A Novel Quantum Belief Entropy for Uncertainty Measure in Complex Evidence Theory

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Abstract

In this paper, a new quantum representation of CBBA is proposed. In addition, a novel quantum belief entropy is proposed to measure the uncertainty of CBBA in complex evidence theory.

Keywords: Complex Evidence Theory, Uncertainty Measurement, Quantum Interference, Quantum Belief Entropy.

1. The proposed QB entropy

Definition 1. The quantum form of $P_k$ in $M$ is represented as

$$|P_i⟩ = \sum_{e \in P_i} z_e |e⟩,$$

(1)

A FOD can be represented through an associated density matrix $ρ = \sum_i p_i ρ_i$ where $ρ_i = |P_i⟩ ⟨P_i|.$

Definition 2. QB entropy of CBBA is defined as follows:

$$E_Q(M) = S(ρ) + \sum_{i \neq j} QI_{ij},$$

(2)

$$S(ρ) = \sum_{θ_k \in Θ} |P(θ_k) log_2 P(θ_k)|.$$

(3)
where $P(\theta_k) = \text{Tr}(\mathcal{M}_{\theta_k}^+ \mathcal{M}_{\theta_k} \rho)$.

Specifically, $QI_{ij}$ in QB entropy is defined by the following formula:

$$QI_{ij} = 2 |P(\theta_i)||P(\theta_j)| \cos \alpha,$$

(4)

Specifically, QB entropy can be used to deal with decision making problems with multiple sources of complex evidence, etc.

References

