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Survey: Weighted extended top-down tree transducers. Part I—Basics and expressive power. (English summary)

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The author begins the paper by recalling some history, saying that tree automata theory and computational linguistics were tightly intertwined at their inception, and in particular, top-down tree transducers were devised for applications in natural language processing (NLP). “However, this tight connection was lost early on and the two fields went separate ways. NLP research focused on the algorithmic and scaling issues, whereas the tree automata theory research focused on refining and extending models of automata and transducers.” It is noted that the following devices were investigated in this line of research: bottom-up tree transducers and attributed tree transducers; macro tree transducers and modular tree transducers, tree bimorphisms; and various models with synchronization.

“Due to the technical difficulties and algorithmic and scaling complexities encountered with tree automata, computational linguists had reverted to finite-state string transducers [...], which are simple to understand, easy to train even on large amounts of data, and have nice theoretical properties. However, finite-state string transducers are not expressive enough for many applications in natural language processing [...]. This realization recently sparked a revival of tree automata in NLP research.” It has been argued that the classical top-down tree transducers are generally inadequate for linguistic tasks without the use of copying and deletion. “In general, copying causes many operations to become intractable or impossible, which severely limits even the use of copying top-down tree transducers.” A promising alternative, as claimed in the paper, is the extended top-down tree transducer. “In this survey we provide an in-depth review of some of the results for weighted extended top-down tree transducers. In fact, we assume that the reader has some fundamental understanding of unweighted tree automata theory. The goal is to present the common definitions and provide an overview of the various techniques used in the weighted setting.”

{For Part II see [A. Maletti, *Fund. Inform.* **112** (2011), no. 2-3, 239–261; [MR2918608](#)].}

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