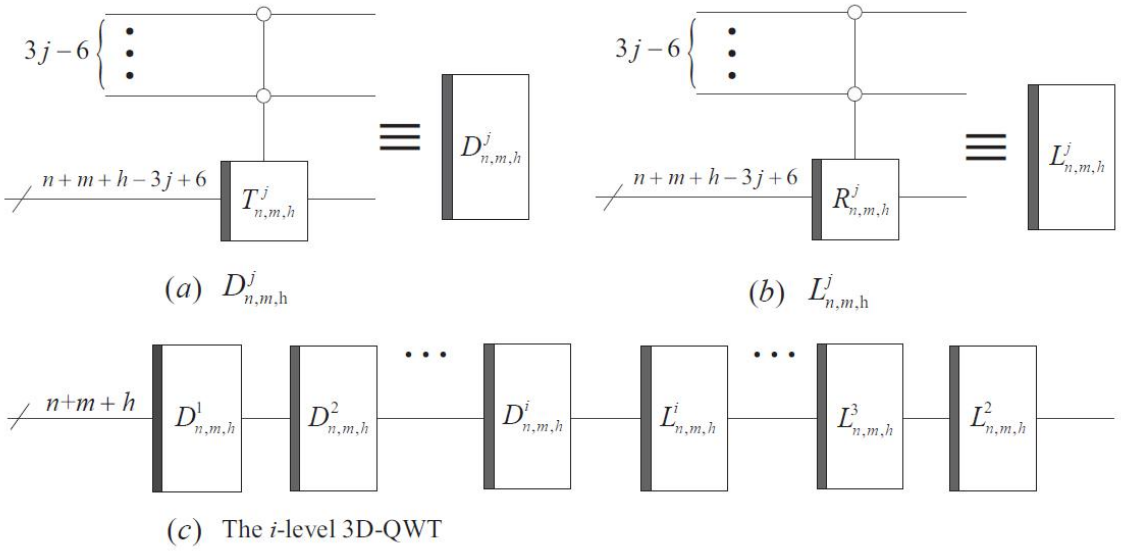
Three-dimensional quantum wavelet transform

Haisheng LI, Guiqiong LI, Haiying XIA

Frontiers of Computer Science, manuscript ID:10.1007/s11704-022-1639-y

Problems & Ideas

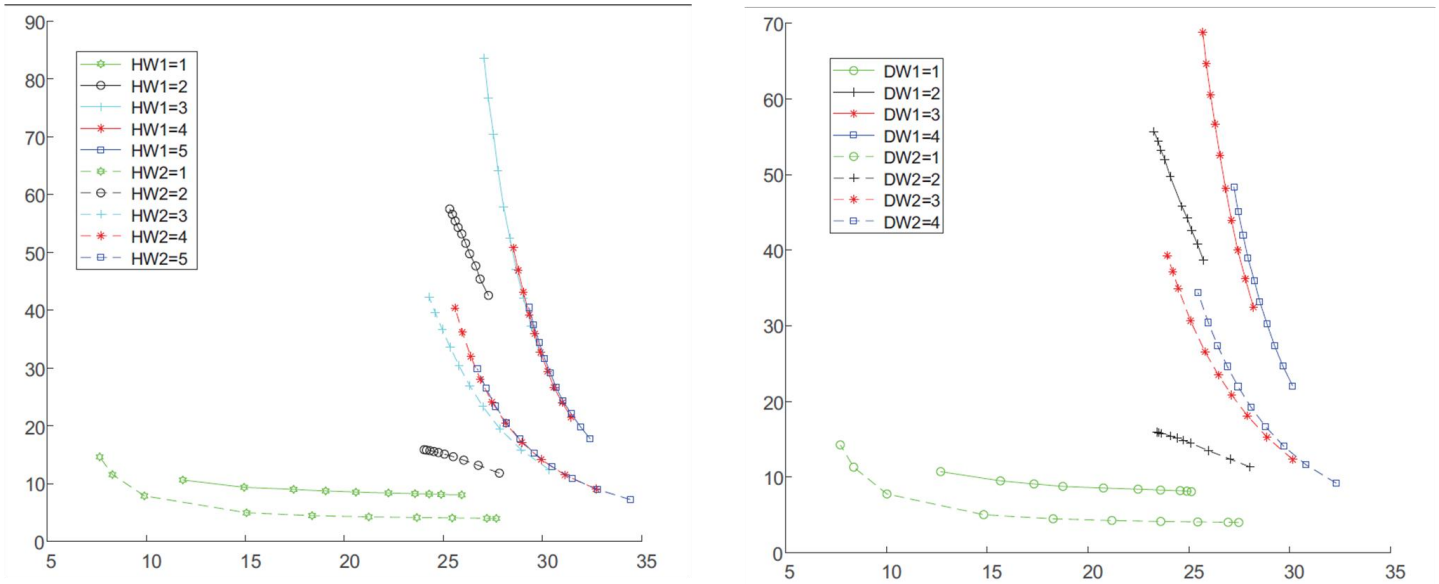
- Problems of quantum wavelet transform:
  - Wavelet transform is being widely used in the field of information processing. One-dimension and two-dimension quantum wavelet transforms have been investigated. However, three-dimensional quantum wavelet transforms have not been reported.
- Ideas: A multi-level three-dimensional quantum wavelet transform theory implements the wavelet transform for quantum videos.



Circuits for the *i*-level 3D-QWT.

Main Contributions

- Contributions:
  - We present the multi-level 3D-HQWT and 3D-DQWT, and design their implementation circuits.
  - We propose quantum image compression for the multi-level 3D-HQWT and 3D-D4QWT. Simulations results reveal that the proposed wavelet transforms have better compression performance for quantum videos than two-dimension quantum wavelet transforms.



Comparison results of quantum video compressions are given in the above figure. Left: comparisons of QVC-3D-HQWT and QIC2DHQWT. HW1=*i* and HW2=*i* denote the *i*-level 3D-HQWT and 2D-HQWT; Right: comparisons of QVC-3D-D4QWT and QIC2DD4QWT. DW1=k and DW2=k denote the k-level 3D-D4QWT and 2D-D4QWT.