



# Precedent-based reasoning with incomplete information for human-in-the-loop decision support

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## Abstract

We define and study the notions of stability and relevance for precedent-based reasoning, focusing on Horty's result model of precedential constraint. According to this model, precedents constrain the possible outcomes for a focus case, which is a yet undecided case, where precedents and the focus case are compared on their characteristics (called dimensions). In this paper, we refer to the enforced outcome for the focus case as its *justification* status. In contrast to earlier work, we do not assume that all dimension values of the focus case or the precedent cases have been established with certainty: rather, each dimension is assigned a set of possible values. We define a focus case as *stable* if its justification status is the same for every choice of the possible values. For focus cases that are not stable, we study the task of identifying *relevance*: which possible values should be excluded to make the focus case stable? In addition, we introduce the notion of *possibility* to verify if a user can assign an outcome to an unstable focus case without making the case base of precedents inconsistent. We show how the tasks of identifying justification, stability, relevance and possibility can be applied for human-in-the-loop decision support. Finally, we discuss the computational complexity of these tasks and provide efficient algorithms.

**Keywords** Precedential constraint · Decision support · Complexity · Algorithms

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# Reasoning With Incomplete Information

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