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Harnessing Non-Uniform Transmit Power Levels for Improved Sequence Based Localization

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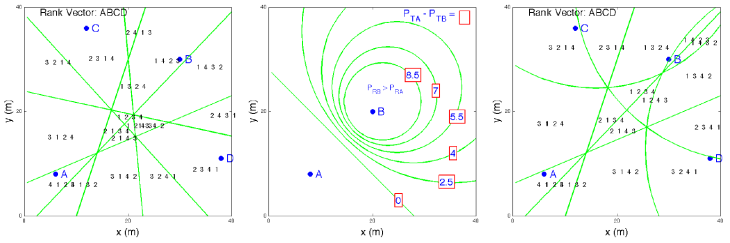
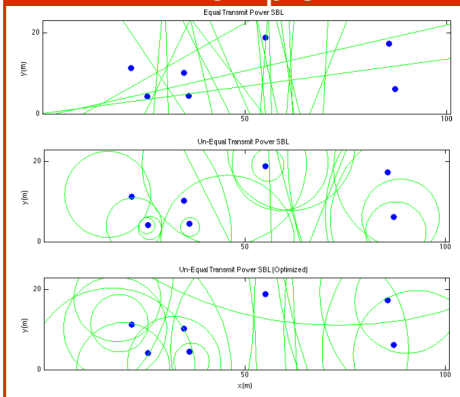
Introduction



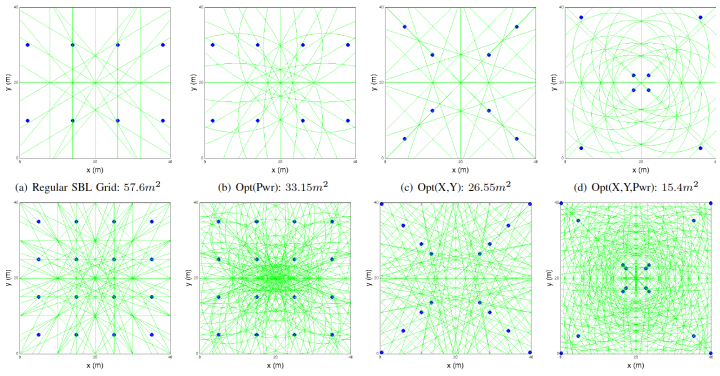
- Sequence Based Localization (SBL) assumes equal transmit power.
- SBL works by dividing the entire area into faces by equal RSS lines. The largest of these faces dictates the worse case localization error.
- We can redistribute these faces by either changing the node locations or their transmit power.
- For Non-Uniform transmit power Equal RSS lines transform into Equal RSS circles.

Example



USC Cinema School Implementation

Non-Uniform SBL



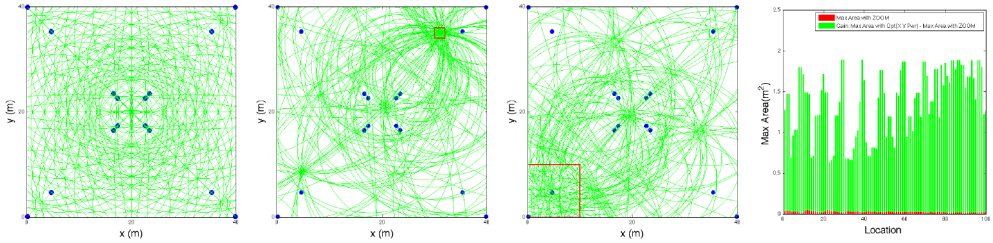
(a) Regular SBL Grid: $57.6m^2$ (b) Opt(Pwr): $33.15m^2$ (c) Opt(X,Y): $26.55m^2$ (d) Opt(X,Y,Pwr): $15.4m^2$

(e) Regular SBL Grid: $16.9m^2$ (f) Opt(Pwr): $3.9m^2$ (g) Opt(X,Y): $3.6m^2$ (h) Opt(X,Y,Pwr): $1.9m^2$

Observations

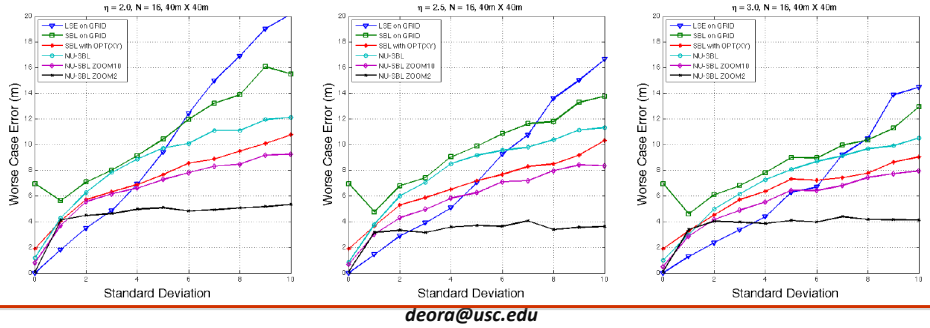
- Beacon locations and power are symmetric with respect to the center of the plane in case of OPT(XY) and OPT(XYPwr).
- Optimized Beacon locations tend to be on X = Y and X = -Y if center of the plane is considered the origin.
- Our simulations suggest first optimizing for location assuming equal powers, and then optimizing for power doesn't yield any further improvement.

NU-SBL with ZOOM



(a) Max-Area: $1.9m^2$ (b) Max-Area: $0.025m^2$ (c) Max-Area: $0.45m^2$ (d) Max-Area: $0.05m^2$

Results



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