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Approximate Lazy Evaluation of Influence Diagrams

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Abstract. Influence Diagrams are a tool used to represent and solve decision problems under uncertainty. One of the most efficient exact methods used to evaluate Influence Diagrams is Lazy Evaluation. This paper proposes the use of trees for representing potentials involved in an Influence Diagram in order to obtain an approximate Lazy Evaluation of decision problems. This method will allow to evaluate complex decision problems that are not evaluable with exact methods due to their computational cost. The experimental work compares the efficiency and goodness of the approximate solutions obtained using different kind of trees.

Keywords: Influence Diagram, Approximate computation, Lazy Evaluation, Deterministic algorithms, Context-specific independencies.

1 Introduction

An Influence Diagram (ID) [1] is a Probabilistic Graphical Model used for representing and evaluating decision problems under uncertainty. IDs can encode the independence relations between variables in a way that avoids an exponential growth of the representation. Several approaches have been proposed to evaluate IDs such as *Variable Elimination* [2,3] and *Arc Reversal* [4]. However, if the problem is too complex the application of these methods may become infeasible due to the high requirement of resources (time and memory). A technique that improves the efficiency of the evaluation is Lazy Evaluation (LE) [5]. The basic idea is to maintain a decomposition of the potentials and to postpone computation for as long as possible. Some other deterministic methods use alternative representations for the potentials, such as *trees* [6,7]. This representation supports the exploitation of *context-specific independencies* [8]. That is, identical values of the potential can be grouped. Moreover, if potentials are too large,

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