Universal Estimation of Directed Information

Download

**DI Code Release**: This matlab package includes two main functions **'compute_DI_MI.m', 'ctwprob.m'**, several auxiliary functions, four examples programs, and a **'userguide.pdf'** document. The four example programs correspond to four examples in the Section V of paper 'Universal Estimation of Directed Information'.

Installation and Execution

1. Download **DI_code_release.rar** from the link above.
2. Extract the archive to a folder on your machine.
3. In Matlab, add to your path the folder where you extracted **DI_code_release.rar**.
4. Call the function 'compute_DI_MI' with the following format:

   [MI, DI, rev_DI]=compute_DI_MI(X,Y,Nx,D,alg,shift_ratio,prob,flag)

   1. **'X'** and **'Y'** are input sequences with the same length;
   2. **'Nx'** is the size of the alphabet of process X, with the assumption that processes X and Y have the same size of alphabets;
   3. **'D'** is the maximum depth of the context tree used in basic CTW method;
   4. **'alg'** is a string that indicates which directed information estimator in paper 'Universal Estimation of Directed Information' is used, namely **'E1', 'E2', 'E3', 'E4'**.
   5. **'prob'** is a struct containing probability assignments generated by function 'ctwprob' in case users want to avoid running CTW many times on the same data sequences;
   6. **'flag'** indicates whether **'compute_DI_MI'** calculates the CTW probability assignment. If **'flag' = 0**, then the input parameter **'prob'** taken as invalid, function 'compute_DI_MI' calculates CTW probability assignment itself; else the input parameter **'prob'** is valid and 'compute_DI_MI' doesn't compute CTW probability assignment but directly take if from input parameter;
   7. **'MI'** is a vector of estimated mutual information $I(X^n;Y^n)$ for different n;
   8. **'DI'** is a vector of estimated directed information $I(X^n \text{-->} Y^n)$ for different n;
   9. **'rev_DI'** is a vector of estimated reverse directed information $I(Y^{n-1} \text{-->} X^n)$ for different n;
   10. **'shift_ratio'** determines what proportion of the estimated directed information will be discarded when generating the outputs. For example, if **'shift_ratio'** = 0.3, and the length of
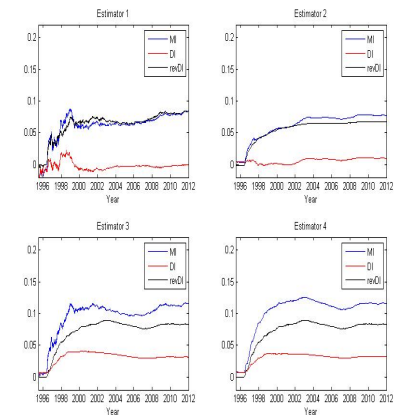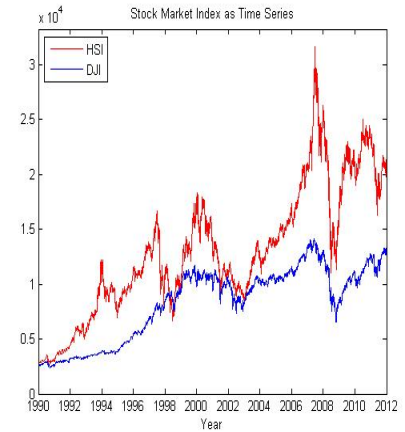
outputs. For example, if **SKIP_RATIO** = 0.3, and the length of input process X is 1000, then output **'MI'** will have length of (1-0.3)*1000 = 700, and it only gives the estimated $I(X^n; Y^n)$ for n not smaller than 300, so do **'DI'** and **'rev_DI'**.

5. Call the function 'ctwprob' with the following format:

   [prob] = ctwprob(X,Y,Nx,D)

   where **'X','Y','Nx','D'** are of the same meanings as shown above.

Universal Estimation of Directed Information