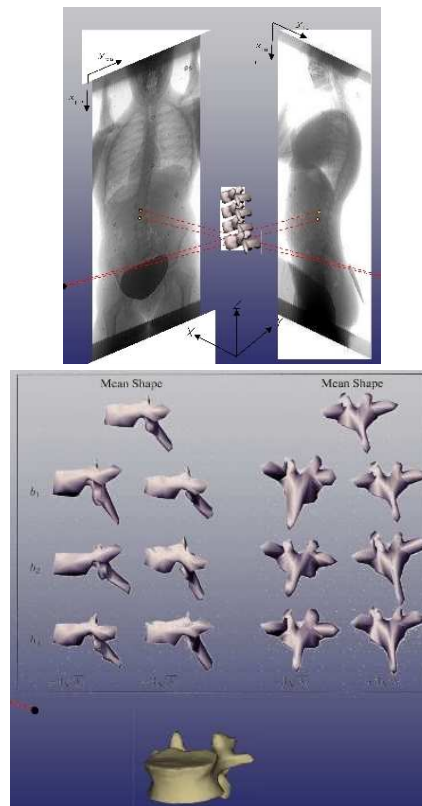


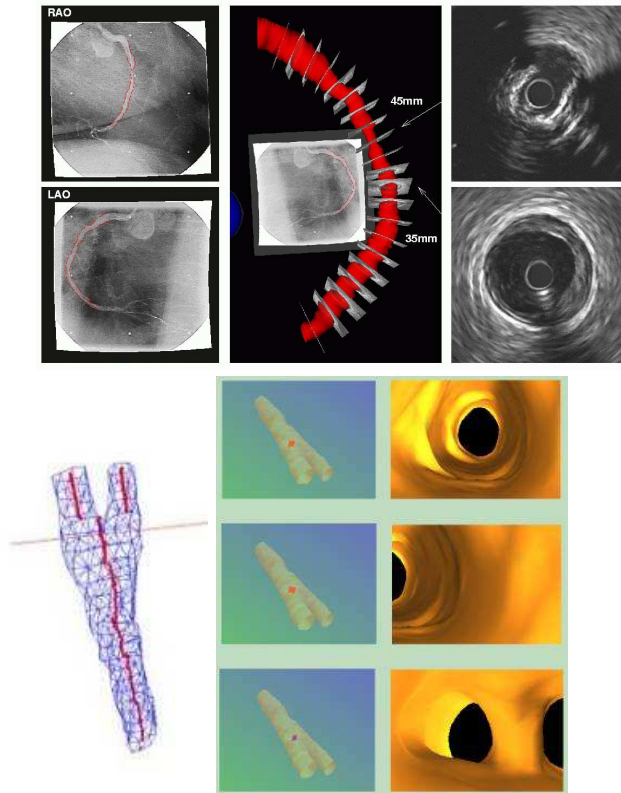
INTRODUCTION

Reconstruction 3D de la Colonne Vertébrale



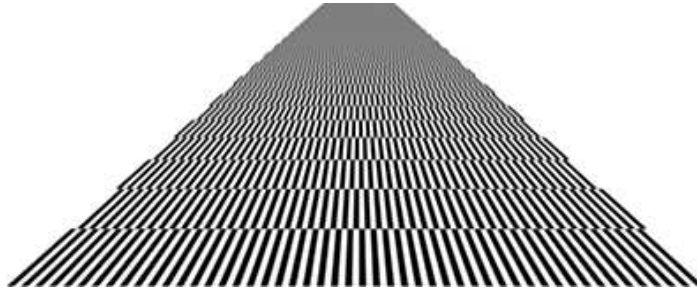
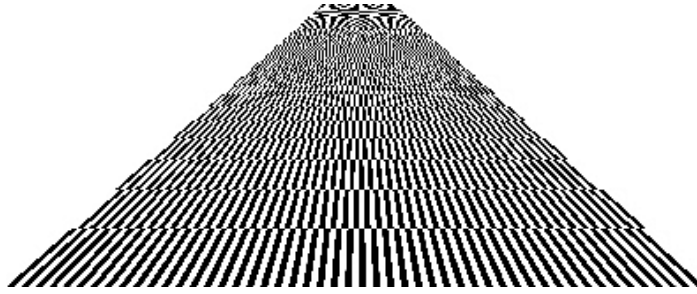
INTRODUCTION

Reconstruction Angiographique



TRANSFORMÉ DE FOURIER

Aliasing & Antialiasing




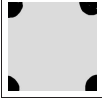
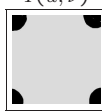
TFD
Périodisation Implicite de l'Image


$$\begin{aligned}
 &\text{TFD} \left(\begin{array}{c} \text{Portrait of a man} \end{array} \right) \\
 &= \\
 &\text{TF} \left(\begin{array}{c} \vdots \vdots \vdots \\ \text{Portrait of a man} \quad \text{Portrait of a man} \quad \text{Portrait of a man} \quad \text{Portrait of a man} \quad \vdots \vdots \vdots \\ \vdots \vdots \vdots \\ \text{Portrait of a man} \quad \text{Portrait of a man} \quad \text{Portrait of a man} \quad \text{Portrait of a man} \quad \vdots \vdots \vdots \\ \vdots \vdots \vdots \\ \text{Portrait of a man} \quad \text{Portrait of a man} \quad \text{Portrait of a man} \quad \text{Portrait of a man} \quad \vdots \vdots \vdots \\ \vdots \vdots \vdots \end{array} \right)
 \end{aligned}$$

TP1
Algorithmiquement

$$f(x,y) \stackrel{\mathcal{F}}{=} F(u,\nu) = R(u,\nu) + jI(u,\nu)$$

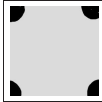



$$\text{TFD} \begin{pmatrix} \text{R  el} \\ \text{Imaginaire} \end{pmatrix} = \begin{pmatrix} R(u,\nu) \\ I(u,\nu) \end{pmatrix}$$



et

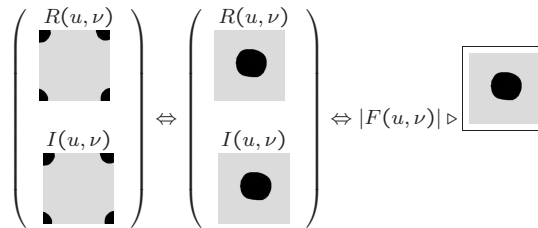
$$\text{TFD}^{-1} \begin{pmatrix} R(u,\nu) \text{ avec centre informatique} \\ I(u,\nu) \text{ avec centre informatique} \end{pmatrix} = \begin{pmatrix} \text{Image trait  e} \\ \text{Abstraction} \end{pmatrix}$$

TP1

Modification et Visualisation du Module

$$|F(u, \nu)| = \sqrt{R^2(u, \nu) + I^2(u, \nu)}$$



Exemples

$$|F(u = 3, \nu = 3)| = 0 \quad \Leftrightarrow \quad \begin{matrix} R(u = 3, \nu = 3) = 0 \\ I(u = 3, \nu = 3) = 0 \end{matrix}$$

$$|F(u = 3, \nu = 3)| \times 2 \quad \Leftrightarrow \quad \begin{matrix} R(u = 3, \nu = 3) \times 2 \\ I(u = 3, \nu = 3) \times 2 \end{matrix}$$

Nota -1-

Mult et $(1 + \log)$

► seulement pour la visualisation d'un module de spectre !

Nota -2-

$$\text{discontinuités horizontales} \stackrel{\mathcal{F}}{\rightleftharpoons} \text{discontinuités verticales}$$

TP1

Recouvrement Spatial



En utilisant la TFD

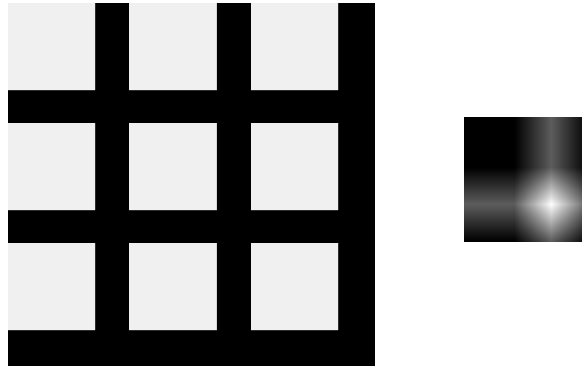


TP1

Recouvrement Spatial

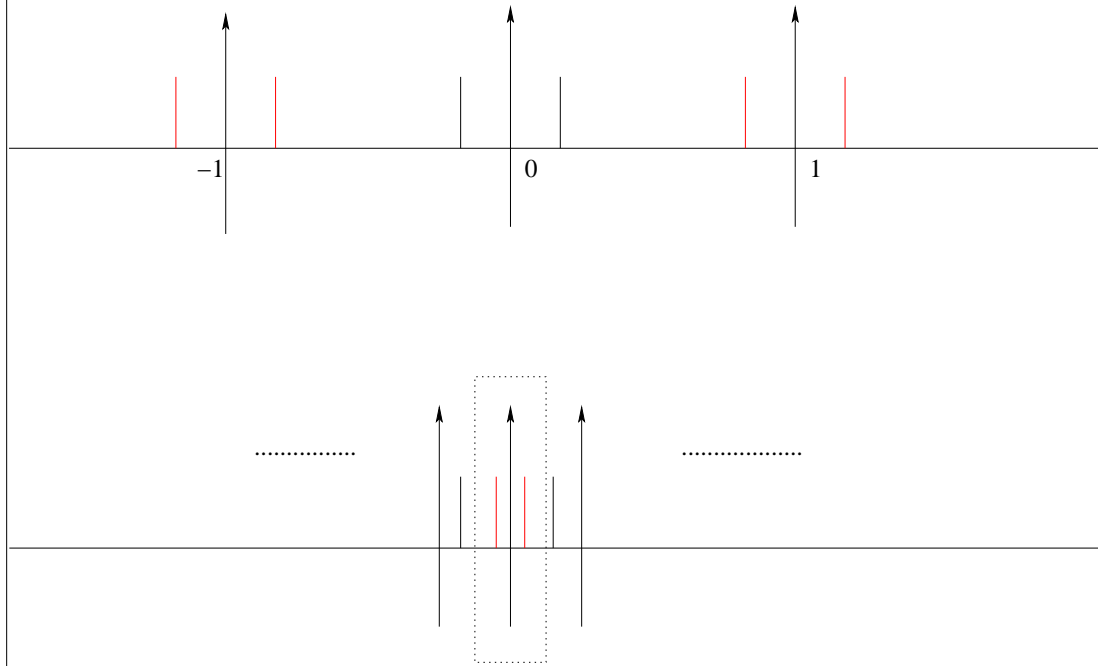


En utilisant la TFD



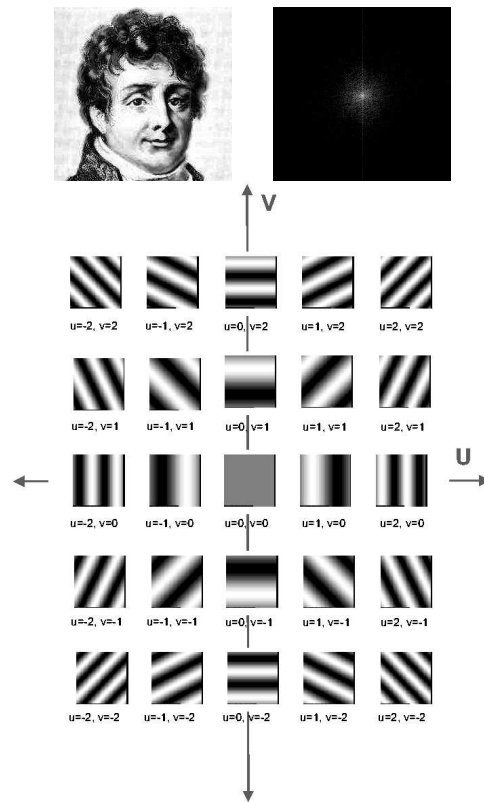
TP1
Sous-Échantillonnage

X



TF DISCRÈTE

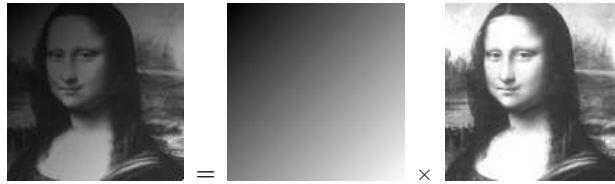
TF discrète 2D (Interprétation)



FILTRAGE FRÉQUENTIEL

Filtrage Homomorphique

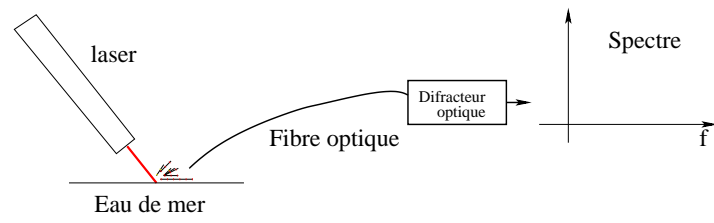
$$f(x, y) = i(x, y) \cdot r(x, y)$$



RESTAURATION

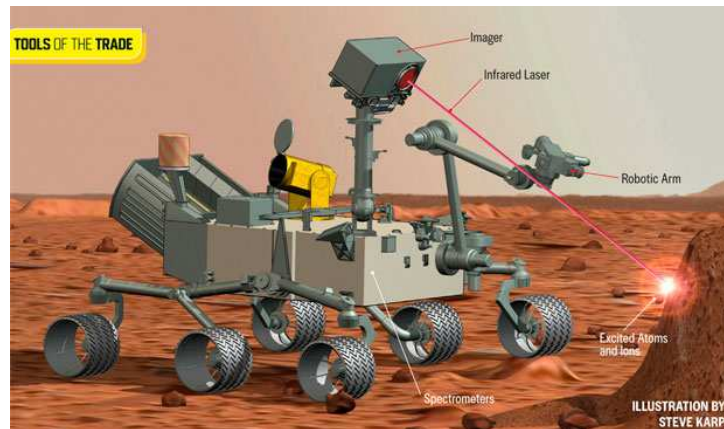
Déconvolution de Fonction d'Appareil

LOE (Ifremer)



RESTAURATION

Mars Curiosity



RESTAURATION

Estimation de la PSF



RESTAURATION

Estimation de la PSF



RESTAURATION

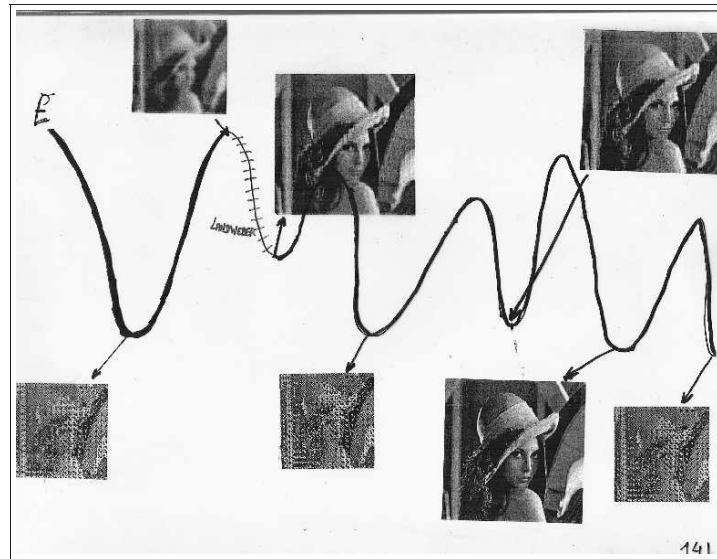
Méthodes Itératives

Méthodes Itératives & Problèmes Inverse Mal-Posés

Fonction de coût :

$$\hat{f}(x, y) = \arg \min_f \left\{ \|\hat{f}(x, y) - f(x, y)\|^2 \right\}$$

$$\hat{f}(x, y) = \arg \min_f \left\{ \|g(x, y) - h(x, y) * \hat{f}(x, y)\|^2 \right\}$$



TOMOGRAPHIE

Applications (1)

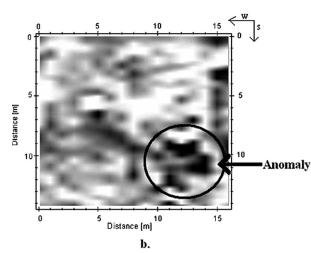
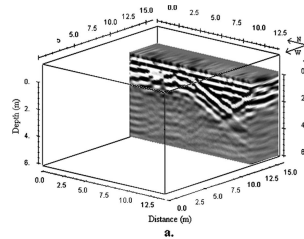
Reconstruction faciale de l'intérieur d'une momie



TOMOGRAPHIE

Applications (2)

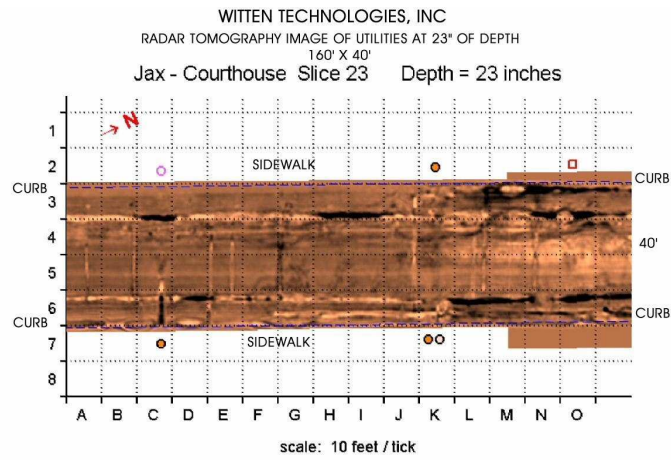
Detection de chambre mortuaires



TOMOGRAPHIE

Applications (3)

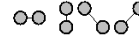
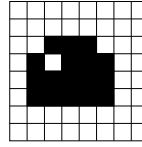
Tomographie Radar des sols



SEGMENTATION D'IMAGES

ICM : Exemple de Calcul

$$\hat{x}_{MAP} = \arg \min_x \left\{ \underbrace{\sum_{s \in S} \left[\ln(\sqrt{2\pi}\sigma_{x_s}) + \frac{(y_s - \mu_{x_s})^2}{2\sigma_{x_s}^2} \right]}_{V(x,y)} + \underbrace{\sum_{c \in C} \beta_c [1 - \delta(x_s, x_t)]}_{U(x)} \right\}$$



Voisinage du 2nd ordre avec cliques binaires

$$U(x) = \sum_{c \in C} V_c(x) \quad \text{avec} \quad V_c(x) = [1 - \delta(x_s, x_t)]$$

• A PRIORI

$$P_{X_s}(x_s = \blacksquare) = \frac{1}{Z} \exp \left\{ - \sum_{c \in C} V_c(x_s = \blacksquare) \right\} = . \quad . \quad . \quad . \quad . \quad . \quad .$$

$$P_{X_s}(x_s = \square) = \frac{1}{Z} \exp \left\{ - \sum_{c \in C} V_c(x_s = \square) \right\} = . \quad . \quad . \quad . \quad . \quad . \quad .$$

• VRAISSEMBLANCE

$$p_{Y_s/X_s}(y_s/x_s = \square) = \mathcal{N}(200, 10) \quad \& \quad p_{Y_s/X_s}(y_s/x_s = \blacksquare) = \mathcal{N}(100, 10)$$

$$\bullet y_s = 160 \triangleright$$

$$\bullet y_s = 155 \triangleright$$

SEGMENTATION D'IMAGES

RS : Effet de la Température

$$P_{X_s/X_{rs},Y_s}(x_s/\eta_s,y_s) = \frac{1}{Z_s} \exp\left\{-\frac{1}{T_k}(U(.))\right\}$$

$$U_{\blacksquare} = 0.85$$

$$U_{\square} = 0.15$$

$$\boxed{\mathbf{T=1} \triangleright}$$

$$P(\blacksquare/y_s) = \frac{e^{-0.85}}{e^{-0.85} + e^{-0.15}} =$$

$$P(\square/y_s) = \frac{e^{-0.15}}{\mathcal{D}} =$$

$$\boxed{\mathbf{T=10} \triangleright}$$

$$P(\blacksquare/y_s) = \frac{e^{-0.85/10}}{e^{-0.85/10} + e^{-0.15/10}} =$$

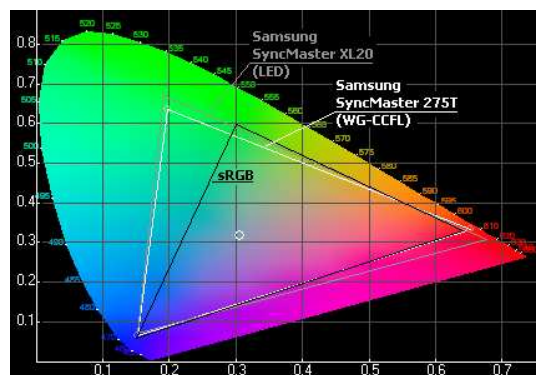
$$P(\square/y_s) = \frac{e^{-0.15/10}}{\mathcal{D}} =$$

$$\boxed{\mathbf{T=0.1} \triangleright}$$

$$P(\blacksquare/y_s) = \frac{e^{-0.85/0.1}}{e^{-0.85/0.1} + e^{-0.15/0.1}} =$$

$$P(\square/y_s) = \frac{e^{-0.15/0.1}}{\mathcal{D}} =$$

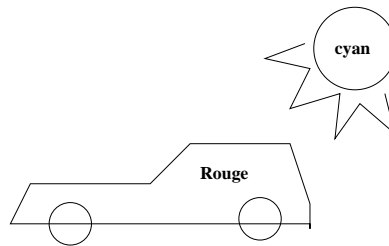
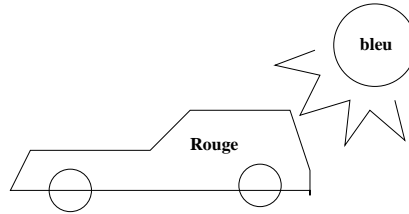
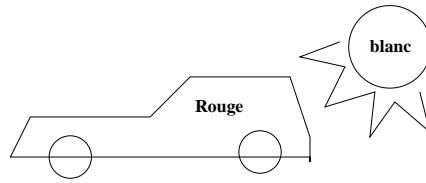
COULEURS GAMUT



@gammatech

COULEURS

CUBE RGB



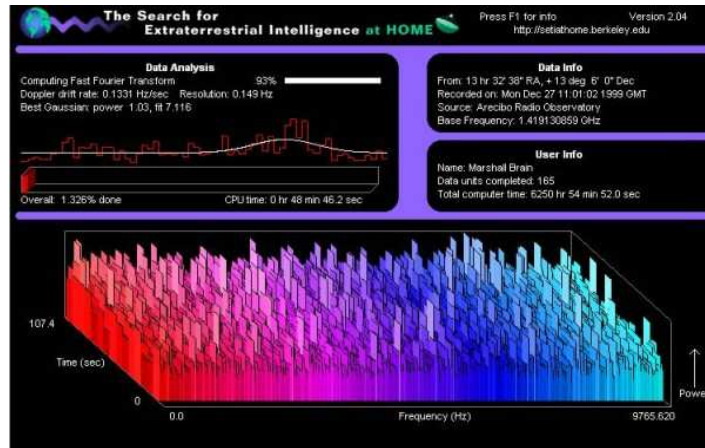
COMPRESSION

DCT

$$\text{TCD} \left(\begin{array}{|c|} \hline \text{😊} \\ \hline \end{array} \right) = \text{TFD} \left\{ \begin{array}{|c|c|} \hline \text{😊} & \text{😊} \\ \hline \text{😬} & \text{😬} \\ \hline \end{array} \right\}$$

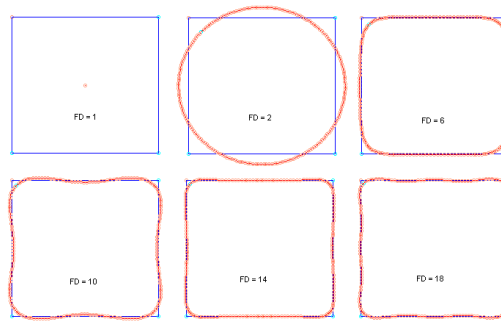
RECONNAISSANCE DES FORMES

PROJET SETI

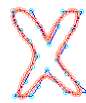


RECONNAISSANCE DES FORMES

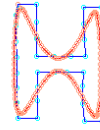
DESCRIPTEUR DE FOURIER



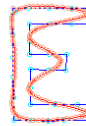
Number of FD: 6



Number of FD: 10



Number of FD: 8



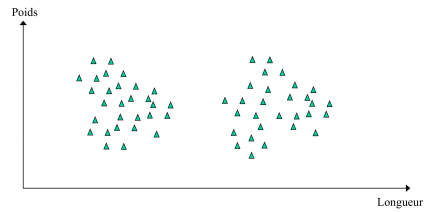
Number of FD: 8

RECONNAISSANCE DES FORMES

ALGORITHME DES K-MOYENNES (1)

Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes

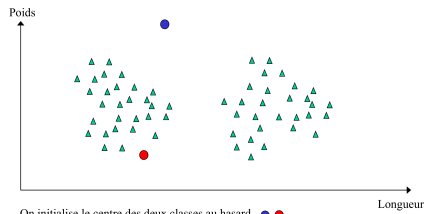


Voici 60 observations. Comment faire pour grouper ces données en deux classes et estimer la moyenne (ou le centre de masse) de ces classes ?

36

Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



On initialise le centre des deux classes au hasard

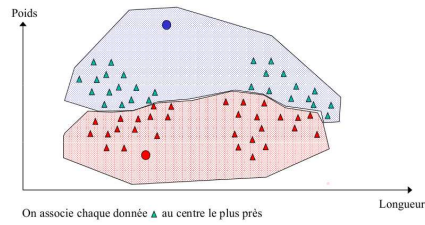
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RECONNAISSANCE DES FORMES

ALGORITHME DES K-MOYENNES (2)

Algorithme des K-moyennes (*K-means*)

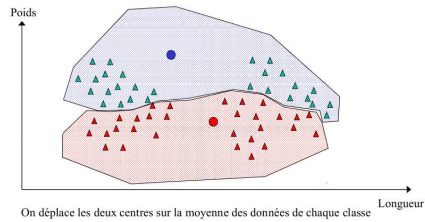
Exemple schématique de l'algorithme des K-moyennes



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Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



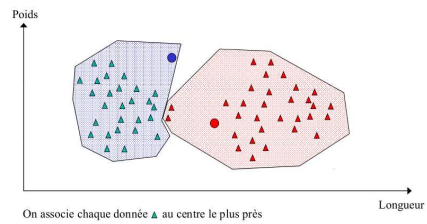
39

RECONNAISSANCE DES FORMES

ALGORITHME DES K-MOYENNES (3)

Algorithme des K-moyennes (*K-means*)

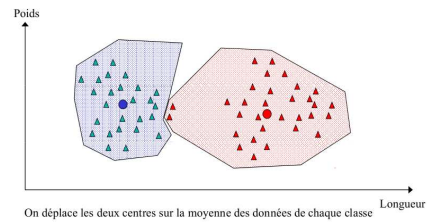
Exemple schématique de l'algorithme des K-moyennes



40

Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



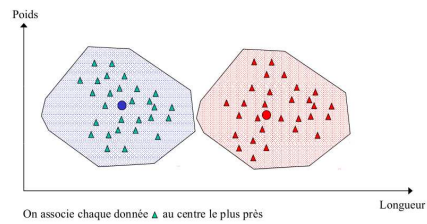
41

RECONNAISSANCE DES FORMES

ALGORITHME DES K-MOYENNES (4)

Algorithme des K-moyennes (*K-means*)

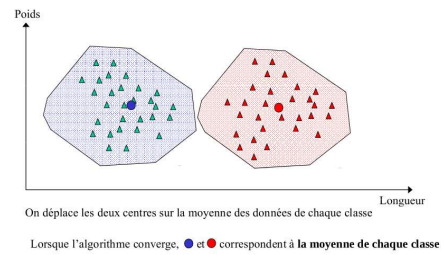
Exemple schématique de l'algorithme des K-moyennes



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Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



43



