Weighted, Circular and Semi-Algebraic Proofs (Abstract Reprint)

Ilario Bonacina[1] , **Maria Luisa Bonet**[1] and **Jordi Levy**[2]

[1] UPC Universitat Politecnica de Catalunya
[2] Artificial Intelligence Research Institute (IIIA)
bonacina@cs.upc.edu, bonet@cs.upc.edu, levy@iiia.csic.es

Abstract Reprint. This is an abstract reprint of a journal by [Bonacina *et al.*, 2024].

Abstract

In recent years there has been an increasing interest in studying proof systems stronger than Resolution, with the aim of building more efficient SAT solvers based on them. In defining these proof systems, we try to find a balance between the power of the proof system (the size of the proofs required to refute a formula) and the difficulty of finding the proofs.

In this paper we consider the proof systems circular Resolution, Sherali-Adams, Nullstellensatz and Weighted Resolution and we study their relative power from a theoretical perspective. We prove that circular Resolution, Sherali-Adams and Weighted Resolution are polynomially equivalent proof systems. We also prove that Nullstellensatz is polynomially equivalent to a restricted version of Weighted Resolution. The equivalences carry on also for versions of the systems where the coefficients/weights are expressed in unary.

The practical interest in these systems comes from the fact that they admit efficient algorithms to find proofs in case these have small width/degree.

References

[Bonacina *et al.*, 2024] Ilario Bonacina, Maria Luisa Bonet, and Jordi Levy. Weighted, circular and semi-algebraic proofs. *J. Artif. Intell. Res.*, 79:447–482, 2024.