Weighted Hexagonal Picture Automata

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Abstract. Two-dimensional picture languages generated by grammars or recognized by automata have been studied since 1970s for the complications arising in the framework of pattern recognition and image analysis. Rani Siromoney and her co-authors (1970) studied two-dimensional picture languages with applications.
K. Inoue and I. Nakamura (1977) introduced two-dimensional on-line tessellation automata (2OTA). D. Giammarresi and her co-authors worked on two-dimensional picture languages and investigated connections to Tiling systems, Domino systems (1997) by defining the family REC of *recognizable picture languages* and 2OTA. The family REC is robust and has been characterized by many different devices, for instance it has been shown that a set of pictures is recognized by a finite tiling system if and only if it is definable in existential monadic second-order logic (1996).
Bozapalidis and Grammatikopoulou (2005) introduced weighted picture automata (WPA). WPA operates (the unweighted version of a WPA characterizes precisely REC) in a natural way on pictures and whose transitions carry weights; the weights are taken as elements from a given commutative semiring. Ina Fichtner (2007, 2011) has investigated formal power series on pictures and proved the equivalence between recognizable picture languages and EMSO-definable picture languages in quantitative setting.
Two-dimensional hexagonal arrays on a triangular grid can be viewed or treated as the two-dimensional representations of three-dimensional rectangular parallelopipeds. R. Siromoney (1976) worked on hexagonal arrays and hexagonal patterns that are found in literature on picture processing and scene analysis. K. G. Subramanian and his co-authors (2005) defined local and hexagonal recognizable picture languages. D. G. Thomas and his co-authors (2007) defined three directions on-line tessellation automata (3OTA) to recognize hexagonal picture languages. In this paper, we introduce weighted three directions OTA (W3OTA) and study formal power series on hexagonal picture languages.