

On Continuity Preserving Weighted Finite Transducers

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Weighted finite automata (WFA) can be used as devices for computing real functions from $[0, 1]$ to \mathbb{R} by reading infinite words. Properties of a special type of WFA called level automata were examined in [1] and [2]. Sufficient and necessary conditions for the function f_A computed by WFA A to be continuous were given, as well as a characterization for continuity of the 2-state level automaton.

The generalized k -tape WFAs are called weighted finite transducers (WFT) in the case $k = 2$. WFTs make versatile tools for image manipulation and function transformation in general, and they have been studied mostly with the first-mentioned aspect in mind (cf. [3]). An application of a k -state WFT M to a l -state WFA A gives another WFA $M(A) = B$ with kl states, which then computes some function $f_B : [0, 1] \rightarrow \mathbb{R}$.

In this work, we further discuss the continuity of WFA, and introduce the concept of *continuity preserving* property of WFT. The transformation induced by WFT M is continuity preserving, if continuity of f_A implies continuity of f_B . We show how to find 2-state WFT that are continuity preserving with respect to level automata. We also give examples as well as characterizations of WFT with this property.

References

- [1] Culik II and Karhumäki: Finite automata computing real functions, *SIAM J. Comput.* 23, 789-814, 1994.
- [2] Derencourt, Karhumäki, Latteux, and Terlutte: On continuous functions computed by finite automata, *Theor. Inform. and Appl.* 28, 387-403, 1994.
- [3] Culik II and Kari: Finite state transformation of images, *Computer and Graphics* 20, 125-135, 1996.