Object Tracking and Selective Attention in a Bat-Inspired Echolocation System

Sairina Mirchandani and Stephanie Doctor
Mentor: Dr. Timothy Horiuchi
Motivation

- Bats’ echolocating abilities coveted for man-made flying agents
- Typical air-coupled sonar devices cannot precisely locate an object
Setup

- 3 sonar transducers, 40 kHz
- Mounted on rotational head controlled by computer through Pololu® servo
Pinger Data
Radial Basis Function Learning

Cloud size = 1 standard deviation
System Performance

![Error vs Target Angle Graph](image)
Tracking a Target
Attention

Collect data for targets in view

Merge looks

Calculate entropy & get saliencies of targets

Update saliency map

Move to highest saliency
Attention

Collect data for targets in view

Merge looks

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Move to highest saliency
Attention

- Collect data for targets in view
- Merge looks
- Calculate entropy & get saliencies of targets
- Update saliency map
- Move to highest saliency

- If an object is seen again its certainty should go up
- Multiply and renormalize the output distributions

Ping 1

Ping 4

Ping 8
Attention

Collect data for targets in view

Merge looks

Calculate entropy & get saliencies of targets

Update saliency map

Move to highest saliency

Entropy = \( -\sum p(x) \log p(x) \) \(^{(1)}\)

Saliency(x) = Entropy \times p(x)

Attention

Collect data for targets in view

Merge looks

Calculate entropy & get saliencies of targets

Update saliency map

Move to highest saliency

Unobserved angles rise slowly

Saliency Map
Attention

Collect data for targets in view

Merge looks

Calculate entropy & get saliencies of targets

Update saliency map

Move to highest saliency

Saliency Map

Head will move here next
Conclusion

- A biological approach is beneficial
- System achieved resolution of 5° (error = ±6°)

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