Time series

In this assignment we will three time series, a modified interest rate I and two prices of correlated financial assets Y_1 and Y_2. Our goal is to predict the vector $(Y_1(t).Y_2(t))$ based on the values of I, Y_1 and Y_2 at previous times. Loading `Time series.Rdata` into `R` will give you four objects, three of which are `I, Y1` and `Y2`, each with 1200 time points. Use the first 1000 time steps as a training set, and use the last 200 as a test set, to evaluate your results. Also, you will have the object `Ifuture`, which is only used in (d).

(a) Fit two random forests, one predicting for Y_1 and one for Y_2. Choose as covariates values of the three time series at previous times (for example up to 4 time steps back). Be careful when predicting at time t, not to use any of the values at that time t, since that would be cheating! Evaluate your predictors on the test set.

(b) Now use two random forests to predict $Y_1(t) - Y_1(t-1)$ and $Y_2(t) - Y_2(t-1)$, so the increments of the time series. Then use this prediction to predict $(Y_1(t), Y_2(t))$ when you know all the values up to $t-1$, and compare the performance of this predictor with the predictor in (a). For the next parts, use the predictor you like best!

(c) Use three random forests to estimate the covariate structure of the predictor you chose in (b). Evaluate this estimate on the test set!

(d) Use your results to make 100 future scenario's of 200 time steps for (Y_1, Y_2), based on the interests given in `Ifuture`. Use normal fluctuations.