Localization Bias Correction in \( n \)-Dimensional Space

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1. Introduction

1.1 The Importance of Localization

Localization - determining the geographical position of targets using some form of measurements related to their position - is an old problem coming in many variations, that has been widely investigated in many applications.

- Disaster Management
- Military
- Scientific Research
- Industry
- Health Care

Generally, localization results are imprecise due to:
- Environment: noise, non line of sight
- Hardware: range or angle measuring devices
- Localization algorithms

Enhancement Algorithms
- Geometric Constraints
- Error Control Mechanisms
- Bias Correction Methods

2. Methods and Simulation Results

2.1 Definition of Bias

The equation set \( \Theta = f(x) \) is over-determined. There will be no solution (estimates of the target position) of the equation set linking target position to measurements when \( \Theta \) is noisy.

We cannot use the property of Jacobians:

To solve these problems we adopt a method based on the least squares idea.

2.2 Formulate the Bias in \( n \)-Dimensional Space with \( N \) sensors

2.2.1 \( N = n \) Situation

The proposed method formulates the bias analytically with an arbitrary number of sensors. The proposed bias-correction method can be used in \( n \)-dimensional space and is independent of the type of measurements.

2.2.2 \( N = n + 1 \) Situation

The proposed bias-correction method is independent of the type of measurements, and can be used with a range measurement device. The proposed method can correct the bias very well.

3. Conclusion

- A novel generic bias-correction method is proposed.
- The proposed method formulates the bias analytically in an easy way by mixing Taylor series and Jacobian matrices.
- The proposed bias-correction method can be used in \( n \)-dimensional space with an arbitrary number of sensors.
- The proposed bias-correction method is independent of the type of measurements.