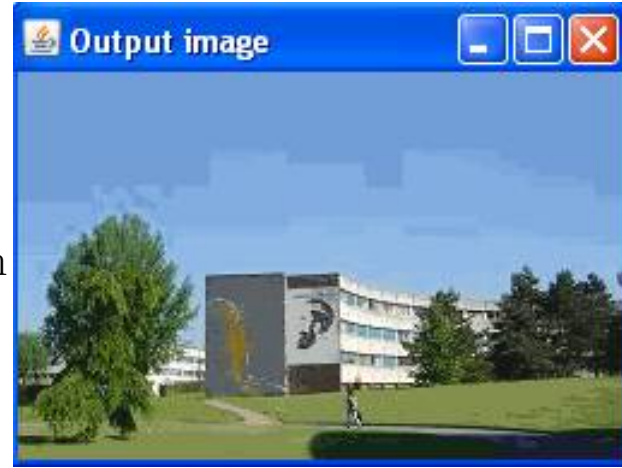


Mean-Shift clustering et segmentations d'images (application des Kd-Trees, voir TD7)



image originale (50700 pixels)

→
image segmentation

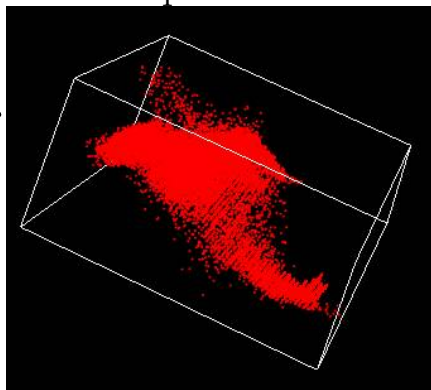


Mean-Shift clustering et segmentations d'images

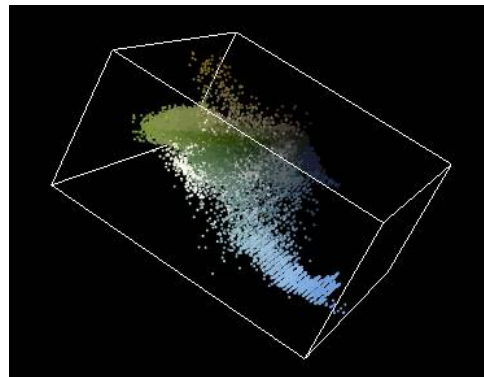
image originale (50700 pixels)



50700 points en 3D
espace Luv

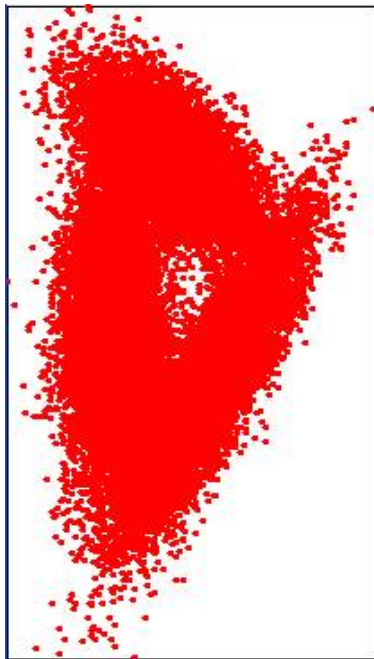


clustering



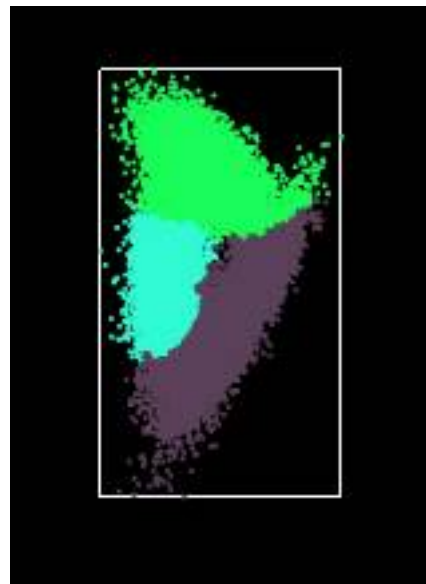
Clustering: en deux mots

n points (exemple en 2D)



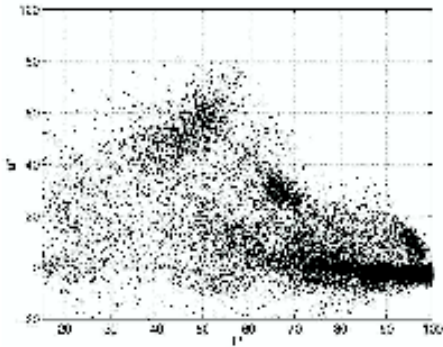
→
clustering

3 clusters

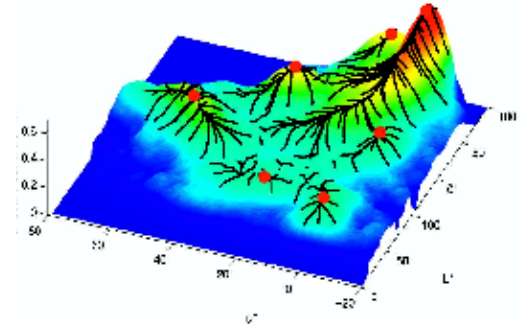
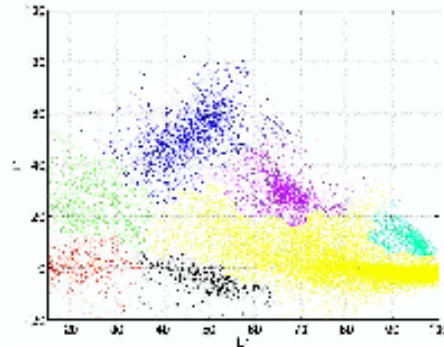


Mean-Shift clustering

n points



7 clusters



- Classification par les bassins d'attraction des maxima de l'estimateur de densité

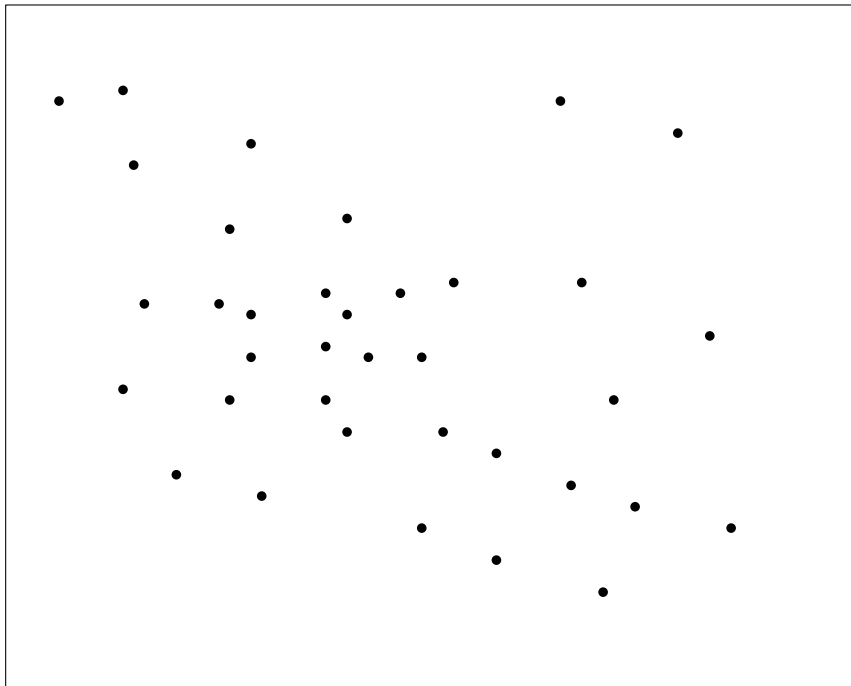
En pratique, on ne connaît pas la densité,
on l'estime par la méthode des noyaux

imaginons qu'on connaisse la fonction densité. Alors,...

- Maxima de l'estimateur = points fixes du mean shift

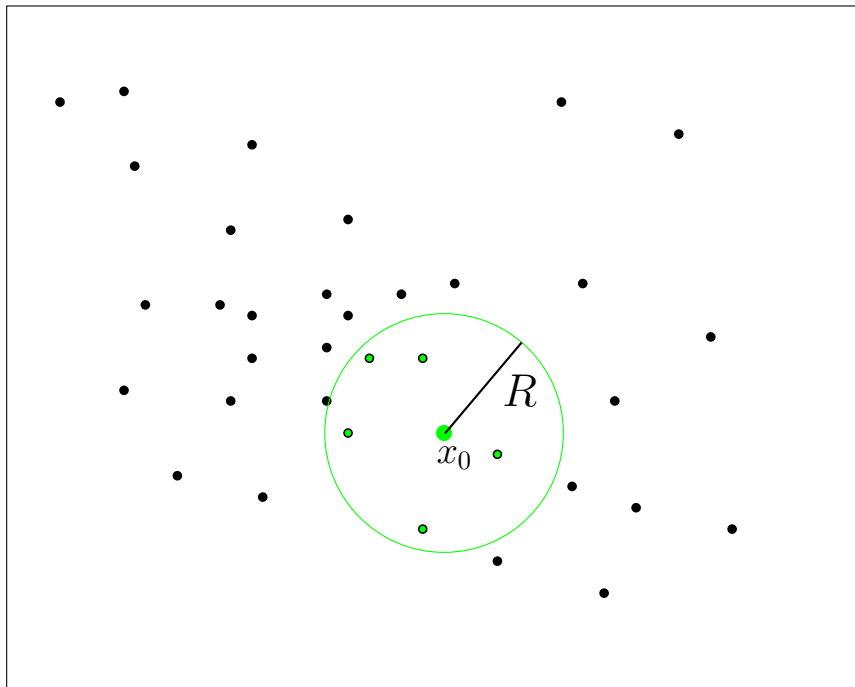
Mean-Shift clustering: detection d'un cluster

n points



Mean-Shift clustering: detection d'un cluster

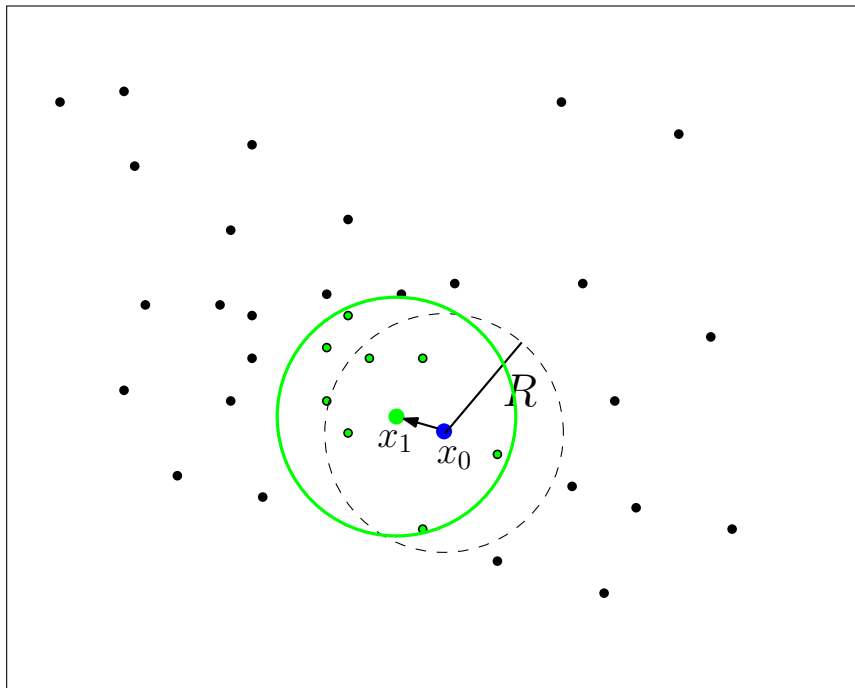
n points 1 seed



Mean-Shift clustering: detection d'un cluster

n points 1 seed R rayon de la fenetre

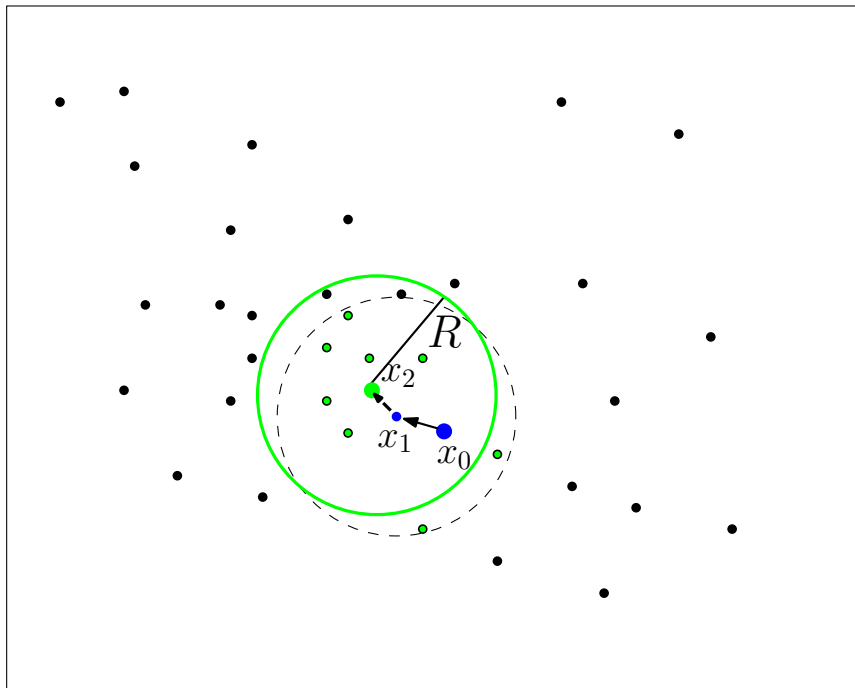
$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$



Mean-Shift clustering: detection d'un cluster

n points 1 seed R rayon de la fenetre

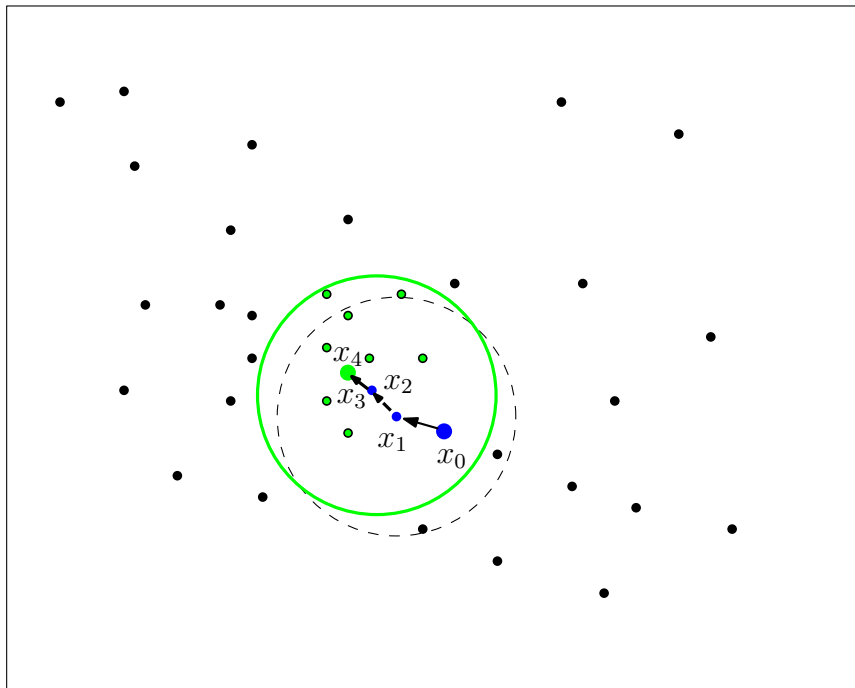
$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$



Mean-Shift clustering: detection d'un cluster

n points 1 seed R rayon de la fenetre

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$



Mean-Shift clustering: detection d'un cluster

n points 1 seed R rayon de la fenetre

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

cluster detecté

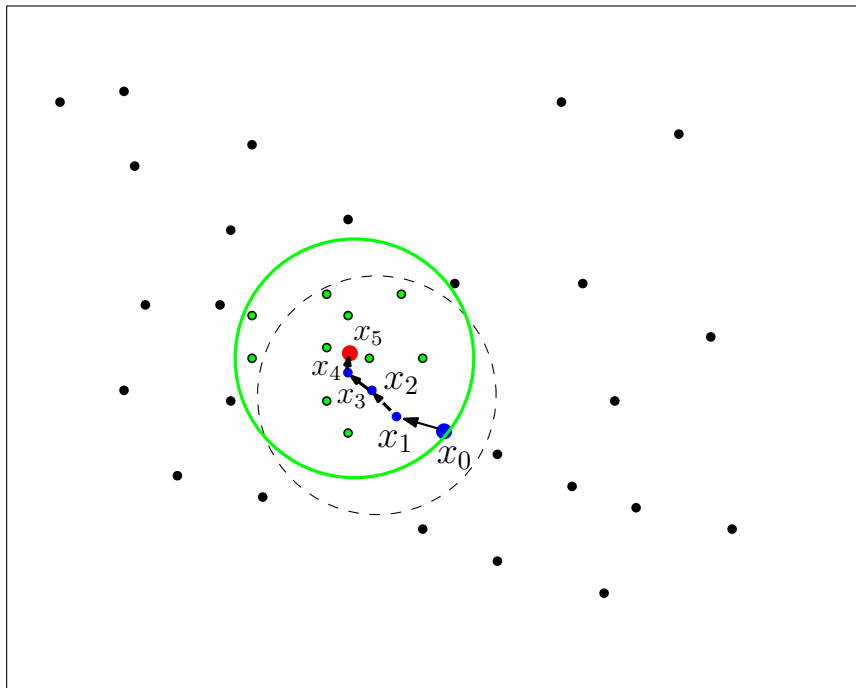
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

$$C_5 = \{x_0\}$$



Mean-Shift clustering: detection d'un cluster

n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

cluster detecté

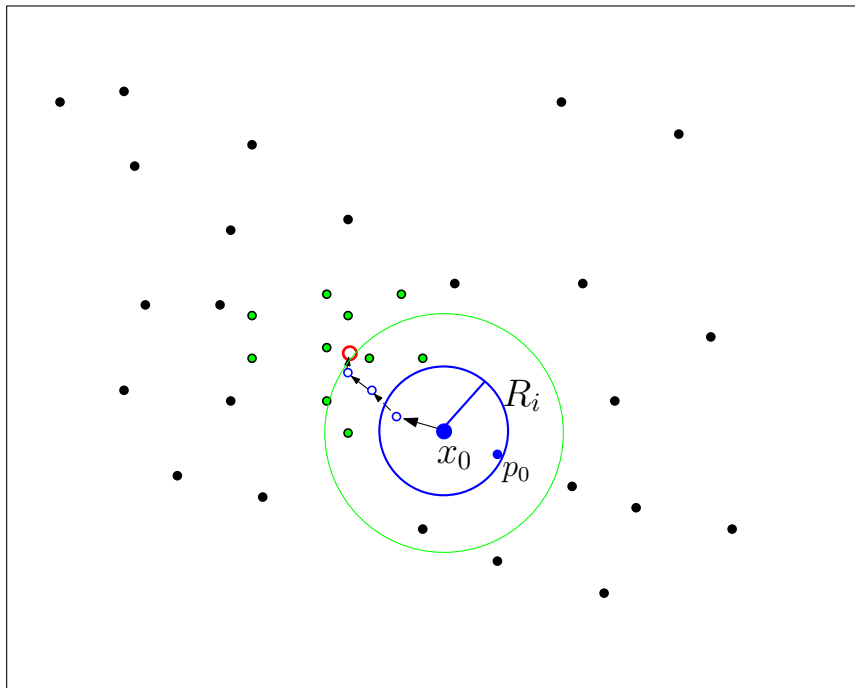
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

$$C_5 = \{x_0, p_0\}$$



Mean-Shift clustering: detection d'un cluster

n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

cluster detecté

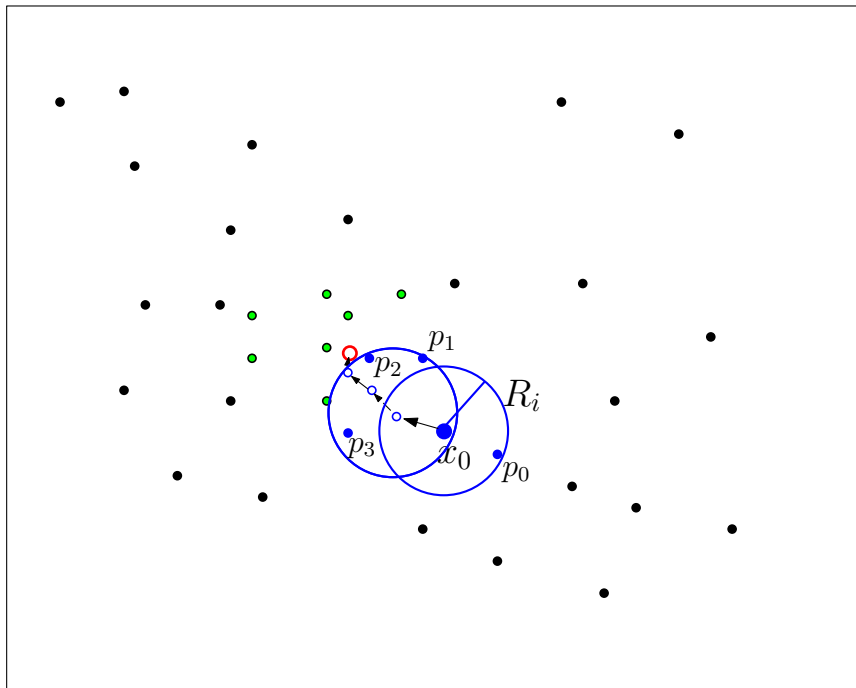
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

$$C_5 = \{x_0, p_0, p_1, p_2, p_3\}$$



Mean-Shift clustering: detection d'un cluster

n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

cluster detecté

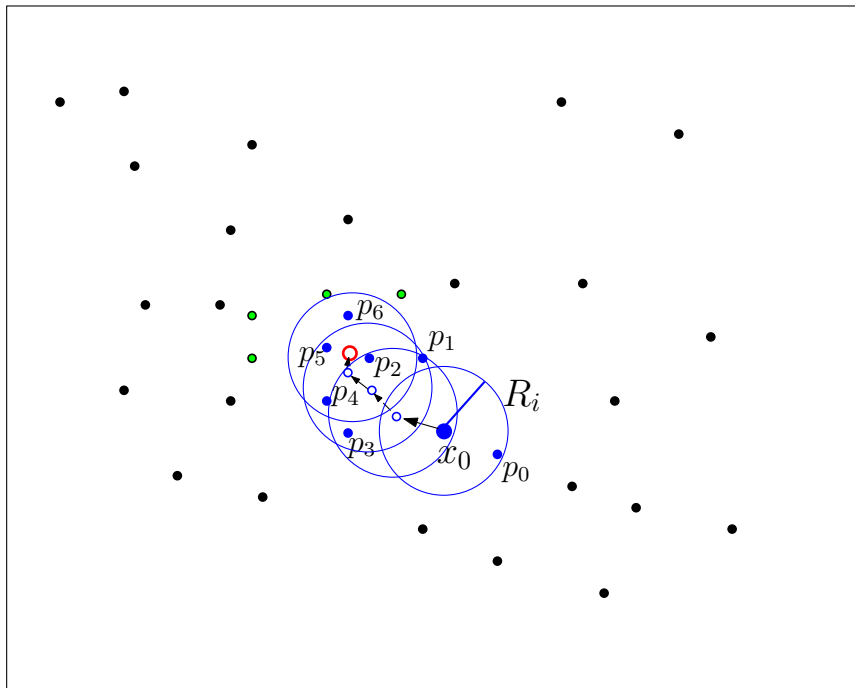
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

$$C_5 = \{x_0, p_0, p_1, p_2, p_3, p_4, p_5, p_6\}$$



Mean-Shift clustering: detection d'un cluster

n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

cluster detecté

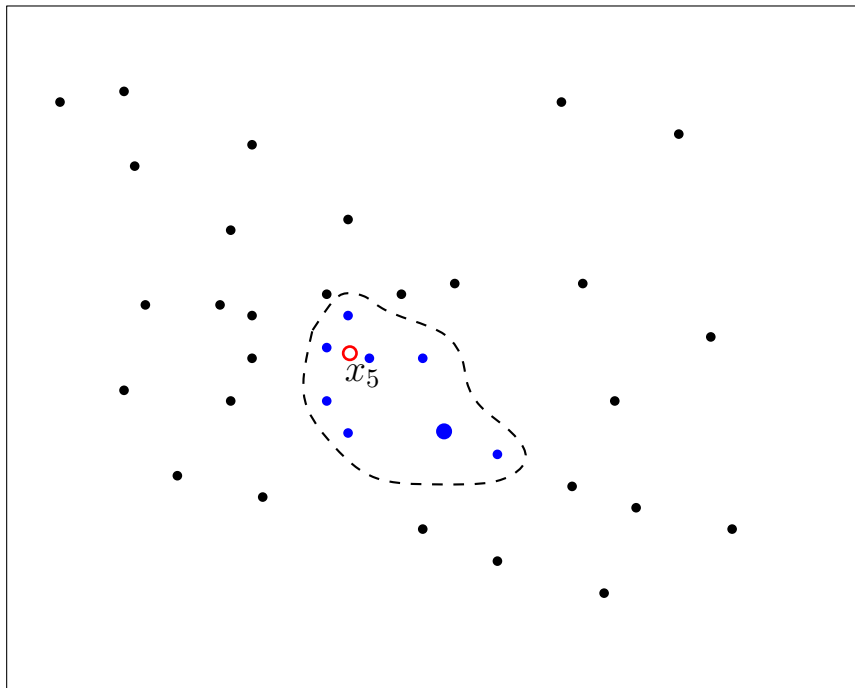
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

$$C_5 = \{x_0, p_0, p_1, p_2, p_3, p_4, p_5, p_6\}$$



Mean-Shift clustering: detection d'un cluster

n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

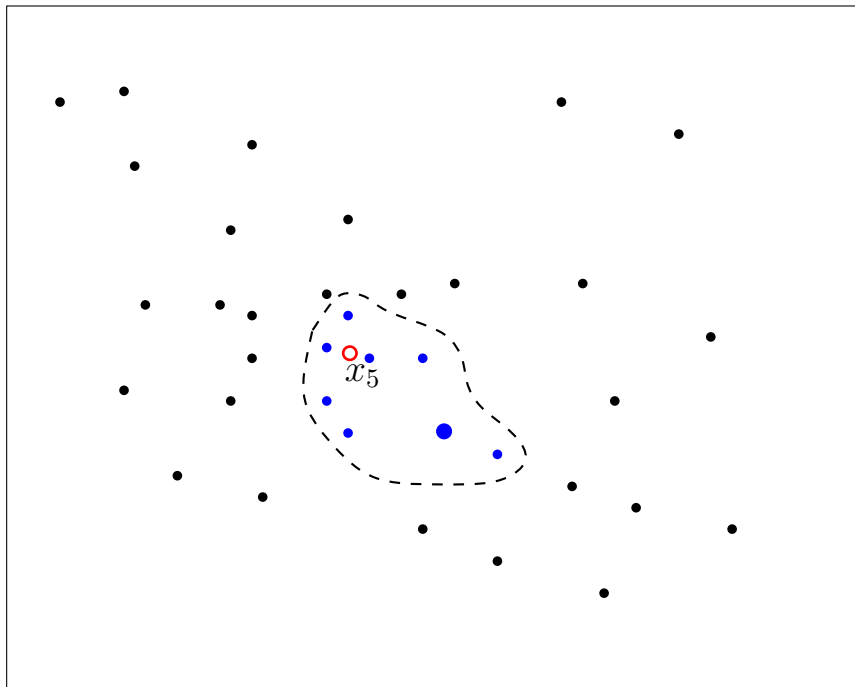
cluster detecté
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

cluster center



$$C_5 = \{x_0, p_0, p_1, p_2, p_3, p_4, p_5, p_6\}$$

Mean-Shift clustering: detection d'un cluster

n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

$$x_{i+1} := \text{mean}\{\text{neighbors}(x_i)\}$$

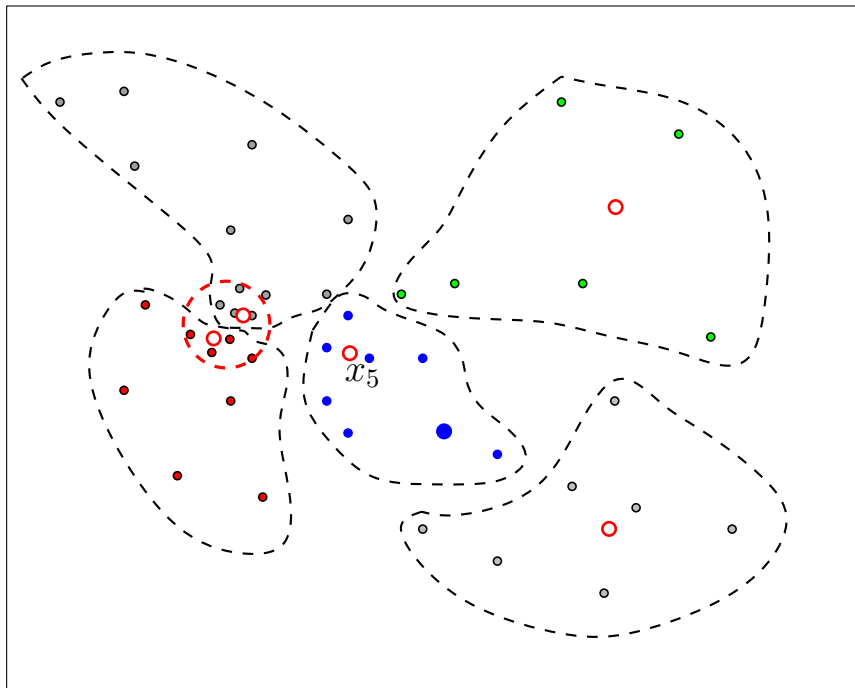
cluster detecté
on a convergence lorsque

$$d(x_{i+1}, x_i) \leq Rc$$

x_5 point stationnaire du Mean-Shift

C_5 cluster associé à x_5

cluster center



$$C_5 = \{x_0, p_0, p_1, p_2, p_3, p_4, p_5, p_6\}$$

$$C_{10} = \{p_7, p_8, \dots\}$$

$$C_{\dots} = \{\dots\}$$

Mean-Shift clustering: detection d'un cluster

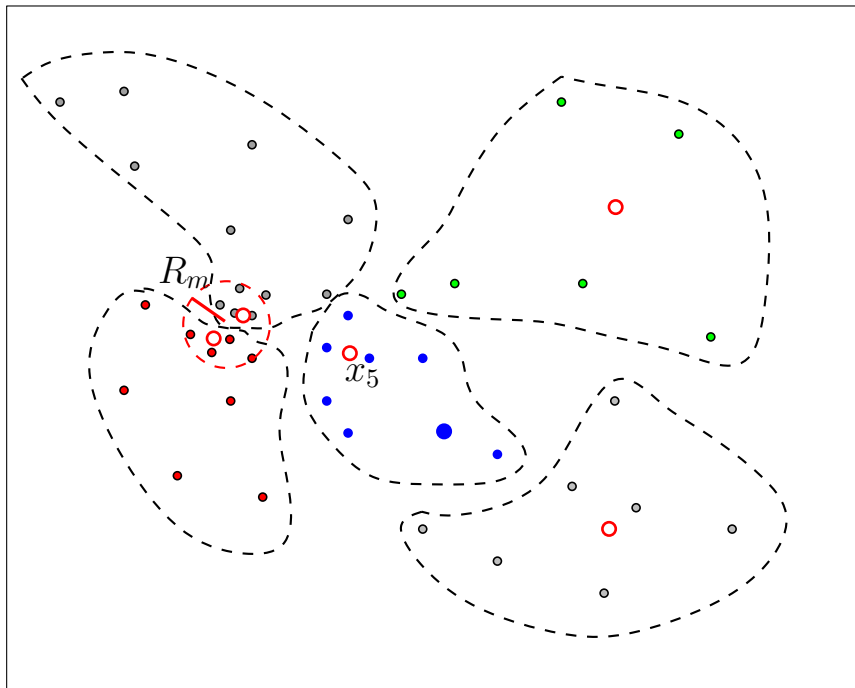
n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

R_m rayon de fusion



fusion de clusters (proches)

x_p, x_q points stationnaires du Mean-Shift

x_p, x_q cluster centers

$$d(x_p, x_q) \leq R_m$$



fusionner C_p et C_q

Mean-Shift clustering: detection d'un cluster

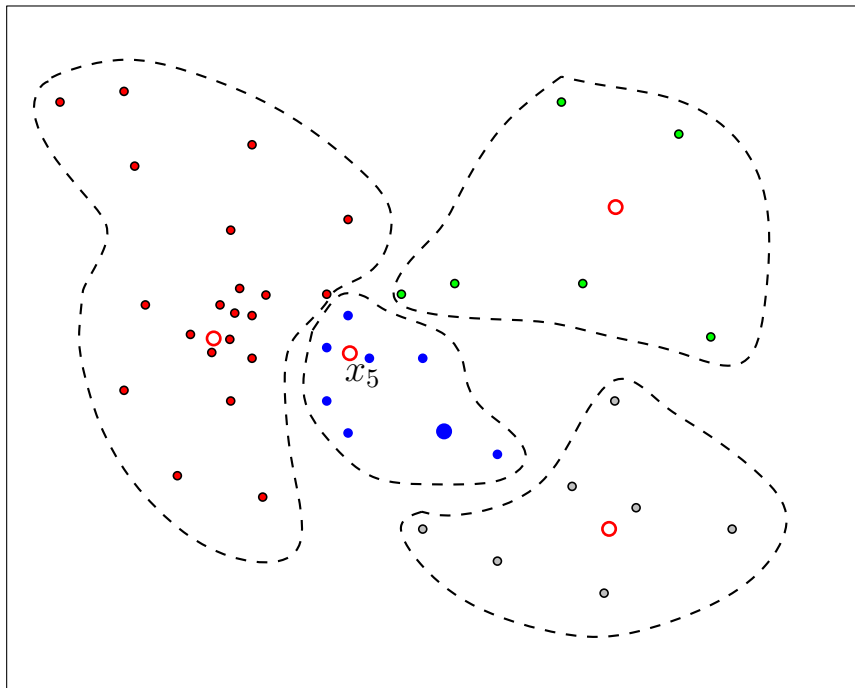
n points

1 seed

R rayon de la fenetre

R_i rayon d'influence

R_m rayon de fusion



fusion de clusters (proches)

x_p, x_q points stationnaires du Mean-Shift

x_p, x_q cluster centers

$$d(x_p, x_q) \leq R_m$$



fusionner C_p et C_q