Quantum Central Limit Theorem and SH Testing in Discrete Quantum Walk

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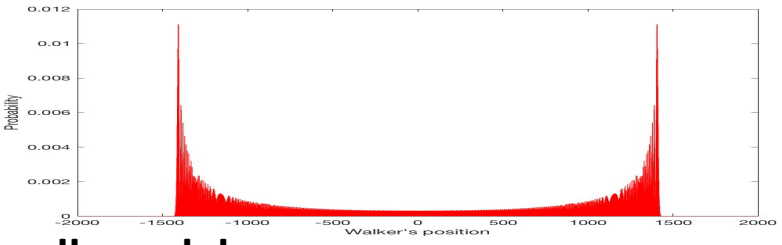
Abstract: This paper proposes a quantum central limit theorem (QCLT) for discrete quantum walks (QW). The statistical hypothesis testing on standard or decayed walker based on QCLT is studied.

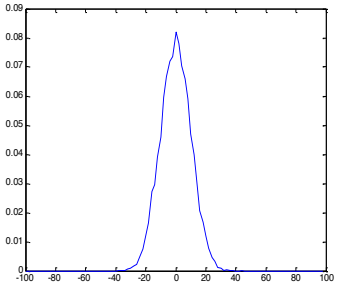
1. Probability of QW

Probability distribution of Hadamard quantum walk after 1000 steps with the initial state ψ_0



2. Probability distribution of the decayed walk model

Decayed quantum walks on an infinite, translationally invariant linear graph



3. Statistical hypothesis testing for decayed quantum walk

Sample data set#	Expectation	Variance	$E(X) \pm \sigma$	$E(X) \pm 2\sigma$	$E(X) \pm 3\sigma$
1	0.03	10.8	7,239	9,633	9,982
2	0.15	10.3	6,944	9,589	9,976
3	0.07	11.2	7,531	9,674	9,999
4	-0.04	9.5	7,216	9,561	9,976
5	-0.14	9.7	7,003	9,573	9,981
6	-0.06	9.8	7,227	9,612	9,983
7	-0.15	11.0	6,891	9,731	9,991
8	-0.08	10.3	7,211	9,685	9,985
9	0.01	10.7	7,017	9,706	9,990
10	0.10	9.8	7,038	9,603	9,985

The calculation of 10 parts of the sample data

4. Conclusion

The decoherence quantum walk data is simulated by software. The experiments on actual open quantum system and the decoherence will be conducted.

References:

R. Feynman and A. Hibbs. Quantum Mechanics and Path Integrals. McGraw, 1965.

W. Gosper. Decision procedure for indefinite hypergeometric summation. Proc. NAS. v. 75, p. 40-42, 1978.