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The Boolean Satisfiability Problem: an overview of solving techniques and applications

Abstract

The Boolean Satisfiability problem (SAT) is one of the most studied problem in artificial intelligence which asks if there can be an assignment of truth values to the variables of a given propositional logic formula so as to make the whole formula evaluates to true. As the first problem to have been shown NP-Complete by Stephen Cook in 1971, SAT has attracted many researchers both at the theoretical and practical level. The proof of the NP-Completeness of SAT has laid the foundation of the famous theory of NP-completeness and is at the heart of the unsolved millennium prize problem P =? NP.

Thanks to many years of cumulative effort, researchers have made persistent improvements to SAT technology to the point that nowadays, the best solvers are routinely used to solve extremely large instances with millions of variables and clauses. This impressive progress has encouraged the use of SAT solvers in solving many other problems of practical interest in various areas of Computer Science including software and hardware verification, cryptanalysis, scheduling etc.

In this talk, we aim to present the Boolean Satisfiability Problem, solving techniques as well as how SAT technology is used in practice for solving other problems.

Keywords: SAT, SAT solvers, SAT applications, CNF encoding

Short biography

Clémentin TAYOU DJAMEGNI obtained the DEA, "Doctorat de Troisième Cycle" and "Doctorat d'Etat" degrees all in computer science from the University of Yaoundé I, Cameroon, in 1995, 1997 and 2005 respectively. In 1996, he joined the Faculty of Sciences (FS) of the University of Dschang (Uds), Cameroon, as an assistant lecturer at the beginning of the creation the "licence" cycle in mathematics and computer science. From December 2007 to March 2018, he was the head of the Department of Mathematics and Computer Science, FS, Uds. In this position, he initiated and coordinated the design and implementation of the first master and doctoral programs in computer science and mathematics at the University of Dschang. He also launched the creation of the first research laboratory in computer science in the same university, the LIFA laboratory later renamed URIFIA. Before his current position as a Full Professor at the Uds, he help visiting research/faculty positions at IRISA, Faculté des Sciences Jean Perrin, IUT-Lens, CRIL, and IRIT, all in France, and UQAM. Since March 2018, he is the head of Department of Computer Engineering of the Fotso Victor University Institute of Technology (IUT-FV), Uds. His research focuses on Artificial Intelligence, Cloud Computing, Data Mining, Sensor Networks and Security. He has supervised eight PhD, published more than twenty journal articles and won three international scientific prizes at SAT Competitions SAT (Competition 2018, SAT Competition 2019 and SAT Race 2020), all in Computer Science.