

RECOGNIZING PICTURE LANGUAGES BY REDUCTIONS TO STRING LANGUAGES

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ABSTRACT

By using a stateless deterministic transducer with a window of size 3-by-3 that employs a simple scanning strategy, we reduce a given picture language to a string language. Then we utilize two types of deterministic automata to accept this string language, finite-state acceptors and finite-state acceptors with translucent letters. In this way, we obtain two classes of picture languages for which the membership problems are easily solvable. We investigate the expressive capacity of these classes as well as their closure properties.

Keywords: picture language, reduction, finite-state acceptor, translucent letter

1. Introduction

In the literature, one finds many different types of grammars and automata for defining classes of picture languages (for a survey, see, e. g., [9]). Essentially, two methods for recognizing picture languages have been studied. On the one hand, various types of grammars and automata have been defined for generating or accepting languages of rectangular pictures that are obtained from well-known classes of grammars and automata for string languages. For example, regular and context-free matrix grammars for generating pictures have been proposed by G. and R. Siromoney and K. Krithivasan in [38] as generalizations of regular and context-free (string) grammars, the four-way finite-state acceptor of M. Blum and C. Hewitt [3] is a generalization of the two-way finite-state acceptor for strings, the Sgraffito automaton introduced and studied by the current authors in cooperation with D. Průša in [34, 35, 36] is a generalization of the Hennie machine of [10], and the deterministic two-dimensional three-way ordered restarting automaton of [20] and the deterministic two-dimensional extended two-way ordered restarting automaton of [31] are extensions of the restarting automaton of [11] to the setting of picture languages.