Quantile Variational Bayes (QVB): **R** code instruction

We use function *quantile_networkvec_bic(..)* for establishing network from a given $n \times P$ dimensional data matrix with P covariates/nodes.

Function input For the function input, we use: standardized data matrix (X), vector of quantile grids (thetavec), initial selection probability, gridvec (default value is 0.5).

Ex: *quantile_networkvec_bic(X,thetavec,gridvec)*

Function Ouput: *quantile_networkvec_bic* outputs a $P \times (m+1)P$ dimensional matrix, where first P columns give the adjacency matrix of the fitted graph. Last mP columns give the neighborhood selection matrices for m quantiles stacked together in columns.

Function Details/description: The function *quantile_networkvec_bic*() uses a *quantile _network*() which performs the Quantile based Variational Bayes(QVB) selection for each quantile and select the neighbors of each node. Functions are given in the file 'function.txt'.

The function *quantile_networkvec_bic(..)* prints the bic value, and the average residual over all node and quantiles for the quantile loss after the fit. To avoid the local maxima in variational Bayes algorithm, comparing

bic scores and select the one with minimum *bic* score gives an adhoc way to select the initial selection probability.

Implementation Examples: Examples are given in the file ‘ example.txt’, where quantile based graph constructions for hub like network structure (hub-graphs), banded inverse covariance structure (band graph), and a non Gaussian case have been shown.