CSE 494/598  3/8/05

Proj. Ass 2: Extended

- Due 3/15 - Email Code to
  valliappan@asu.edu
  preferred: valliappan.anamalai@gmail.com

- Demo: 3/22


3rd H.A.:

Proj.

P.A. 4
P.A. 5-

Theoretical

H.A. 4
H.A. 5-
WSN for Target Detection, Classification & Tracking (cont.)

Sensor Selection:

Metrics:
1. Orientation Invariant: The sensor can operate regardless of azimuth and zenith orientation.
2. No Special Packaging
3. Reasonable Signal Processing Requirements
4. Established
5. Long Range
6. NLOS
7. Co-locatable
8. Passive Operation
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Appr. detection of Sol., Human Being, Person, Vehicle.

\[ Radar \rightarrow \text{Mas} \rightarrow \text{Mas} \rightarrow \text{Mas} \]
How to use distributed sensors to detect targets?  

\[ \text{SNR} \geq \text{threshold} \]

Influence field of Soldier

How to decide the boundary of Influence Field?

What is the difference between I.F. of different targets?  
- size, shape

Sensor Field

Influence Field of Vehicle
How to use the notion of I.E. in target detection, classification & tracking?

Detection: based on

1. # of sensors which "detect"?
2. Is this based on some assumption?

Sensor Fusion:

person: radar \& \neg mag.

soldier: radar \& mag \& \left( \hat{f} < \hat{x} \right)

vehicle: radar \& mag \& \left( \hat{f} > \hat{x} \right)

Sensor 1 Info \rightarrow Fuse them \rightarrow Sensor 2 Info

Radar

Location, speed, (Velocity), Size?

\hat{f} : estimated influence field
\hat{x} : decision boundary
Architecture

- When detect "I detected" Base Station.

Some assumption about mean sensor density. — uniform sensor density in the sensor field.

Communication is unreliable? B.S. may hear or may not hear.
Suppose the probability of a message delivery from a sensor to B.S is \( p \).

\[ A : \text{area of I.F.} \]
\[ d : \text{density} \]
\[ A \cdot d \cdot \# \text{sensor which detect} \]

How many readings out of \( A \cdot d \) readings will reach B.S? (speaking probabilistically)

\[ = A \cdot d \cdot p \quad 0 \leq p \leq 1 \]

\[ 10 \text{ sq.m} \]
\[ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \]
\[ 5 \text{-node sq.m} \]

In reality, \( p \) is unknown.
Probability $p$ depends on the density $d$.

- Quoc
- Ling, Su, Yan
- ? Ahmed
- ? Vern
- Gianni Tridib
- Dan

Bell Curve Mathematical Model

- Normal
- Gaussian

(same channel)

finite time to deliver all messages

Spatial reuse

Fixed latency

Upper bound

How to validate?
interval width depends upon
1) how tightly nodes are time synchronized
2) variability in sensitivity of sensors
3) Speed of the object

What does this imply for designing detection algorithm?

"# of sensor which detected the event" should be computed over a "time window". How wide should this time window be?