5th school on Belief Functions and Their Applications

La Certosa di Pontignano, Siena, Italy

27-31 October 2019



First Name:
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1 Information correction and fusion using belief functions [Frédéric Pichon]

Please answer the following questions by selecting the appropriate answer, or providing detailed answer as requested.

1.1 Let X be a variable with possible values in $\mathcal{X} = \{a, g, h\}$. Let m_1 and m_2 be two simple mass functions on $\mathcal{X}$ such that:

$$m_1(\{a, g\}) = 0.7, m_1(\mathcal{X}) = 0.3$$
$$m_2(\{a, h\}) = 0.6, m_2(\mathcal{X}) = 0.4$$

Let m be the mass function on $\mathcal{X}$ resulting from the conjunctive combination of m_1 and m_2, with dependence structure characterized by parameter σ such that $\sigma = 0.1$. m is defined by

- ☐ $m(\{a\}) = 0.52, m(\{a, g\}) = 0.08, m(\{a, h\}) = 0.18, m(\mathcal{X}) = 0.22$
- ☑ $m(\{a\}) = 0.52, m(\{a, h\}) = 0.08, m(\{a, g\}) = 0.18, m(\mathcal{X}) = 0.22$
- ☐ $m(\{a\}) = 0.42, m(\{a, g\}) = 0.18, m(\{a, h\}) = 0.28, m(\mathcal{X}) = 0.12$

1.2 Let X be a variable with possible values in $\mathcal{X} = \{a, g, h\}$. Let m_S be an uncertain piece of information about the actual value of X provided by a source S, such that:

$$m_S(\{a, g\}) = 0.8, m_S(\{h\}) = 0.2$$

Assuming that S is relevant with probability 0.9 and truthful with probability 0.6, and that its relevance is independent from its truthfulness, the induced knowledge about X is represented by the mass function m such that

- ☐ $m(\{a\}) = 0.252, m(\{g\}) = 0.252, m(\{h\}) = 0.396, m(\mathcal{X}) = 0.1$

- ☐ $m(\{a,g\}) = 0.72, m(\{g\}) = 0.18, m(\mathcal{X}) = 0.1$
- ☑ $m(\{a,g\}) = 0.504, m(\{h\}) = 0.396, m(\mathcal{X}) = 0.1$

1.3 Let $\odot$ denote the combination rule defined for any two mass functions m_1 and m_2 by

$$(m_1 \odot m_2)(A) = \sum_{(B\cap\overline{C})\cup(\overline{B}\cap C)\cup(\overline{B}\cap\overline{C})=A} m_1(B)m_2(C), \quad \forall A \subseteq \mathcal{X}.$$

Which set of assumptions on the sources providing m_1 and m_2 induce this rule ?

- ☑ the sources are independent, relevant, and at least one of them is not truthful
- ☐ the sources are independent, truthful, and at least one of them is not relevant