PFE / Master Thesis

Semaine 10

Calcul score (Cohen's Kappa)

Data: I_0: $l \times w \times 3 \rightarrow [0..255]$, I: $l \times w \times 3 \rightarrow [0..255]$, $l \in \mathbb{N}$, $w \in \mathbb{N}$
with I_0 the ground truth image and I the image to score.
Result: $\kappa \in [0, 1]$

```
TP ← 0
TN ← 0
FP ← 0
FN ← 0
for i ← 1 to l do
    for j ← 1 to w do
        if is_label_1(I_0(i, j)) then
            if is_label_1(I(i, j)) then
                TP ← TP + 1
            end
            else
                FN ← FN + 1
            end
        end
        else
            if is_label_1(I(i, j)) then
                FP ← FP + 1
            end
            else
                TN ← TN + 1
            end
        end
    end
end
```

$$f_c \leftarrow \frac{(TN+FN)(TN+FP)+(FP+TP)(FN+TP)}{TP+TN+FN+FP}$$

$$\kappa \leftarrow \frac{TP+TN-f_c}{TP+TN+FN+FP-f_c}$$

Algorithm 1: Calcul du score Cohen-Kappa

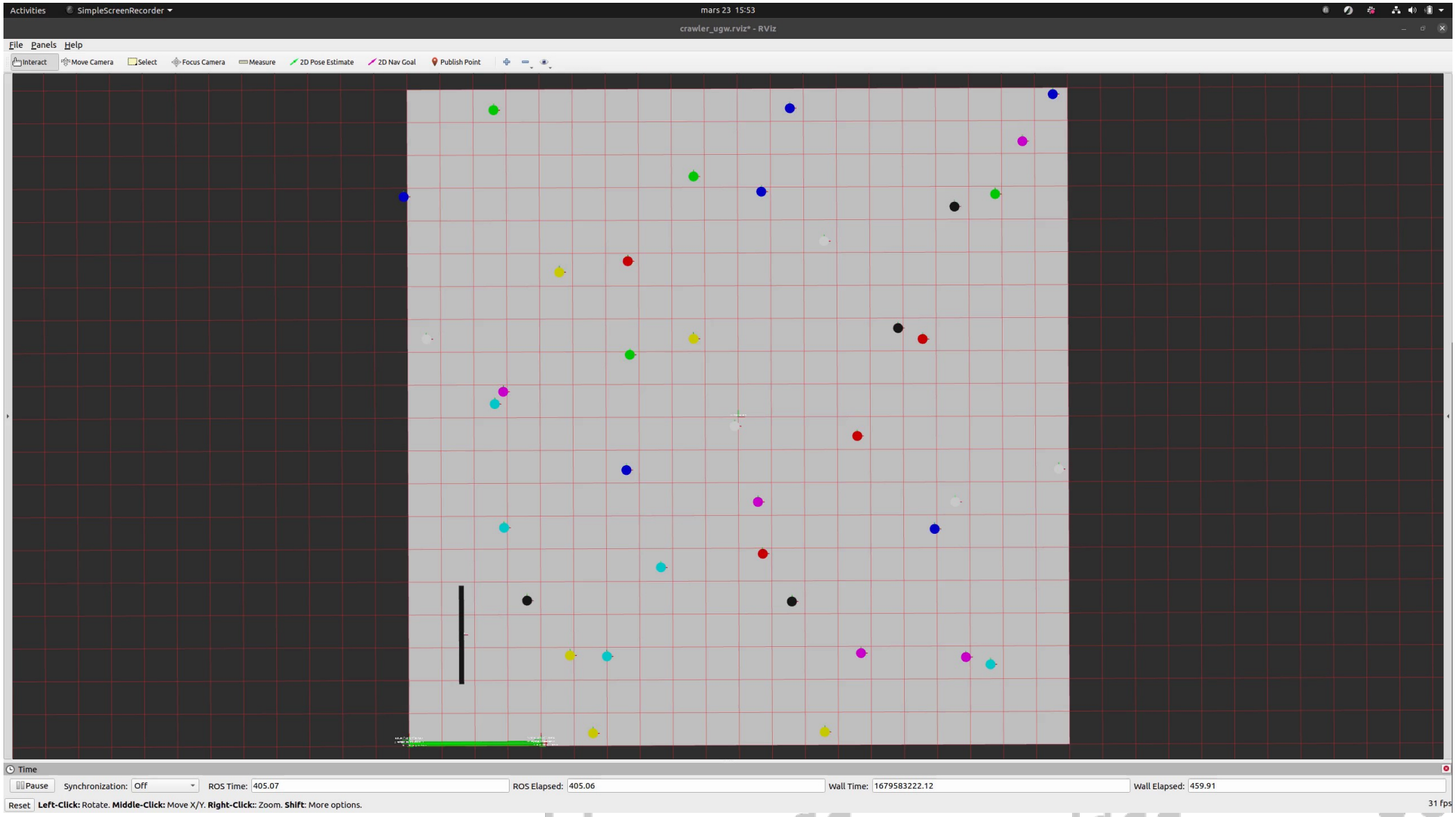
Mise à jours de la grille d'occupation (Bresenham's line)

Data: $P_1 \in \mathbb{R}^2$, $P_2 \in \mathbb{R}^2$, $pw \in \mathbb{R}$, $threshold \in \mathbb{R}$, G:
$l \times w \rightarrow [\text{UNKNOWN}, \text{EMPTY}, \text{OCCUPIED}]$, $l \in \mathbb{N}$, $w \in \mathbb{N}$
with P_1 and P_2 the two points to connect, pw the power of the UGW, $threshold$ the threshold above which the power of the UGW is considered undistributed and G the grid to update.
Result: The updated grid.

$p_0 \leftarrow$ from_position_to_grid_coordinate(P_1)
$p_1 \leftarrow$ from_position_to_grid_coordinate(P_2)
if *is_out_of_grid*(p_0) ***or*** *is_out_of_grid*(p_1) **then**
  return
end
$dx \leftarrow p_1.x - p_0.x$
$dy \leftarrow p_1.y - p_0.y$
$sx \leftarrow \text{sign}(dx)$
$sy \leftarrow \text{sign}(dy)$
$err = dx - dy$
while $p_0 \neq p_1$ **do**
  if $pwd \leq threshold$ ***and*** $G(p_0) = UNKNOWN$ **then**
    $G(p_0) \leftarrow$ OCCUPIED
  end
  else if $pwd > threshold$ **then**
    $G(p_0) \leftarrow$ EMPTY
  end
  $e2 \leftarrow 2 \times err$
  if $e2 > -dy$ **then**
    $err \leftarrow err - dy$
    $p_0.x \leftarrow p_0.x + sx$
  end
  if $e2 < dx$ **then**
    $err \leftarrow err + dx$
    $p_0.y \leftarrow p_0.y + sy$
  end
end

Algorithm 2: Mise à jours de la grille d'occupation en utilisant l'algorithme de tracé de ligne de Bresenham.

Peinture au rouleau

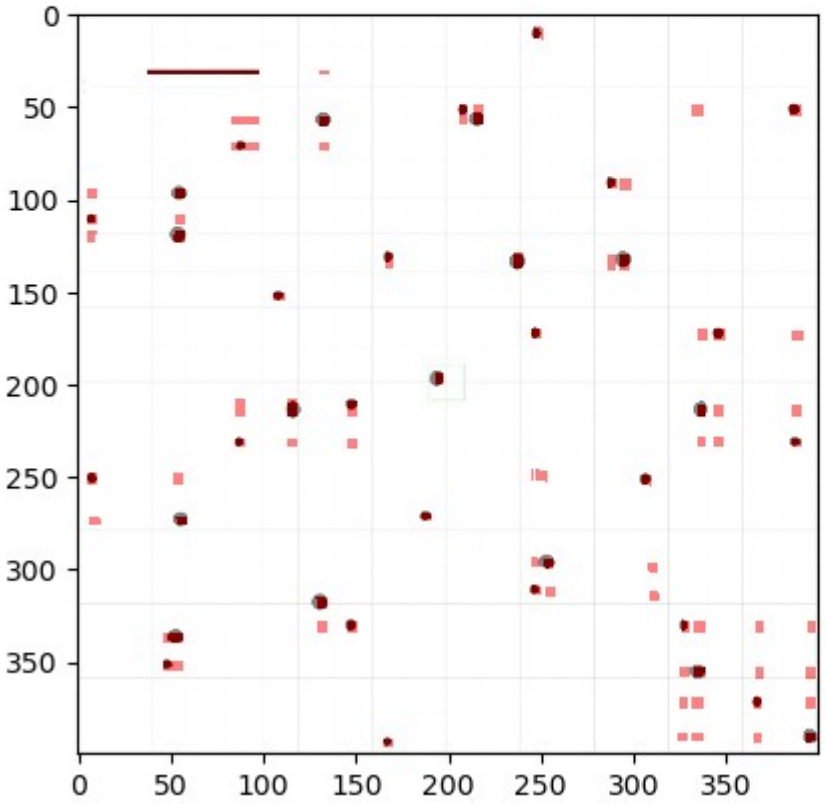


Peinture au rouleau

velocity=0.3, distance=4.0, overlap=0.1, 1 receiver

```
peinture = cv.imread('graphics/velocity=0.3_distance=4.0_overlap=0.1.png')
```

```
TP:  156959 TN:  966 FP:  1813 FN:  262 Unmatched:  0
Kappa score:  0.4765840543514098
```

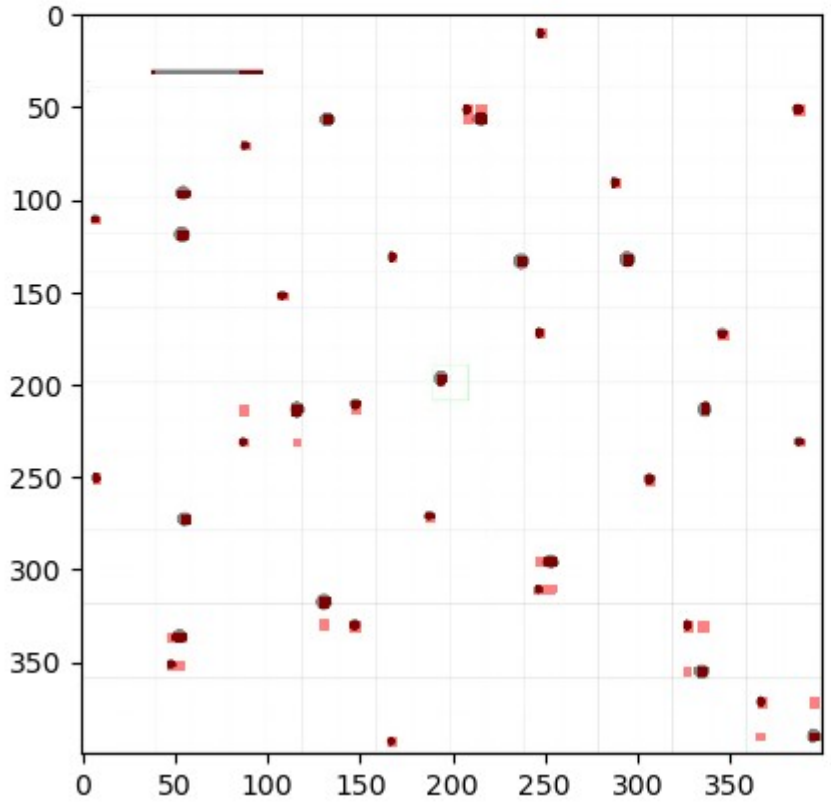


Peinture au rouleau

velocity=0.3, distance=2.0, overlap=0.1, 1 receiver

```
peinture = cv.imread('graphics/velocity=0.3_distance=2.0_overlap=0.1.png') ···
```

```
TP:  158049 TN:  898 FP:  723 FN:  330 Unmatched:  0
Kappa score:  0.6271401795176628
```

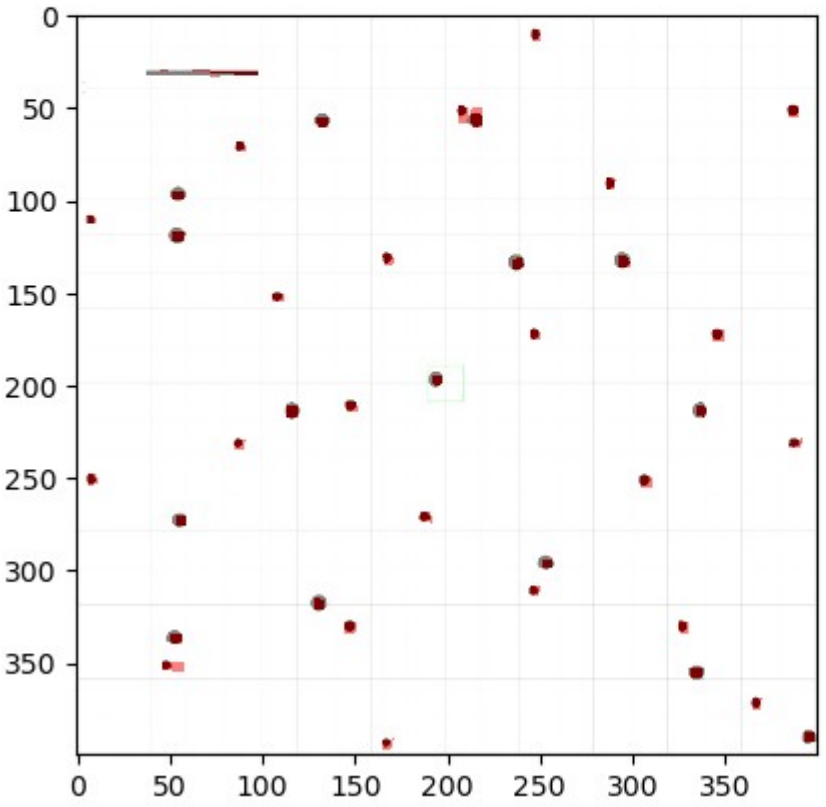


Peinture au rouleau

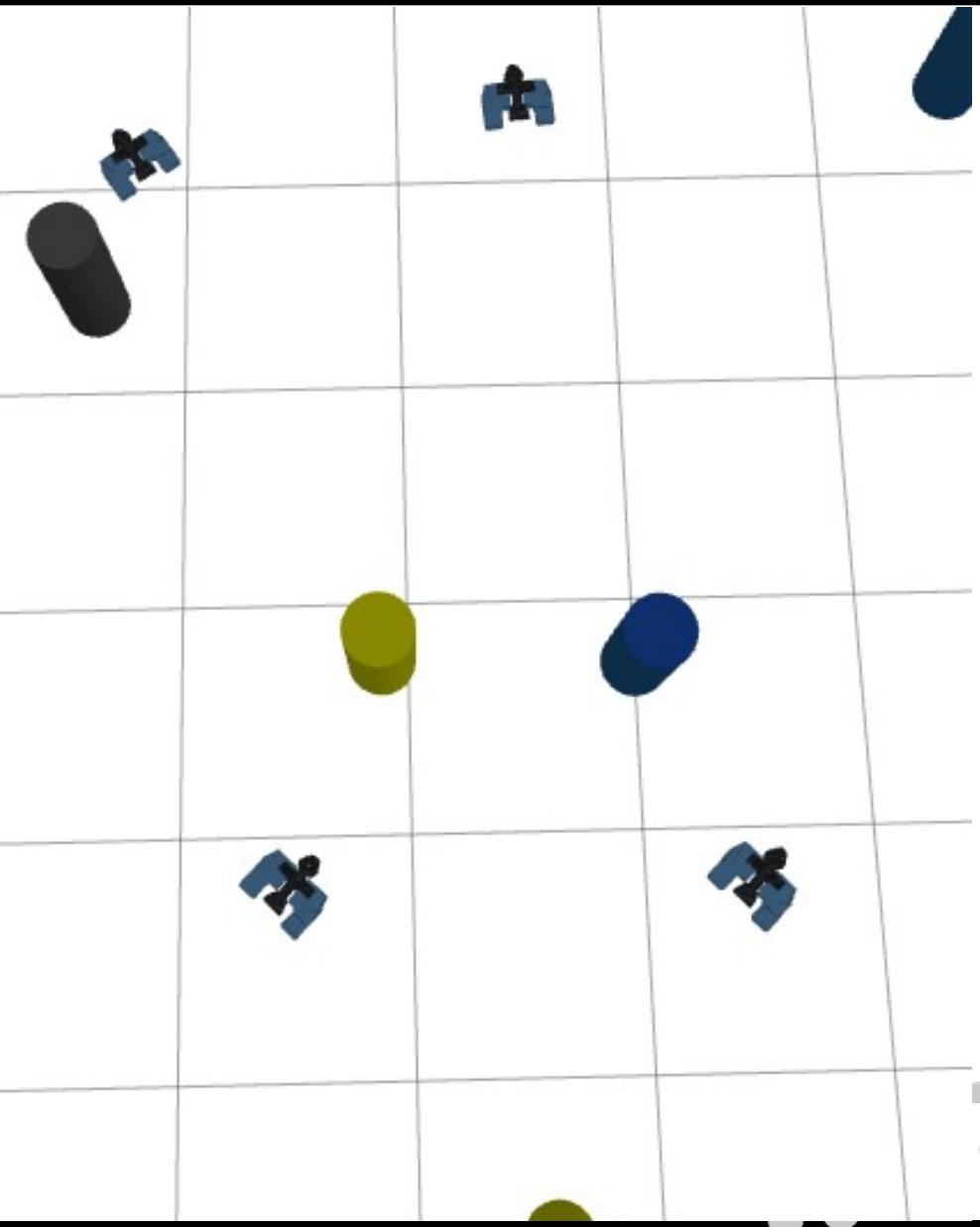
velocity=0.3, distance=1.0, overlap=0.1, 1 receiver

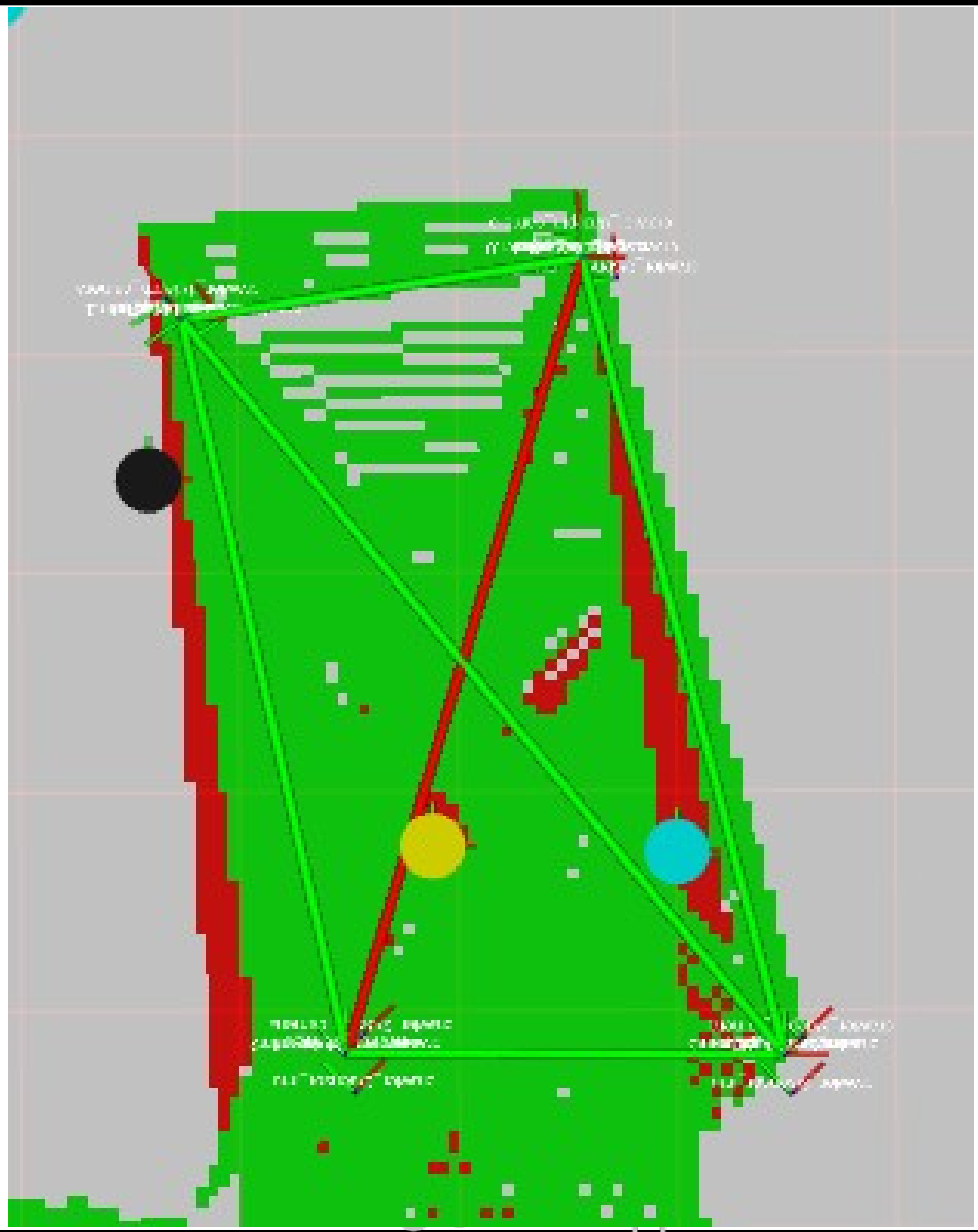
```
peinture = cv.imread('graphics/velocity=0.3_distance=1.0_overlap=0.1.png')
```

```
TP:  158303 TN:  891 FP:  469 FN:  337 Unmatched:  0
Kappa score:  0.6860299697248763
```

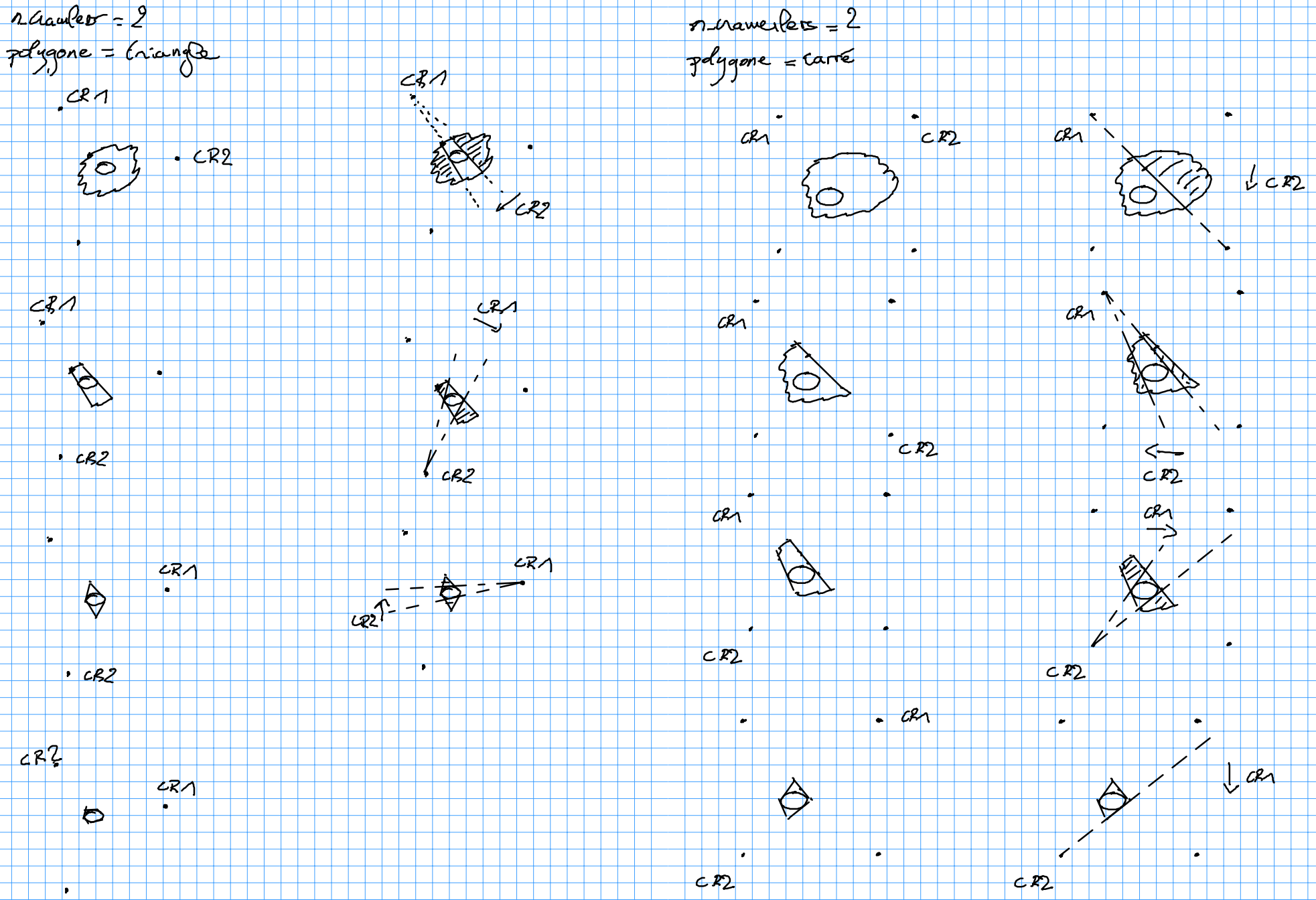


4 robots

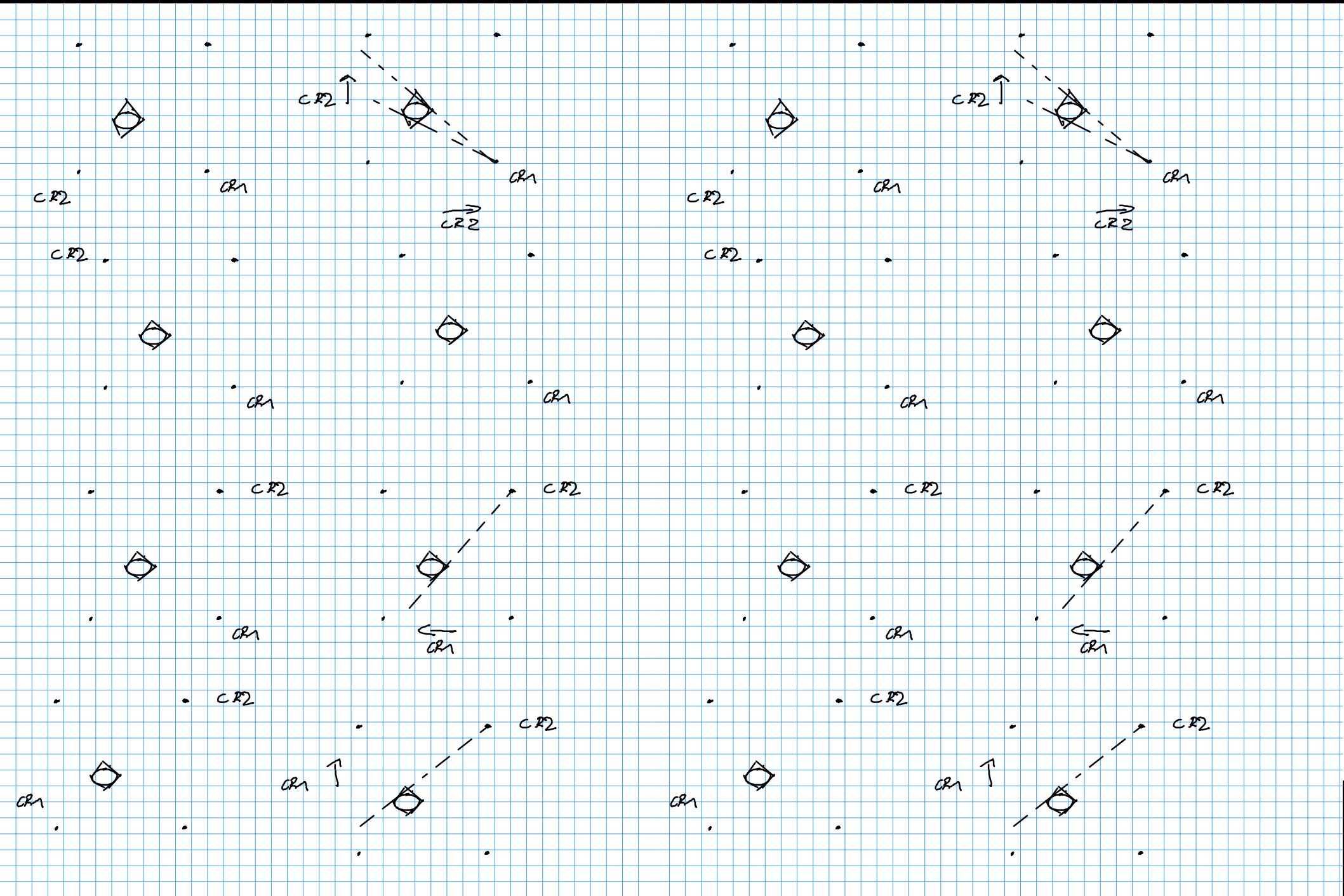




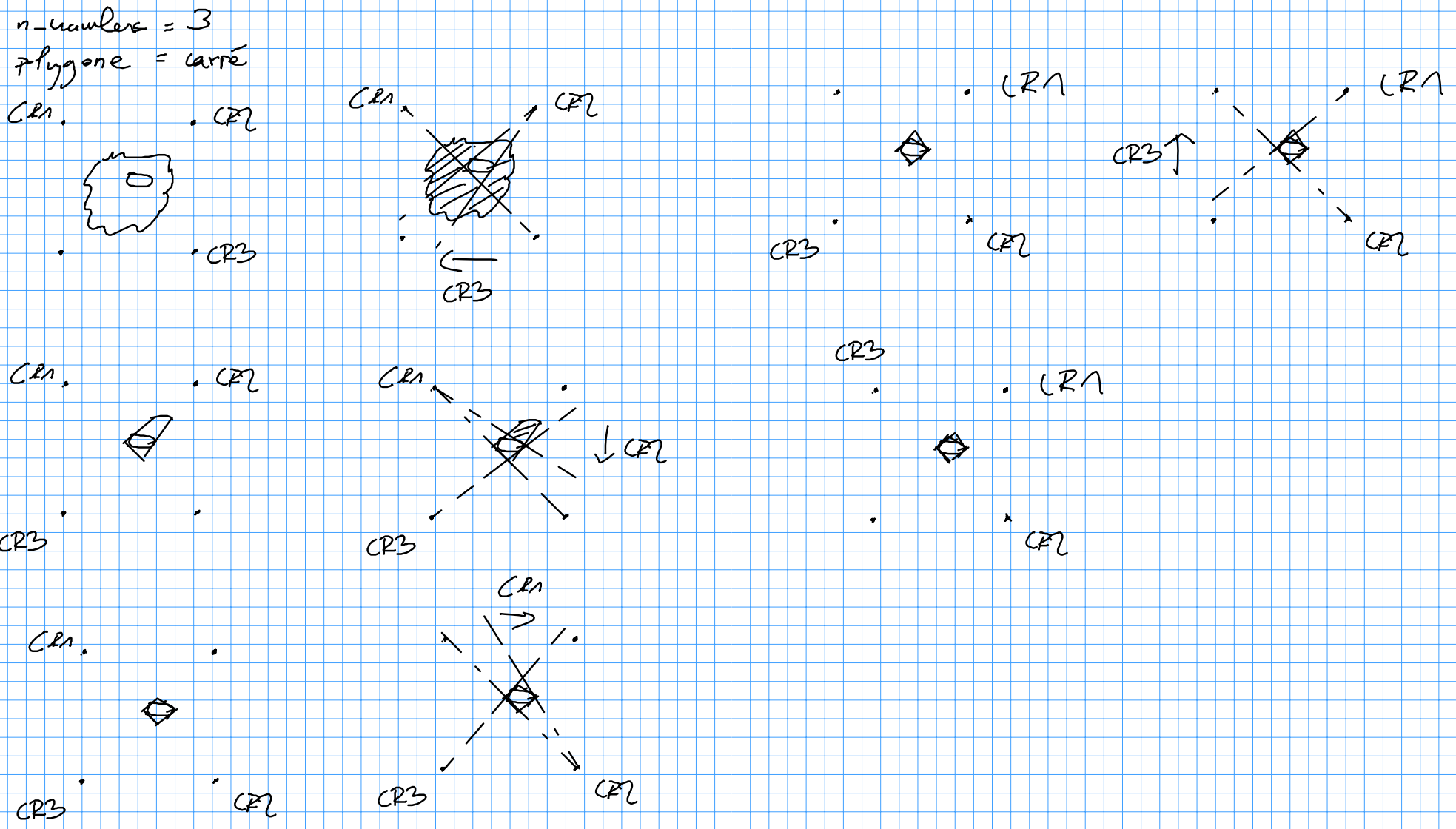
Affinement polygone



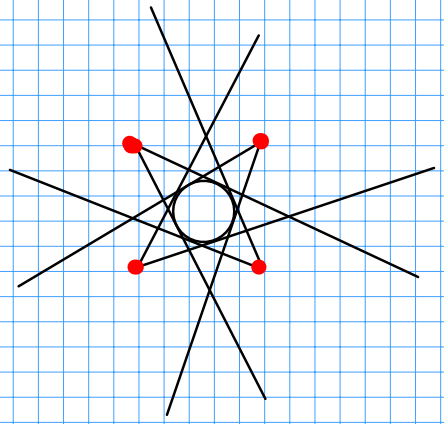
Affinement polygone

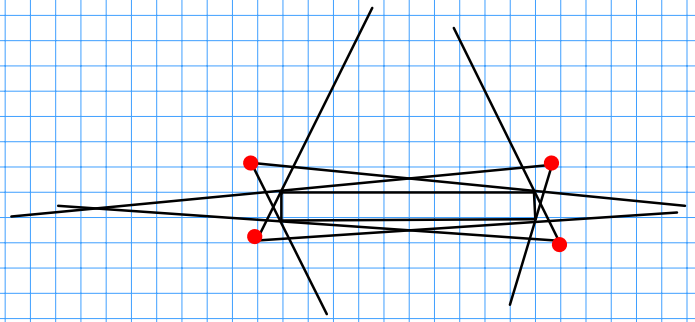


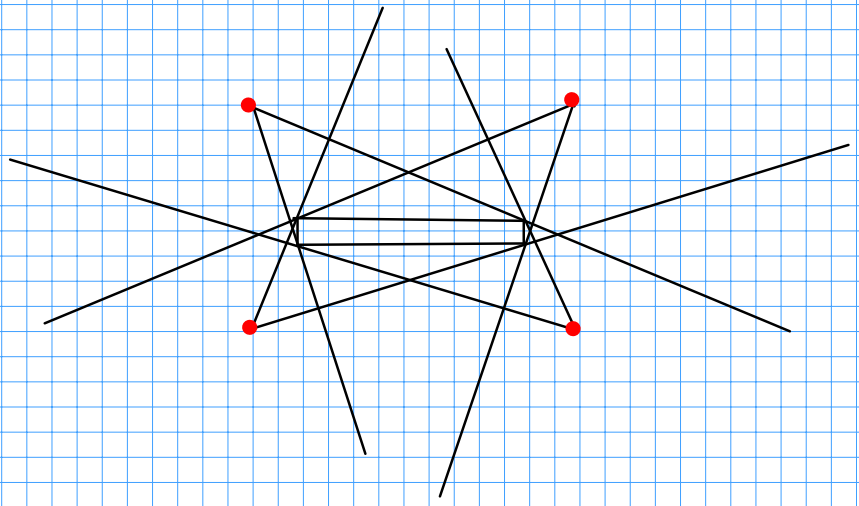
Affinement polygone

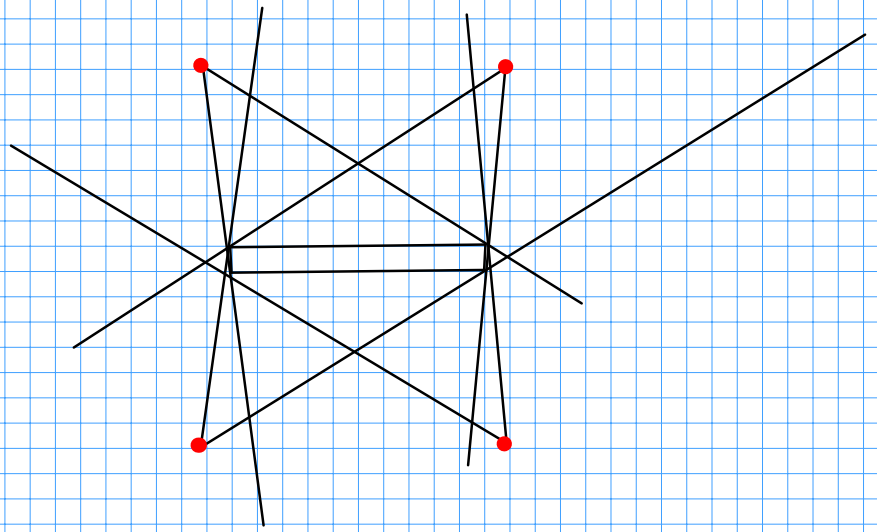


Affinement polygone

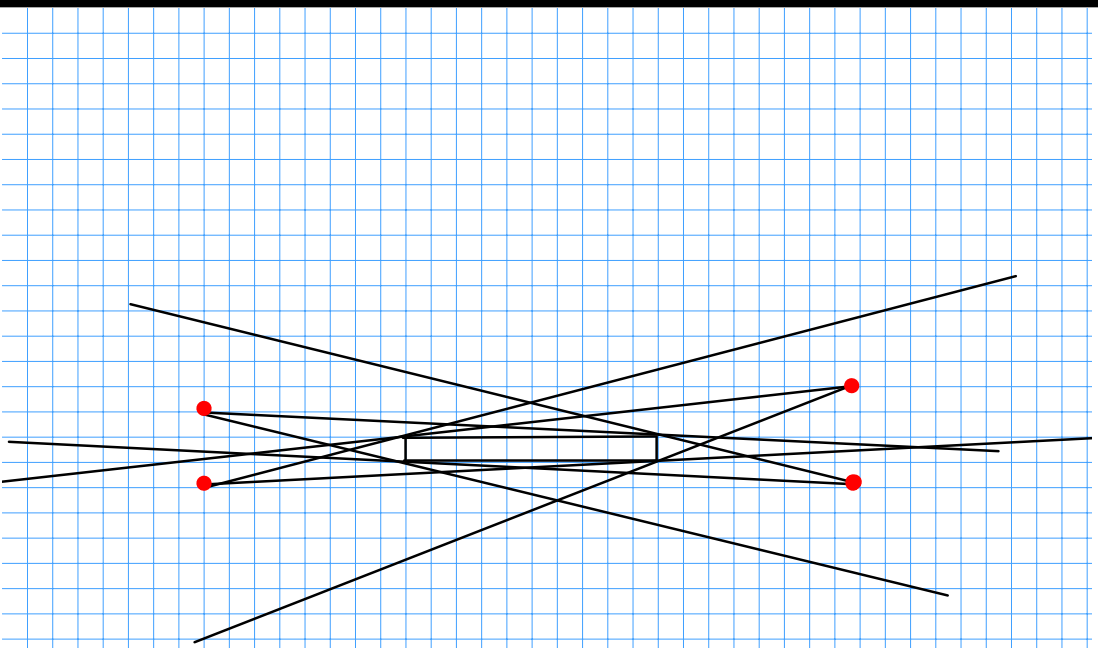








Affinement polygone



- Contours convexes uniquement
- n_crawlers ↑ → time ↓
- polygone ↑ → precision ↑, time ↑
- epsilon = distance entre forme et arrêtes du polygone
- Il semble que

  epsilon ↓ → precision ↑

Politique multi-robots réactive

- 2 robots effectuent peinture au rouleau
- k équipes de n robots effectuent affinement polygones autour des zones détectées, avec k > 0 et n > 1.
- Les 2 missions sont effectuées en parallèle

Politique multi-robots réactive - méthode

- Récupérer les composantes fortements connexes de la grille d’occupation en cours de construction pour trouver les zones suspectes
- Récupérer le centre (c) et les 2 rayons (rx, ry) des zones supectes
- Récupérer les points du polygone de centre (c) et distant de (rx + epsilon) et (ry + epsilon)
- Positionner les robots d’afinnement sur des sommets consecutifs et lancer affinement polygone

Zones suspectes et polygones