Piecewise segmentation for financial data

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Abstract

Time series data is characterised as large in data size, high dimensionality and update continuously. Moreover, the time series data is always considered as a whole instead of individual numerical fields. As a consequence, in order to analyse and mine time series data, segmentation and dimensionality reduction are essential. In particular, in the following pages we are going to collect and study some segmentation methods, applied in particular to stock market data. Stock time series has its own characteristics over other time series.

1 Introduction

The tasks of segmentation ad dimensionality reduction are fundamental to allow many time series analysis and mining tasks. In particular, our objective is to find significant trends in stock market data, which is inherently large in size, noisy and continuously updated.

In this paper we are going first to list some of the main research papers where dimensionality reduction and piecewise segmentation are studied, in section 2. Then, in section 3 we are going to present some implementations of the methods.

2 Methods

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3 Implementations

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3.1 Turning points in Matlab

Here we are presenting our implementation of the method to find *turning points*, as it was presented in

The method is developed and tested over `CSV` files downloaded from Yahoo! Finance website[1]. Should another source be used, basic adaptations may be necessary, mostly in the handling of temporal data (i.e., dates).

After importing the aforementioned `CSV` file (we suggest to use the graphical interface provided by Matlab itself), the user should issue the command in listing 1, in order to convert dates into a tractable format, generate the matrix over which the function works and compute the results.

```
t = datenum(Date, 'yyyy-mm-dd');  % converts dates to tractable format
M = [t Close];  % generates the matrix
y = TurningPoints(M);  % computes the results
```

Listing 1: User commands.

Actually, `TurningPoints()` function is implemented as shown in listing 2. The first part of the function implements what was presented in XXX,

[1] `http://finance.yahoo.com/market-overview/`

whereas the second part performs some operations in order to present in an appropriate way the results.

```
function y = TurningPoints( x )

%% Boundary elements hanlding
y(1,:) = x(1,:);  % first element of the time series
y(length(x),:) = x(length(x),:);  % last element of the time series

%% Core
for i=2:(length(x)-1)

    prec = x(i-1,2);
    curr = x(i,2);
    succ = x(i+1,2);

    condMIN = curr <= prec && curr <= succ;  % curr: local minimum
    condMAX = curr >= prec && curr >= succ;  % curr: local maximum
    if condMIN || condMAX
        y(i,:) = x(i,:);
    end

end

%% Cleaning of the result
Z = y(:,2)==0;
y(Z,:) = [];  % deletes rows according to Z

%% Final operations and presentation
totItems = length(x(:,1));
delItems = totItems - length (y(:,1));
fprintf ('Deleted %d elements out of %d.\n', delItems, totItems)

plot( datetime ( y(:,1), 'ConvertFrom', 'datenum'), y(:,2), ...
      datetime ( x(:,1), 'ConvertFrom', 'datenum'), x(:,2));

end
```

Listing 2: `TurningPoints()` function

We also performed some tests, to guarantee the proper functioning of the implemented algorithm. Weekly stock market data from A2A (`A2A.MI`) over the whole 2015 was used as source. The result of the processing is in fig. 1.

3.2 Other implementations

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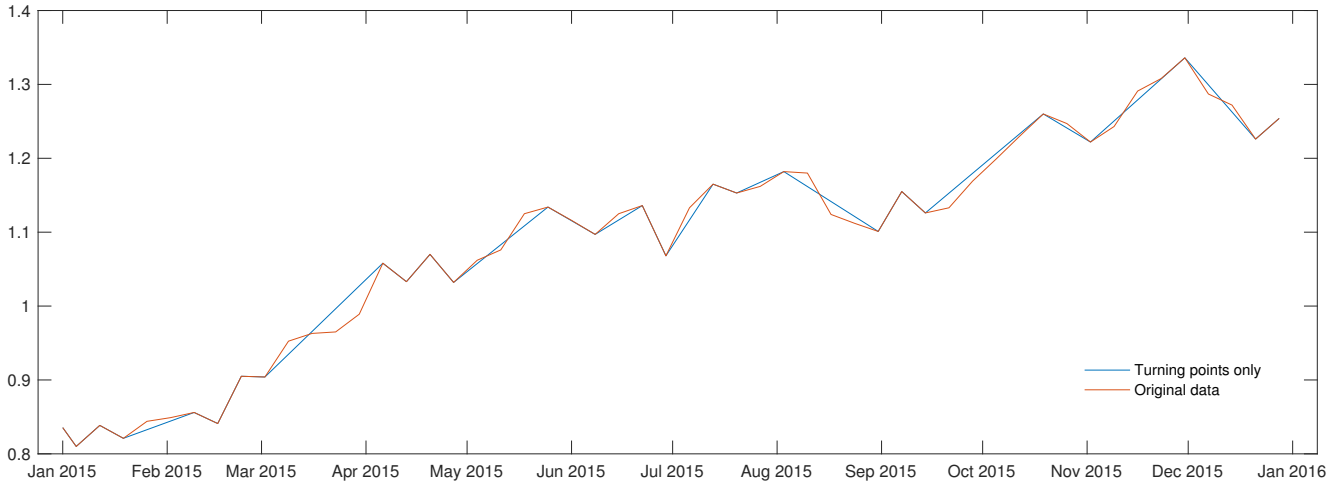

Figure 1: `A2A.MI` weekly 2015

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