



# SYNC or Swim

## A Particle Model of the Interaction within Fish Schools

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Tarleton State University

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# Motivation



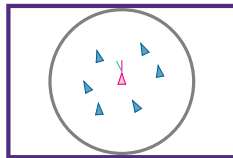


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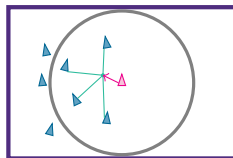
- **Alignment**





Our model represents each fish adhering to the following three rules:

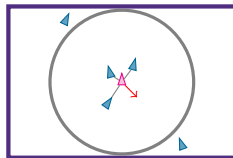
- **Alignment**
- **Cohesion**





Our model represents each fish adhering to the following three rules:

- **Alignment**
- **Cohesion**
- **Separation**





- Lagrangian Algorithm



- Metric distance model



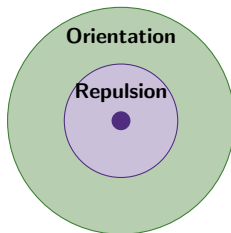


- Metric distance model



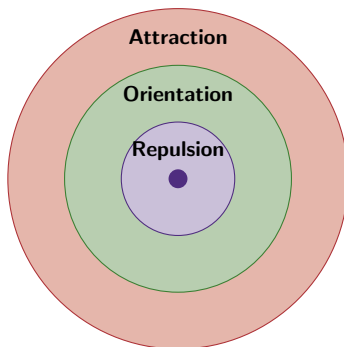


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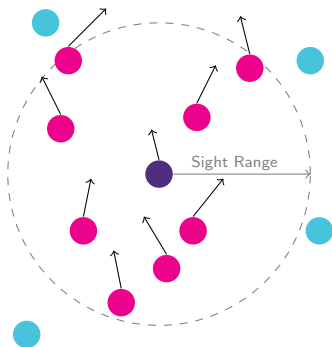




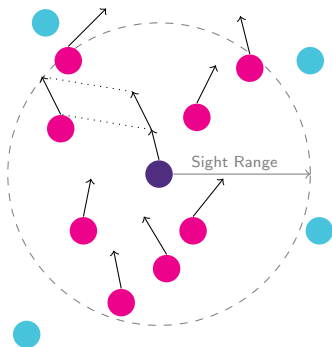
- Metric distance model



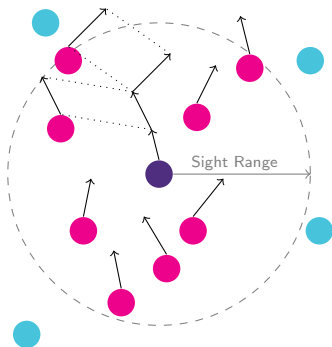
# Directional Alignment of Fish



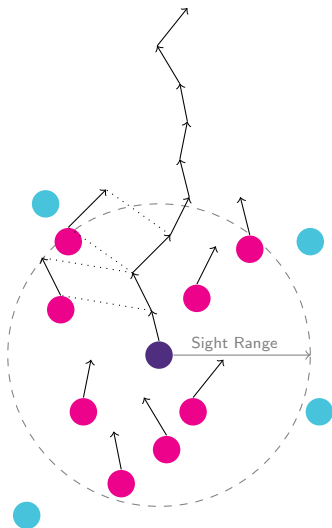
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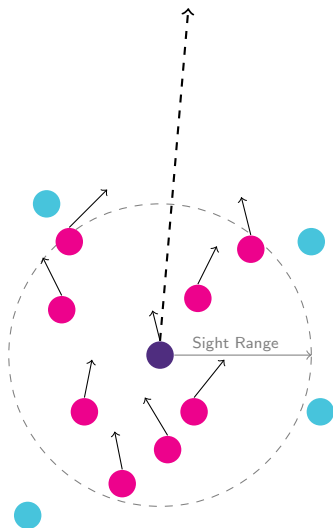
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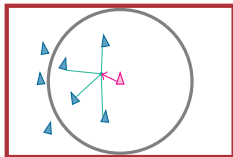
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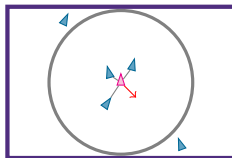
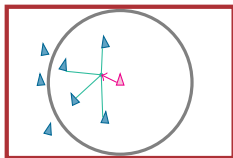




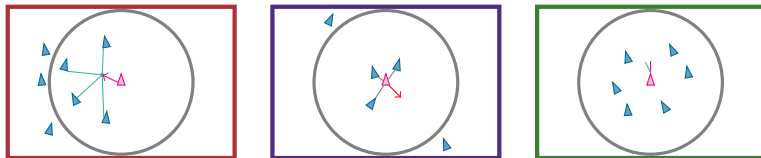
$$F_{i_N} = \sum_{j=1}^N \left( \right. \tag{1}$$



$$F_{iN} = \sum_{j=1}^N \left( W_a \left( c_a \frac{p_j - p_i}{d^2} \right) \right) \quad (1)$$



$$F_{iN} = \sum_{j=1}^N \left( W_a \left( c_a \frac{p_j - p_i}{d^2} - c_r \frac{p_j - p_i}{d^4} \right) \right) \quad (1)$$



$$F_{i_N} = \sum_{j=1}^N \left( W_a \left( c_a \frac{p_j - p_i}{d^2} - c_r \frac{p_j - p_i}{d^4} \right) + W_d \left( \frac{v_j}{\|p_i - p_j\|} \right) \right) \quad (1)$$

