Abstract (Xiaodian Xie)

In statistics, signal processing, and mathematical finance, a time series is a sequence of data points, measured typically at successive time points spaced at uniform time intervals. Examples of time series are the daily closing value of the Dow Jones index or the hourly flow volume of a river.

Pre-Processing is the first step of data mining. And my tutorial will start with a pre-processing routine for time-series data; including outlier removal, linear trend observation etc.

Then the tutorial will be followed by two main approaches of time series mining—the signal processing approach as well as the model based approach. For signal processing approach, known as the technical analysis in the finance industry mainly use the technique of filtering, smoothing as well as normalizing in order to follow the trend of cycle. Methods including moving average, MACD and haar wavelet analysis will be introduced.

Other signal processing techniques including fisher transform, CG oscillator and relative vigor index will be touched upon but not in detail, as their operations are similar—perform smoothing, normalizing and filtering to time series data sets.

Model based time series mining, also known as quantitative analysis in the finance industry is another powerful tool. Models including autoregressive, extensible markov model as well as the famous GARCH model will be presented as well as some back-testing performance evaluation.

Model tuning and calibration is also very important for data mining and knowledge discovery. In this tutorial, AR model was used for EMM model calibration; and the performance result was compared with the AR model result.

Two discussion sessions have been included for students to interact and better understand the subject matter. One is for the comparison of signal processing approach with the model based approach toward time series mining; the other one is about the performance of AR-EMM tuned model.

Future research directions will be introduced as well, for instance the SABR model and the black-shole model. Most technical indicators as well as statistical models introduced will have R implementation examples included in the tutorial, for the purpose of better illustration and re-produce.