COVARIANCE FILTERING USING NEURAL NETWORKS

The goal of this project is to use an AI based method to estimate the true covariance matrix of a d dimensional stochastic process. This task is often referred to as "covariance shrinkage" and a lot of literature has been written on this topic, whose mathematical foundations lie in random matrix theory (RMT). The problem is the following : having a set of d time series, and N observations, if the ratio T/d is not very large compared to 1, the classical covariance estimator does not perform well.
The goal here is to train a neural network (NN) to actually recover the true covariance from the empirical covariance.
(1) Generate a training set of correlation matrices
(2) Generate a training set of individual variances processes (Garch like)
(3) Simulate the multivariate process
(4) Compute the empirical correlation/covariance (might be good to first compute the individual variances to normalize and then compute the approximate correlation.)
(5) obtain a data set of pairs (p; e) where p (resp. e) is the vector of the population (resp. empirical) correlation matrix.
(6) train a neural network on this data set
(7) use this to compute a global mean variance ptf on simulated / empirical data, and compare with other methods.

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