A Fractal Belief KL Divergence

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Abstract

In this paper, a novel symmetric fractal-based belief KL divergence is proposed to more appropriately measure the conflict between BPAs.

\textit{Keywords:} Dempster–Shafer evidence theory; Fractal Belief KL divergence; Conflict management; Multi-source data fusion; Classification;

1. The proposed method

\textbf{Definition.} (Symmetric fractal-based belief KL divergence measure)

Let \( m_1 \) and \( m_2 \) be two belief functions in the frame of discernment \( \Theta \). The symmetric fractal-based belief KL divergence \( FBD_{SKL}(m_1, m_2) \) is defined as:

\[
FBD_{SKL}(m_1, m_2) = \frac{1}{2} \sum_{i=1}^{2^n-1} \left[ m_{F_1}(H_i) \log \frac{m_{F_1}(H_i)}{\sqrt{m_{F_1}(H_i) \times m_{F_2}(H_i)}} + m_{F_2}(H_i) \log \frac{m_{F_2}(H_i)}{\sqrt{m_{F_2}(H_i) \times m_{F_1}(H_i)}} \right],
\]

where \( m_{F_k}(H_i) \) is based on fractal process and is defined as:

\[
m_{F_k}(H_i) = \sum_{H_i \subseteq G_i} \frac{m_k(G_i)}{2^{|G_i|} - 1},
\]

where \( H_i, G_i \subseteq \Theta \).

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