An Approach to Group Modeling

TradingSolutions gives you the flexibility to take a wide variety of approaches in developing trading models. Below is a summary of the various aspects involved in creating a model using one potential approach. The idea behind the approach is to import the data for a large variety of symbols and use TradingSolutions group field features to create potential models for all of them. Many of TradingSolutions' key <u>features</u> are utilized, including optimal signal modeling, genetic optimization of inputs and parameters, and time-lagged recurrent neural networks.

Where can I get my data and how much do I need?

TradingSolutions offers several methods of importing data. The first method is by a direct data supplier such as: <u>Prophet</u>, <u>eSignal</u>, <u>IQFeed</u> or <u>QuotesPlus</u>. eSignal and IQFeed both offer real-time streaming data into TradingSolutions. The second method is by importing data from text files obtained from a variety of other <u>sources</u>.

The more data you can use to train a neural network the better your results are likely to be, provided that the data is applicable to the current time frame. For most stocks this optimal time frame for training data is the preceding 4-6 years. When creating real-time models with intraday data, a much shorter time frame can be used since each day contains more data.

Step-By-Step – Importing the S&P 100 w/ Direct Data Provider

To get started on our approach to group modeling we will need sufficient data to work with. The S&P 100 provides a good variety of symbols without overloading our portfolio and using too much of our time on processing rather than analyzing our data.

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To start off with an empty portfolio, click on the File menu and choose "Change Work Directory". In the next panel, select "Make New Folder" and name it "SP100" and click OK to continue. In the Portfolio View in TradingSolutions create a new subgroup called "S&P 100" by right clicking on the My Portfolio folder and choosing

Add New Subgroup. Select the folder you just created and choose the Import Data button from the toolbar.

Import Data Wizard					×
	This wizard will After the data I spreadsheets. entry/exit syste Target Group: What type of What type of What type of Comparison Com	I help you to imp has been importe It can also be us ems, predictions, S&P 100 import would you Update dat O Download	ort new data into, ad, it can displaye sed as inputs to fu and other calcula ou like to perform? ta in the target gro new data from the a from files on you	your portfolio. ed in charts or inctions, ations. Select y oup. e Internet. r computer.	Group Settings Data Sources Update Options
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In the Import Data dialog, choose "Download new data from the Internet" and click Next.

Import Data Wizard: Select Data to Download	×
Specify the general characteristics of the data to be downloaded.	
Data Source: eSignal Data Sources Periodicity: End-of-day	
Amount of Data: 6 Tears Start Date: 7/23/1998 C End Date: 7/22/2004 C	
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Next, you will choose your data provider and choose *6-years of historical data to import, click Next to continue.

Import Data Wizard: Select Symbol Enter or select symbols for the data Exchange: All United States Ex © Enter Symbols: or - Select from: Indices	Is to Download to download. change: New Starting with:	- Currently Selec	ted Symbols:	×
Name \$MID FLEX Op \$DEX FLEX Av \$DEX FLEX Av \$DEX FLEX Av \$RUT FLEX Av \$RUT FLEX Av \$RUT FLEX Av \$RUT FLEX Op \$SPX FLEX Av \$SPX FLEX Av \$SPX FLEX Av \$SPX FLEX Op \$SPX Index 12	- Notepad nat Help TYC, UIS, USB, U	TX, VIA. B, VZ	* Undo Cut Copy Paste Delete Select All	X
		< Back 🛛 🕅	Next > Ca	ncel Help

Rather than going through the list we have compiled (of the S&P 100) a list in a comma-separated.

[Click here to download S&P 100-symbol list]

After downloading the SP100.csv file, open it with Notepad. In Notepad, select the Edit menu and choose "Select All". After all the symbols are selected right-click on the highlighted text and choose Copy (or ctrl+c on the keyboard). Finally, click inside the Enter Symbols text box and right-click and choose Paste (or ctrl+v on the keyboard). Click the Add Symbol button; click Next and then Finish to complete the import process.

*Remove any data set that is shorter than 6-years by right-clicking on the data set and clicking "Remove Data".

How can the Optimal Signal help my Portfolio?

The Optimal Signal is an entry/exit signal that indicates what would have been the best trading position for a series of price data. Its value is calculated by looking ahead at each point in the data series to determine whether the price went up or down enough to cover a specified minimum profit within a specified amount of time.

Step-By-Step – Creating the Optimal Signal using Group Operations

One of the strengths of TradingSolutions is its intuitive portfolio-based interface. Using the Portfolio View, you can group your stocks into meaningful groups and perform operations on an entire group at one time. This allows you to quickly try a technique out on stocks sharing similar characteristics and compare the results. Creating fields at the group level allows you make changes to one field so that it will affect all fields under it saving your fingers from hundreds of modifications.



In the Portfolio View of TradingSolutions right-click on the subgroup named "S&P 100" and choose Add New Field...

Create a Field for S&P 100): Select Type			×
	This wizard will help you to create data or group of data. New fields can be used to calcula predictions, and analyses. You ca your Pottfolio View, chart, or spre- as inputs when creating other fiel	e a new f ate value an then c adsheet, ds.	ield for the selected as such as indicators, display these values in as well as use them	
ath				
MACD O C	alculate an indicator or value.	•	Apply a rule-based entry/exit system.	
• • •	enerate an optimal signal.	∞	C Combine values with a committee.	
о р	redict or model a value.	•	O Apply a trading solution.	
🚺 • G	enerate an alert.			
A • 😥	nalyze a signal.		O Store manually entered values.	
	<	Back	Next > Cancel Help	

In the Add New Field Wizard choose "Generate an optimal signal" and click Next.

Generate an Optimal Signal for S&P 100: Signal Parameters
Indicate the parameters to use for this optimal signal. Trading style to use for simulating trades. Default Trading Style Edit Styles
- Settings to use to identify previous profit opportunities.
Maximum number of bars to look 10 🖃
< Back Next > Cancel Help

In the Signal Parameters dialog box you have several different parameters that you can adjust to suit your specific trading needs.

- 1. Trading Style: Trading styles are named collections of settings that you use to indicate how you like to trade. For example: types of trades, limit and stop orders, volatility, and much more.
- 2. Minimum profit per trade: The minimum profit that the optimal signal will look for over *x*-bars (based on Maximum number of bars to look into the future for profit) for generating entry/exit signals.
- 3. Maximum drawdown before profit: (optional) Entry signals are only generated if they will result in a trade, which does not produce the maximum drawdown prior to achieving the minimum profit.
- 4. Maximum number of bars to look into the future for profit: Entry signals are only generated if they will result in the given profit within this number of bars.
 - a. Example: If you would like to analyze the next two weeks from a data series with daily trading data, this value should be set to 10.

	Inputs Required By This Function	
ptimal Signal	This function does not require any in	iputs.
enerate optimal entry/exit si D samples.	ignal by looking ahead M C F e	
Se In	elect a name for this field or enter a new one.	
	Add to portfolio display for this group.	

For this particular approach leave the defaults and choose Next and Finish to complete the Optimal Signal.

The processing time on creating the Optimal Signal at the group level for the S&P 100 may take some time depending on your computers speed.

Past performance does not guarantee future results. The financial markets are inherently risky. NeuroDimension is not recommending the purchase or sale of any security. The data provided is gathered from sources believed to be reliable, but no representation is made as to the accuracy of any data presented. Investors should use their own judgment in making investment decisions. NeuroDimension assumes no liability for any losses incurred when using its software for trading. Copyright © 2004 NeuroDimension, Inc.

Let Genetic Optimization do the thinking for you!

Genetic algorithms can be combined with neural networks to enhance their performance by taking some of the guesswork out of optimally choosing neural network parameters, input parameters, input selection, etc.

Step-By-Step – Creating a Neural Network Model using Group Operations

Due to the intense calculations over numerous symbols, this operation will take several hours depending on your computers speed.

Much like the creation process of the Optimal Signal, creating the neural network model at the group level will allow you to create a model with the same setup for all symbols without having to create each model individually. Even though you are setting up the model with the same input variables, neural network topology, etc. the neural network will be optimized based on the symbol itself.



In the Portfolio View of TradingSolutions right-click on the subgroup named "S&P 100" and choose Add New Field...

Create a Field for S&P 100:	Select Type			×
	This wizard will help you to create data or group of data. New fields can be used to calcula predictions, and analyses. You ca your Portfolio View, chart, or sprea as inputs when creating other field	a new fir ate value: in then di adsheet, s ds.	ield for the selected is such as indicators, lisplay these values in as well as use them	
What would you like	this new held to do?			
A + b MACD O Cal	culate an indicator or value.	*	O Apply a rule-based entry/exit system	n.
	nerate an optimal signal.	ക	O Combine values with a committee.	
🔶 📀 Pre	dict or model a value.	•	O Apply a trading solution.	
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🔊 • Ani	alyze a signal.		C Store manually entered values.	
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	<	Back.	Next > Cancel	Help

In the Add New Field dialog choose "Predict or model a value" and click Next.

redict a Value for S&P	100: Select Desired Outputs	
- Select the desired outp	ut for this prediction.	
Value to Pre	dict: Optimal Signal (Default Trading Style)	
Samples in Adva	nce: 0	
	Signal Postprocessing Settings	
	Predict multiple values with this prediction.	
0		
	< Back Next > Cancel Help	

On the Select Desired Outputs page, choose the Optimal Signal created earlier (Optimal Signal (Default Trading Style)) and click Next to continue.

Select from fields in this group	•	Change in 0	lose	
Select from fields in this group				
Select from rields in a specific data series		1		
Accumulation/Distribution (C H L	vi			
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Linear Regression Slope (C, 107)				
Linear Regression Slope (C, 101)				
	- P			
Add Selected Input Create a New F	rield	Modity Inpu	it	Remove Input

Next, in the Select Inputs page first add the Close to the "Currently selected inputs" display and then click on the drop down menu "Select from fields in this group" and choose the option "Select from optimizable functions".

Select from	optimizable functions Median Median Median (Variable Length) Moving Average Moving Average (Exponential Bars) Moving Average (Exponential Percent) Moving Average (Exponential Support) Moving Average (Variable Length) Moving Average (Variable Length) Moving Average (Weighted) Percent Difference from Median Percent Difference from Moving Average Percent Difference from Moving Average Percent Difference from Moving Average		 Change in Close Change in Opt. Accumulation/Distribution Opt. Vertical Horizontal Filter (C, *) Opt. Stochastic Oscillator (C, H, L, *, *) Opt. Relative Strength Index (C, *) Opt. Linear Regression Slope (C, *) Opt. Percent Difference from Moving Aver
Add Se	ected Input Function Information	1	Modify Input Remove Input

Next, select the inputs from the list below as your optimizable inputs for the neural network model:

- Accumulation/Distribution
- Vertical Horizontal Filter
- o Stochastic Oscillator
- o Relative Strength Index
- o Linear Regression Slope
- Percent Difference from Moving Average

Modify Field: S&P 100: Opt. Percent Difference from Moving Ave	rage (C, *) #16 🛛 🔀
Function Inputs	
Select the input values for this function. Selected Function Percent Difference from Moving Average Calculate the percent difference between a value and its moving average.	quired By This Function se D (Opt: 1 100)
Select a value for the current input. Select from fields for:— Image: 10 mm Image: 10 mm Image: 1 mm Image: <td>C Series — C Entire Portfolio —</td>	C Series — C Entire Portfolio —
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After adding the Optimizable functions, select the Percent Difference from Moving Average and choose Modify Input. On this page you can adjust the parameters of the range to be optimized for.

Optimizable functions take away the "trial and error" giving genetic algorithms more control of the input parameters as well as the selection of the inputs themselves. For example: Rather than specifying a 10-day Percent Difference from Moving Average you can select a range of *x*-day Percent Difference from Moving Average as an optimizable input and let the computer figure out the specified amount of days.

Choose Next to continue on to the next page of the wizard.

Predict a Value for S&P 100: Select Options	×
Select the general options to use for making this prediction.	
How should this model be trained?	
 Train without optimizing the inputs (quick). 	Optimization Settings
 Briefly optmize the inputs and settings. Enterprise hereitable settings the inputs and settings. 	Training Settings
 Extensively optimize the inputs and settings (slow). 	
─What data should be used to train this model?	
Lest EVenue (Date	Training Range
View or modify the neural network model for t	this prediction
< Back	Next > Cancel Help

The next page is the optimization and training options where you can set the type of optimization (none, brief, or extensive) as well as the amount of training data you would like to use.

Choose "Briefly optimize the inputs and settings" option for the optimization settings and choose "Last 5 Years of Data" from the drop down menu in the section of "What data should be used to train this model?" Choose next and finish to complete the neural network model.

How can I determine which symbol is worth trading?

Here is where the Portfolio View in TradingSolutions really shines. Continuing to operate at the group level of the S&P 100 subgroup we will now create fields that will help analyze our models. With the "Analyze a Signal" option you can easily determine several key factors when choosing if a symbol is worthy for real trading. Some of those key factors are: Percent Gain 1-year, Percent Gain Over Buy/Hold, Number of Trades, Percent Wins, and many more. All of which can be viewed right in the Portfolio View display.

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Ban	Import Data									
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	Create Empty Data Series									
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In the Portfolio View of TradingSolutions right-click on the subgroup named "S&P 100" and choose Add New Field...

Create a Field for S&P	100: Select Type			×					
This wizard will help you to create a new field for the selected data or group of data. New fields can be used to calculate values such as indicators, predictions, and analyses. You can then display these values in your Pottfolio View, chart, or spreadsheet, as well as use them as inputs when creating other fields.									
a+b MACD	C Calculate an indicator or value.	**	O Apply a rule-based entry/exit system.						
	🔾 Generate an optimal signal.	ති	O Combine values with a committee.						
	O Predict or model a value.	•	O Apply a trading solution.						
0	O Generate an alert.								
<u></u>	 Analyze a signal. 		C Store manually entered values.						
		< Back	Next > Cancel Help						

In the Add New Field dialog choose "Analyze a signal" and click Next.

Create Signal Analysis Field	ds for S&P 100: Trading Parameters r the simulated trading of an entry/exit signal.	X						
Entry/Exit Signal:	Model: Optimal Signal (Default Trading Style)							
Trading Style:	Trading style used for default analysis of signal.							
Analysis Range:	Most recent one year (adjusted)							
Select Analysis Fields To 0 Account Equity Percent Gain Buy/Hold Percent Gain Percent Gain Over Buy/H Number of Trades Percent Winning Trades Current Position Current Position Length Current Position Percent 0 Add Selection	Create Analysis Fields Being Created *Gain (Model: Optimal Signal () 1Y, w/CurPos) Hold Gain dd Other Copy An Analysis Remove Selection							
	< Back Finish Cancel He	lp						

In the Trading Parameters dialog box, add the following Analysis Field:

- Percent Gain
 - Entry/Exit Signal: Model: (Optimal Signal: Default Trading Style)
 - Trading Style: Use Default
 - Analysis Range: Most recent one year (adjusted)

Once all of the options are setup as described above, click the "Add Selection" button.

To complete all of the analyses for our neural network model follow the same steps above to also create the following analysis:

- Percent Gain Over Buy/Hold
- Percent Winning Trades
- Number of Trades

Create Signal Analysis Fiel	ds for S&P 100:	Trading Parameters		×				
Specify the parameters for the simulated trading of an entry/exit signal.								
Entry/Exit Signal:	Entry/Exit Signal: Model: Optimal Signal (Default Trading Style)							
Trading Style:	Trading style use	ed for default analysis of signal.	Edit Styles					
Analysis Range:	Most recent one	year (adjusted)	Custom Range					
- Select Analysis Fields To I Account Equity Percent Gain Buy/Hold Percent Gain Percent Gain Over Buy/H Number of Trades Percent Winning Trades Current Position Current Position Length Current Position Percent	Create A	Analysis Fields Being Created %Gain (Model: Optimal Signal () 1Y, v %OverBH (Model: Optimal Signal () 1 %Wins (Model: Optimal Signal () 1Y, Trades (Model: Optimal Signal () 1Y,	w/CurPos) Y, w/CurPos) w/CurPos) w/CurPos)					
Add Selection A	dd Other	Copy An Analysis	Remove Selection					
		< Back Finish	Cancel Help					

When all of the analyses are added, click the Finish button to complete the fields.



Next, to add the signal analysis fields to the Portfolio View display simply right-click on the "S&P 100" subgroup and choose Modify Display Fields...



In the Display Fields dialog, click on the + signs for Other Display Fields and then Signal Analyses. In the Signal Analyses, click and add each one until all of the signal analyses are displayed in the right pane. You can arrange each analysis for your preference by using the Slide Up and Slide Down buttons. When finished adding the specified fields click close to complete this operation.

If TradingSolutions								
<u>File E</u> dit <u>V</u> iew <u>D</u> ata <u>P</u> rocessing Portfolio <u>T</u> ools <u>W</u> indow <u>H</u> elp								
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Portfolio View July 22, 2004 (Thursday)								
End-of-Day Last Updated:	July 21, 2004 (Wednesday)						
My Portfolio								
S&P 100	%Gain (1Y, 1 -3.519 37.409	Sort Values A Sort Values D	scending escending					
AT&T Corp. Alcoa Inc. Allstate Corporation	49.979 5.989 23.489	Modify Display Fields Remove Display Field Modify Field Analyze Correlations						
	7.559 31.819							
	26.409	Portfolio View	Help					
Amgen, Inc.	-6.91% 16.06%	15.87% 14.38%	-2.35% -0.98%					

Finally, right-click on %Gain (1Y, CurPos) analysis fields and choosing "Sort Values Descending", which will sort the values from the most profitable to the least profitable.

Choosing the Trading System that actually works!

A good trading system should be a vital part of one's portfolio so that one can enjoy superior returns with controlled risk. Listed below are a few key statistics you might want to look at in considering whether or not a system will work for you or not.



The Portfolio should still be sorted by %Gain (1Y, CurPos), which will give you a good start off point of which symbols to analyze first.

To view the Signal Analysis panel, right-click on the symbol you wish to analyze and choose Analyze Signals... In the Entry/Exit Signals page you can view the annualized return, annualized trades as well as the percent wins. To see greater statistical information, select the model and click the Analyze button.

Modify Field: Delta Air Lines, Inc.: Model: Optimal Signal (Sharpe Stop Loss) 15-Day								
Overview Prediction Inputs Prediction Model Training Analysis Signal Analysis								
Select from the following options to analyze how the signal would be traded.								
Overview Trading Overview Trading Risk Equity Risk Equity Curve Analysis By Trade Analysis By Bar								
	Signal Anal	ysis Settings		Change	Equity Curve		1	
	Style	Default Trading	g Style v3.0 (S	Sharpe)		ment	my	
	Range	07/31/1998 thr	ough 08/05/20	004	-			
	Comments	Analysis matc	hes optimizatio	on.				
	Profitability	1	Signal		Buy/Hold Bencl		mark	
	Net Profit	~~~	\$24,669.03		-\$9,266.04		n/a	
	Gain/Loss		246.69%		-92.66%		n/a	
	Annualized F	Return	22.96%		-35.22%		n/a	
	Trading Ov	erview	Total	% VVIIIC	Rusk Overvie	w .		
	Overall Trad	es	191	64.9%	Annual Trades		31.8	
	Long Trades	1	8	75.0%	Profit Factor		1.36	
	Short Trades			64.5%	Sharpe (Annua	alized)	0.80	
10000								
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One of the first recommendations is that the Annualized Return be greater than the Buy/Hold of the symbol.

Field: El Paso Corporatior	n: Model: Optimal 9	Signal (Defa			
ew Prediction Inputs Predi	ction Model Training	Analysis Si			
ect from the following options (o analyze how the sig	nal would be			
)verview Trading Overview	Trading Risk Equit	ty Risk Equit			
Win / Loss Ratios		Entry			
Percent Winners	Percent Winners 76.3%				
Profit Factor	3.4	43 Trades			
Avg Win / Avg Loss	122.30	% Limits f			
Maximum Drawdown	-	Conse			
from Trade Entry	-22.87	% Max C			
from Trade High	-24.39	% May. C			
Expectancy Ratings		Fitnes			
Trade Expectancy	% Fitness				
Risk-Adjusted Value	0.3	70			
Annualized Score	21.3	34			

Field: El Paso Corporation: Mo	del: Optimal Signal	(Defa					
ew Prediction Inputs Prediction Model Training An							
ect from the following options to ana	yze how the signal wo	uld be					
verview Trading Overview Trad	ing Risk Equity Risk	Equit					
Trading Overview	Overall	Win					
Number of Trades	38						
Profitability	Overall	Win					
Cumulative	248.54%)					
Average Trade	3 60%	/					
Largest Win/Loss							
Length of Trades	Overall	Win					
Cumulative	310						
Average Length	8						
Shortest	1						
Longest	69						

Another suggested aspect is that the maximum drawdown as a percentage of the total account value does not exceed ½ of the Cumulative Return. To view the overall profitability click on the "Trading Overview" tab in the Signal Analysis page. To view the Maximum Drawdown click on the "Trading Risk" tab in the Signal Analysis page.

Modify Field: Delta Air Lines, Inc.: Model: Optimal Signal (Sharpe Stop Loss) 15-Day									×
Overview Prediction Inputs Prediction Model Training Analysis Signal Analysis									
Se C	Select from the following options to analyze how the signal would be traded. Overview Trading Overview Trading Risk Equity Curve Analysis By Trade Analysis By Bar								
	Signal Anal	- lysis Settings		Change	Equity Cu	IDre			
	Style	Default Trading	g Style v3.0 (S	Sharpe)			many	amel	
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	10								
	Profitability	1	Signal		Buy/Hold		Bencl	Benchmark	
	Net Profit		\$24,669.03			-\$9,266.04		n/a	
	Gain/Loss		246.69%		-92.66%			n/a	
	Annualized I	Return	22,96%		-35.22%			n/a	
	Trading Ou	erniew /	Total	% Mine		Risk Queruie	W		
	Overall Trad	es	191	64.9%		Annual Trades		31.8	
	Long Trades		8	75.0%		Profit Factor		1.36	
	Short Trade:	s	183	64.5%		Sharpe (Annualized) 0.80		0.80	
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There should be a high enough number of trades over the period being back-tested to reduce the chance of the model getting "lucky". We generally recommend that the model produces at least 10 trades over that period.

erview Prediction Select from the follo	Inputs Predi	ction Model to analyze hov	Training Analy v the signal wo	isis Signal Analysis	Ru Trada Ì Ai	oalusis Ru Rar Ì
Signal Analys	is Settings		Change	Equity Curve Analysis	oby Hade A	
Repres	7/31/1008 the	3 SLYIE VO.U (S ough 08/05/00	narpe)		mark	my
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Profitability Signal Buy/Hold Benchmark						
Net Profit		\$24,669.03		-\$9,266.04		n/a
Gain/Loss		246.69%		-92.66%		n/a
Annualized Re	turn		22,96%	-35.22%		n/a
Trading Over	view	Total	% Wins	Risk Overv	iew	
Overall Trades		191	64.9%	Annual Trad	les	31.8
Long Trades		8	75.0%	Profit Factor		1.36
Short Trades		183	64.5%	Sharpe (Ani	nualized)	0.80
			-			

The higher the percent wins the better, but generally speaking anything over 60% is a fairly rounded model. The Overall Percent Wins can be found in the "Overview" tab.

Modify	Field: Delta	Air Lines, Inc	c.: Model: O	ptimal Signa	al (Sharpe Stop Loss) 1	5-D ay		×		
Overv	view Predictio	on Inputs Pred	liction Model	Training Analy	ysis Signal Analysis					
Select from the following options to analyze how the signal would be traded.										
	Overview Tra	ading Overview	Trading Risk	< Equity Risk	k Equity Curve Analysis t	sy Trade Ar	alusis By Bar			
	Signal Anal	ysis Settings		Change	Equity Cupre					
	Style	Default Tradin	g Style v3.0 (S	Sharpe)	Lidaily conce	and	my			
	Range	07/31/1998 th	ough 08/05/20	004		Jr. Was				
	Comments	Analysis mate	hes optimizatio	on.						
			-							
	Profitability	1	Signal Bu		Buy/Hold	Benck	Mark			
	Net Profit		\$24,669.03		-\$9,266.04		n/a			
	Gain/Loss		246.69%		-92.66%		n/a			
	Annualized F	Return	22.96%		-35.22%		n/a			
	Trading Ov	erview	Total	% Wins	Risk Overvie	ew .				
	Overall Trad	es	191	64.9%	Annual Trade	s	31.8			
	Long Trades		8	75.0%	Profit Factor		1.36			
	Short Trades	S	183	64.5%	Sharpe (Annu	ualized)	0.80			
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Lastly, the Equity Curve should be as smooth and linear as possible.

Conclusion

Choosing a trading system that is profitable and accurate is the most vital part of the whole process. Group modeling off an index such as the S&P 100 gives you a wide range of symbols and gives you more possibilities of developing a good model. This approach can be applied again and again to the same group with different indicators, variations of the Optimal Signal, different neural network topologies, and so on.