

Title: Bounded Nondeterminism and Alternation in Parameterized Complexity Theory

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Abstract: We give machine characterisations and logical descriptions of a number of parameterized complexity classes. The focus of our attention is the class $W[P]$, which we characterise as the class of all parameterized problems decidable by a nondeterministic fixed-parameter tractable algorithm whose use of nondeterminism is bounded in terms of the parameter. We give similar characterisations for $AW[P]$, the "alternating version of $W[P]$ ", and various other parameterized complexity classes.

We also give logical characterisations of the classes $W[P]$ and $AW[P]$ in terms of fragments of least fixed-point logic, thereby putting these two classes into a uniform framework that we have developed in earlier work.

Furthermore, we investigate the relation between alternation and space in parameterized complexity theory. In this context, we prove that the COMPACT TURING MACHINE COMPUTATION problem, shown to be hard for the class $AW[SAT]$ by Abrahamson, Downey and Fellows (1995), is complete for the class uniform-XNL.

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