Algebraic methods in Computer Vision

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Many problems in computer vision require efficient algorithms for solving systems of non-linear polynomial equations. Good examples are problems of estimating relative or absolute pose of a camera. These problems can be formulated as minimal problems, i.e. they can be solved from a minimal number of input data and lead to solving systems of polynomial equations with a finite number of solutions. Often, these minimal problems are non-trivial and general algorithms for solving systems of polynomial equations are not efficient for them. Therefore, special algorithms have to be designed to achieve numerical robustness and computational efficiency.

In this talk I will discuss a method for creating such efficient solvers of systems of polynomial equations. The presented method is based on Groebner bases and may result in high speed solvers. I will also introduce an automatic generator of Groebner basis solvers which could be used even by non-experts to efficiently solve polynomial problems. Finally, I will demonstrate the usefulness of our approach by presenting new, efficient and numerically stable solutions to several important problems from computer vision and robotics.