The Stability of Geometric Inference in Location Determination

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Abstract

Geometric inference is widely used in computer vision, but very little attention has been given to the question of how geometric properties affect the resulting errors in the inferences made. This thesis addresses the problem of the stability of geometric inference in determining locations with a goal of being able to predict type and magnitude of the errors which occur and to determine on what basis to make geometric inferences which will minimize error. It is shown that the amount of the error occurring in a localization process using angular measurements to features depends heavily on which features are used, that the amount of the error occurring in such a localization process is not a function of the number of features used, that it is possible to develop simple heuristic functions for choosing features for localization which will significantly decrease error in that localization, that it is possible to decrease localization error in a particular direction, and that, if features have been identified but knowledge of left to right order in the view is unknown, simple steps can be taken to aid in determining that ordering. This knowledge is applied in the domain of robot navigation in outdoor, unstructured environments.

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