**“Software that writes Software”**
**“Stochastic, Evolutionary, MultiRun Strategy Auto-Generation”**

# TRADING SYSTEM LAB
**Product Description**
**Version 1.1**
**08/08/10**

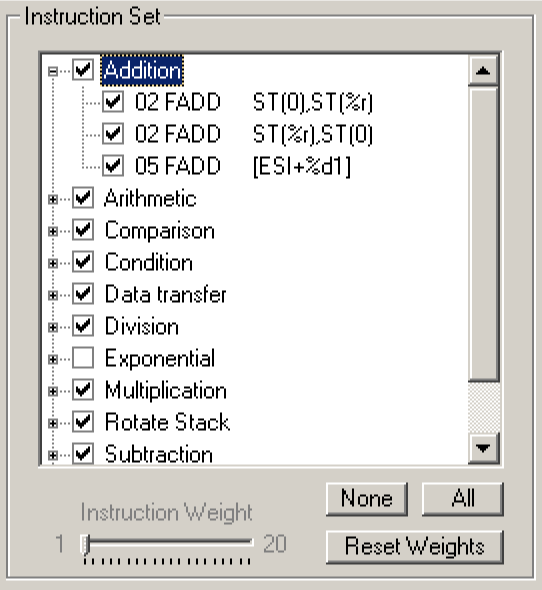
Trading System Lab (TSL) will automatically generate various Trading Strategies in as little as a few minutes using a very advanced computer program known as an AIMGP (Automatic Induction of Machine Code with Genetic Programming). Register level genetic manipulations and an advanced trading simulator provides for convergence to solutions far faster than other algorithms. TSL is a significant departure from the current traditional manual design workflow used to create trading strategies. No trading strategy exists prior to the initiation of a run in TSL as is the case in traditional Genetic Algorithm optimization. Trading strategy logic, triggers, inputs and equations are written for you in what has been described as an explosion of mathematics. Single Market Directional Trading Systems, Pairs Trading Systems, Portfolios Trading Systems, Daytrading Systems and Options Trading Systems may be automatically evolved with TSL. Creation of a Trading System within Trading System Lab is accomplished in 3 easy steps. First, a simple preprocessor is run using your development platform or TradeStation® (or any of our other data preprocessors) that automatically extracts and preprocesses the necessary data from the market you wish to work with. Second, the Trading System Lab is run for about 2 to 20 minutes (Intel Core 2 Duo or equivalent, 10-20 years daily data) to evolve a new Trading System. Third, the evolved Trading System is translated and exported into C, JAVA, Assembler, Easy Language®, C# or several other languages to produce new Trading System signals.

Trading Systems that took weeks or months to produce in the past may now be produced in minutes through the use of Trading System Lab. Trading System Lab is a platform for the automatic generation of Trading Systems. TSL makes use of a high speed Genetic Programming Engine and will produce Trading Systems at rates faster than 16 Million System-DataPoints/second (on fast processors such as the Intel Core i7 990x). **Note that we are not simply running a brute force optimization, nor are we using older technology such as a Genetic Algorithm, looking for optimum parameters from which to use in an already structured Trading System.**

With this application you will be able to automatically create Trading Systems far faster than conventional methods involving manually writing Trading System code. Trading System Lab makes use of a Linear, Automatic Induction of Machine Code with Genetic Programming Algorithm under an exclusive license from Register Machine Learning, Inc (RML). This Genetic Programming engine has been extensively studied and has been applied to many fields of and applications and is currently being studied by the U.S. military. For additional information please view and download appropriate white papers at http://www.tradingsystemlab.com/whitepaper.aspx, including white papers on speed and accuracy studies from Register Machine Learning, Inc., Jet Propulsion Lab (JPL) and Scientific Applications International Corporation (SAIC).

Trading System Lab not only evolves Trading Systems extremely fast, but it also writes Trading System code. Additionally, the evolutionary algorithm begins the design of the Trading System from a zero point origin. In other words, at the beginning of a TSL run, no Trading System exists, and no Trading System code exists. The only Trading System elements that exist at the start of a run are the initial genetic material, known as a terminal set, which would be known by traders as "patterns, indicators and data". A maximum of 56 inputs may be used as this starting point. This terminal set consists of preprocessed facts in either a Boolean (0 or 1) or a Numeric (finite numbers) form. Only basic Trading System and Genetic Programming constraints are defined at the beginning of the run. The trader or Trading System developer may use his own data, filters, indicators, inter-market data, fundamental data or patterns within TSL. Additionally, the developer may inject his own "domain expertise" in feeding this initial genetic material to TSL. This way the intelligence gathered over time from the trader may be taken advantage of by TSL during the course of the evolutionary path to your genetically engineered Trading System.

TSL then combines this initial genetic material with 34 instruction sets such as simple addition, subtraction, multiplication and division, or more complex stack rotation, conditionals or data transfers and randomizations, producing new Trading System equations in terms of machine instructions operating directly within the registers of your CPU. For example, there are several ways to perform an addition in terms of machine code:



- ☑ Addition
  - ☑ 02 FADD ST(0),ST(%r)
  - ☑ 02 FADD ST(%r),ST(0)
  - ☑ 05 FADD [ESI+%d1]
- ☑ Arithmetic
- ☑ Comparison
- ☑ Condition
- ☑ Data transfer
- ☑ Division
- □ Exponential
- ☑ Multiplication
- ☑ Rotate Stack
- ☑ Subtraction

The Genetic Program will use these various machine code instructions to write or rewrite Trading System equations.

The general concept here is “Machine Learning applied to Trading System design”.

In a recent study only a filter bank was used as the initial genetic material. TSL then automatically created Trading Systems in a just a few minutes that displayed adequate Out of Sample performance. In another study, only 9 simple candlestick patterns were used as the initial genetic material. TSL then evolved Trading systems in a few minutes that also displayed adequate Out of Sample performance.

TSL may also enhance, reengineer, modify or expand upon any existing Trading System or Technical Analysis approach by adding the existing Trading Systems or Technical Analysis facts, equations, preprocessing, or logic to TSL’s internal development logic. To accomplish this, the user simply merges signals derived from the existing Trading System with additional preprocessed facts. The TSL platform will then take this mixture of facts, rearrange and combine them with the GP’s function set so as to create a new Trading System. Simple Parameter Optimization would not suffice, nor does it take place, however a new Trading System structure emerges, perhaps with characteristics derived from both the legacy Trading System and the newer preprocessed facts.

**TSL begins at a zero point origin making no assumptions about the movement of the market in the future and then "evolves" Trading Systems at a very high rate combining information present in the market and formulating new filters, functions, conditions and relationships as it progresses towards a "genetically engineered" Trading System, then writes the portable code for you.**

It is important to note that mathematical equations are written for you at the completion of the evolutionary path in the form of code in a variety of languages.

Key evolutionary issues that make this approach the best approach for Trading System development are:

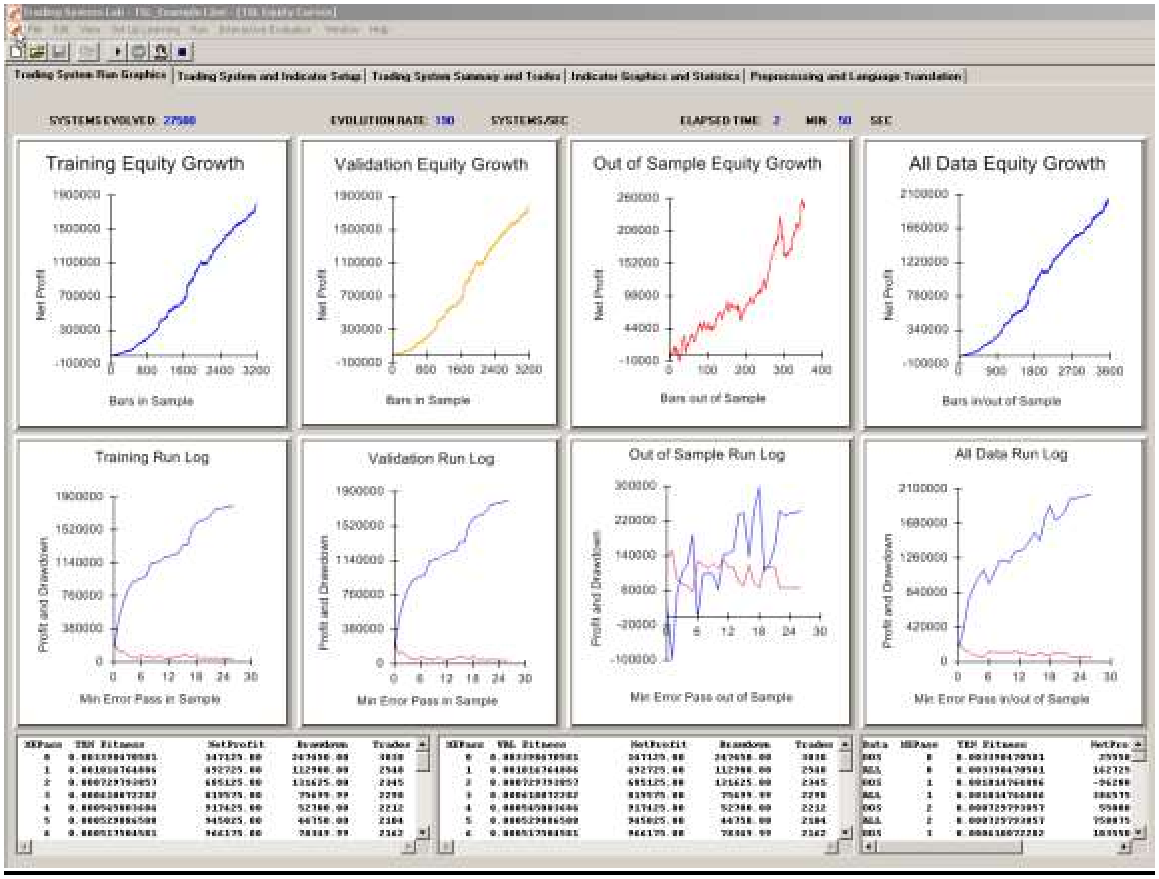
1. Rapid convergence at rates up to 200 times faster than conventional methods. (See speed and accuracy white papers from JPL and SAIC)
2. Input data set reduction occurring far faster than conventional methods. (Often only 5 to 10 parameters are used, out of the initial 56 inputs, in the final Trading System resulting in a simple, efficient Trading System)
3. Out of Sample results displayed both **during** the evolutionary process as well as **immediately available upon completion.** (Allows "path" intelligence to be seen.)
4. Efficient model complexity reduction through Parsimony Pressure. (Draws from minimal description length concept; Simpler systems are better.)
5. Non-homologous crossover resulting in very dynamic evolutions. (Varies the size of the evolved code. This is a critical LAIMGP concept.)
6. Production of C-code, Java, Assembler, EasyLanguage® and others. (Allows for portability and integration into industry API's, platforms, and Algorithmic Trading Engines.)

The result is that an excellent Trading System may be generated in a few minutes using 20-30 years of market data on virtually any market.

It is important to note that Genetic Programs are superior to the older and less efficient technology known as Genetic Algorithms. Further discussion on this topic may be found on the web site and in demos.

The TSL platform is the result of the convergence of many languages and technologies into an operational whole. Since TSL will either create a Trading System or indicate rapidly if a market is too random to allow the creation of a Trading System, we believe that TSL will soon become the standard for development of new Trading Systems and a metric for performance measurements of existing Trading Systems. Since TSL's speed grows with the rate of processor speed improvements, faster processors will allow yet greater and greater functionality and convergence speed. We estimate that within a few years, TSL will be producing Trading Systems in seconds. We are investigating concurrent, parallel, and multi core/multi processor configurations. Our plans include the capabilities to design Trading Systems on most of the major securities and commodity markets in the world quickly and efficiently.

## Equity Graphics Tab:



Trading System Run Graphics
Trading System and Indicator Setup
Trading System Summary and Trades
Indicator Graphics and Statistics
Preprocessing and Language Translation
Training Equity Growth
Net Profit
Bars in Sample
Validation Equity Growth
Out of Sample Equity Growth
Bars out of Sample
All Data Equity Growth
Bars in/out of Sample
Training Run Log
Profit and Drawdown
Min Error Pass in Sample
Validation Run Log
Out of Sample Run Log
Min Error Pass out of Sample
All Data Run Log
Min Error Pass in/out of Sample

SYSTEMS EVOLVED 27500 EVOLUTION RATE 190 SYSTEMS/SEC ELAPSED TIME 2 MIN 50 SEC

```
MEPass  TRN Fitness        NetProfit    Drawdown    Trades
   0    0.003398470581     347125.00   247650.00    3038
   1    0.001816764886     492725.00   112900.00    2540
   2    0.000729793057     685125.00   131625.00    2345
   3    0.000618872282     819575.00    75699.99    2290
   4    0.000545803686     917425.00    52700.00    2212
   5    0.000529866509     945025.00    44750.00    2184
   6    0.000517504581     964175.00    70349.99    2162
```

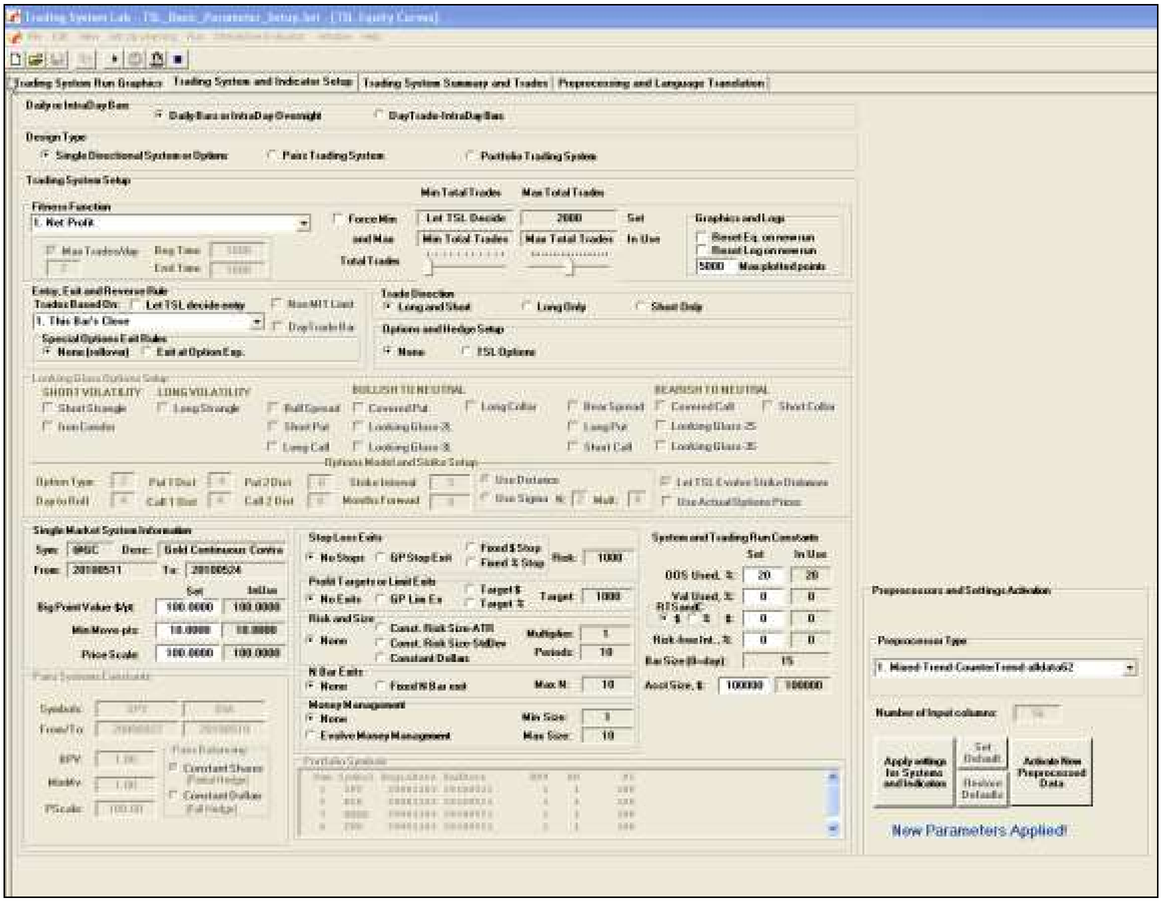
```
MEPass  VAL Fitness        NetProfit    Drawdown    Trades
   0    0.003398470581     347125.00   247650.00    3038
   1    0.001816764886     492725.00   112900.00    2540
   2    0.000729793057     685125.00   131625.00    2345
   3    0.000618872282     819575.00    75699.99    2290
   4    0.000545803686     917425.00    52700.00    2212
   5    0.000529866509     945025.00    44750.00    2184
   6    0.000517504581     964175.00    70349.99    2162
```

```
Data  MEPass  TRN Fitness         NetPro
OOS     0     0.003398470581      25550
ALL     0     0.003398470581     142725
OOS     1     0.001834764886     -96200
ALL     1     0.001834764886     386575
OOS     2     0.000729793057      55000
ALL     2     0.000729793057     750875
OOS     3     0.000618872282     103550
```

There are 8 graphs and 3 numeric readouts on the Run Graphics Tab. In the upper row, Training, Validation, Out of Sample and the All Data equity curves are displayed. These graphs show the profit or loss over time of the most recent system that best meets the requirements of the selected fitness function. Numeric run log information is also displayed assisting the developer in choosing the best trading model.

Out of Sample test data is data that was not used by the GP during evolution. It is important to note that OOS data is not part of the Training process and is considered blind, hidden, applied, held out or walk-forward data. Testing on Out of Sample (OOS) data is critical in the determination of the degree of robustness of a Trading System. **TSL displays both the latest performance of our Trading System on the OOS data and the OOS performance of our Trading System “during” the evolutionary process.** If the general path of the OOS log shows continual poor performance during the stochastic path, not implementing that particular configuration, data set, or market-model combination should be considered.

## System Setup Tab:


Trading System Lab - TSL_Basic_Parameter_Setup.txt - [TSL Equity Curves]
Trading System Run Graphics
Trading System and Indicator Setup
Trading System Summary and Trades
Preprocessing and Language Translation
Apply settings for Systems and Indicators
Set Default
Restore Defaults
Activate New Preprocessed Data

Daily or IntraDay Bars: ● Daily Bars or IntraDay Overnight ○ DayTrade-IntraDay Bars

Design Type: ● Single Directional System or Options ○ Pairs Trading System ○ Portfolio Trading System

Trading System Setup

Fitness Function: 1. Net Profit

□ Force Min and Max Total Trades

| | Min Total Trades | Max Total Trades |
|---|---|---|
| Set | Let TSL Decide | 2000 |
| In Use | Min Total Trades | Max Total Trades |

Graphics and Logs: □ Reset Eq. on new run □ Reset Log on new run 5000 Max plotted points

Entry, Exit and Reverse Rule: Trades Based On: □ Let TSL decide entry 1. This Bar's Close

Special Options Exit Rules: ● None (rollover) □ Exit at Option Exp.

Trade Direction: ● Long and Short ○ Long Only ○ Short Only

Options and Hedge Setup: ● None ○ TSL Options

Single Market System Information

Sym: @GC Desc: Gold Continuous Contra

From: 20100511 To: 20100524

| | Set | InUse |
|---|---|---|
| Big Point Value: $/pt | 100.0000 | 100.0000 |
| Min Move-pts: | 10.0000 | 10.0000 |
| Price Scale: | 100.0000 | 100.0000 |

Stop Loss Exits: ● No Stops ○ GP Stop Exit ○ Fixed $ Stop ○ Fixed % Stop Risk: 1000

Profit Targets or Limit Exits: ● No Exits ○ GP Lim Ex ○ Target $ ○ Target % Target: 1000

Risk and Size: ● None ○ Const. Risk Size-ATR ○ Const. Risk Size-StdDev ○ Constant Dollars Multiplier: 1 Periods: 10

N Bar Exits: ● None ○ Fixed N Bar exit Max N: 10

Money Management: ● None ○ Evolve Money Management Min Size: 1 Max Size: 10

System and Trading Run Constants

| | Set | In Use |
|---|---|---|
| OOS Used, %: | 20 | 20 |
| Val Used, %: | 0 | 0 |
| RTS and C ● $ ○ % $: | 0 | 0 |
| Risk-free Int., %: | 0 | 0 |
| Bar Size (B=day): | | 15 |
| Acct Size, $: | 100000 | 100000 |

Preprocessors and Settings Activation

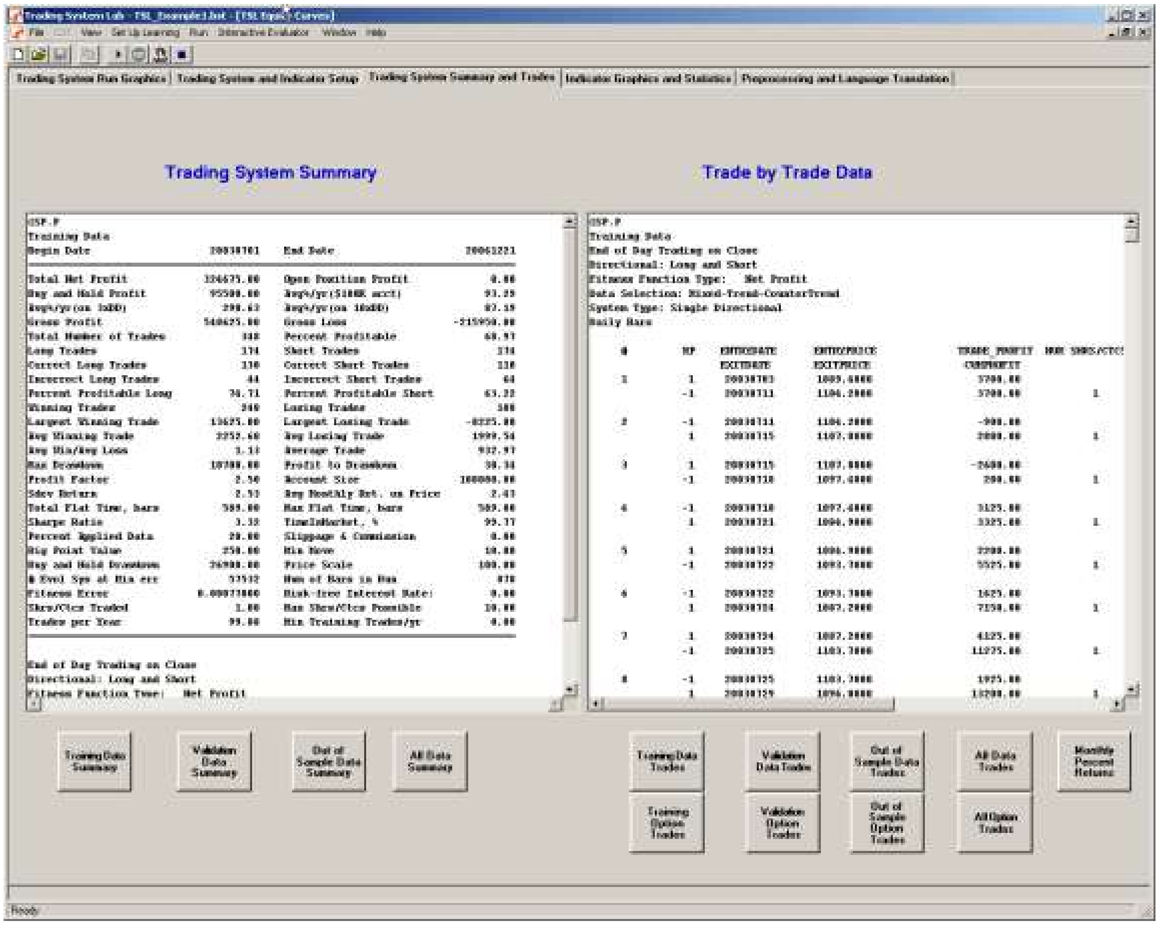
Preprocessor Type: 1. Mixed-Trend CounterTrend-alldata62

Number of Input columns:

New Parameters Applied!

The Trading System Setup Tap allows the configuration of 33 Fitness Functions, 19 evolved Entry Tactics, 5 Preprocessed Data Sets, 7 evolved Exit Tactics and numerous other Trading System design configurations. TSL has ongoing and frequent updates and enhancements with Version 1.1 being a major update following many earlier updates and numerous client and trader feedback.

**System Results Tab:**

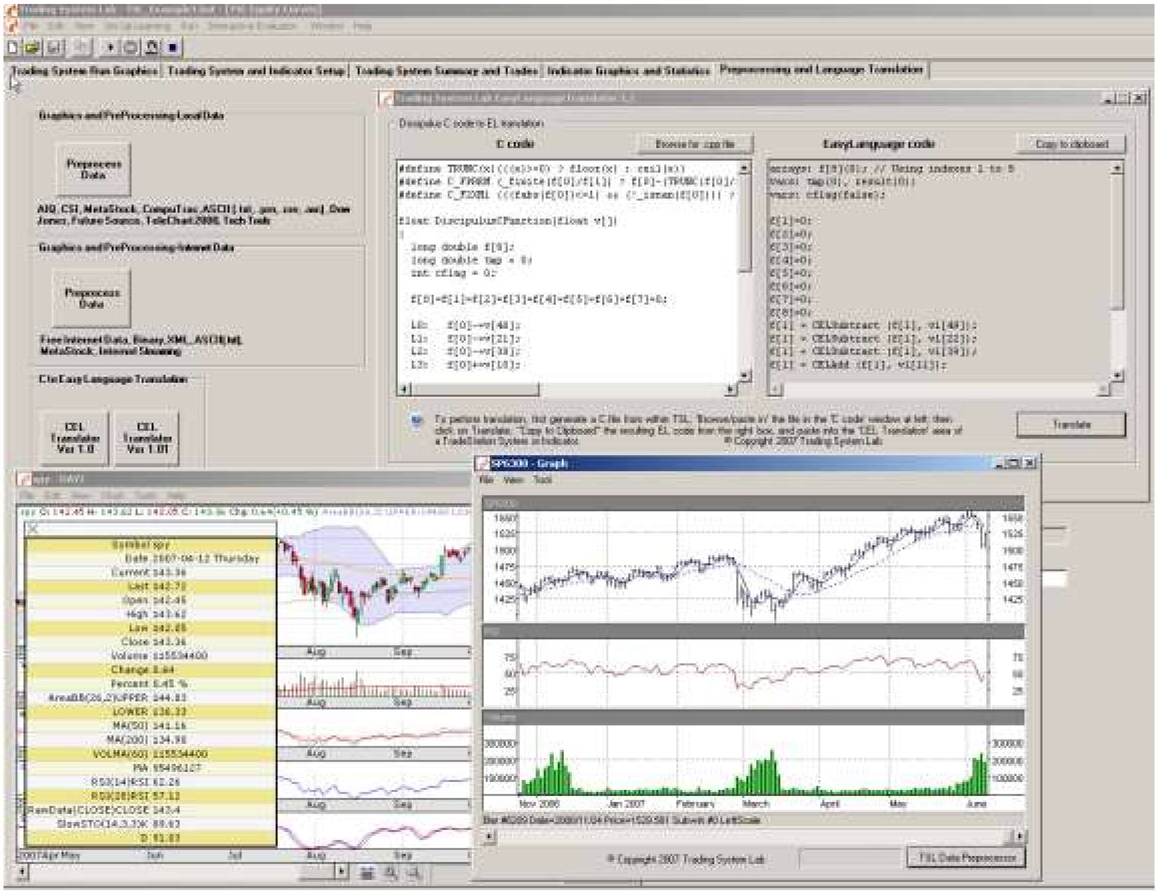

Trading System Lab - TSL_Example1.tsl - [TSL Equity Curves]
File Edit View Set Up Learning Run Interactive Evaluator Window Help
Trading System Run Graphics
Trading System and Indicator Setup
Trading System Summary and Trades
Indicator Graphics and Statistics
Preprocessing and Language Translation
Trading System Summary
Trade by Trade Data
Training Data Summary
Validation Data Summary
Out of Sample Data Summary
All Data Summary
Training Data Trades
Validation Data Trades
Out of Sample Data Trades
All Data Trades
Monthly Percent Returns
Training Option Trades
Validation Option Trades
Out of Sample Option Trades
All Option Trades
Ready

```
@SP.P
Training Data
Begin Date                  20030701    End Date                        20061221
--------------------------------------------------------------------------------
Total Net Profit           324675.00    Open Position Profit                0.00
Buy and Hold Profit         95500.00    Avg%/yr($100K acct)                93.29
Avg%/yr(on 1xDD)              298.63    Avg%/yr(on 10xDD)                  87.19
Gross Profit               540625.00    Gross Loss                    -215950.00
Total Number of Trades           348    Percent Profitable                 68.97
Long Trades                      174    Short Trades                         174
Correct Long Trades              130    Correct Short Trades                 110
Incorrect Long Trades             44    Incorrect Short Trades                64
Percent Profitable Long        74.71    Percent Profitable Short           63.22
Winning Trades                   240    Losing Trades                        108
Largest Winning Trade       13625.00    Largest Losing Trade            -8225.00
Avg Winning Trade            2252.60    Avg Losing Trade                 1999.54
Avg Win/Avg Loss                1.13    Average Trade                     932.97
Max Drawdown                10700.00    Profit to Drawdown                 30.34
Profit Factor                   2.50    Account Size                   100000.00
Sdev Return                     2.53    Avg Monthly Rtn. on Price           2.43
Total Flat Time, bars         505.00    Max Flat Time, bars               505.00
Sharpe Ratio                    3.33    TimeInMarket, %                    99.77
Percent Applied Data           20.00    Slippage & Commission               0.00
Big Point Value               250.00    Min Move                           10.00
Buy and Hold Drawdown       26900.00    Price Scale                       100.00
# Eval Sys at Min err          57512    Num of Bars in Run                   878
Fitness Error             0.00073000    Risk-free Interest Rate:            0.00
Shrs/Ctcs Traded                1.00    Max Shrs/Ctcs Possible             10.00
Trades per Year                99.00    Min Training Trades/yr              0.00
--------------------------------------------------------------------------------

End of Day Trading on Close
Directional: Long and Short
Fitness Function Type:   Net Profit
```

```
@SP.P
Training Data
End of Day Trading on Close
Directional: Long and Short
Fitness Function Type:   Net Profit
Data Selection: Mixed-Trend-CounterTrend
System Type: Single Directional
Daily Bars

    #        MP    ENTRYDATE     ENTRYPRICE          TRADE_PROFIT  NUM SHRS/CTCS
                   EXITDATE      EXITPRICE           CUMPROFIT
    1         1    20030703      1089.6000                3700.00
             -1    20030711      1104.2000                3700.00             1

    2        -1    20030711      1104.2000                -900.00
              1    20030715      1107.0000                2800.00             1

    3         1    20030715      1107.0000               -2600.00
             -1    20030718      1097.4000                 200.00             1

    4        -1    20030718      1097.4000                3125.00
              1    20030721      1086.9000                3325.00             1

    5         1    20030721      1086.9000                2200.00
             -1    20030722      1093.7000                5525.00             1

    6        -1    20030722      1093.7000                1625.00
              1    20030724      1087.2000                7150.00             1

    7         1    20030724      1087.2000                4125.00
             -1    20030725      1103.7000               11275.00             1

    8        -1    20030725      1103.7000                1925.00
              1    20030729      1096.0000               13200.00             1
```

The Results Tab shows the Trading System Summary and the Trades during the run as well as when the run is finished. All information is held in spreadsheet importable text files. The Options trade window shows over 70 Options Trading Systems columns. System Summary information is available for Single Market Directional Trading Systems, Pairs, Portfolios and Options Trading Systems.

## Language Translation and Preprocessing Tab:


Trading System Run Graphics
Trading System and Indicator Setup
Trading System Summary and Trades
Indicator Graphics and Statistics
Preprocessing and Language Translation
Graphics and PreProcessing Local Data
Preprocess Data
AIQ, CSI, MetaStock, CompuTrac, ASCII (.txt, .prn, .csv, .asc), Dow Jones, Future Source, TeleChart 2000, Tech Tools
Graphics and PreProcessing Internet Data
Preprocess Data
Free Internet Data, Binary, XML, ASCII, html, MetaStock, Internet Streaming
C to EasyLanguage Translator
CEL Translator Ver 1.0
CEL Translator Ver 1.01
Discipulus C code to EL translation
C code
Browse for .cpp file
EasyLanguage code
Copy to clipboard
Translate
SP500 - Graph
File
View
Tools
TSL Data Preprocessor

C code:

```
#define TRUNC(x)(((x)>=0) ? floor(x) : ceil(x))
#define C_FPREM (_finite(f[0]/f[1]) ? f[0]-(TRUNC(f[0]/
#define C_F2XM1 (((fabs(f[0])<=1) && (!_isnan(f[0]))) ?

float DiscipulusCFunction(float v[])
{
  long double f[8];
  long double tmp = 0;
  int cflag = 0;

  f[0]=f[1]=f[2]=f[3]=f[4]=f[5]=f[6]=f[7]=0;

  L0:   f[0]-=v[48];
  L1:   f[0]-=v[21];
  L2:   f[0]-=v[38];
  L3:   f[0]+=v[18];
```

EasyLanguage code:

```
arrays: f[8](0); // Using indexes 1 to 8
vars: tmp(0), result(0);
vars: cflag(false);

f[1]=0;
f[2]=0;
f[3]=0;
f[4]=0;
f[5]=0;
f[6]=0;
f[7]=0;
f[8]=0;
f[1] = CELSubtract (f[1], v1[48]);
f[1] = CELSubtract (f[1], v1[22]);
f[1] = CELSubtract (f[1], v1[39]);
f[1] = CELAdd (f[1], v1[11]);
```

To perform translation, first generate a C file from within TSL. "Browse/paste in" the file in the "C code" window at left, then click on Translate. "Copy to Clipboard" the resulting EL code from the right box, and paste into the "CEL Translator" area of a TradeStation System or Indicator. © Copyright 2007 Trading System Lab

Symbol spy
Date 2007-06-12 Thursday
Current 143.36
Last 142.73
Open 142.45
High 143.62
Low 142.05
Close 143.36
Volume 115534400
Change 0.64
Percent 0.45 %
AreaBB(26,2)UPPER 144.83
LOWER 136.33
MA(50) 141.16
MA(200) 134.98
VOLMA(60) 115534400
MA 95496127
RSI(14)RSI 62.26
RSI(28)RSI 57.12
RawData(CLOSE)CLOSE 143.4
SlowSTO(14,3,3)K 89.63
D 91.83

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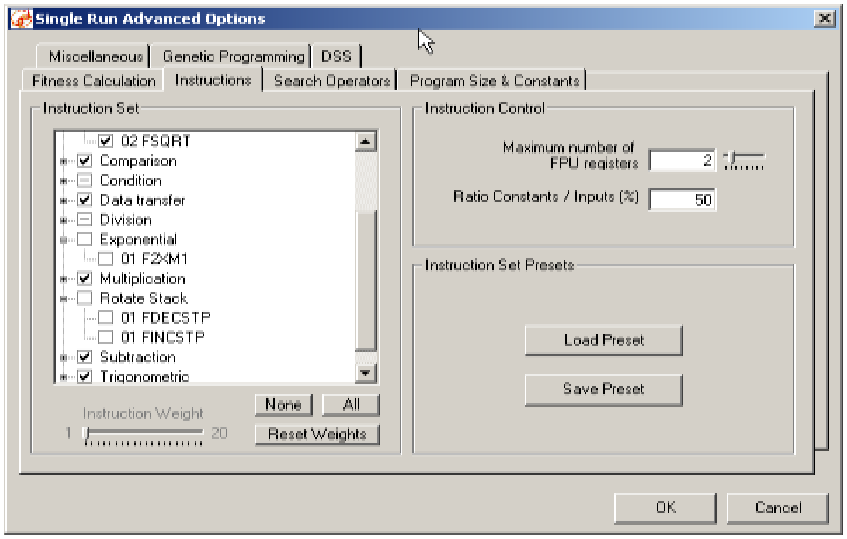
The Preprocessing and Language Tab provides for data preprocessing, C to EasyLanguage® translation, options database preprocessing (if available), and TSL platform license settings. The functionality here is extremely simple providing for fast preprocessing and language translation. Available data formats include: CSI, MetaStock, AIQ, TradeStation®, Free Internet data, ASCII, TXT, CSV, CompuTrac, DowJones, FutureSource, TeleChart2000v3, TechTools, XML, Binary and Internet Streaming data. Available endpoint languages include C, JAVA, Assembly, EasyLanguage® and others. Check with TSL for the latest information on currently available languages.

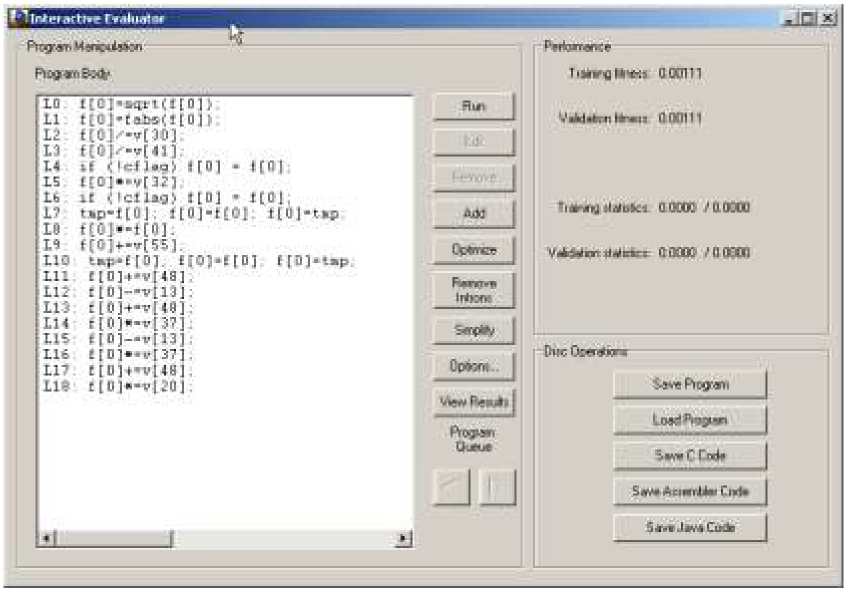
## Genetic Programming Setup Section:



☑ 02 FSQRT
☑ Comparison
□ Condition
☑ Data transfer
□ Division
□ Exponential
□ 01 F2XM1
☑ Multiplication
□ Rotate Stack
□ 01 FDECSTP
□ 01 FINCSTP
☑ Subtraction
☑ Trigonometric

Maximum number of FPU registers: 2

Ratio Constants / Inputs (%): 50



```
L0: f[0]=sqrt(f[0]);
L1: f[0]=fabs(f[0]);
L2: f[0]/=v[30];
L3: f[0]/=v[41];
L4: if (!cflag) f[0] = f[0];
L5: f[0]*=v[32];
L6: if (!cflag) f[0] = f[0];
L7: tmp=f[0]; f[0]=f[0]; f[0]=tmp;
L8: f[0]*=f[0];
L9: f[0]+=v[55];
L10: tmp=f[0]; f[0]=f[0]; f[0]=tmp;
L11: f[0]+=v[48];
L12: f[0]-=v[13];
L13: f[0]+=v[48];
L14: f[0]*=v[37];
L15: f[0]-=v[13];
L16: f[0]*=v[37];
L17: f[0]+=v[48];
L18: f[0]*=v[20];
```

Training fitness: 0.00111

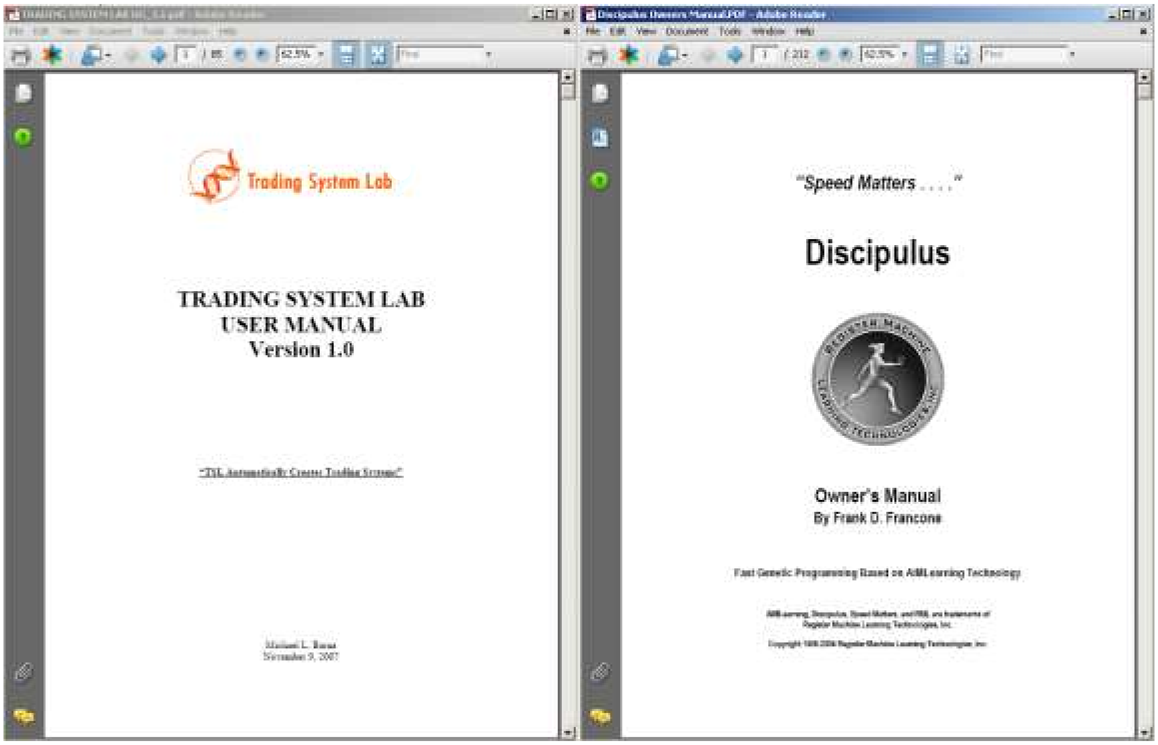
Validation fitness: 0.00111

Training statistics: 0.0000 / 0.0000

Validation statistics: 0.0000 / 0.0000

GP instruction sets may be edited, or weights adjusted for each machine instruction. The GP produced C code may be edited and viewed in the Interactive Evaluator window following evolution, prior to translation to other languages The Genetic Program used within TSL is hundreds of times faster than competing algorithms. Moreover, TSL writes the Trading System code for you.

## TSL Platform User Manuals:


TRADING SYSTEM LAB_1.0.pdf - Adobe Reader
File Edit View Document Tools Window Help
1 / 85
62.5%
Discipulus Owners Manual.PDF - Adobe Reader
File Edit View Document Tools Window Help
1 / 212
62.5%
Find

Trading System Lab

TRADING SYSTEM LAB
USER MANUAL
Version 1.0

"TSL Automatically Creates Trading Systems"

Michael L. Barna
November 9, 2007

"Speed Matters . . . ."

Discipulus

REGISTER MACHINE LEARNING TECHNOLOGIES, INC.

Owner's Manual
By Frank D. Francone

Fast Genetic Programming Based on AIMLearning Technology

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The Trading System Lab and Discipulus Genetic Programming User Manuals provide nearly 300 pages of support. Discussions on how to develop robust trading systems are included as well as methods to enhance OOS performance. Technical Support is available directly through TSL.

For pricing information, please visit our web site.

Trading System Lab
7227 Glenview Drive
San Jose, CA
408-356-1800
www.tradingsystemlab.com

Register Machine Learning Technologies, Inc.
7606 S. Newland St.
Littleton, CO. 80128
www.aimlearning.com