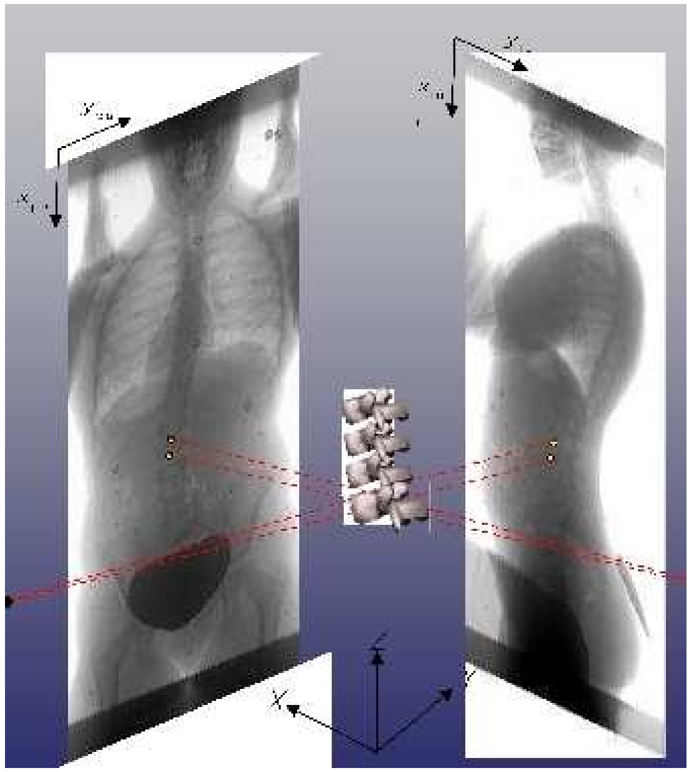
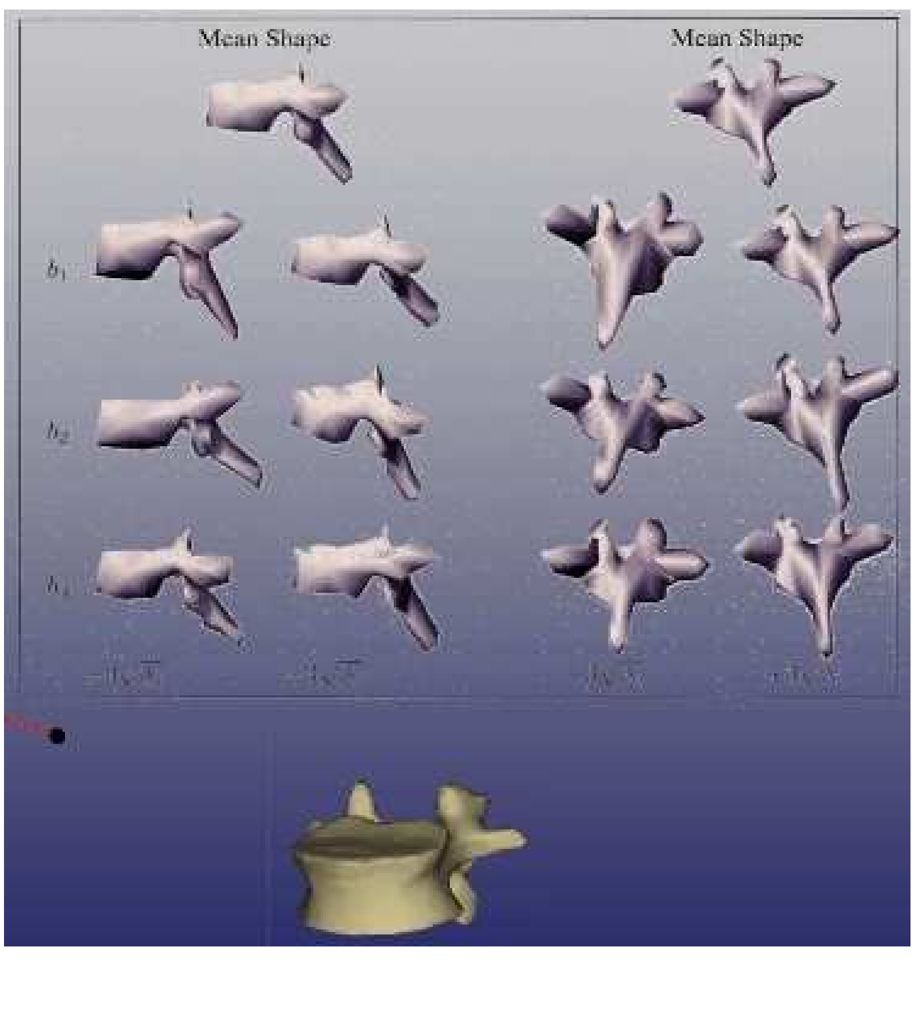
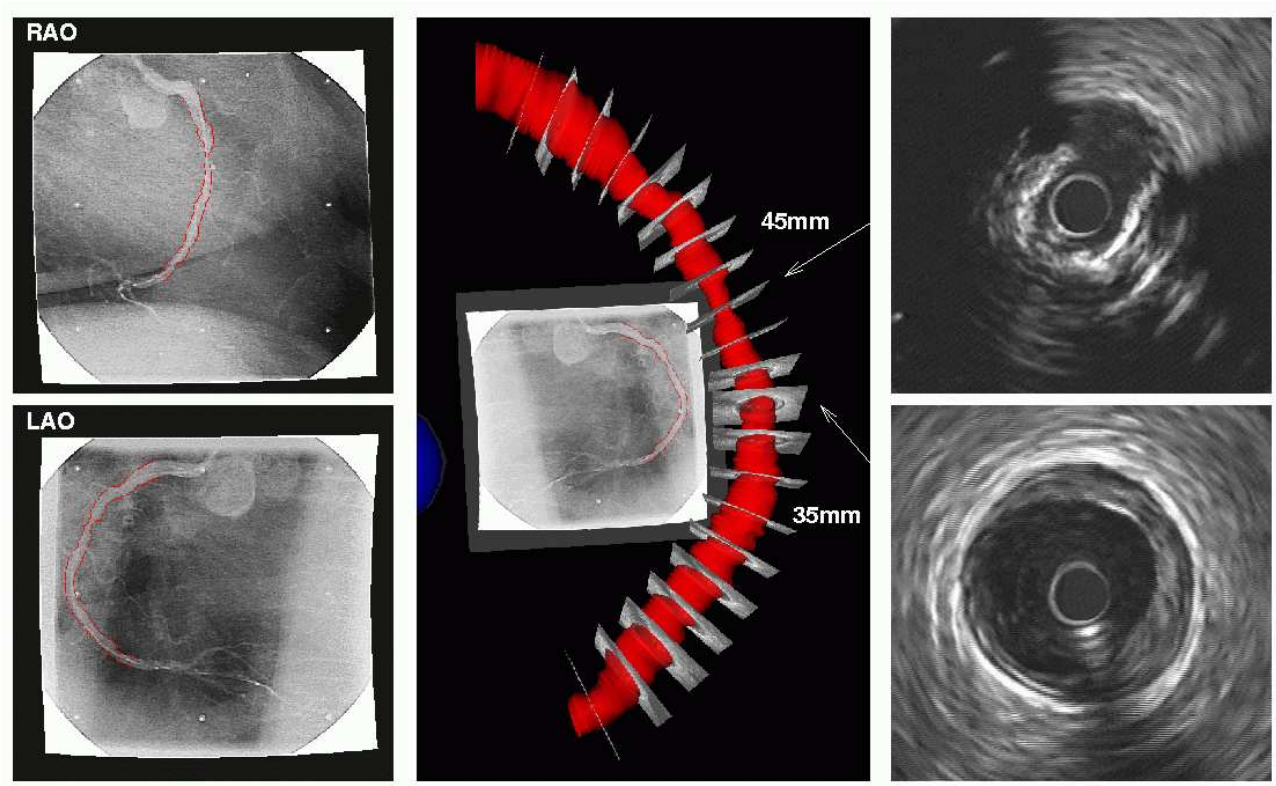
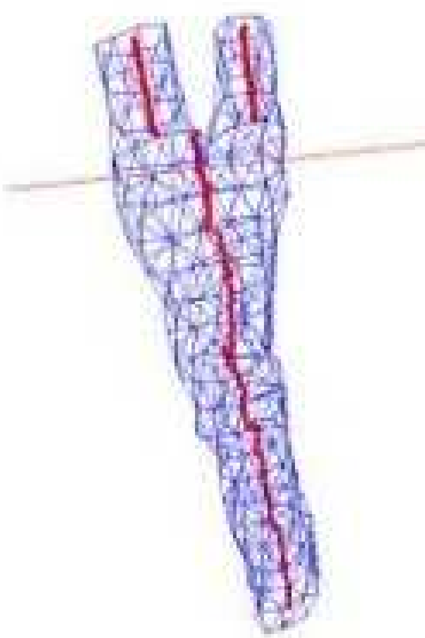
INTRODUCTION
Reconstruction 3D de la Colonne Vertébrale

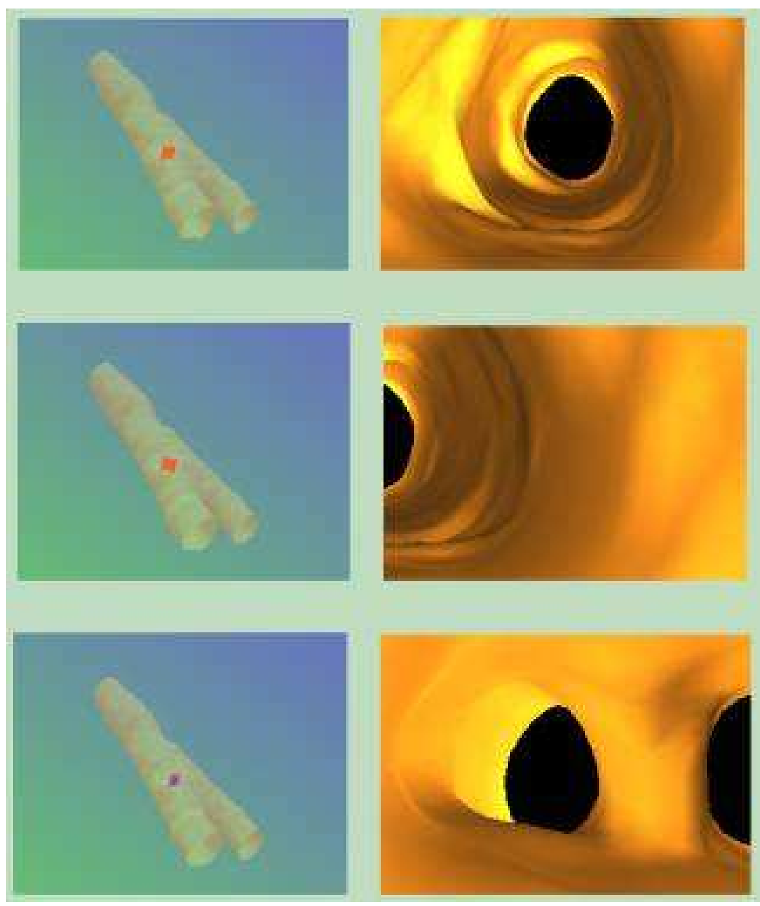


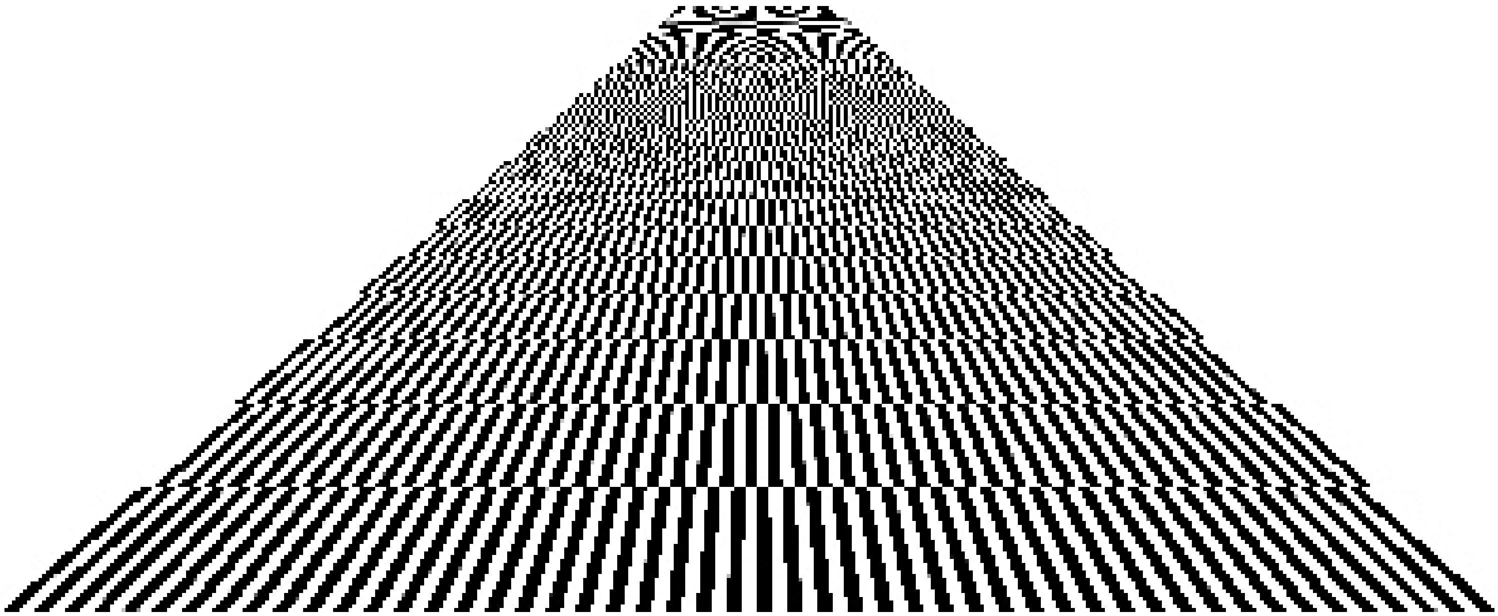


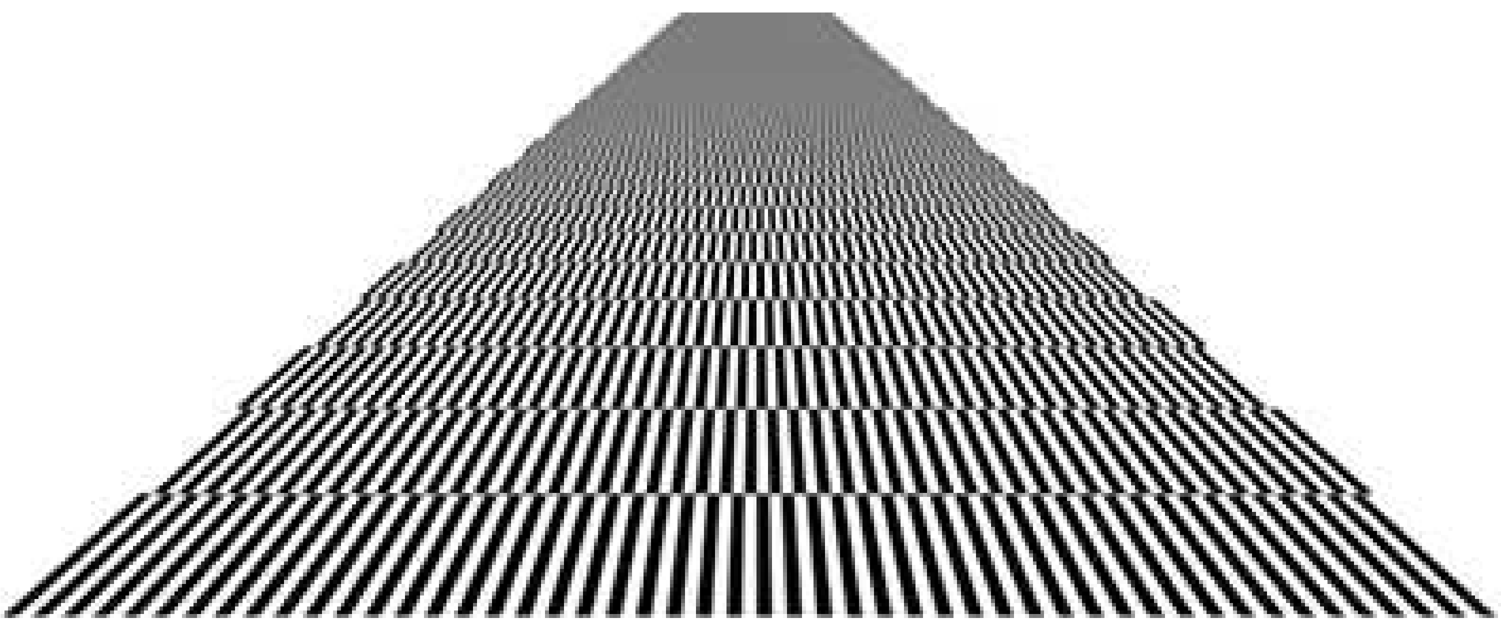
INTRODUCTION
Reconstruction Angiographique











Périodisation Implicite de l'Image

TFD ()

=

TF ()

TP1

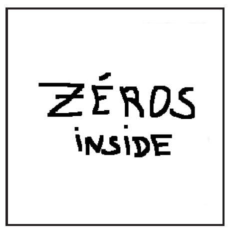
Algorithmiquement

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

TFD

Réel

Imaginaire



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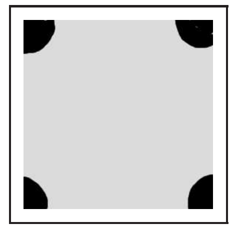
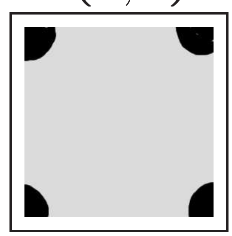
$R(u,\nu)$



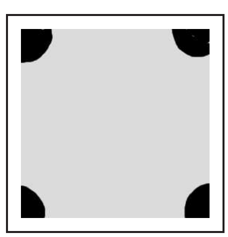
$I(u,\nu)$



et

TFD^{-1}

$R(u,\nu)$ avec centre informatique



$I(u,\nu)$ avec centre informatique

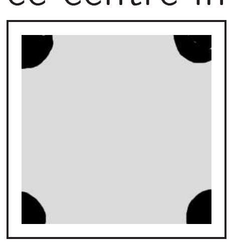


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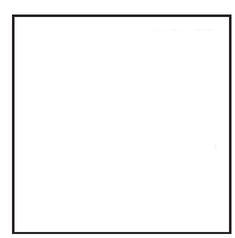
Image traitée

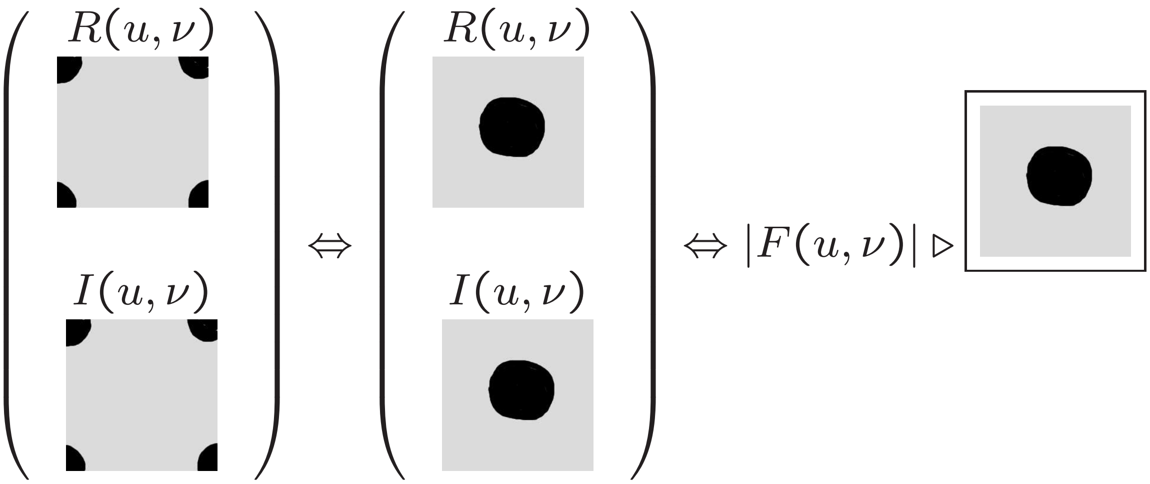
Abstraction



TP1

Modification et Visualisation du Module

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



Exemples

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

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

Nota -1-

Mult et $(1 + \log)$

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

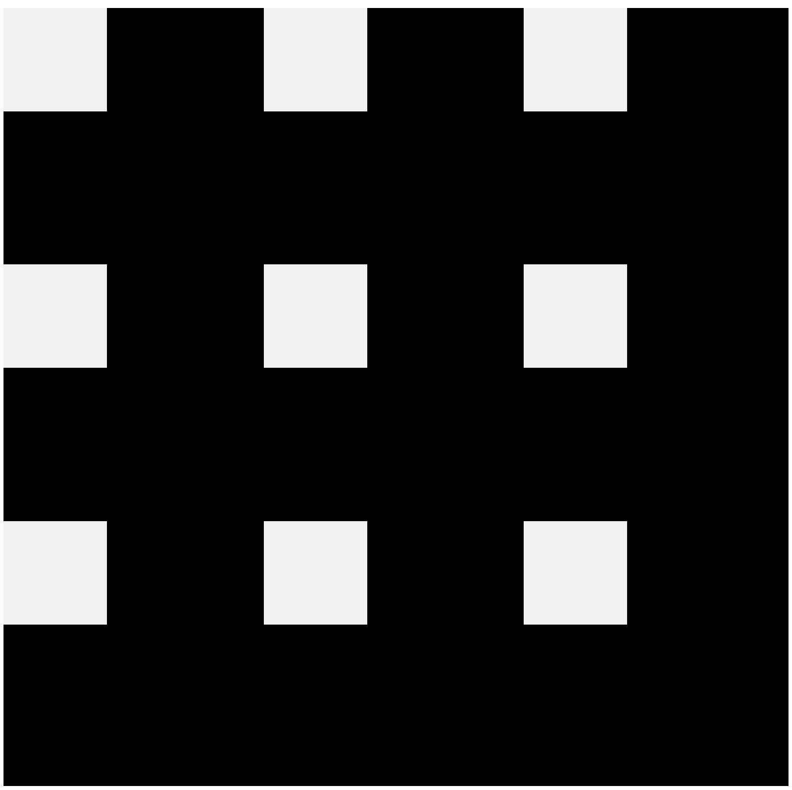
Nota -2-

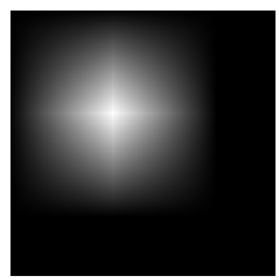
discontinuités horizontales $\overset{\mathcal{F}}{\rightleftharpoons}$ discontinuités verticales

TP1
Recouvrement Spatial

$*$

En utilisant la TFD

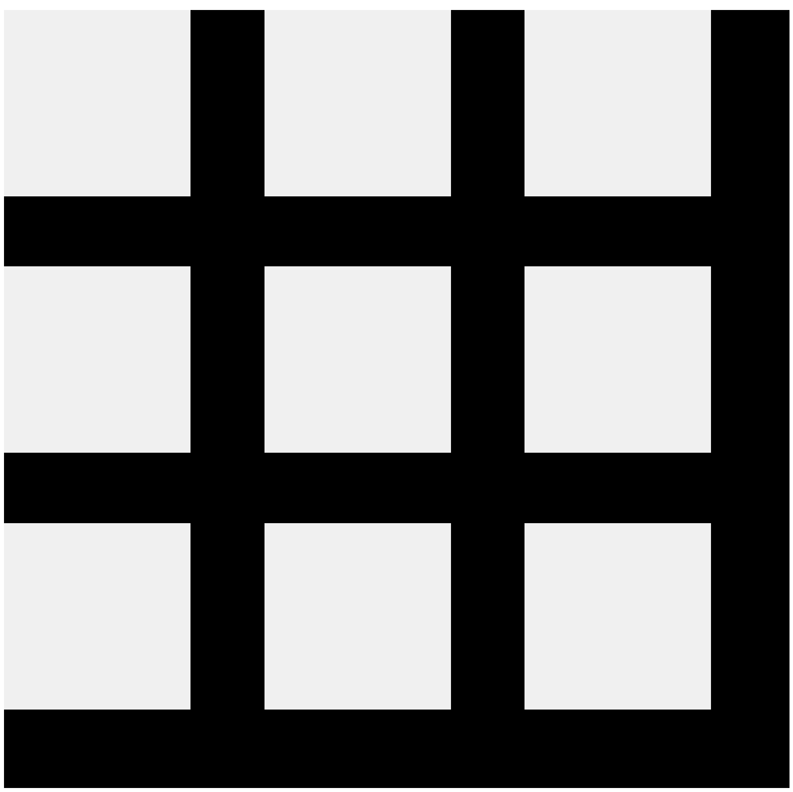


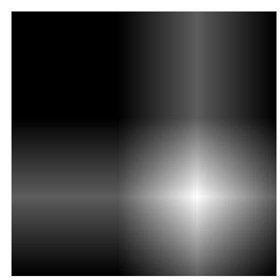


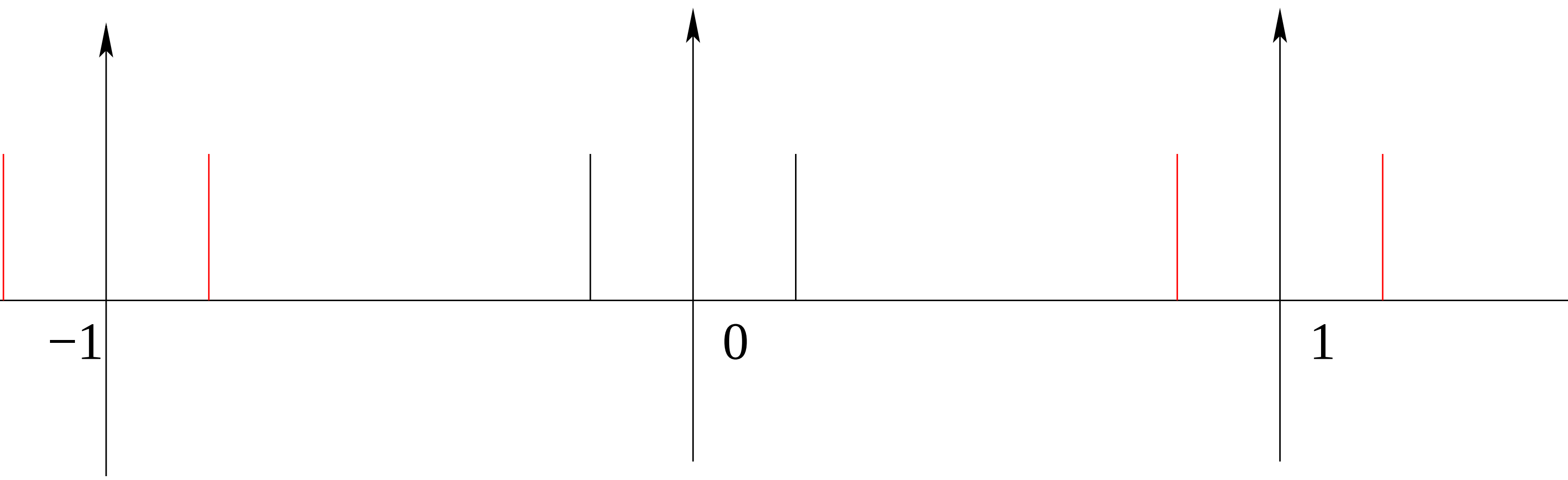
TP1
Recouvrement Spatial

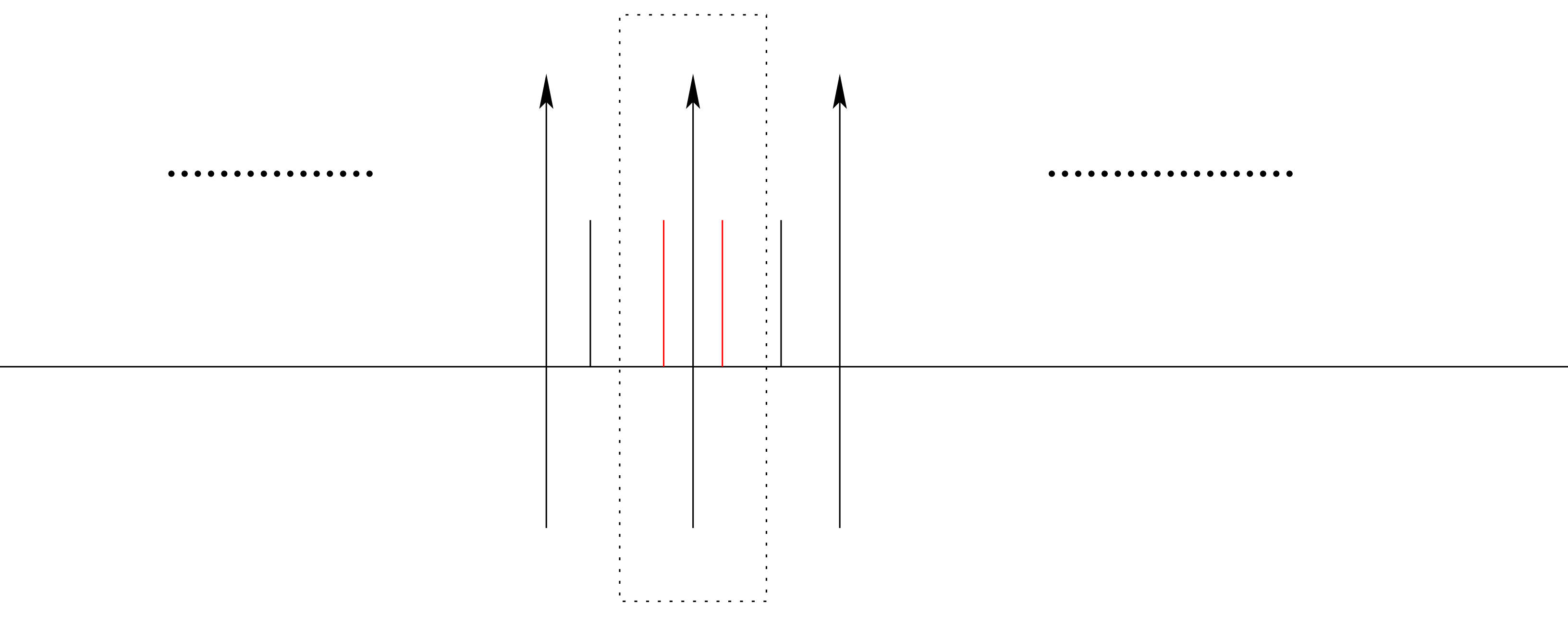
$*$

En utilisant la TFD



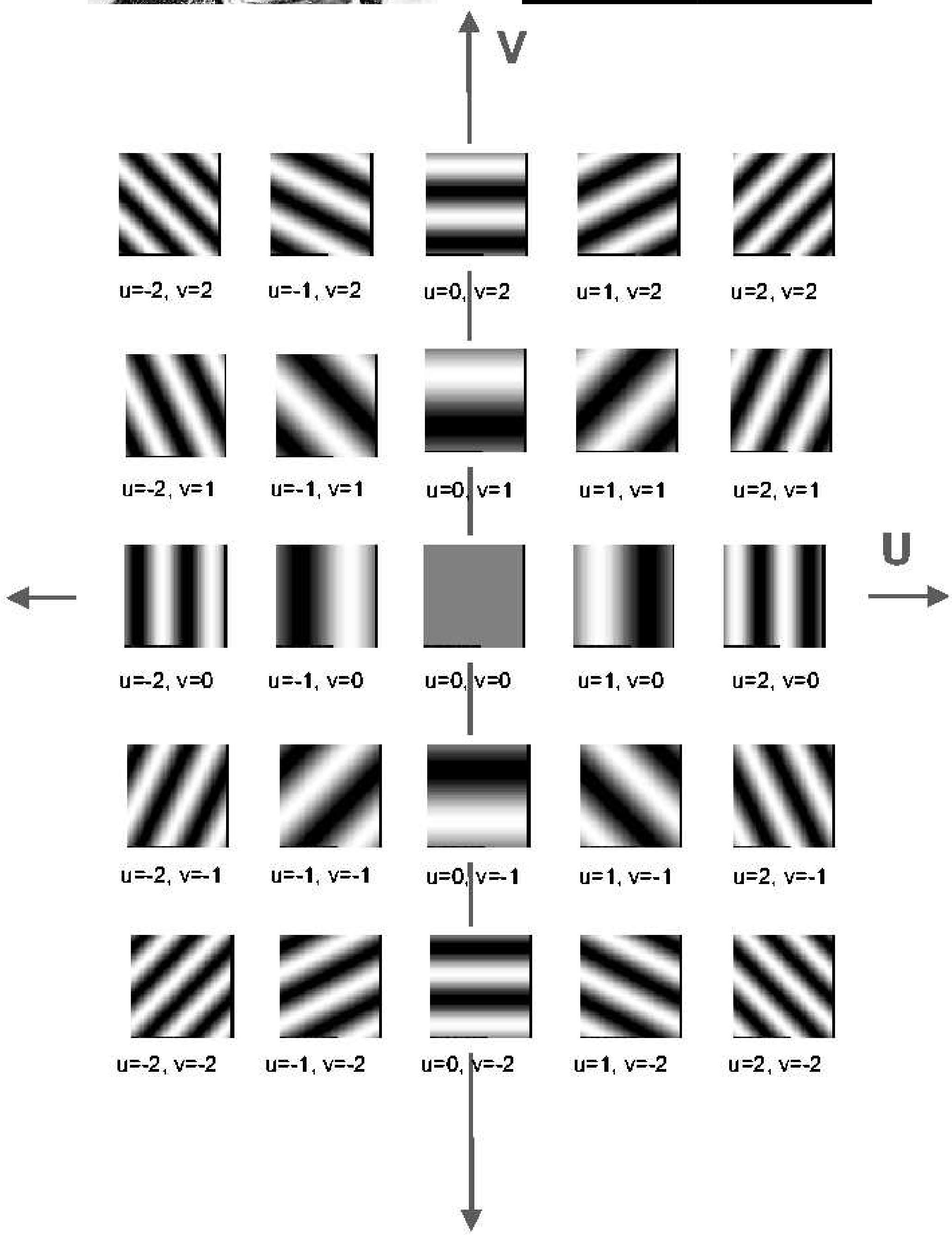



−1
0
1



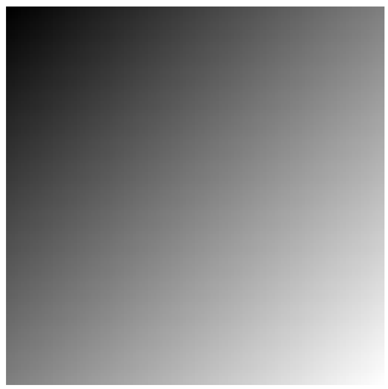
TF DISCRÈTE

TF discrète 2D (Interprétation)

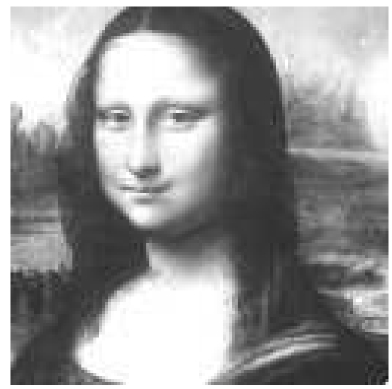


$$f(x,y) \quad = \quad i(x,y) \quad \cdot \quad r(x,y)$$

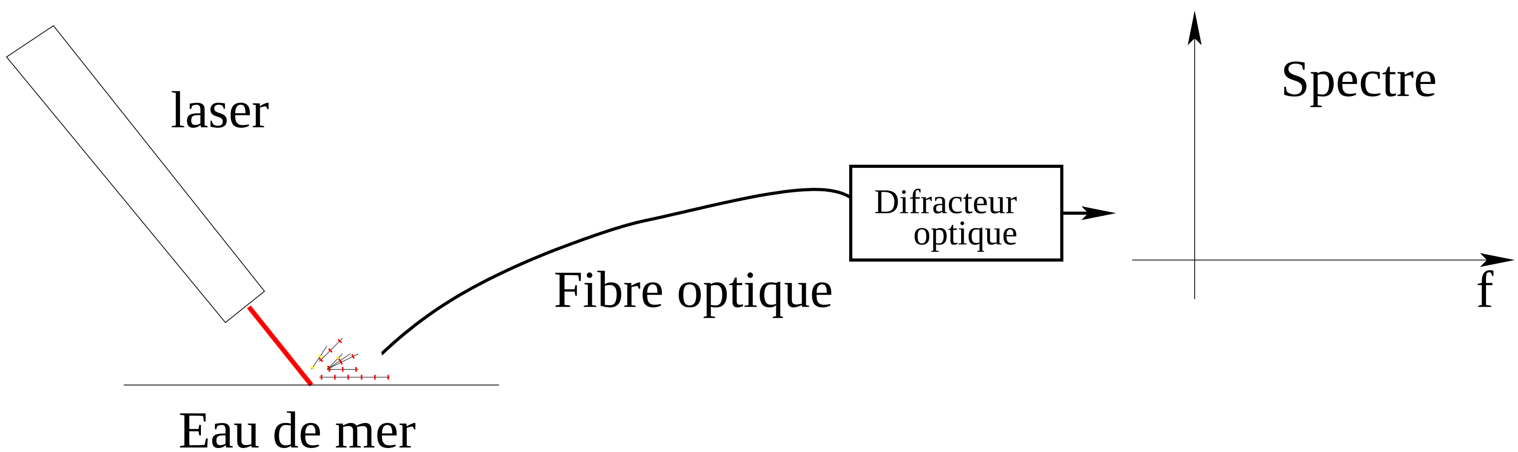
$=$



$\times$

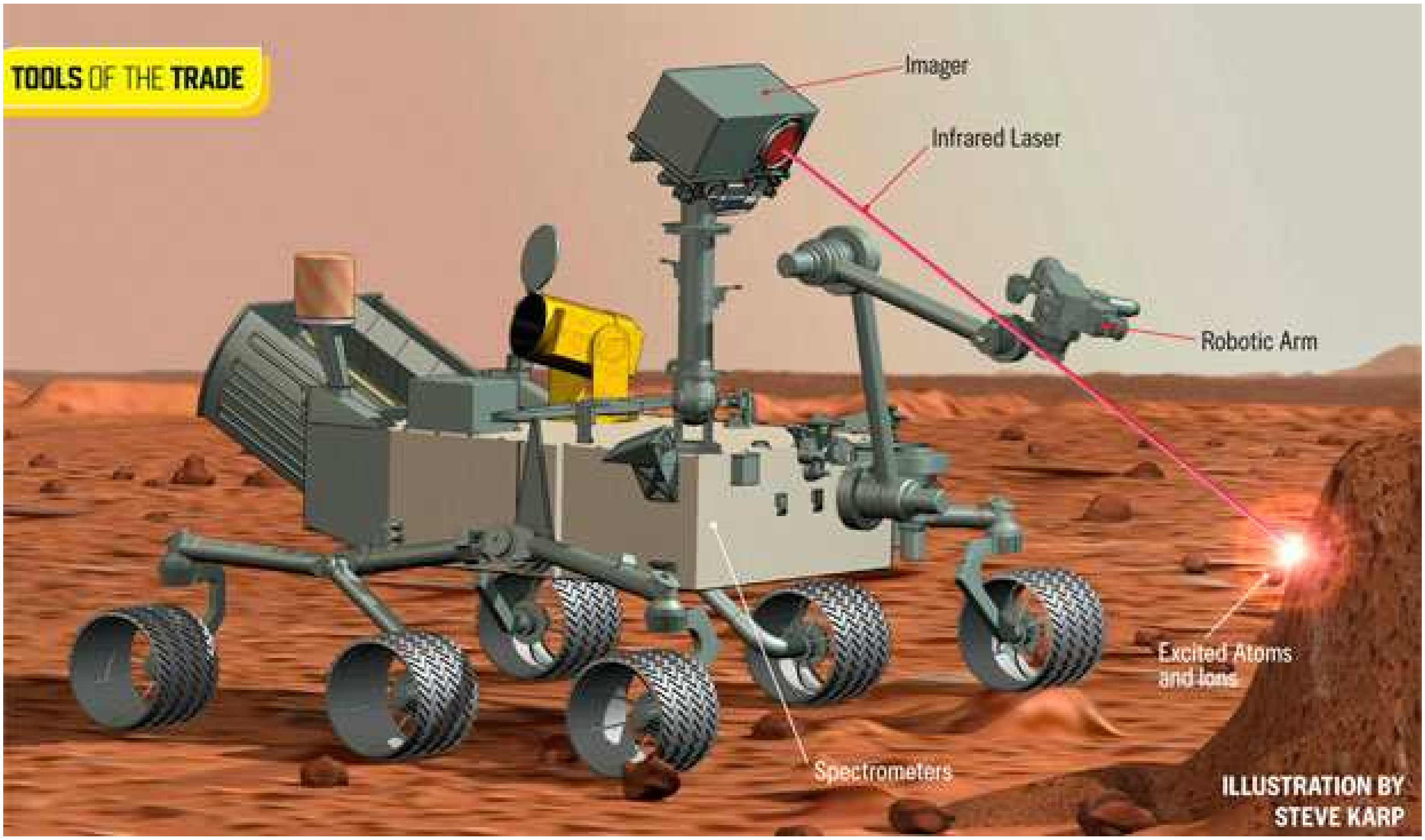


LOE (Ifremer)


laser
Eau de mer
Fibre optique
Difracteur
optique
Spectre
f

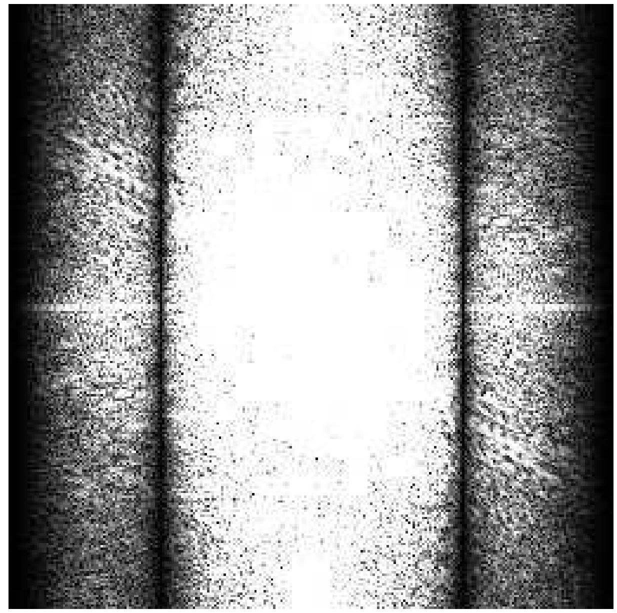
RESTAURATION

Mars Curiosity



RESTAURATION
Estimation de la PSF

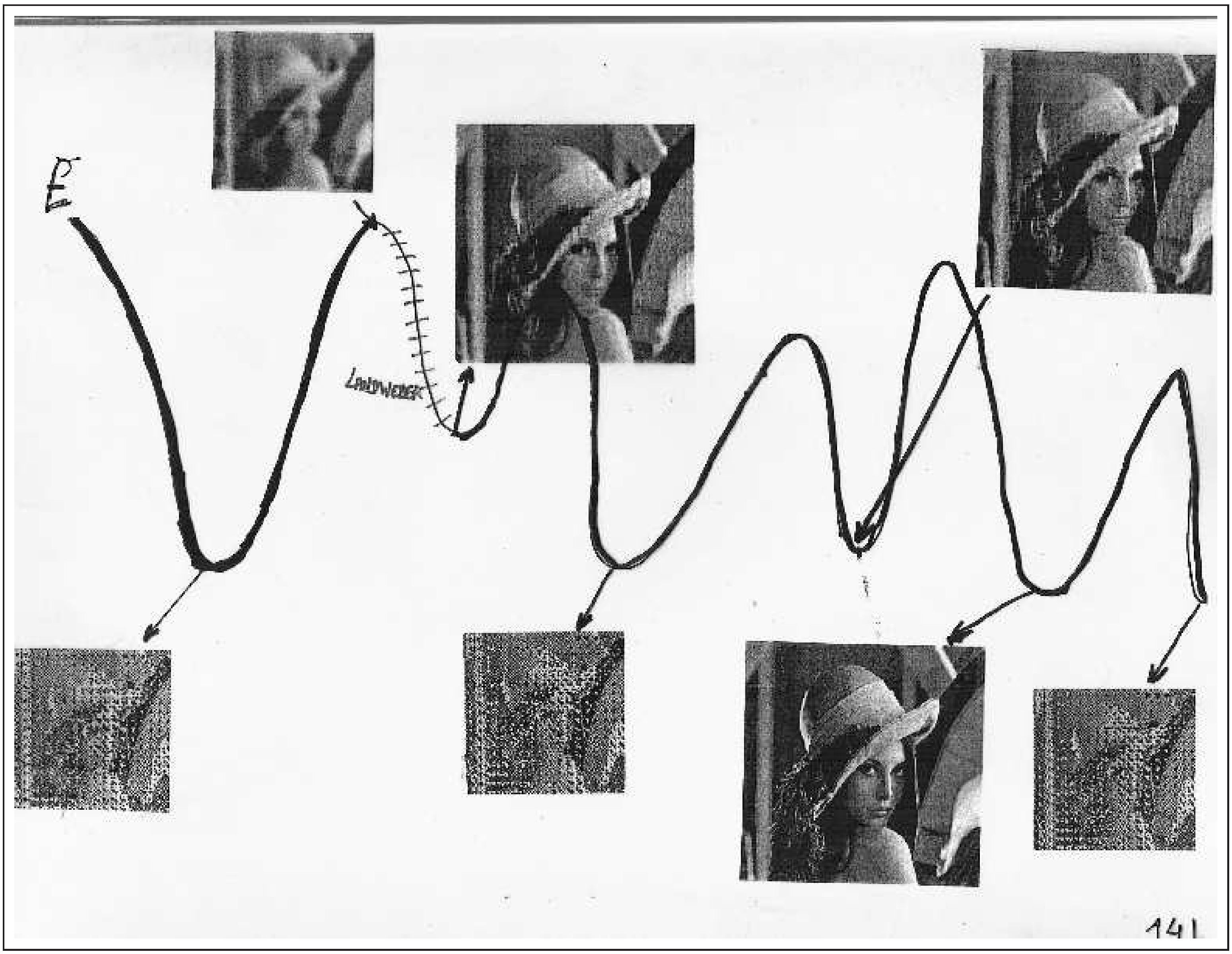
RESTAURATION
Estimation de la PSF



Méthodes Itératives & Problèmes Inverse Mal-Posés

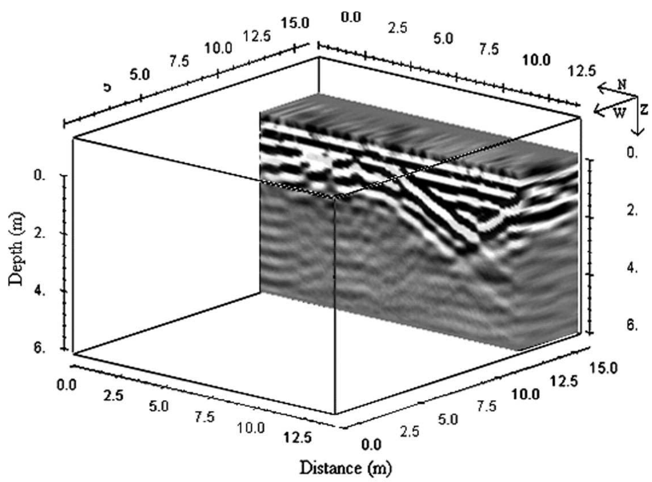
Fonction de coût :

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

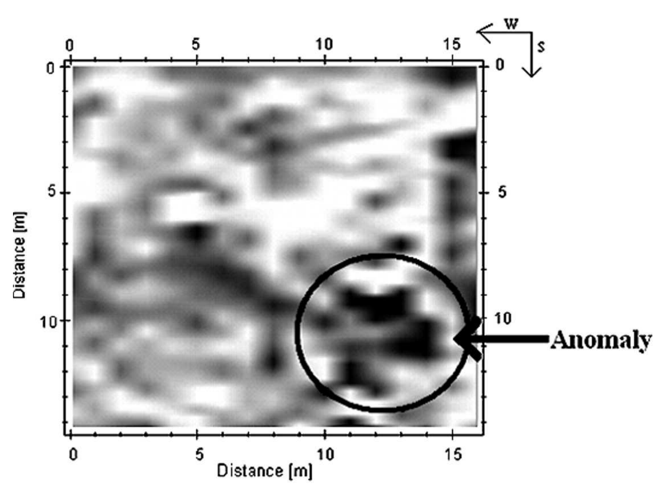


Reconstruction faciale de l’interieur d’une momie

Detection de chambre mortuaires



a.

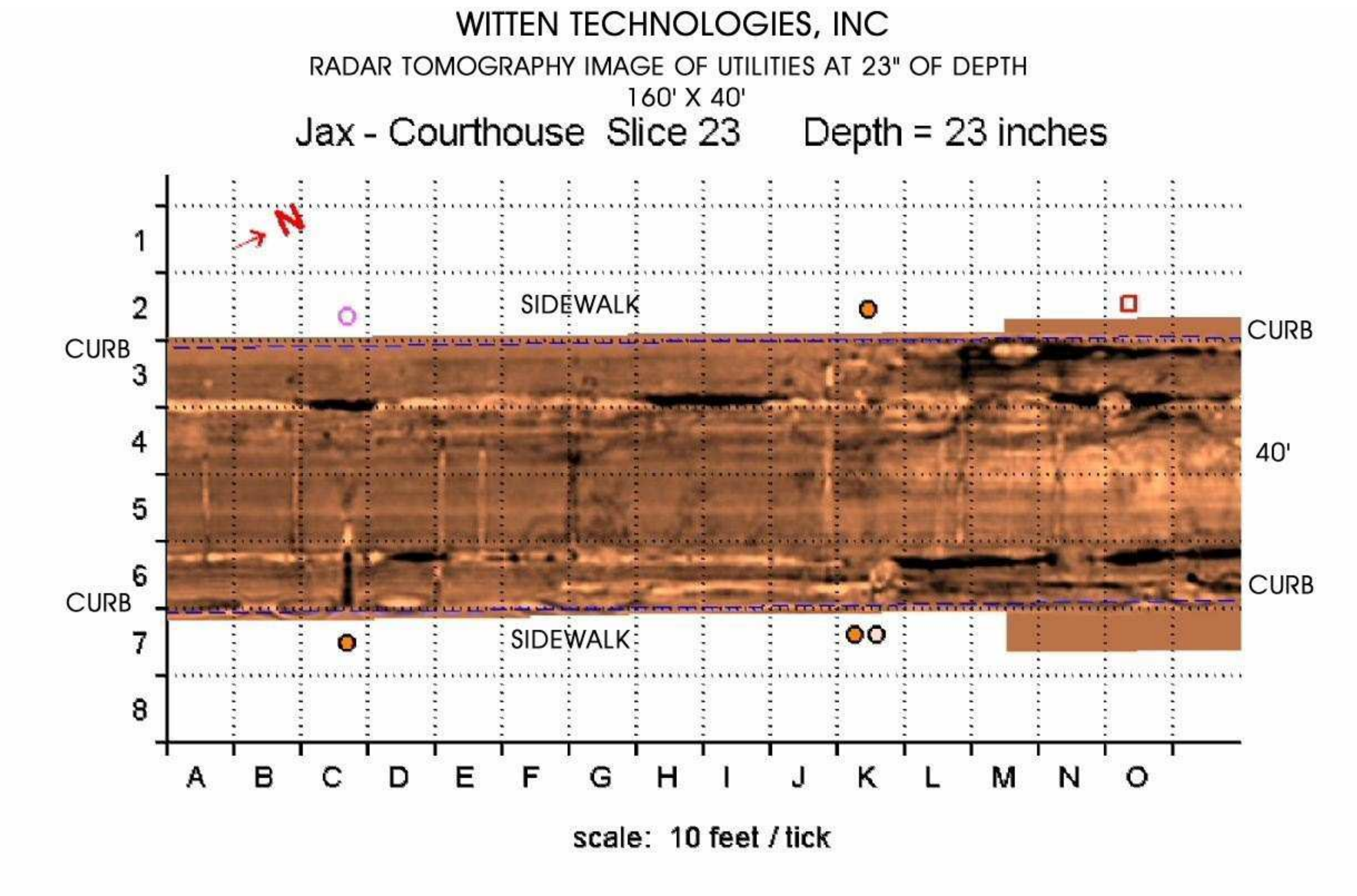


b.

TOMOGRAPHIE

Applications (3)

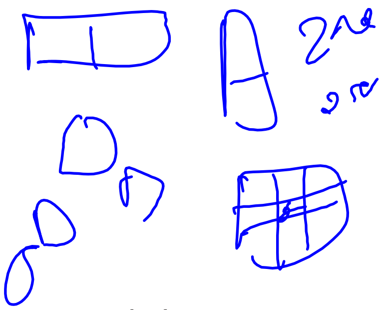
Tomographie Radar des sols

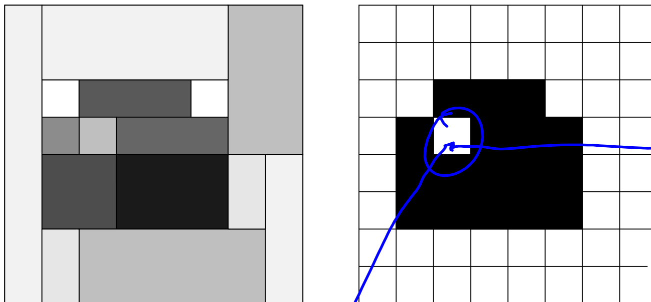


SEGMENTATION D'IMAGES

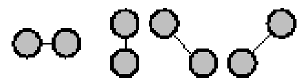
ICM : Exemple de Calcul

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





itération k



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**

$$P_{X_s}(xs = \blacksquare) = \frac{1}{Z} \exp\{-\sum_{c \in C} V_c(x_s = \blacksquare)\} = \frac{1}{2} e^{-1}$$

NRJ ■ = 1

$$P_{X_s}(xs = \square) = \frac{1}{Z} \exp\{-\sum_{c \in C} V_c(x_s = \square)\} = \frac{1}{2} e^{-7}$$

NRJ □ = 7

MAP

- **VRAISSEMBLANCE**

$$p_{Y_S/X_S}(y_s/xs = \square) = \mathcal{N}(200, 10) \quad \& \quad p_{Y_S/X_S}(y_s/xs = \blacksquare) = \mathcal{N}(100, 10)$$

- $y_s = 160 \ \triangleright$ □

NRJ ■ = 18 — 19

NRJ □ = 8 — 15

- $y_s = 155 \ \triangleright$ □

NRJ ■ = 15.125 + 1 → ■

NRJ □ = 10.125 + 7

SEGMENTATION D'IMAGES

RS : Effet de la Température

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

2 classes

$U_{\blacksquare} = 0.85$ $\qquad$ $U_{\square} = 0.15$

T=1 ▷

$$P(\blacksquare/y_s) = \frac{e^{-0.85}}{e^{-0.85}+e^{-0.15}} = 0.328 \qquad P(\square/y_s) = \frac{e^{-0.15}}{\mathcal{D}} = 0.6718$$

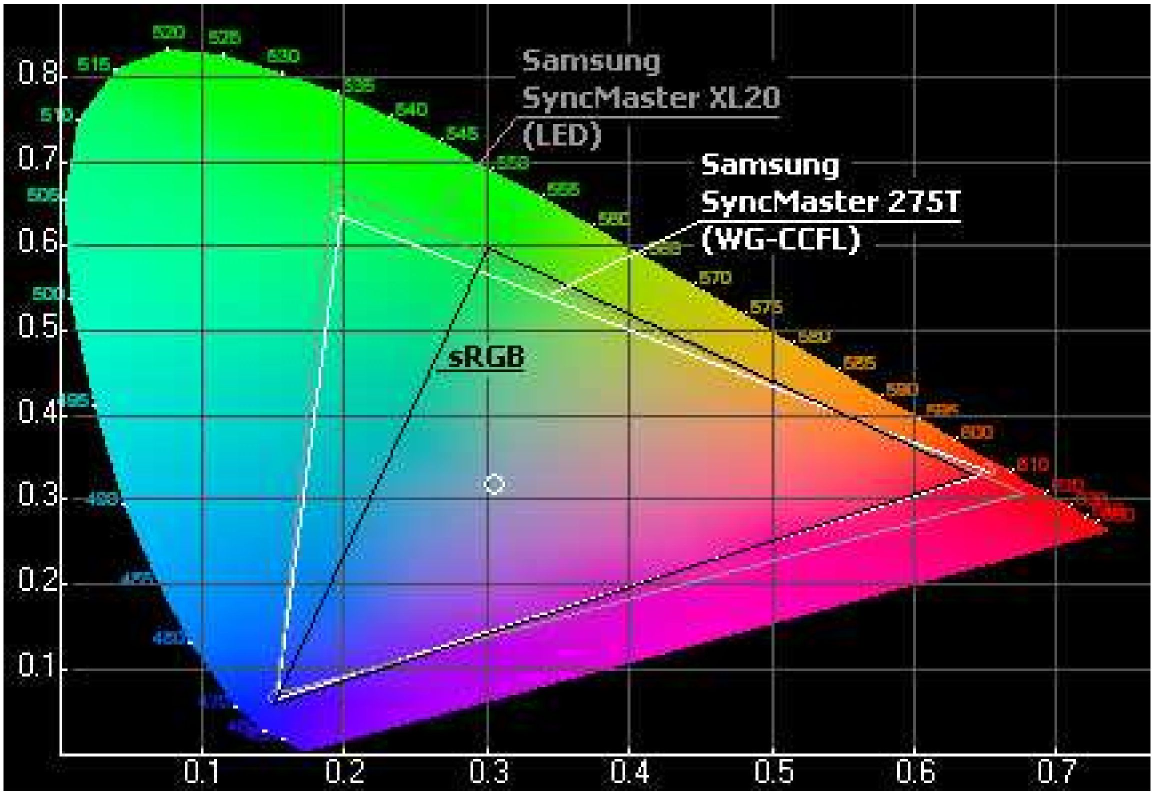
T=10 ▷

$$P(\blacksquare/y_s) = \frac{e^{-0.85/10}}{e^{-0.85/10}+e^{-0.15/10}} = 0.483 \qquad P(\square/y_s) = \frac{e^{-0.15/10}}{\mathcal{D}} = 0.517$$

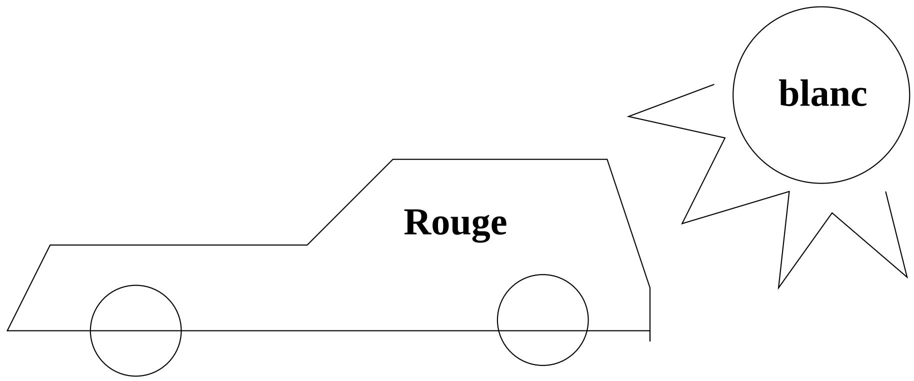
T=0.1 ▷

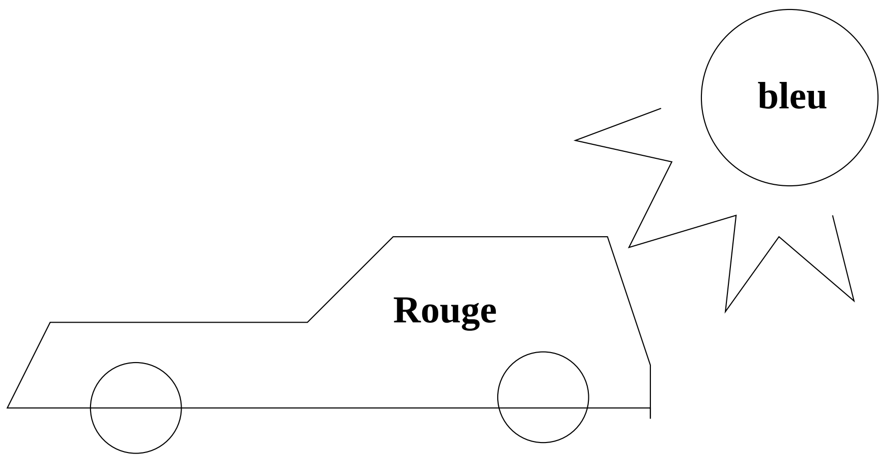
$$P(\blacksquare/y_s) = \frac{e^{-0.85/0.1}}{e^{-0.85/0.1}+e^{-0.15/0.1}} = 0.01 \qquad P(\square/y_s) = \frac{e^{-0.15/0.1}}{\mathcal{D}} = 0.999$$

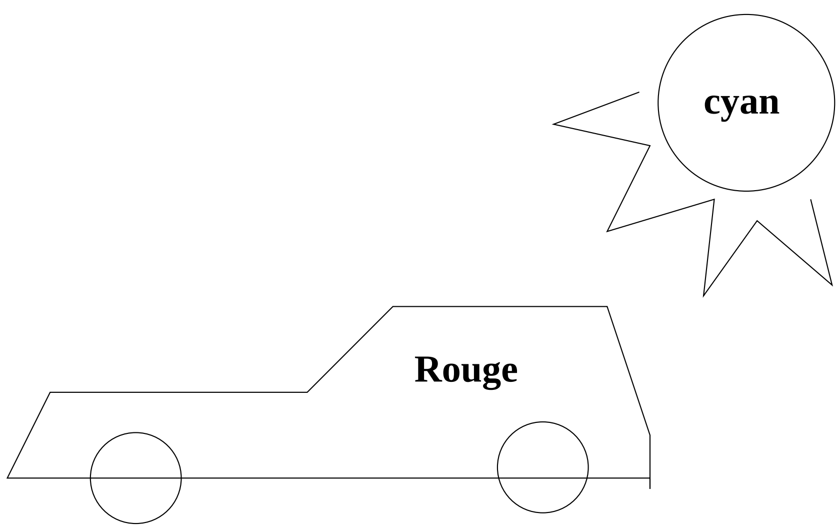
COULEURS
GAMUT



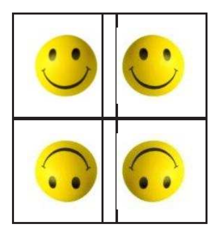
COULEURS
CUBE RGB



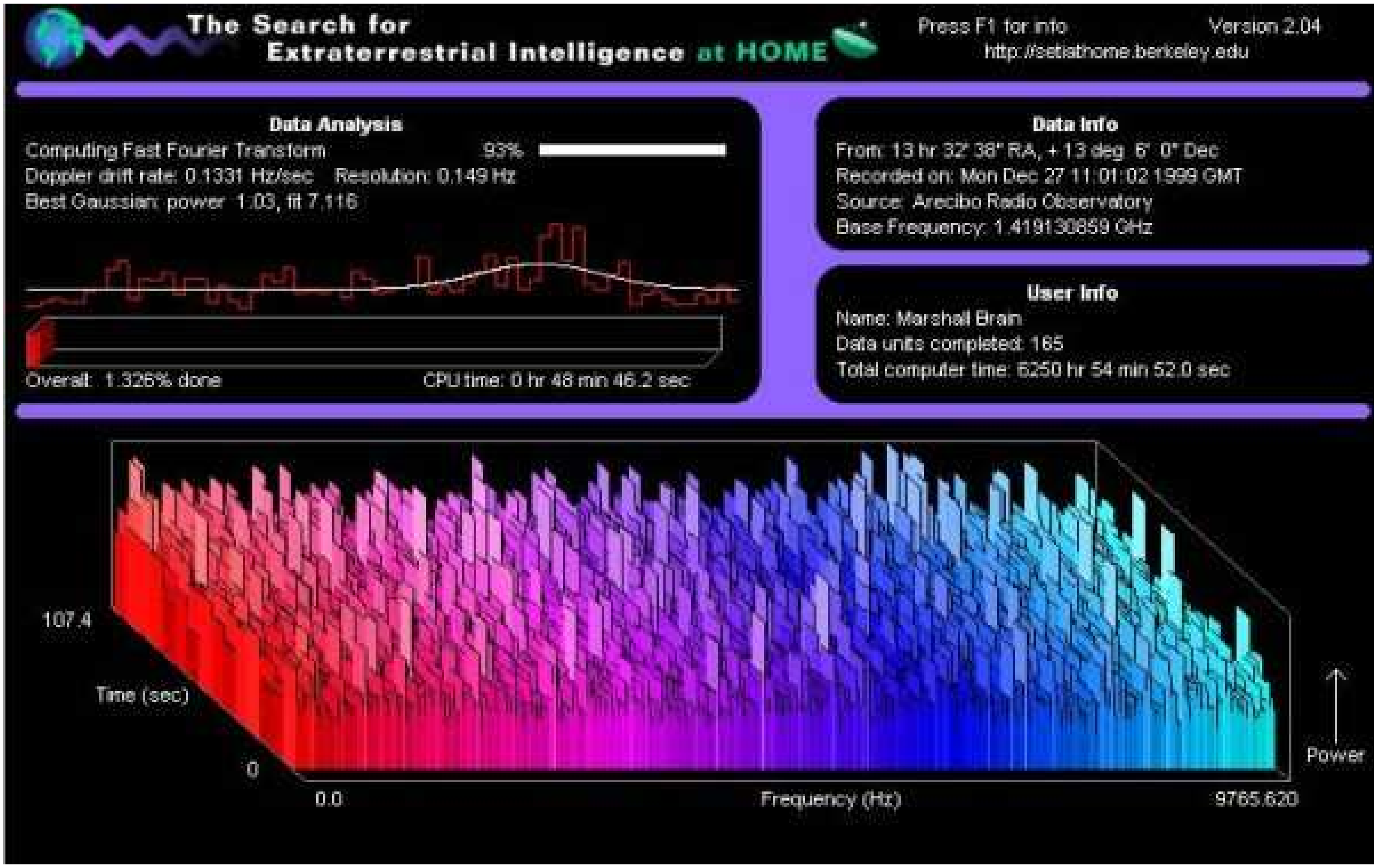


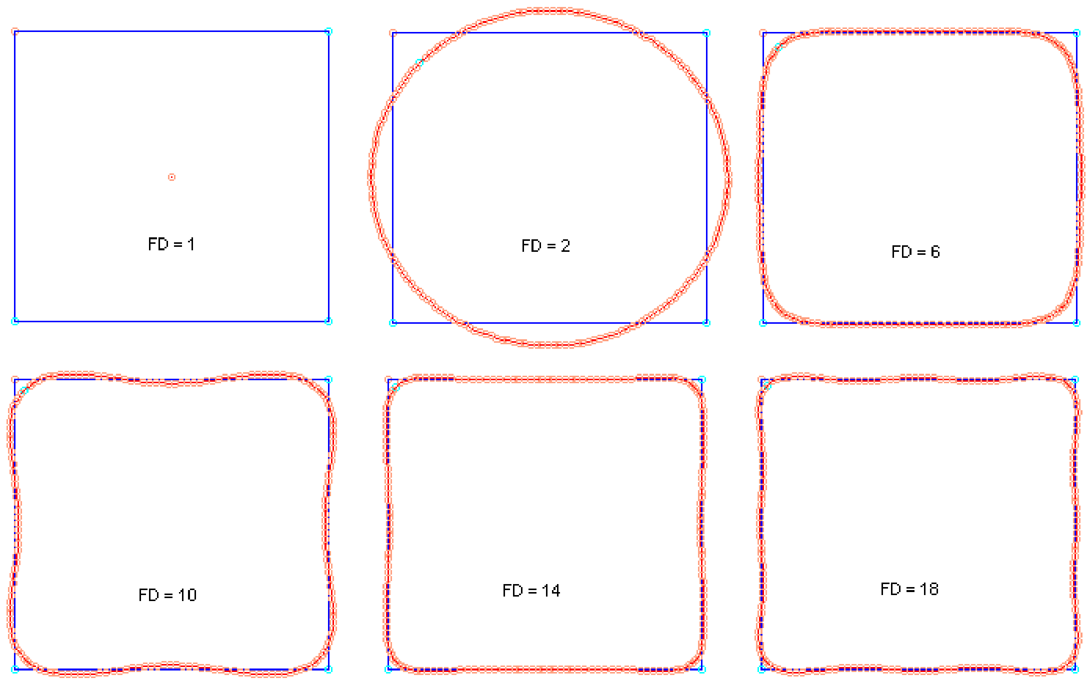


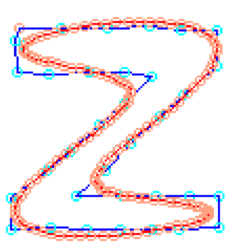
COMPRESSION
DCT

TCD () = TFD {  }

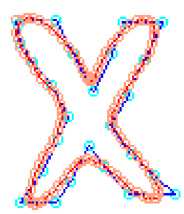
RECONAISSANCE DES FORMES
PROJET SETI



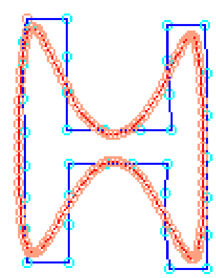




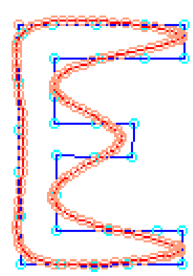
Number of FD: 6



Number of FD: 10



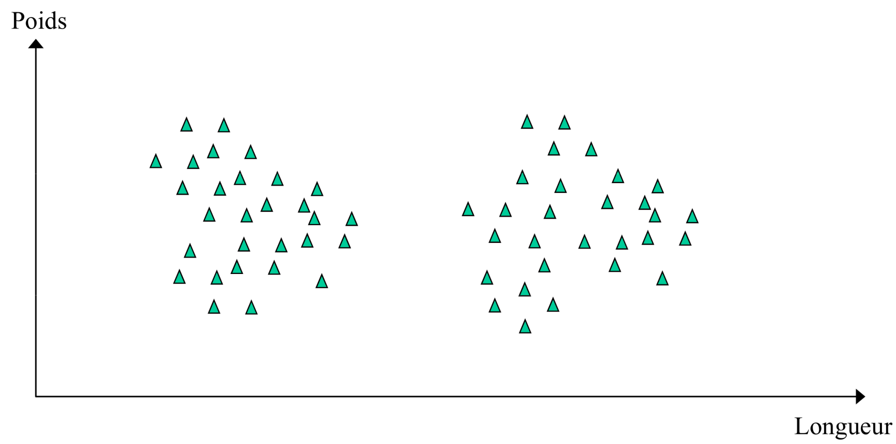
Number of FD: 8



Number of FD: 8

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

Exemple schématique de l'algorithme des K-moyennes

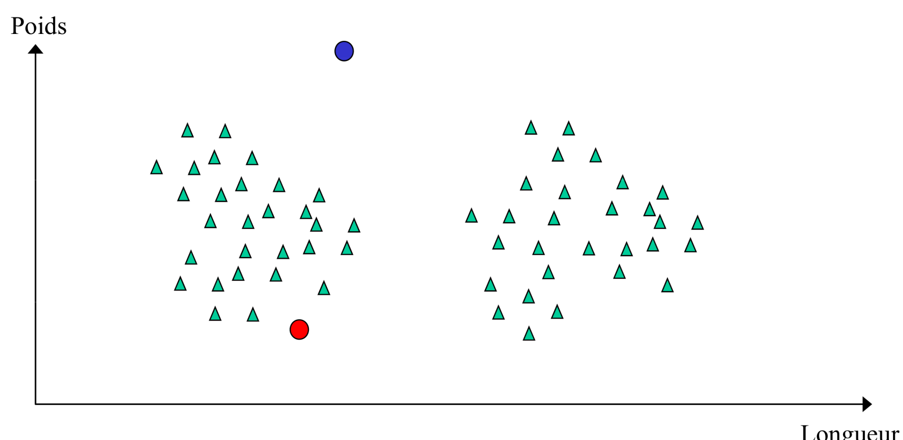


Voici 60 observations. Comment faire pour grouper ces données en deux classes et estimer la moyenne (ou le centre de masse) de ces classes ?

36

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

Exemple schématique de l'algorithme des K-moyennes

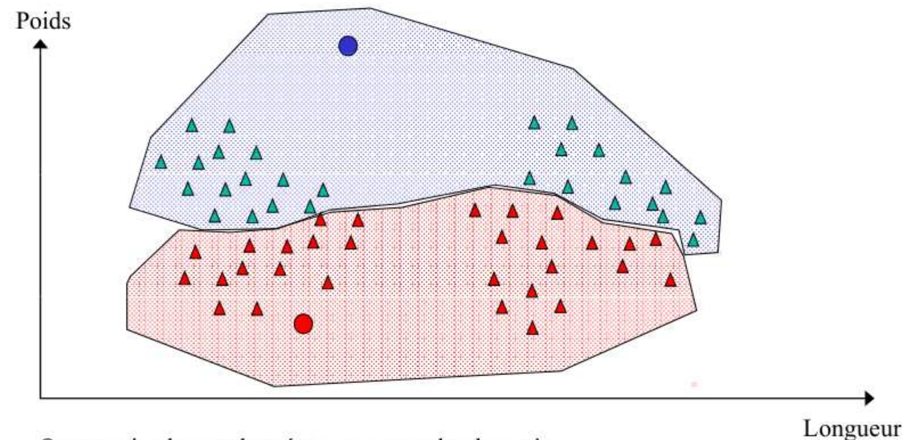


On initialise le centre des deux classes au hasard

37

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

Exemple schématique de l'algorithme des K-moyennes

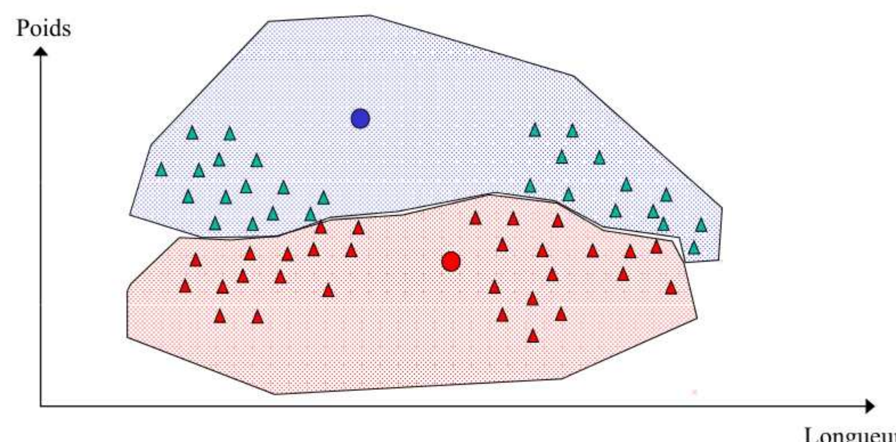


On associe chaque donnée ▲ au centre le plus près

38

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

Exemple schématique de l'algorithme des K-moyennes



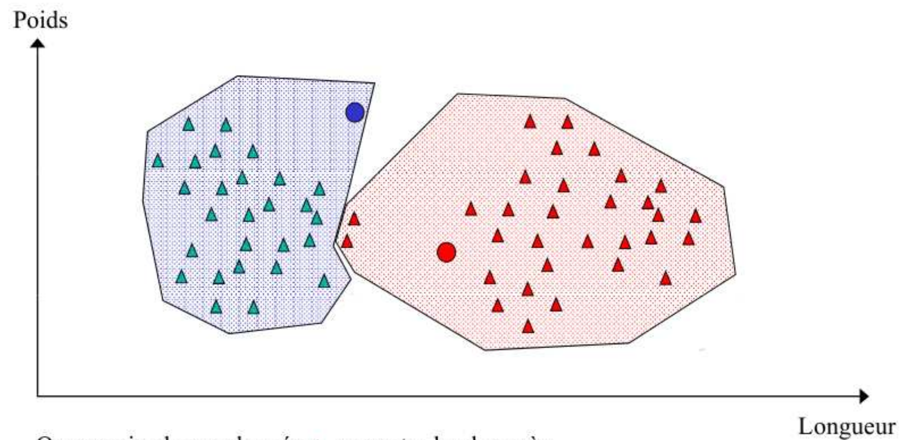
On déplace les deux centres sur la moyenne des données de chaque classe

39

ALGORITHME DES K-MOYENNES (3)

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

Exemple schématique de l'algorithme des K-moyennes

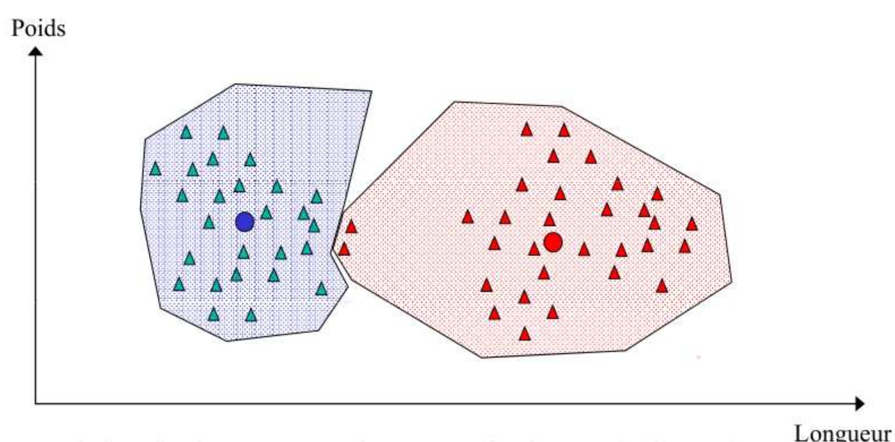


On associe chaque donnée ▲ au centre le plus près

40

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

Exemple schématique de l'algorithme des K-moyennes



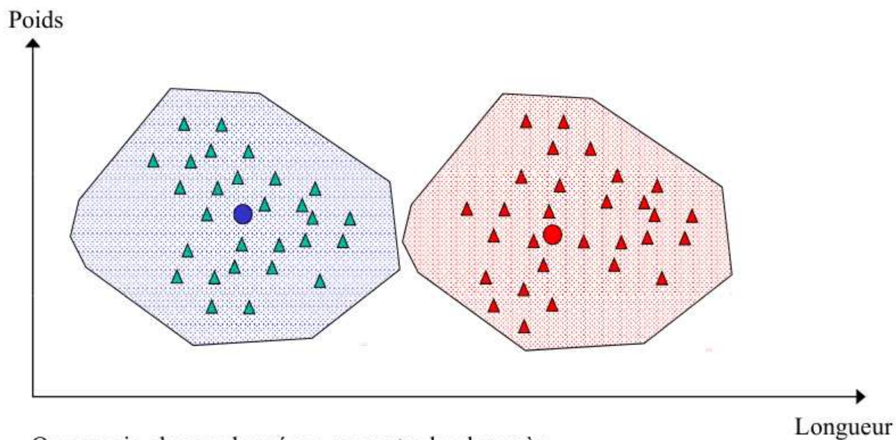
On déplace les deux centres sur la moyenne des données de chaque classe

41

RECONAISSANCE DES FORMES
ALGORITHME DES K-MOYENNES (4)

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

Exemple schématique de l'algorithme des K-moyennes

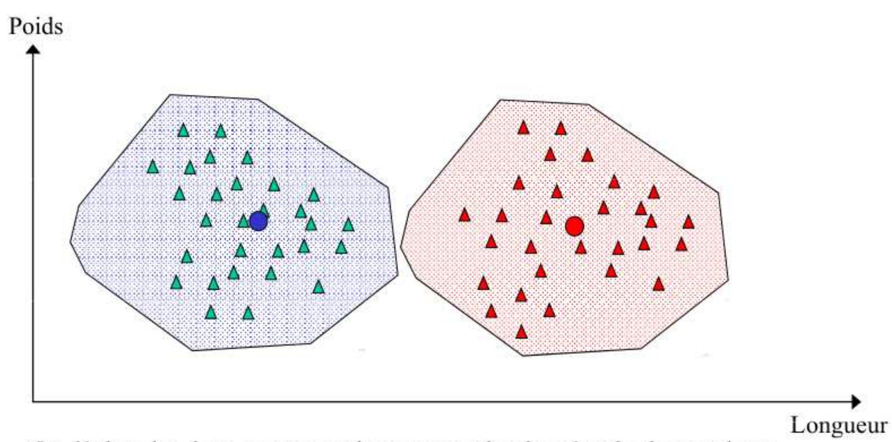


On associe chaque donnée ▲ au centre le plus près

42

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

Exemple schématique de l'algorithme des K-moyennes



On déplace les deux centres sur la moyenne des données de chaque classe

Lorsque l'algorithme converge, ● et ● correspondent à **la moyenne de chaque classe**

43