EFFICIENT LOCALIZATION METHODS
FOR A POINT SOURCE AND RIGID BODY

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ABSTRACT

Localization has been a very important and fundamental research topic in GPS, radar, sonar, and especially in mobile communications and sensor networks over the past few years.

When only the position is interested, we introduce the range weighting into suboptimal squared distance measurements based least squares. It remains the computational advantage and is shown to achieve Cramer-Rao lower bound performance, and the resultant bias is also studied. We also conduct similar range weighting for squared range difference least squares under TDOA measurements and for the scenario where the sensor positions are not exactly known.

When the orientation in addition to position is interested, such as a rigid body, we can collect some measurements between the fixed sensors on the object and the anchors at fixed locations. Under distance measurements, we develop two-step procedure to improve the accuracy, the first step obtains the coarse solution that is better than existing closed-form method, and the second step refines obtained solution. In addition, we study the moving rigid body using additional Doppler measurements.

We also conduct similar position and orientation study using AOA (direction) measurements, and solve the 3D scenario that is seldom considered before. Furthermore, we extend it to the scenario where there is more than one AOA sensor on-board, which either increases the robustness and accuracy or decreases the minimum requirement on number of landmarks.