusTrader*

4.1 Backtesting Systems

When you've set up your trading system it is an important step to test its performance. *GeniusTrader* is producing a report as shown in fig. 4.2 when you call the program

```
./backtest.pl SYSTEMNAME 13000
```

This report consists of three sections:

- History of the portfolio

- Global analysis of the portfolio

- Theoretical analysis of the portfolio

The history shows the trades made with the system (name shown in line no. 1).It shows the prices of the stock and buy- and sell-date.

```
## Analysis of S:CCI 20 120|CS:Stop:Fixed 4|MM:Basic
History of the portfolio :
-------------------------
Long position (0) on code 13000
  2000-06-05  Buy      153 at 64.9000
  2000-06-06  Sell     153 at 62.3040
Long position (2) on code 13000
  2000-06-21  Buy      140 at 70.5000
  2000-06-29  Sell     140 at 67.6800
Long position (1) on code 13000
  2000-06-13  Buy      151 at 65.1000
  2000-07-13  Sell     151 at 79.6000
Long position (3) on code 13000
  2000-07-10  Buy      134 at 73.0500
  2000-07-13  Sell     134 at 79.6000
## Global analysis (each position is 10keuros, value of portfolio)
Analysis of the portfolio (2000-06-01 / 2000-07-13) :
--------------------------------------------------
Performance :  19.5% (340.6%)    Buy & Hold :  30.5% (818.7%) () => by year
MaxDrawDown :        9.4%  B&H MaxDrawDown :    68.3%
Best performance :  19.5%  Worst performance :  -9.4%
Net gain :        1947.71  Gross gain :       2275.21

Trades statistics :
Number of gains :        2  Number of losses :        2  Win. ratio :   50.0%
Max consec. win :        2  Max consec. loss :        2
Average gain :      14.54%  Average loss :      -4.77%  Avg. perf  :   4.55%
Biggest gain :      21.34%  Biggest loss :      -4.77%  Profit fac :   3.05
Sum of gains :    2891.93  Sum of losses :    -944.22  Risk of ruin : 2.6%

## Theoretical analysis (10keuros, full portfolio reinvested)
Analysis of the portfolio (2000-06-01 / 2000-07-13) :
--------------------------------------------------
Performance :  19.0% (325.2%)    Buy & Hold :  30.5% (818.7%) () => by year
MaxDrawDown :        9.3%  B&H MaxDrawDown :    68.3%
Best performance :  19.0%  Worst performance :  -9.3%
Net gain :        1896.83  Gross gain :       2224.33

Trades statistics :
Number of gains :        2  Number of losses :        2  Win. ratio :   50.0%
Max consec. win :        2  Max consec. loss :        2
Average gain :      14.55%  Average loss :      -4.78%  Avg. perf  :   4.44%
Biggest gain :      21.26%  Biggest loss :      -4.80%  Profit fac :   3.04
Sum of gains :    2830.00  Sum of losses :    -933.17  Risk of ruin : 2.5%
```

Figure 4.2: Example for a backtest-report

Some more examples, explain the parameters, ...

5 Indicators

In this chapter will have a closer look at the indicators. The documentation is partly taken from the *.pm-files. This chapter describes not only describes the calculation of the different Indicators but claims also to be a kind of guide how to use them an when to use them.

5.1 Basic Indicators

The indicators in `GT::Indicators::Generic::*`...

5.2 Trend-following Indicators

5.3 Oscillators

5.4 Volume Indicators

5.5 Misc Indicators

5 Indicators

6 Signals

A signal is – in contrast to a system – independent of a buy- or sell decision. A signal is generated if an indicator, the price or any other datasource shows a specific behaviour (crossing an other indicators, beeing above zero, etc.). These signals can later be used by systems to indicate a buy- or sell-decision.

7 Closing-Strategies

7 Closing-Strategies

8 Money-Management

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