

Bay of Biscay Project

Modeling the Secure Zone Using OpenCV Erosion and Image Contractor

MRIS meeting 03/28/2017

Summary

- Ellipse Strategy
- Erosion OpenCV
- Image contractor



ENSTA
Bretagne

Presentation



Presentation

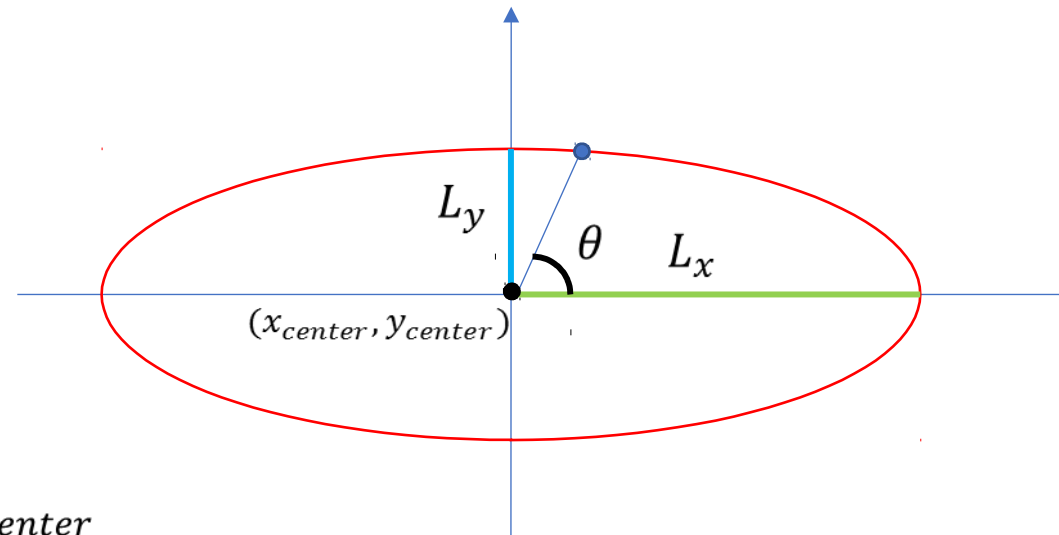
To model this problem we got the following state equation:

$$\mathbb{X}(t) = \mathbb{G} \cup \mathbb{F}_d(\mathbb{X}(t-d)) \cap \bigcap_i g_{a_i(t)}^{-1}([d_i(t), \infty])$$

- Where \mathbb{X} represents the complementary of the Secure Zone
- Where \mathbb{G} represents the Bay Of Biscay
- Where $\mathbb{F}_d(\mathbb{X}(t-d))$ represents the potential intruder
- Where $\bigcap_i g_{a_i(t)}^{-1}([d_i(t), \infty])$ represents the instantaneous complementary secure zone
- Where $\mathbb{X}(t-d)$ represents the potential intruder
- Where $\bigcap_i g_{a_i(t)}^{-1}([d_i(t), \infty])$ represents the instantaneous complementary secure zone

Ellipsoid Strategy

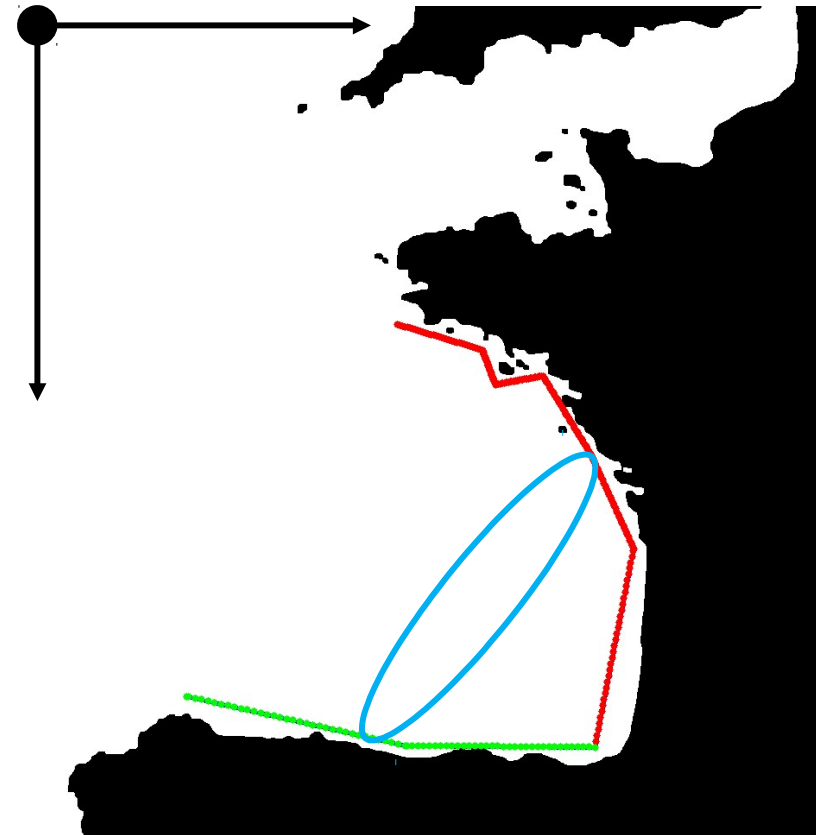
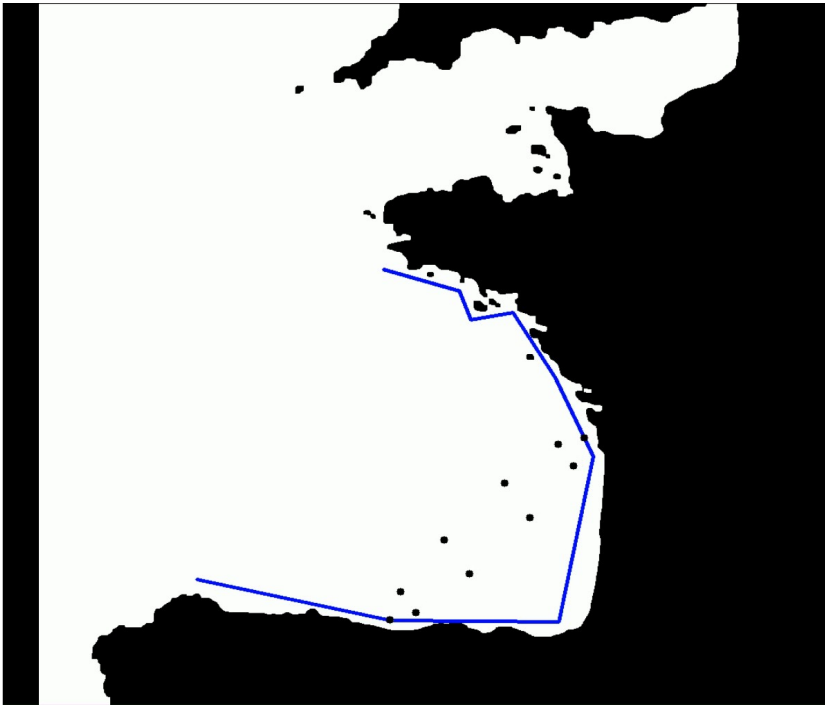
$$\begin{cases} x = L_x \cos(\theta(t)) + x_{center} \\ y = L_y \sin(\theta(t)) + y_{center} \end{cases}$$



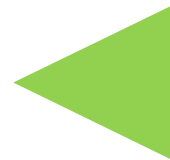
For the i -th robot,

$$\begin{cases} x = L_x \cos\left(\theta(t) + \frac{2\pi i}{n_{robots}}\right) + x_{center} \\ y = L_y \sin\left(\theta(t) + \frac{2\pi i}{n_{robots}}\right) + y_{center} \end{cases}$$

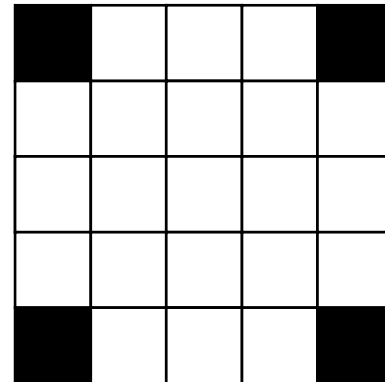
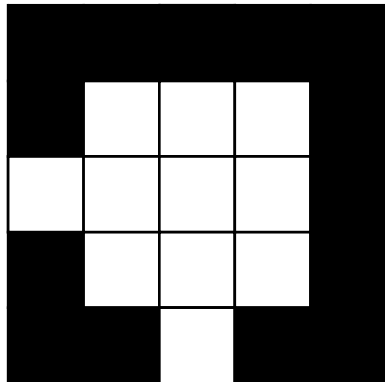
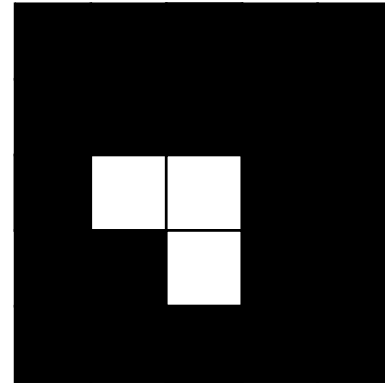
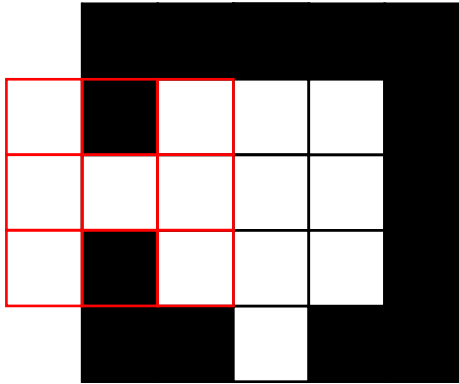
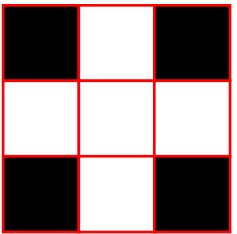
Ellipsoid Strategy



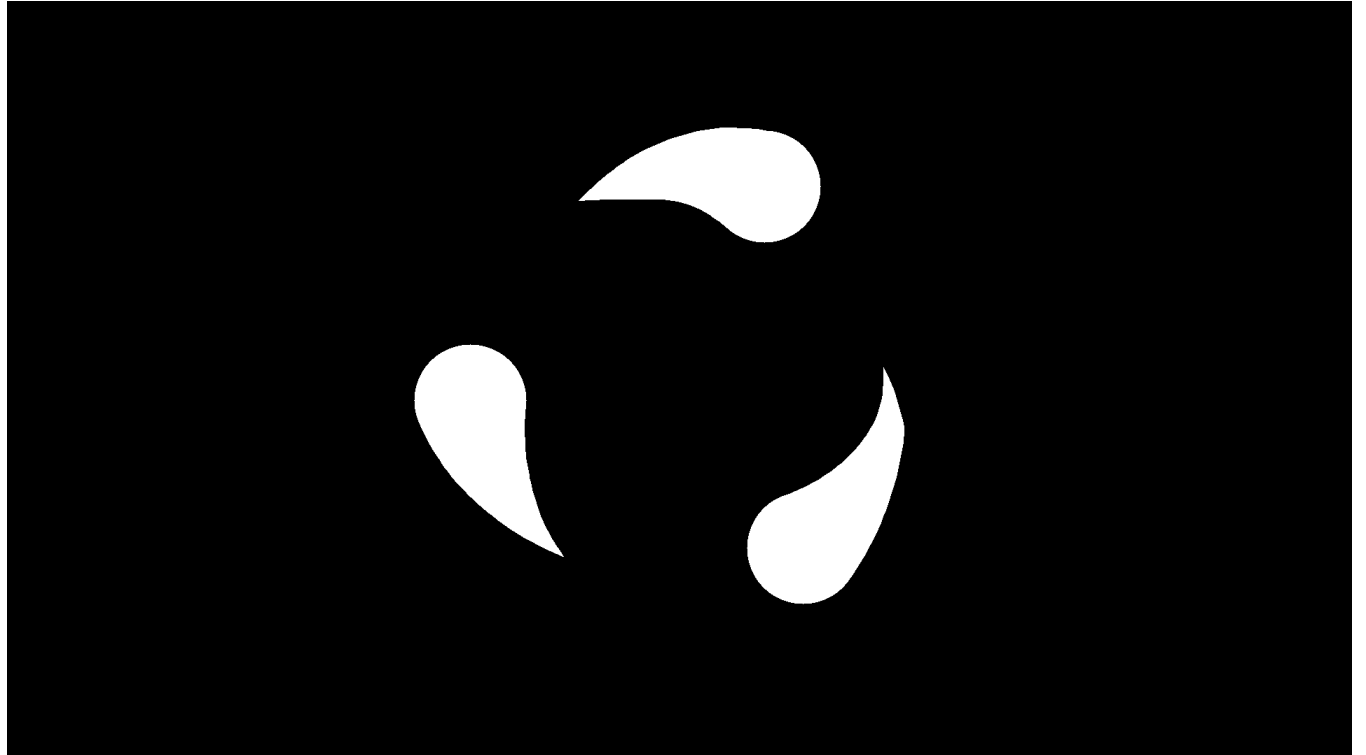
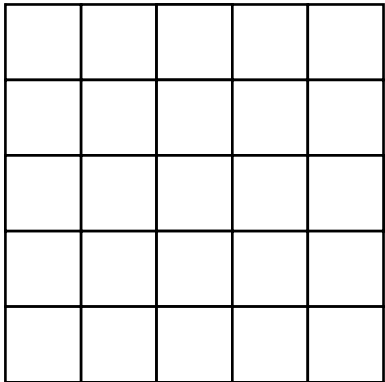
Trail Modeling



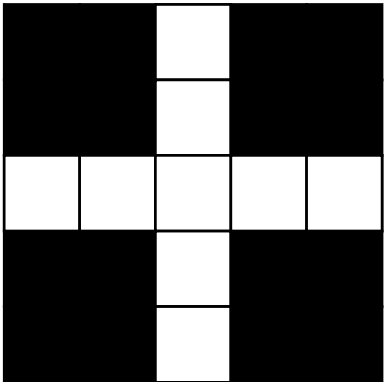
Erosion



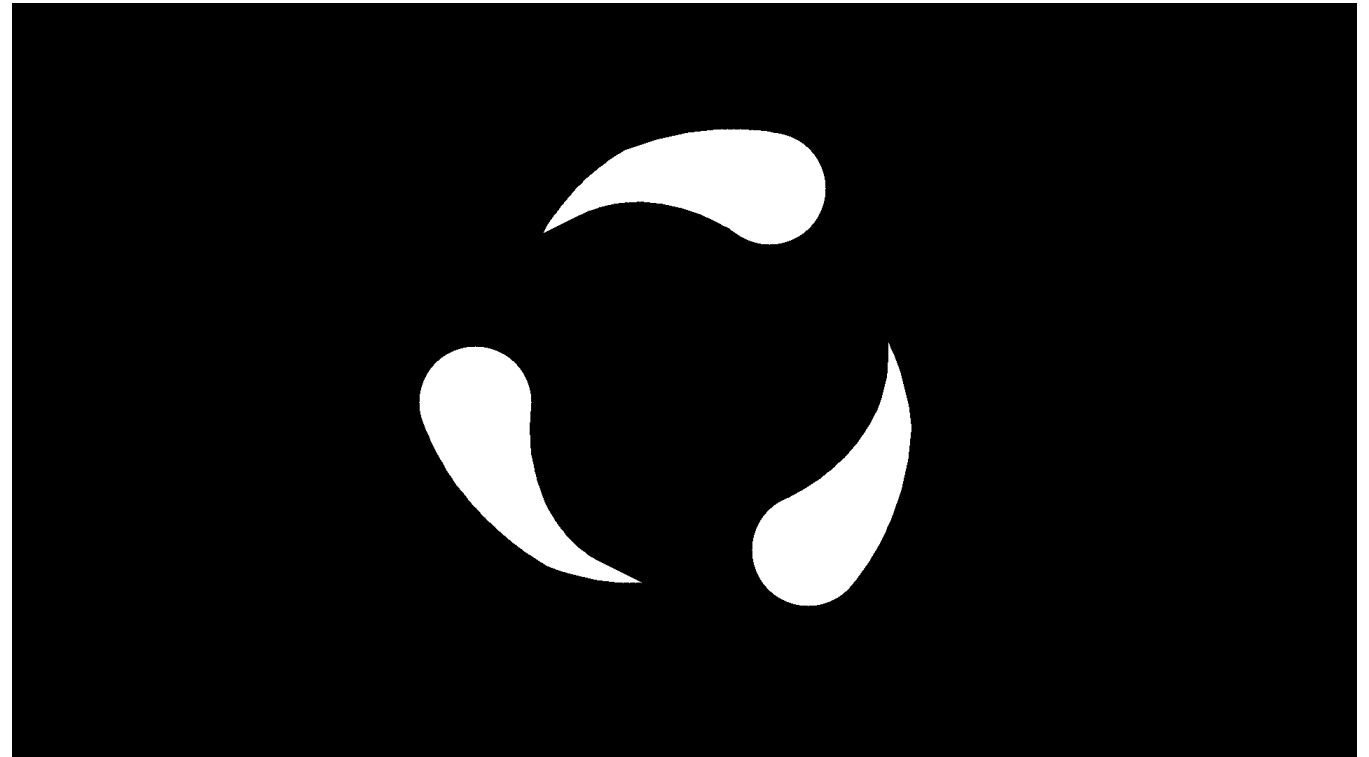
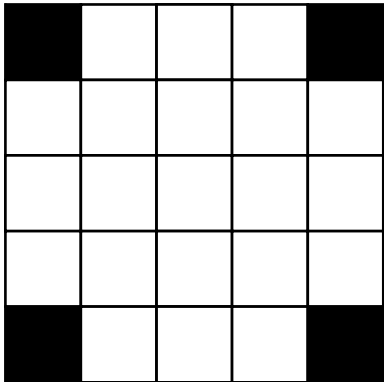
Erosion Rectangle Kernel



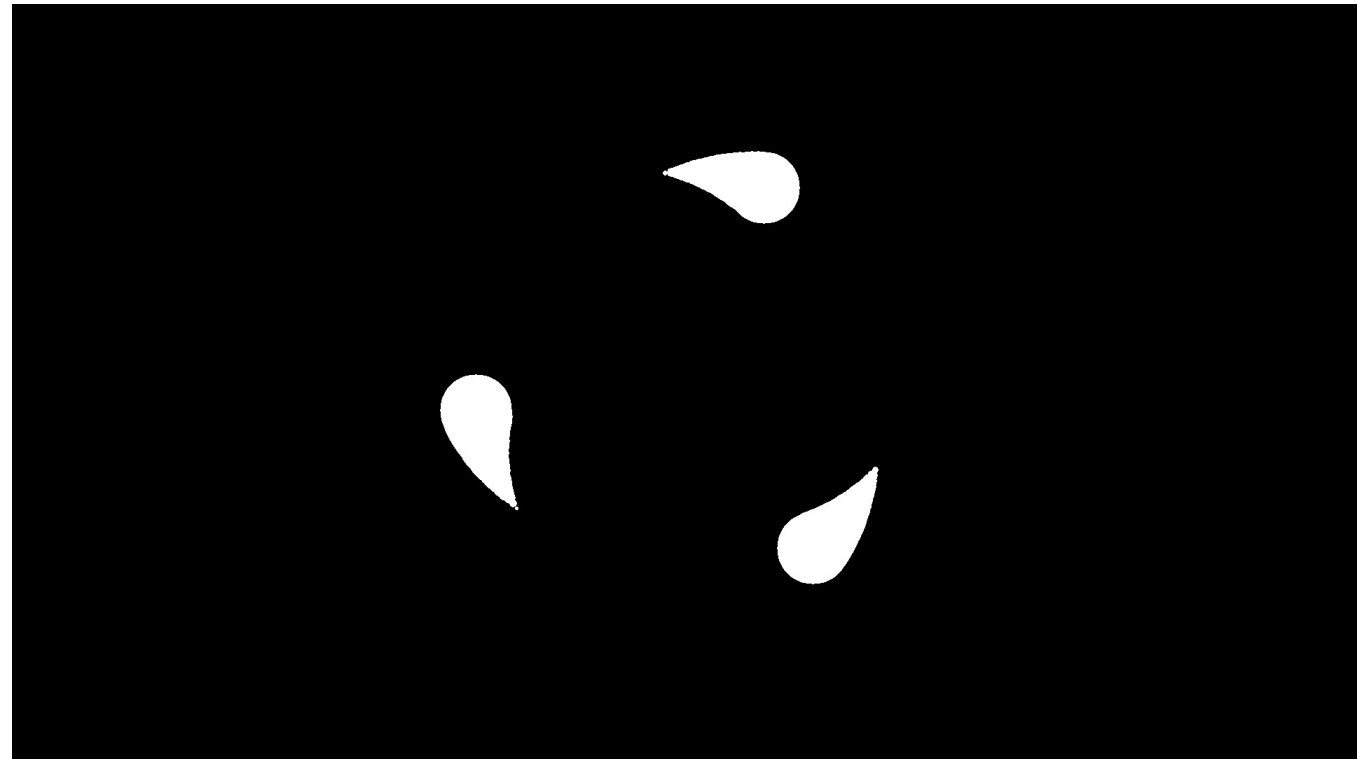
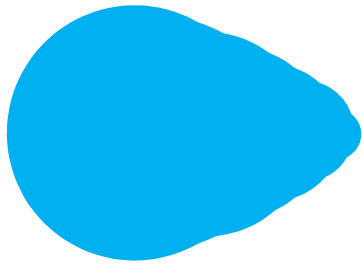
Erosion Cross Kernel



Erosion Ellipse Kernel

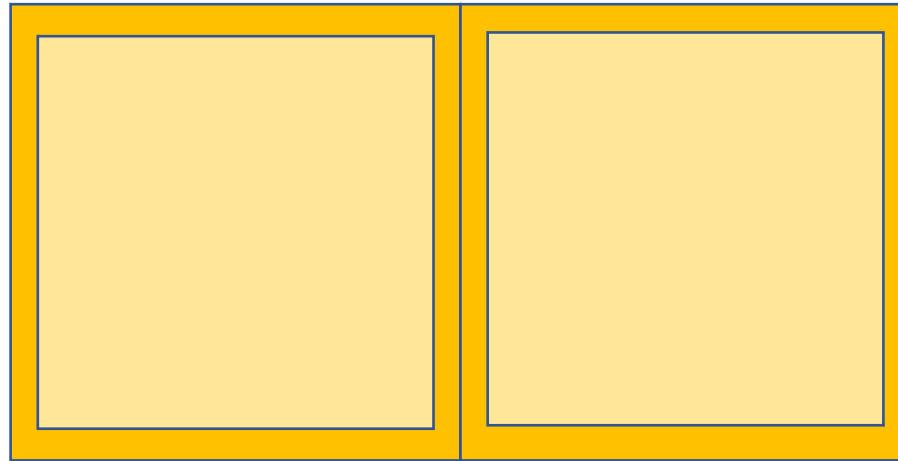


Trail with Circles



Erosion vs Trail With Circles

$$M \cup N \subset (M \dot{\cup} N)$$



Erosion vs Trail With Circles

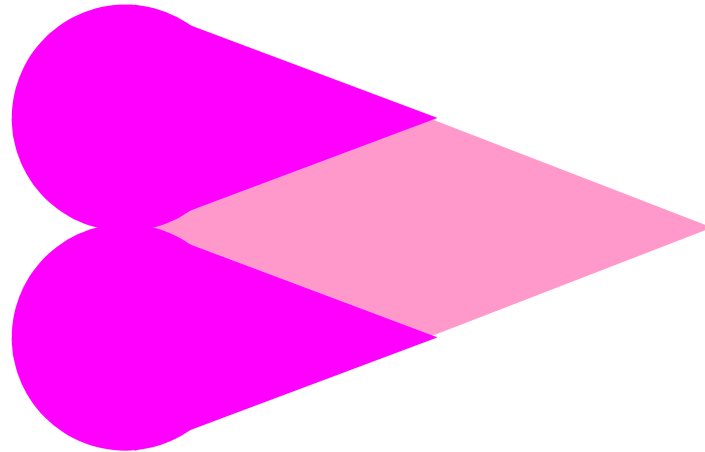
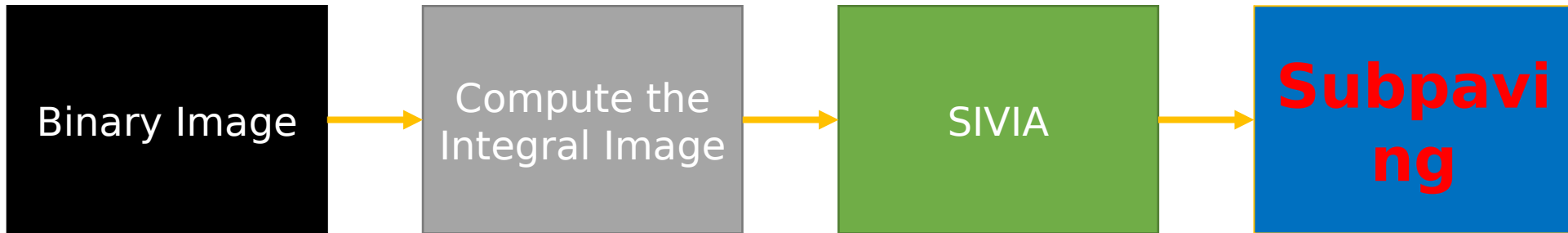
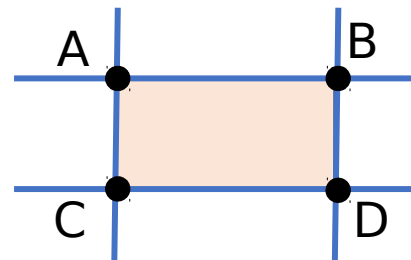


Image Contractor



IN =
White
Out =
Black

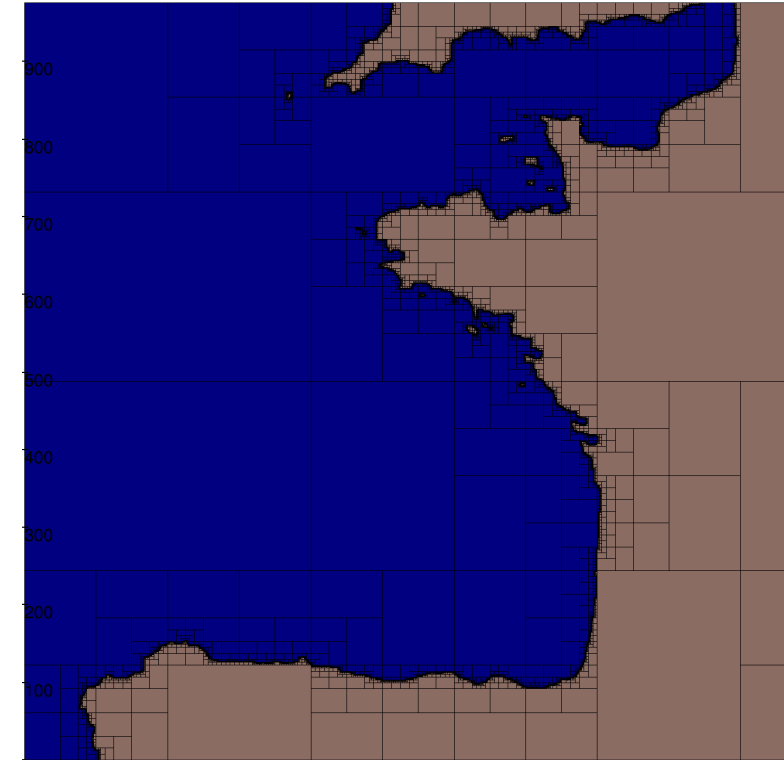
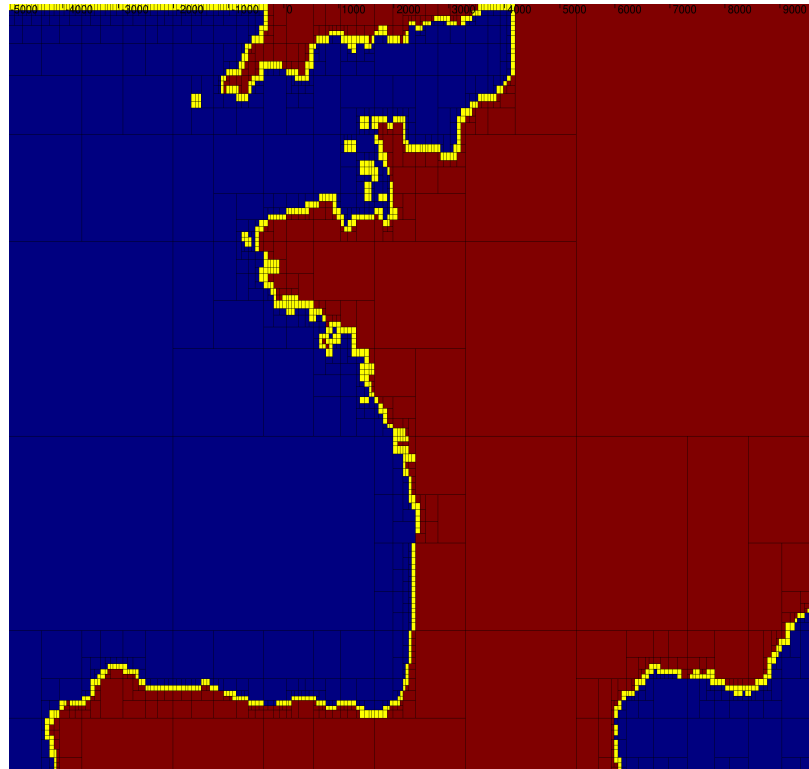


$$S = D - B - C + A$$

```

Test(S)
{
  If S = 0:
    Then OUT
  If S =
  NbPixelInRect :
    Then IN
  Else:
    UNKNOWN
}
  
```

Image Contractor



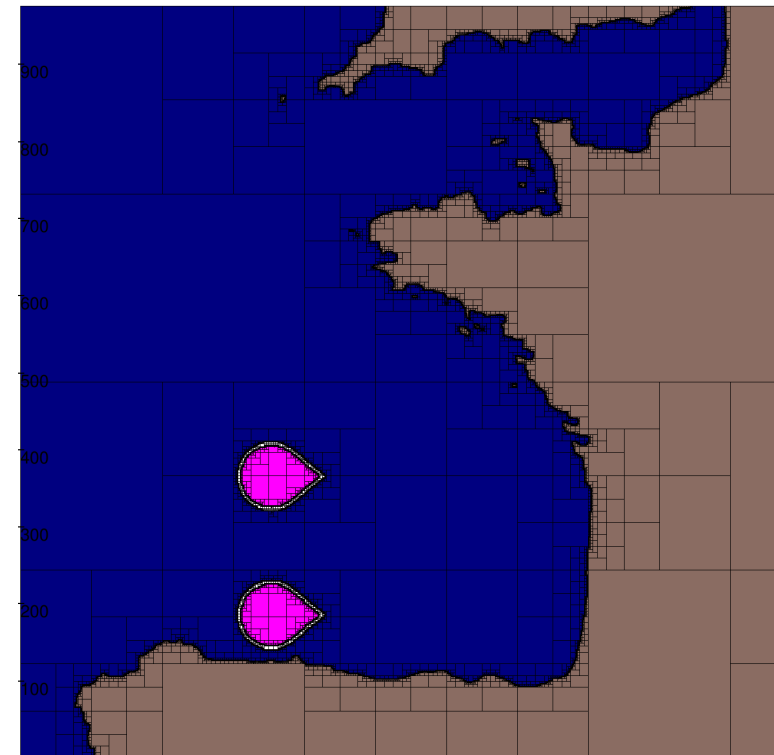
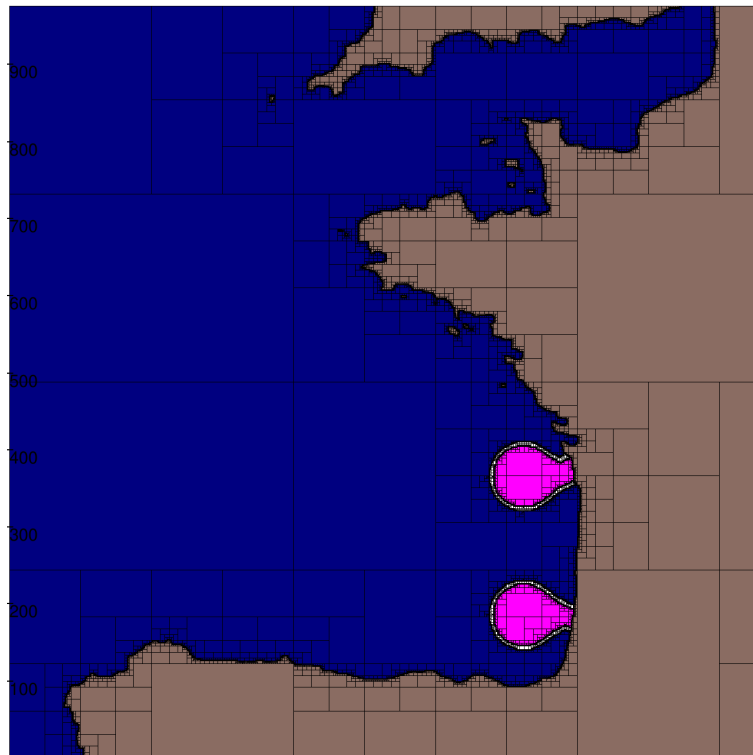
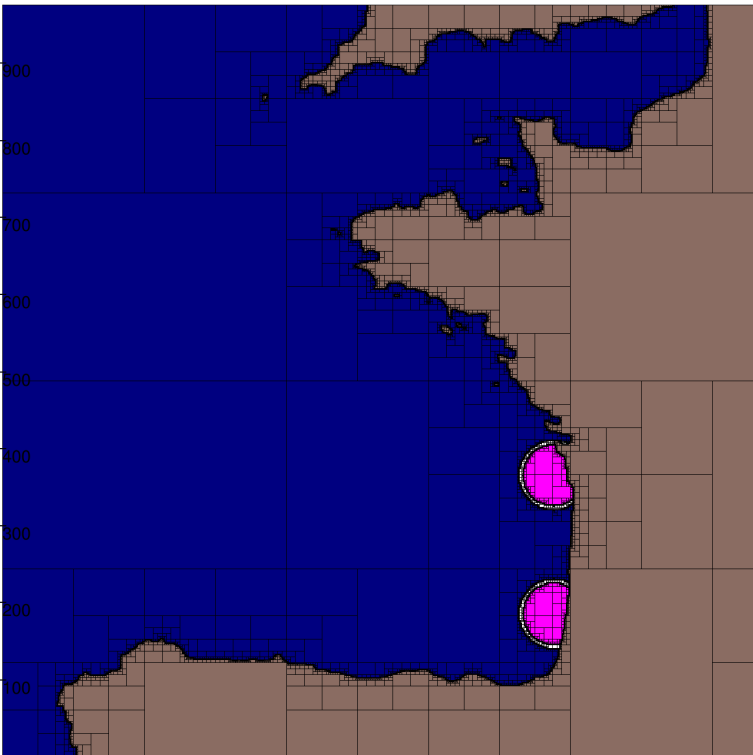
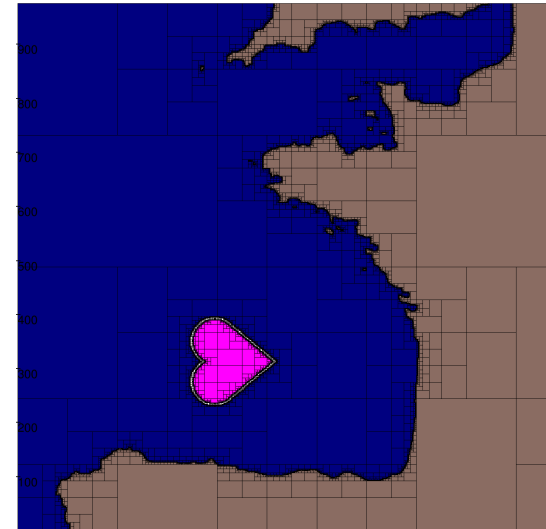
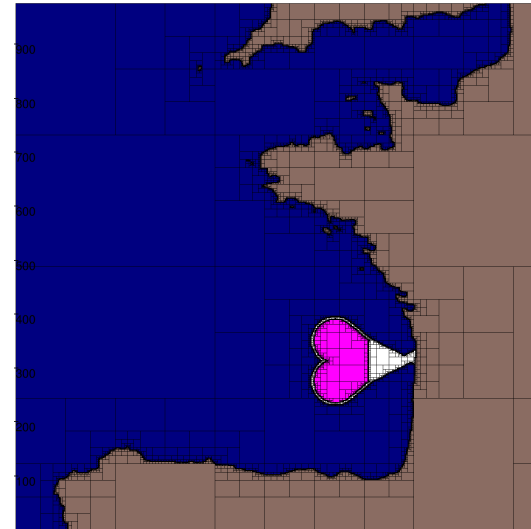
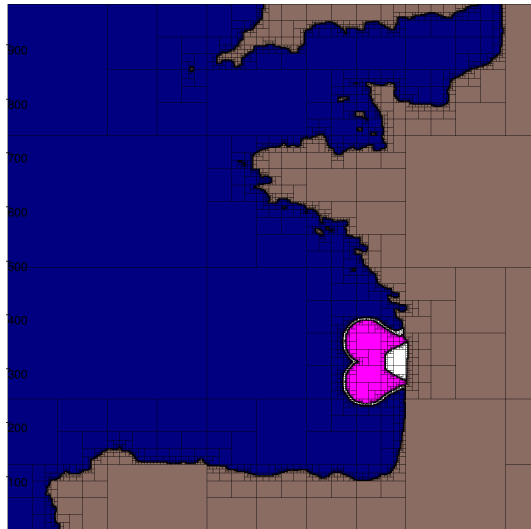
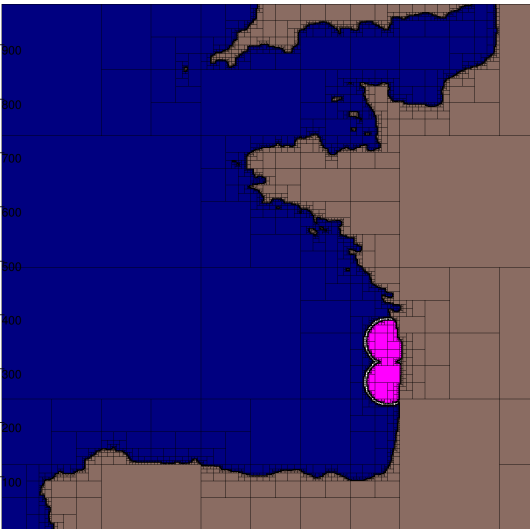
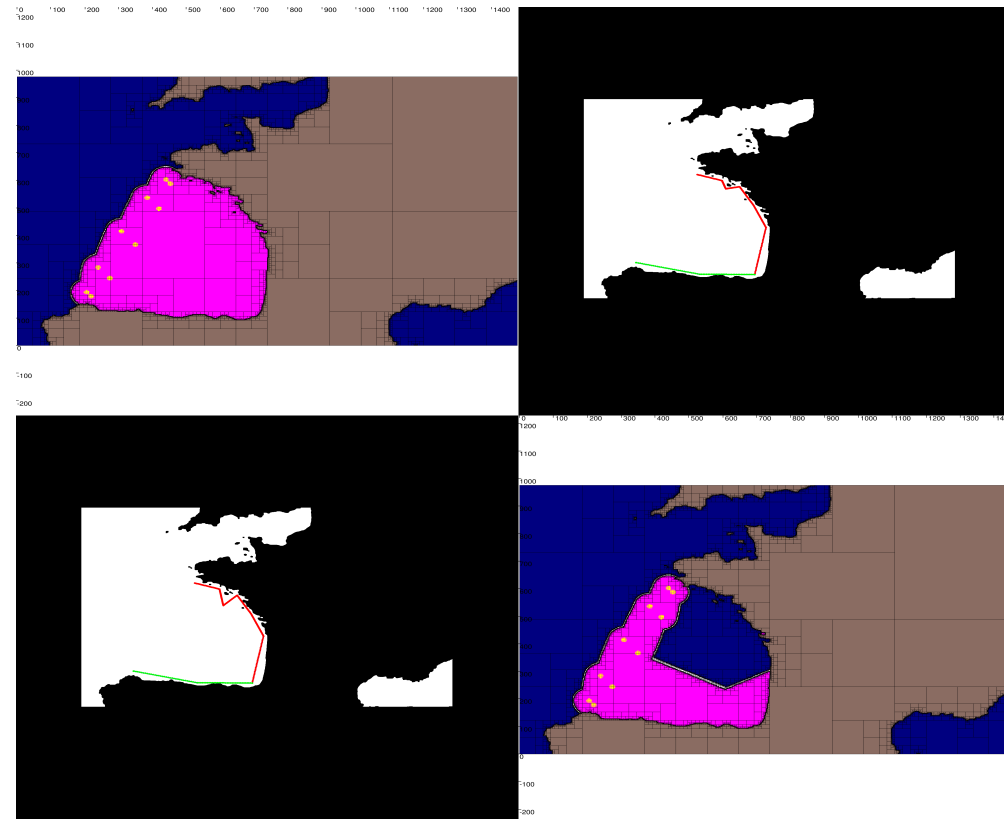


Image Contractor



Final Results



Next Work

Use dilate function in
pylBex instead of
OpenCV

Regulation of the
robots

Non causal case

Intruder Interception

Simulation /
Experiment