Algorithmic Trading with MATLAB: Rule Selection

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Previously, we developed a back testing framework to calibrate a simple trading strategy to intraday data. In this demo we'll use extend the approach to three signals: MA, RSI, and Williams %R.

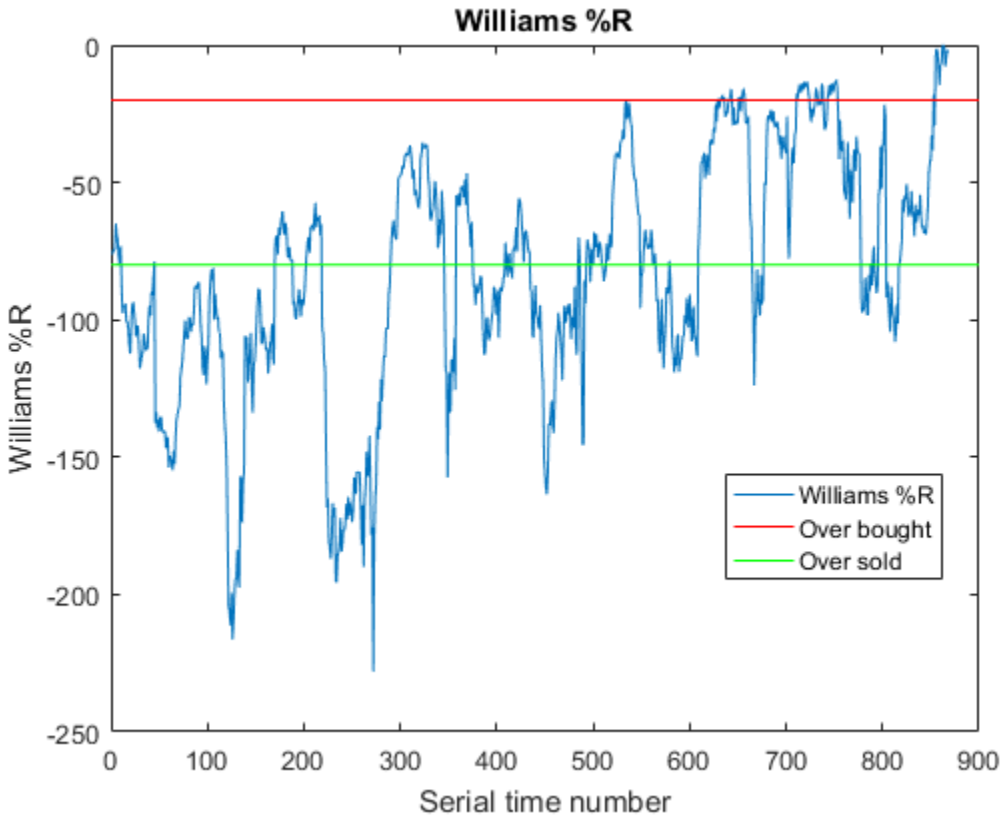
Load data

```
step = 153; % minute intervals
annualScaling = sqrt(250*60*7/step);

cost = 0.01;

% Rather than forcing the customer to define and populate a database,
 we
% will instead read from a prepared data file.  If you wish, you may
 write
% the data from this file to a database of your choosing and adapt the
% GETMINUTEDATAFROMDB command to connect to and read from it.

% LCO = getMinuteDataFromDB('LCO');
c    = yahoo;
Data = fetch(c,'CSCO',{'High','Low','Adj Close'},now-5*252,now,'d');
Dates = flipud(datetime(Data(:,1),'ConvertFrom','datenum'));
Prices = flipud(Data(:,2:end));

% load oilData
% LCO = double(brent);
% clearvars -except LCO step annualScaling cost

% Prices = dsample(Prices(:,2:4), step);
```

Williams %R

By adapting the existing moving average strategy's code, we can make other trading strategies based on, for example, the Relative Strength Index and Williams %R. The key here is re-use: we only need to change a few lines of code to change from one strategy to the next. We can take a look at this indicator with, say, a 50-day window:

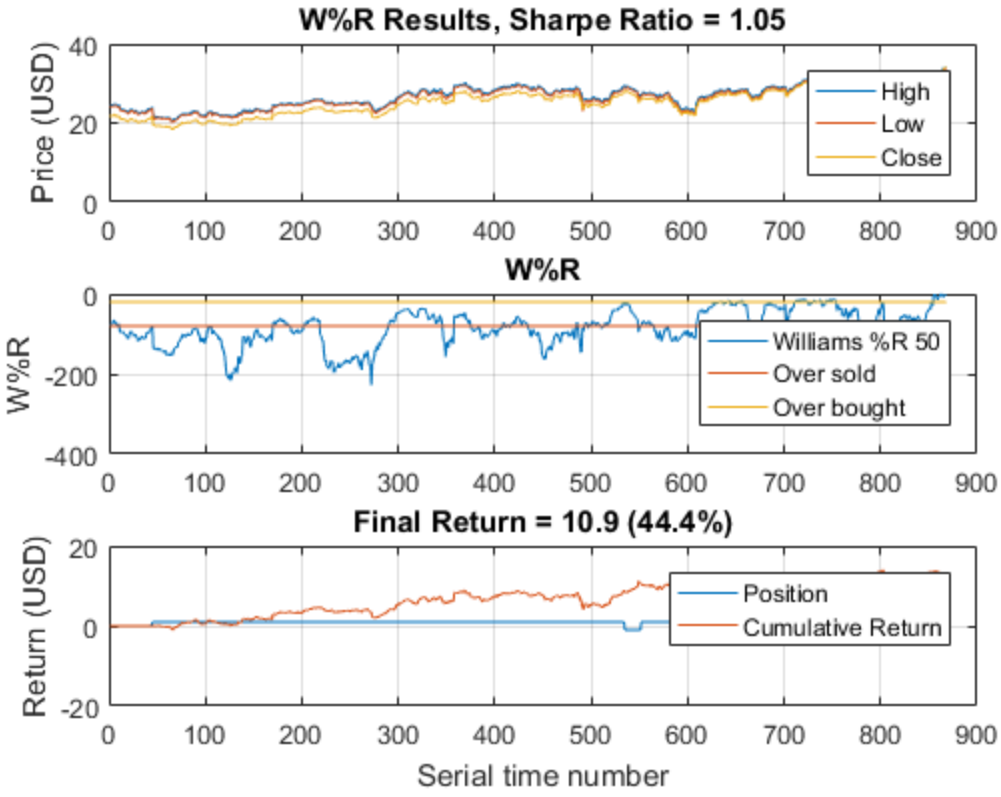
```
w = willpctr(Prices, 50);

indicatorChartWPR(w)
```



Williams %R trading strategy

Generate a trading signal each time we cross certain thresholds (up is a buy, down is a sell). We will set our trading thresholds at -20% and -80% and vary only the size of the window, but of course we can have all three of these be free parameters.

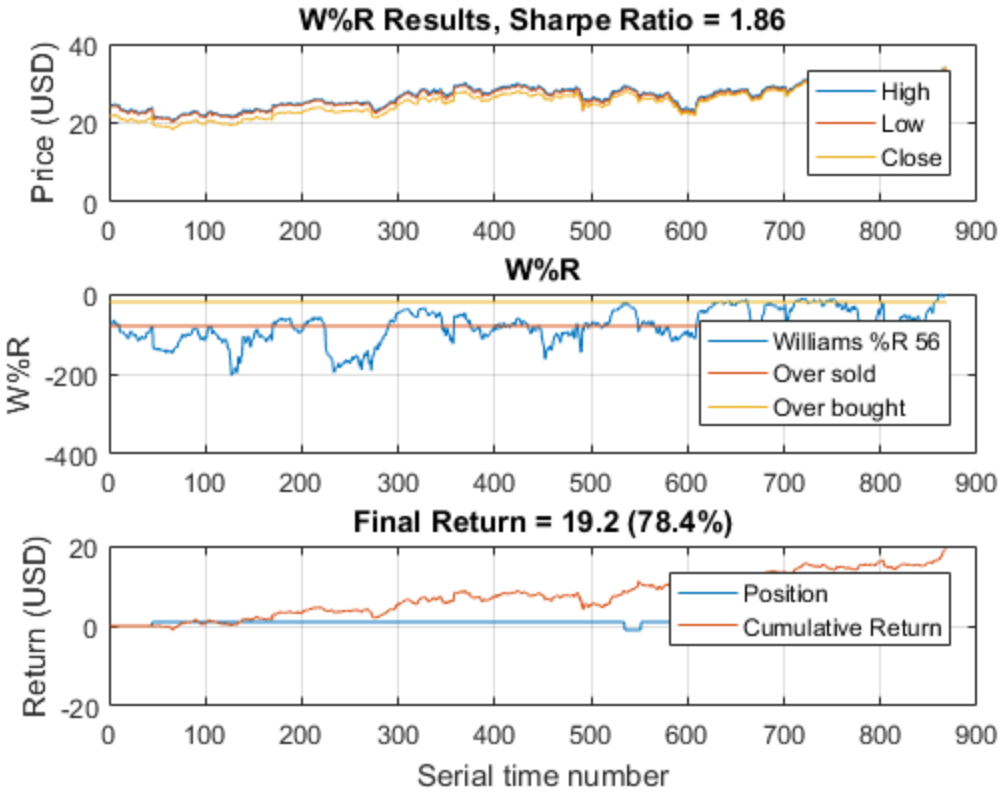
```
wpr(Prices,50,annualScaling,cost)
```



WPR performance

There is no reason to prefer the window parameter of 50 over other possibilities; let us sweep across many values to identify the optimal parameter setting.

```
range = {4:4:500};
wfun = @(x) wprFun(x,Prices,annualScaling,cost);

tic
[maxSharpe,param,sh] = parameterSweep(wfun,range);
toc

wpr(Prices,param,annualScaling,cost)

Elapsed time is 1.099849 seconds.
```



Generate trading signals

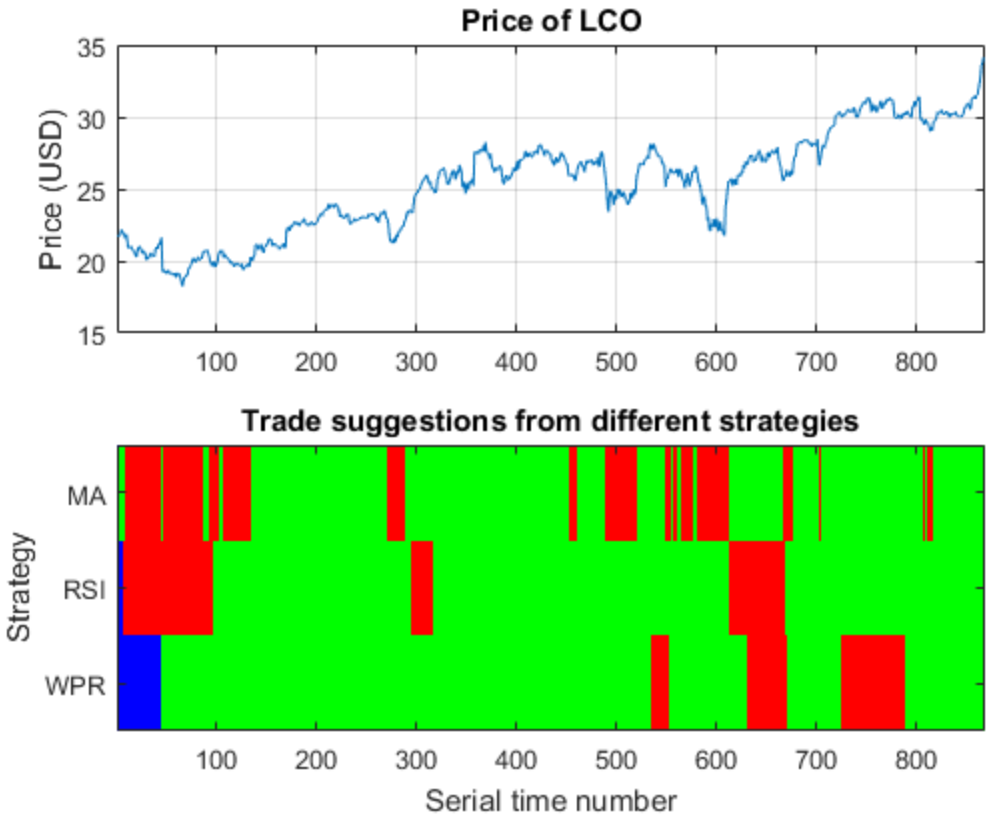
We will now generate three distinct trading signals based on a moving average, the Williams %R described above, and a Relative Strength Index. The parameters for each model have already been determined independently; we could just as easily determine the optimal set of parameters as an ensemble, if we wish.

```
%N = 25; M = 650; thresh = 80; P = 400; Q = 34; R = 10;
N = 1; M = 129; P = 22; Q = 14; R = 24; thresh = 80;
sma = leadlag(Prices(:,end), N, M, annualScaling, cost);
srs = rsi(Prices(:,end), [P Q], thresh, annualScaling, cost);
swr = wpr(Prices, param, annualScaling, cost);

signals = [sma srs swr];
names = {'MA','RSI','WPR'};
```

Trading signals

Plot the 'state' of the market represented by the signals. On the bottom plot, green is a long position and red is a short position.

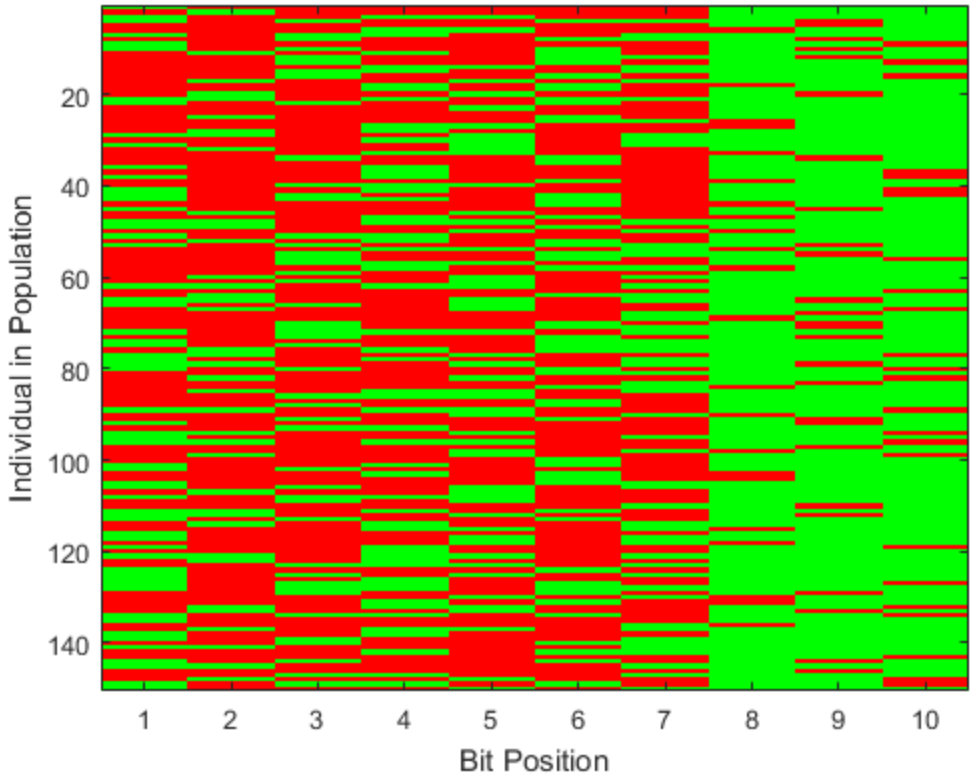
```
indicatorChartALL(Prices(:,end), names, signals)
```



Generate initial population for Genetic Algorithm

Generate initial population for signals

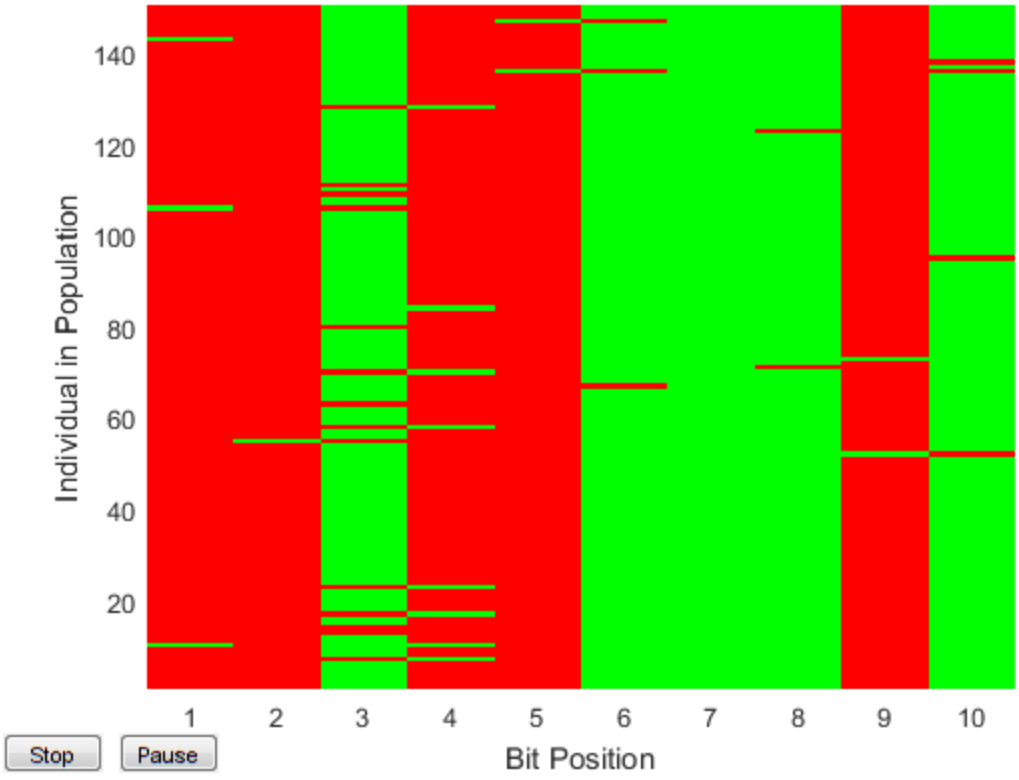
```
I = size(signals,2);
pop = initializePopulation(I);

close all
plotRules(1,pop);

% Objective function definition
obj = @(pop) fitness(pop,signals,Prices(:,end),annualScaling,cost);
```



Solve With Genetic Algorithm

Find best trading rule and maximum Sharpe ratio (min -Sharpe ratio)

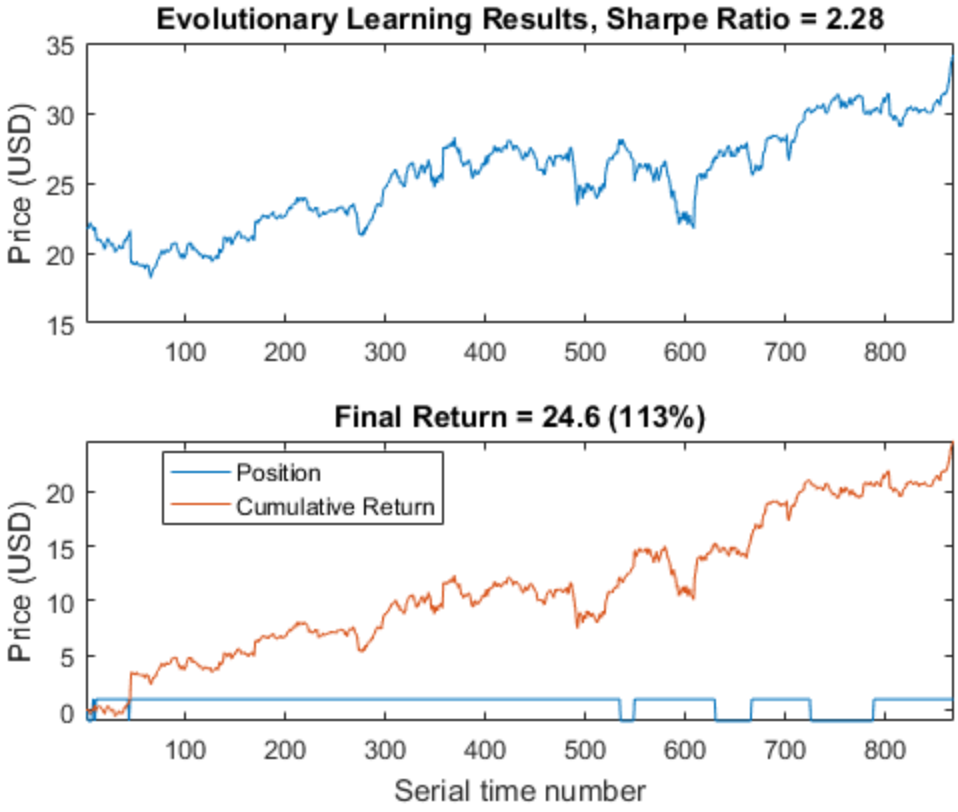
```
options = gaoptimset('PopulationType','bitstring',...
                     'PopulationSize',size(pop,1),...
                     'InitialPopulation',pop,...
                     'CrossoverFcn', @crossover,...
                     'MutationFcn', @mutation,...
                     'PlotFcns', @plotRules,...
                     'Vectorized','on');

best = ga(obj,size(pop,2),[],[],[],[],[],[],[],options)

Optimization terminated: average change in the fitness value less than
 options.FunctionTolerance.

best =

     0     0     1     0     0     1     1     1     0     1
```



Evaluate Best Performer

Evaluate the objective at the best value, and flip the sign convention for the optimal Sharpe ratio.

```
[minSh,s,r] = obj(best);
sh = -minSh;

ruleChartALL(Prices, sh, s, r)
```



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