SHEEPDOG DRIVEN ALGORITHM FOR SHEEP HERD TRANSPORT

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Collective behaviour course
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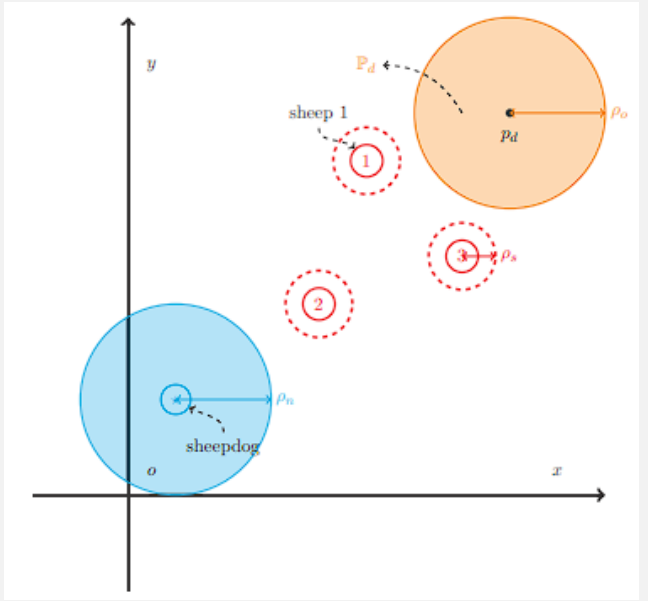
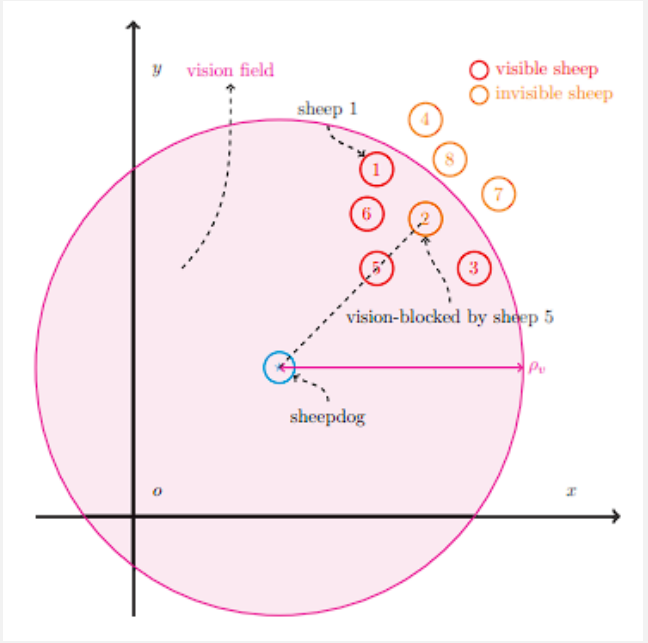
INTRODUCTION

- Overview
- Motivation
  - Optimized navigation strategies
  - Multiple entity coordination
  - Robotics
- Plan
  - Analysis
  - Re-creation
  - Improvements/extensions

METHODS

- Base sheepherding model
  - Sheepdog
  - Sheep
  - Sheepfold
  - Vision blocking
  - Goal





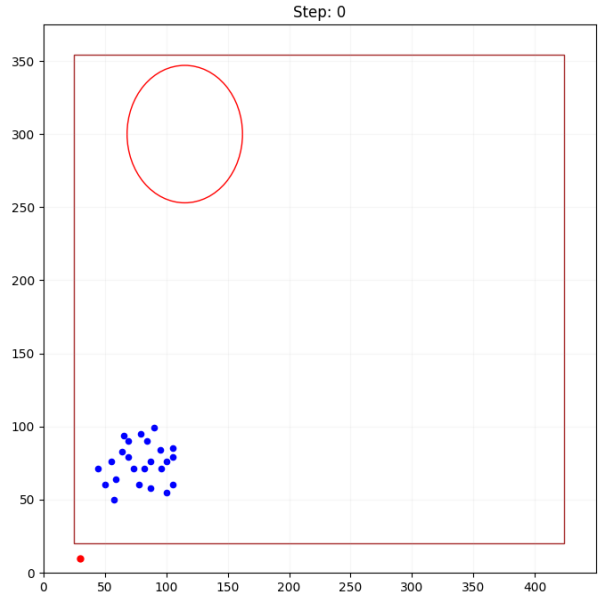
Algorithm 1 Sheepdog Driven Algorithm

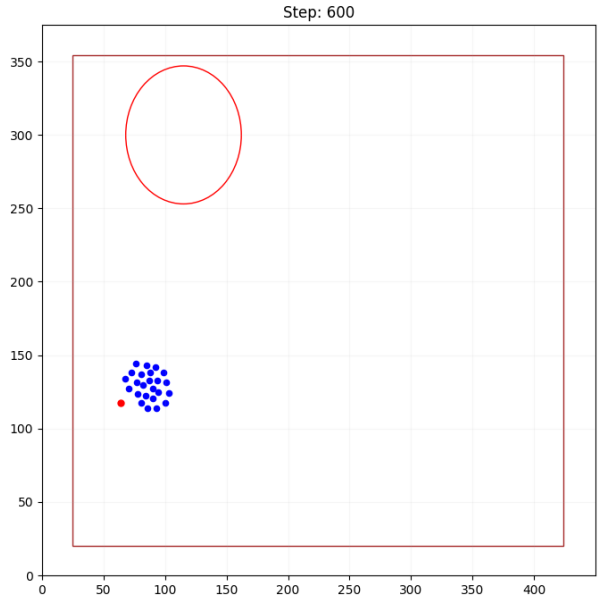
Input: $p_1(t), \ldots, p_n(t), q(t), \lambda(k)$.
Output: $u(k)$.

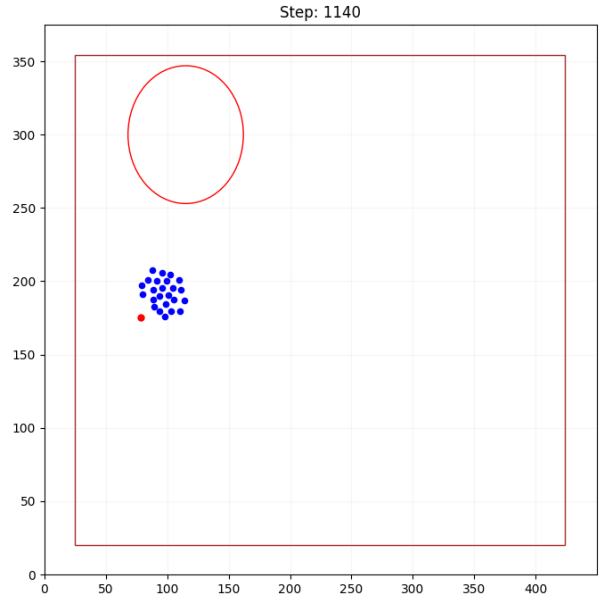
Set $\varpi = 0$.
for $(i = 1, i \leq \underline{N}, i = i + 1)$ **do**
  if $\mathbf{d}(p_i(t), \mathbb{P}_d) = 0$ **then**
    $\varpi = \varpi + 1$.
if $\varpi < \underline{N}$ **then**
  if $q(k) \in \mathbb{Q}_l(k)$ & $L_c(k) > \theta_t$ **then**
    $\lambda(k) = 0$,
    if $||q(k) - D_r(k)|| \geq r_a$ **then**
      $u(k) = \gamma_a \mathbf{o}(q(k) - D_r(k))$.
    else
      $u(k) = \gamma_b \mathbf{R}(\theta_r)\mathbf{o}(q(k) - D_r(k))$.
  else if $q(k) \in \mathbb{Q}_r(k)$ & $R_c(k) > \theta_t$ **then**
    $\lambda(k) = 1$,
    if $||q(k) - D_l(k)|| \geq r_a$ **then**
      $u(k) = \gamma_a \mathbf{o}(q(k) - D_l(k))$.
    else
      $u(k) = \gamma_b \mathbf{R}(\theta_l)\mathbf{o}(q(k) - D_l(k))$.
  else if $\lambda(k) = 1$ **then**
    if $||q(k) - D_l(k)|| \geq r_a$ **then**
      $u(k) = \gamma_a \mathbf{o}(q(k) - D_l(k))$.
    else
      $u(k) = \gamma_b \mathbf{R}(\theta_l)\mathbf{o}(q(k) - D_l(k))$.
  else
    if $||q(k) - D_r(k)|| \geq r_a$ **then**
      $u(k) = \gamma_a \mathbf{o}(q(k) - D_r(k))$.
    else
      $u(k) = \gamma_b \mathbf{R}(\theta_r)\mathbf{o}(q(k) - D_r(k))$.
else
  $u(k) = 0$.

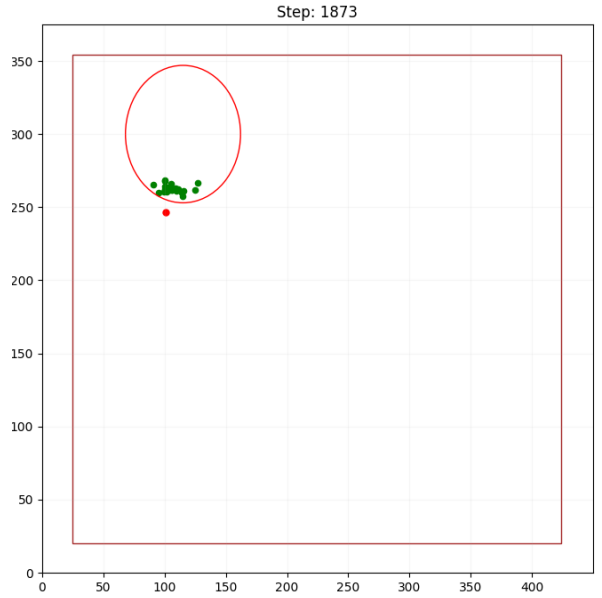
ALGORITHM

- Base sheepherding algorithm
  - Sheep behaviour
  - Dog behaviour
- Biggest challenges and how we solved them
  - Understanding mathematical notation
  - Ambiguous implementation for different parts of algorithm
  - Finding optimal parameters
- Improvements



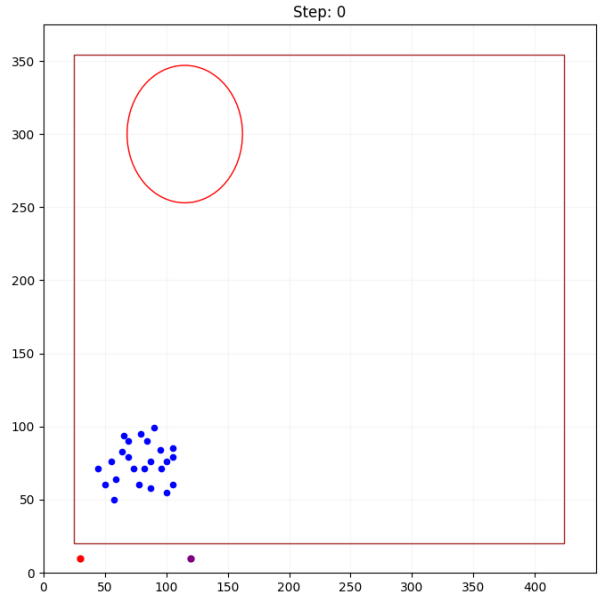


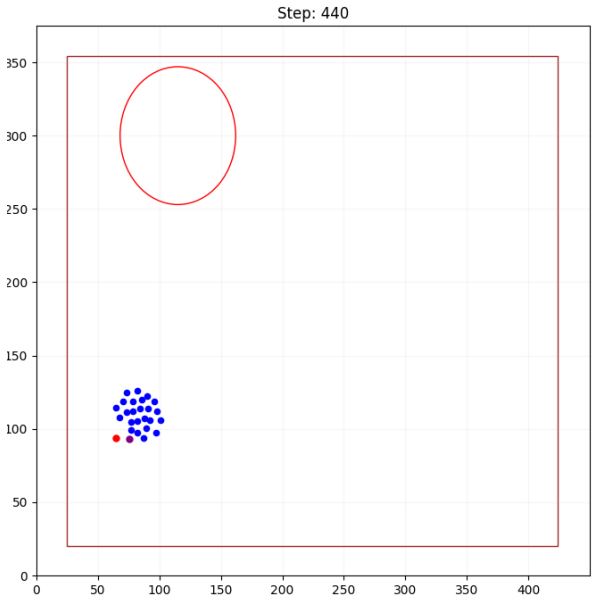


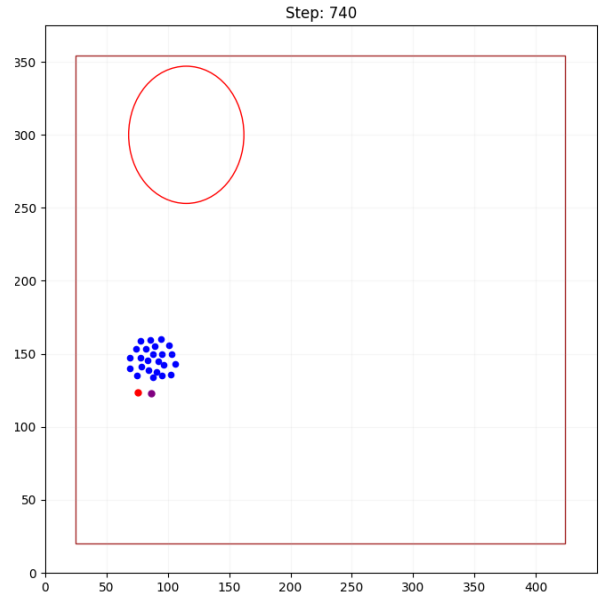


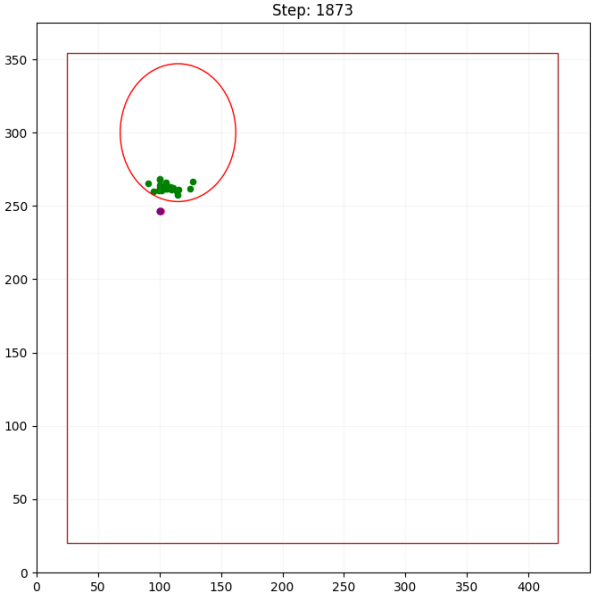
RESULTS

SIMULATION OF THE RE-CREATED BASIC ALGORITHM (ONE SHEEPDOG)



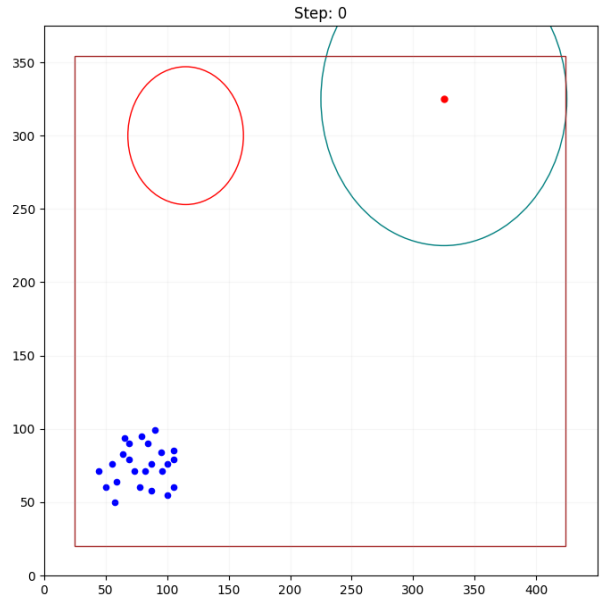


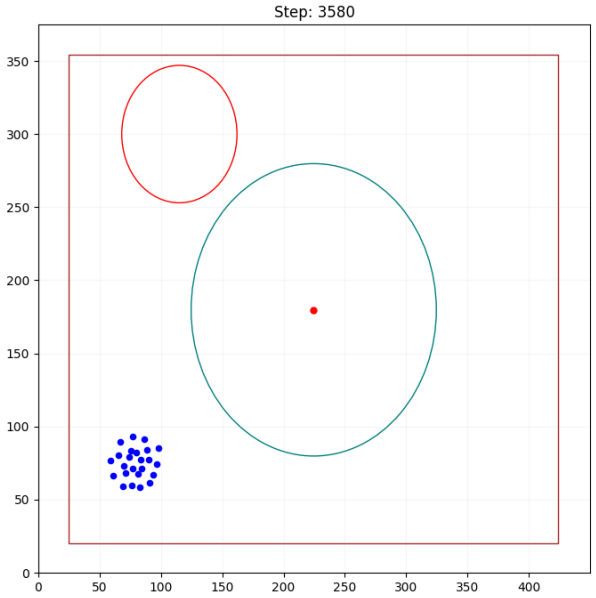


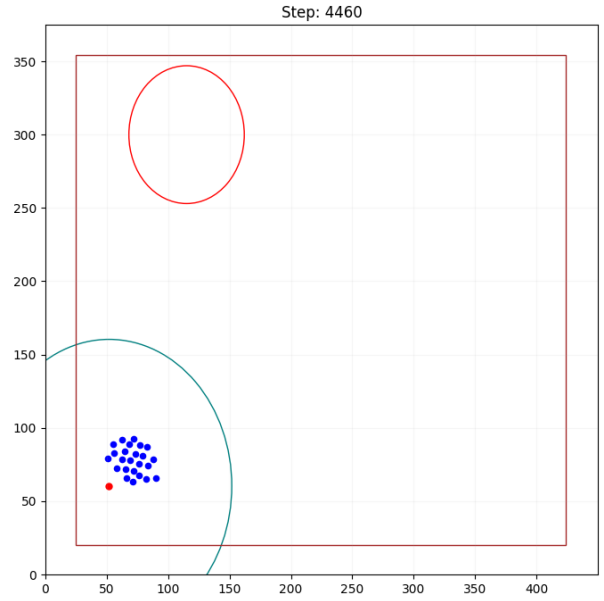


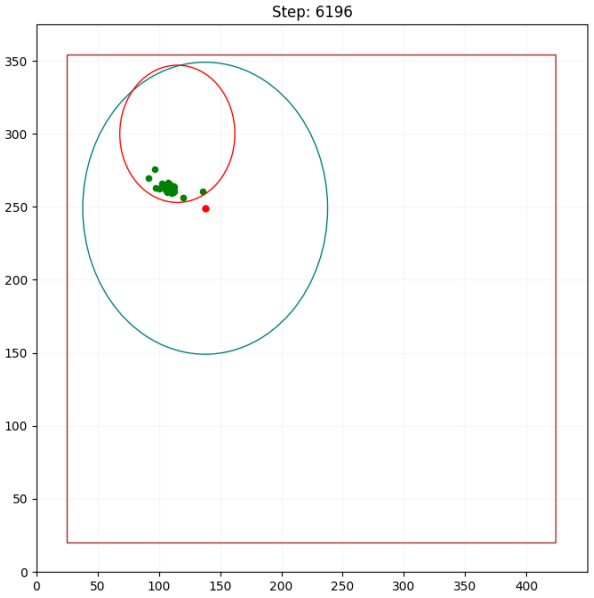
RESULTS

SIMULATION OF THE RE-CREATED BASIC ALGORITHM (TWO SHEEPDOGS)









RESULTS

SIMULATION OF THE RE-CREATED BASIC ALGORITHM (WANDERING)

CONCLUSIONS

- What have we managed to achieve?
- What would we change if we started all over again?
- What could we possibly improve (future work)?

THANK YOU FOR YOUR ATTENTION

Questions?