Fast and Efficient Bit-Level Precision Tuning

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Résumé

In this talk, we introduce a new technique for precision tuning. This problem consists of finding the least data types for numerical values such that the result of the computation satisfies some accuracy requirement. State of the art techniques for precision tuning use a try and fail approach. They change the data types of some variables of the program and evaluate the accuracy of the result. Depending on what is obtained, they change more or less data types and repeat the process. Our technique is radically different. Based on semantic equations, we generate an Integer Linear Problem (ILP) from the program source code. Basically, this is done by reasoning on the most significant bit and the number of significant bits of the values which are integer quantities. The integer solution to this problem, computed in polynomial time by a classical linear programming solver, gives the optimal data types at the bit level. A finer set of semantic equations is also proposed which does not reduce directly to an ILP problem. So we use policy iteration to find the solution. Both techniques have been implemented in our tool named **POP**, short for **P**recision **OP**timizer. Results on on the effect of **POP** in term of mixed-precision tuning compared to the state-of-the-art tools are discussed.

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