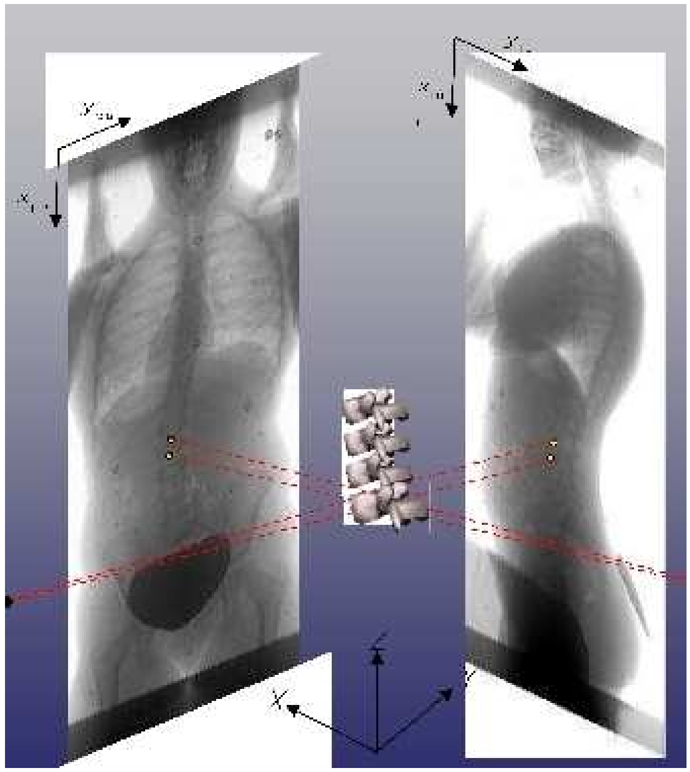
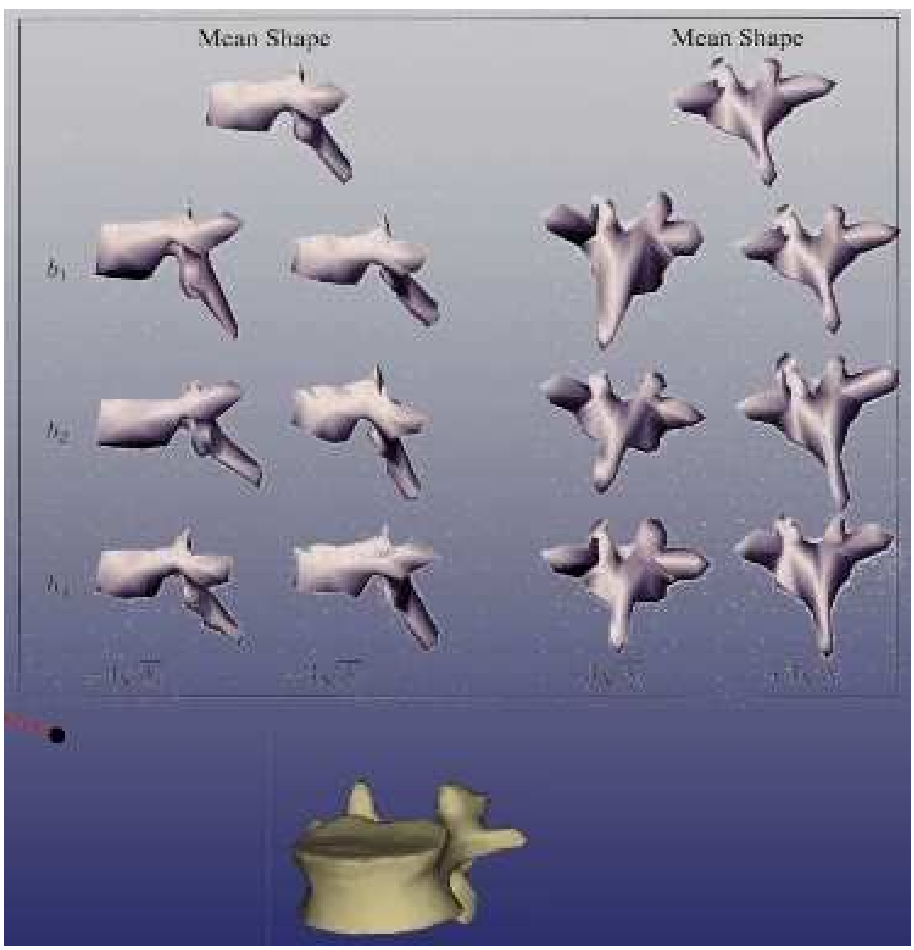
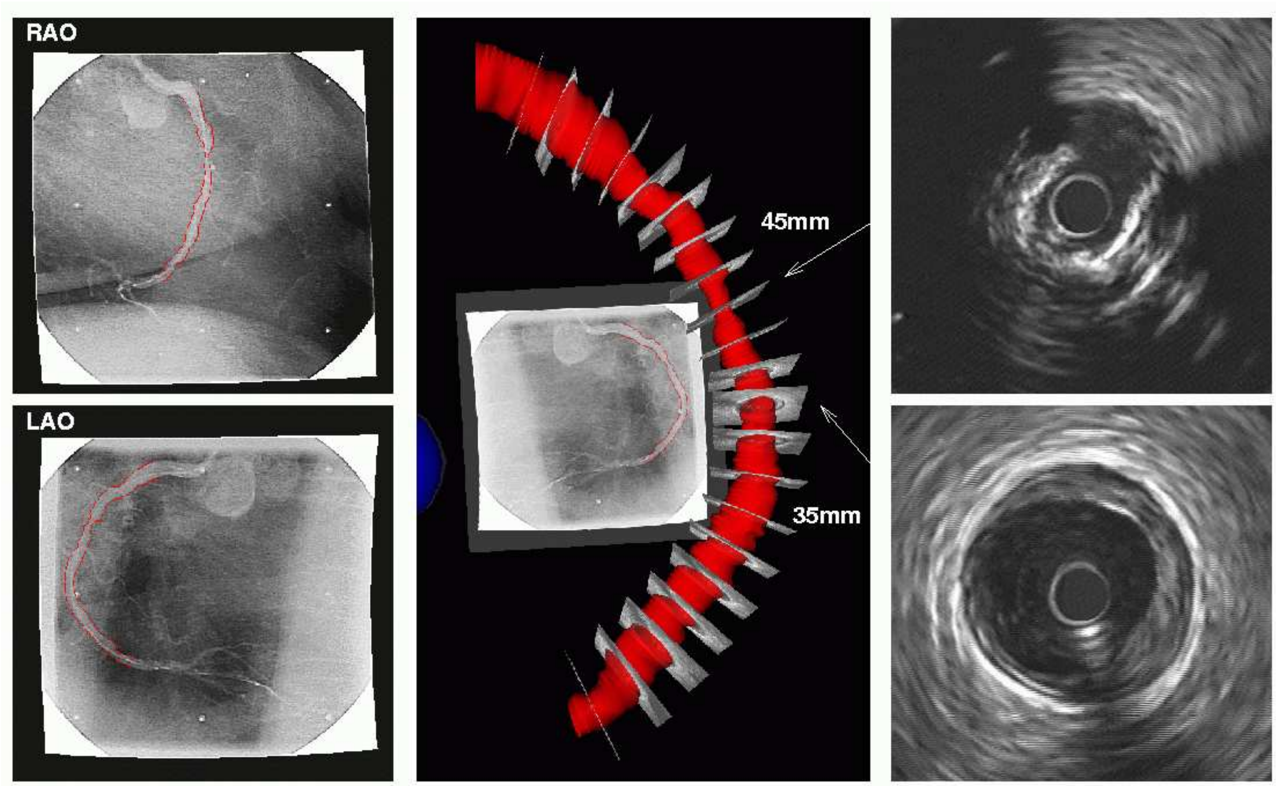
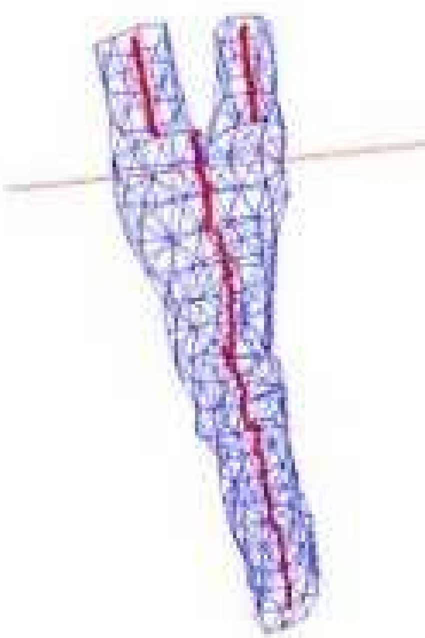
INTRODUCTION
Reconstruction 3D de la Colonne Vertébrale

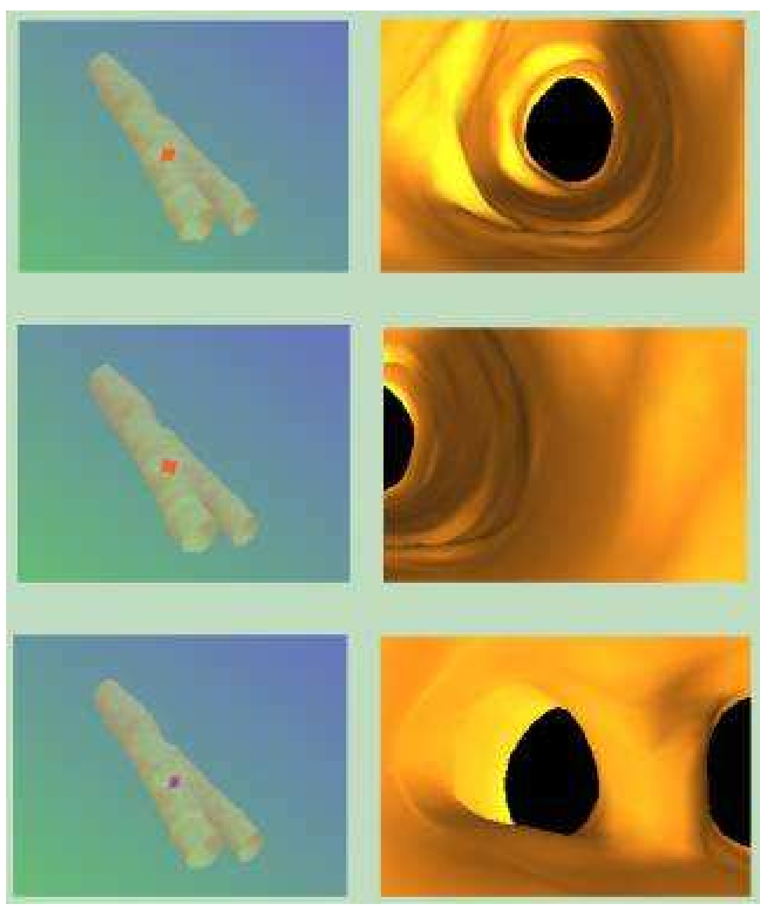




INTRODUCTION
Reconstruction Angiographique

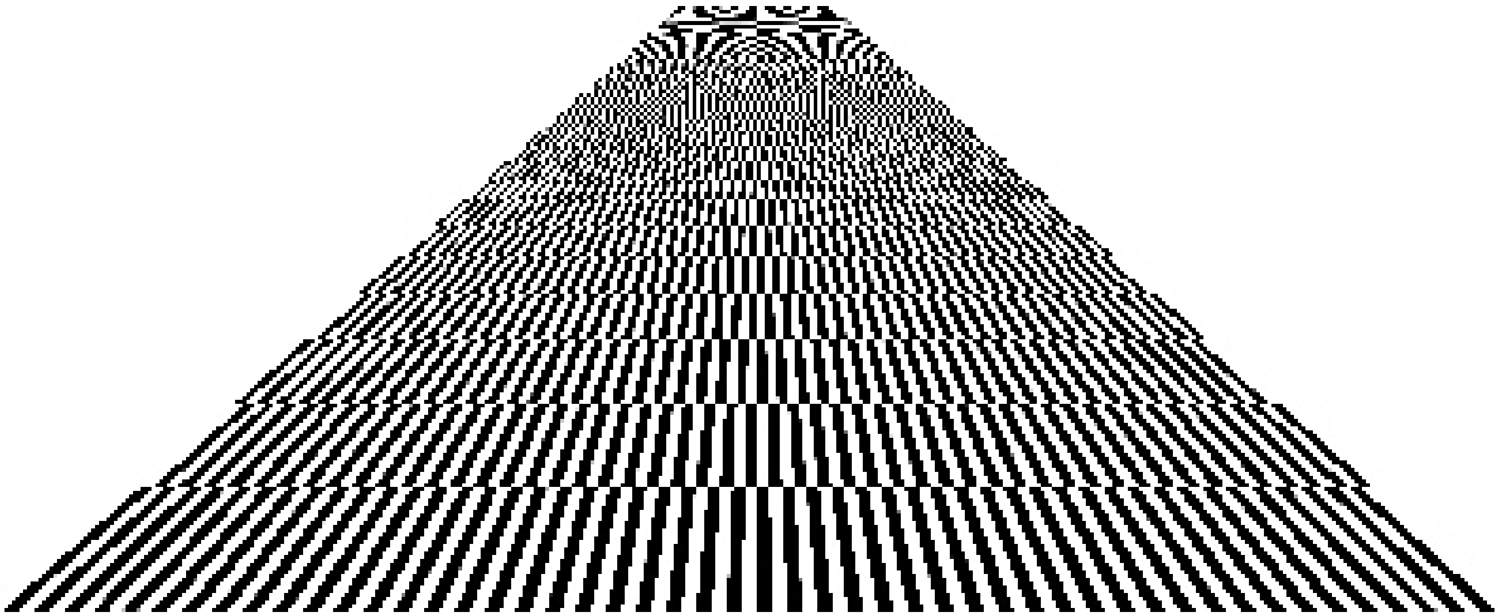


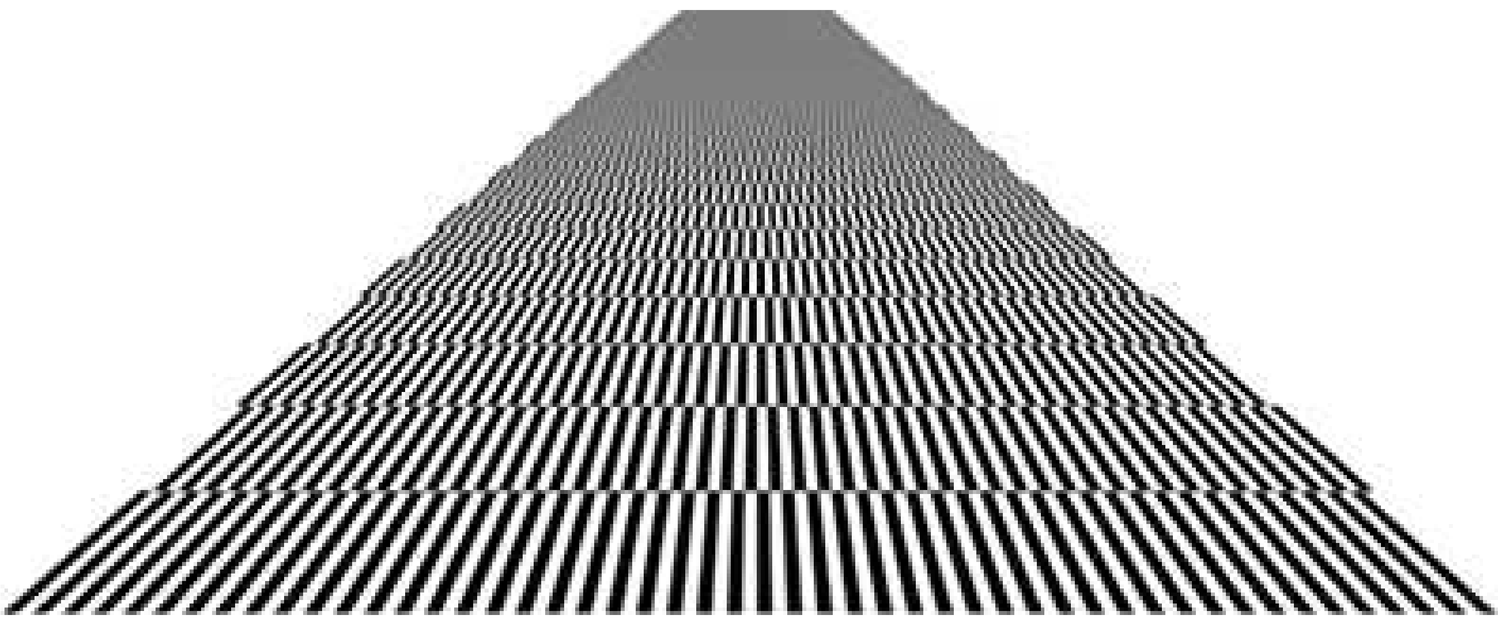




TRANSFORMÉ DE FOURIER

Aliasing & Antialiasing





TFD
Périodisation Implicite de l'Image

TFD ()

=

TF ()

TP1

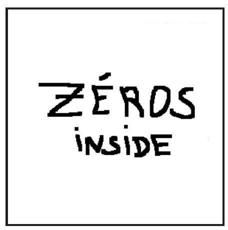
Algorithmiquement

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

TFD

Réel

Imaginaire



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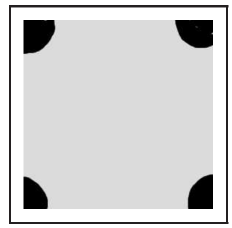
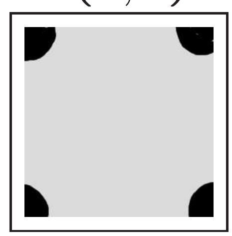
$R(u,\nu)$



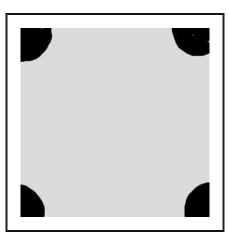
$I(u,\nu)$



et

TFD^{-1}

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



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

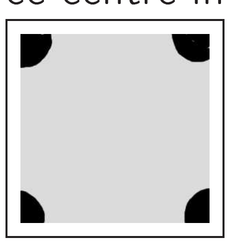


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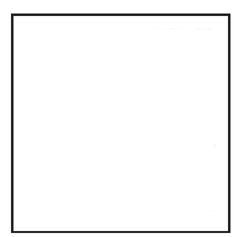
Image traitée

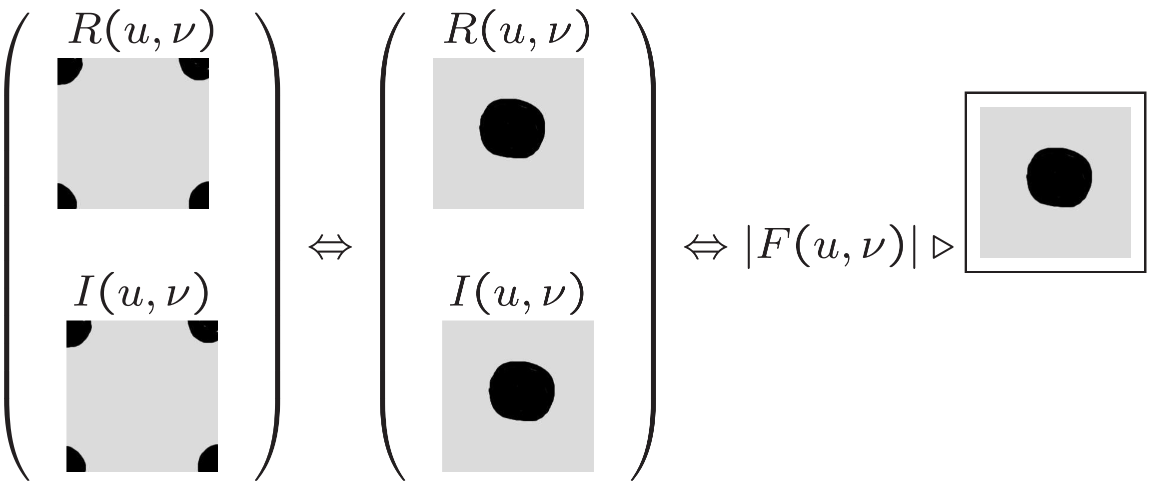
Abstraction



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-

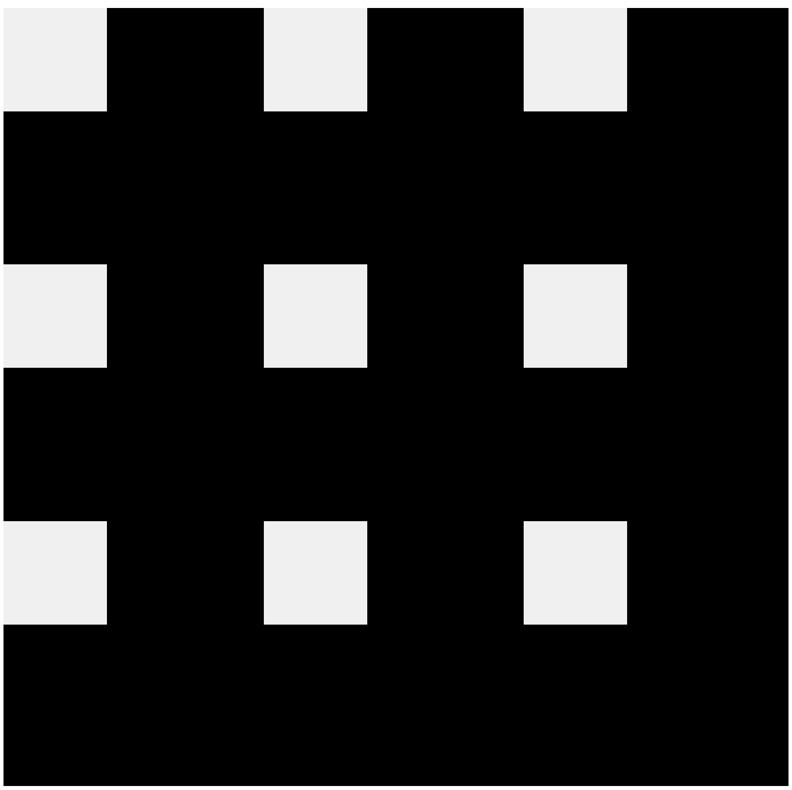
discontinuités horizontales $\overset{\mathcal{F}}{\rightleftharpoons}$ discontinuités verticales

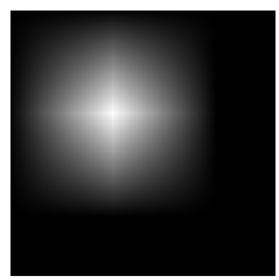
TP1

Recouvrement Spatial

$*$

En utilisant la TFD

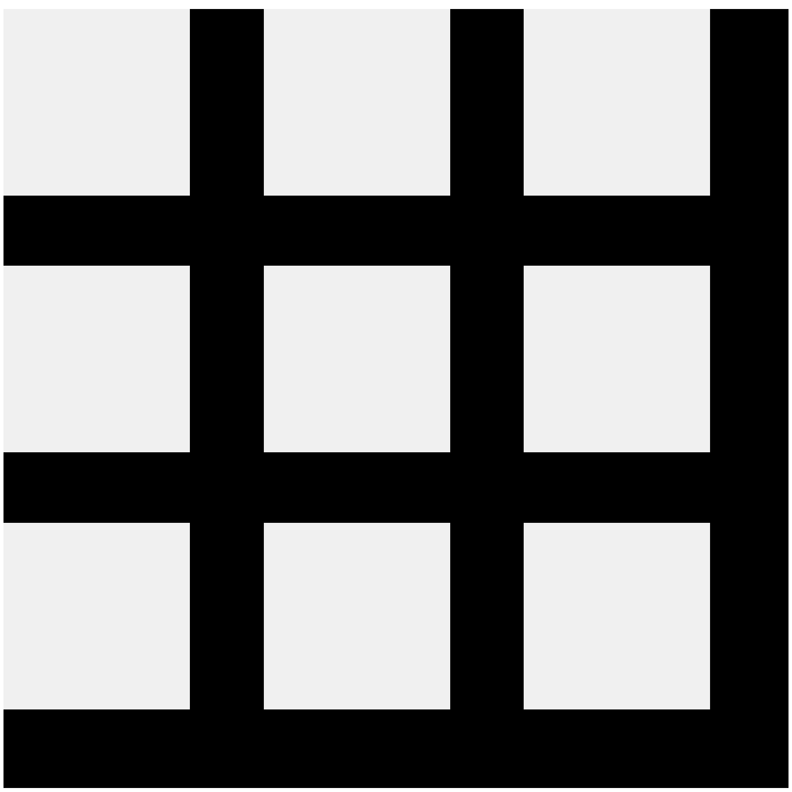


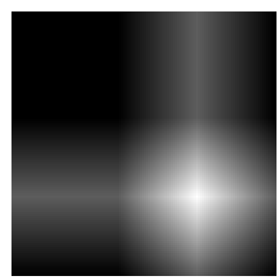


TP1
Recouvrement Spatial

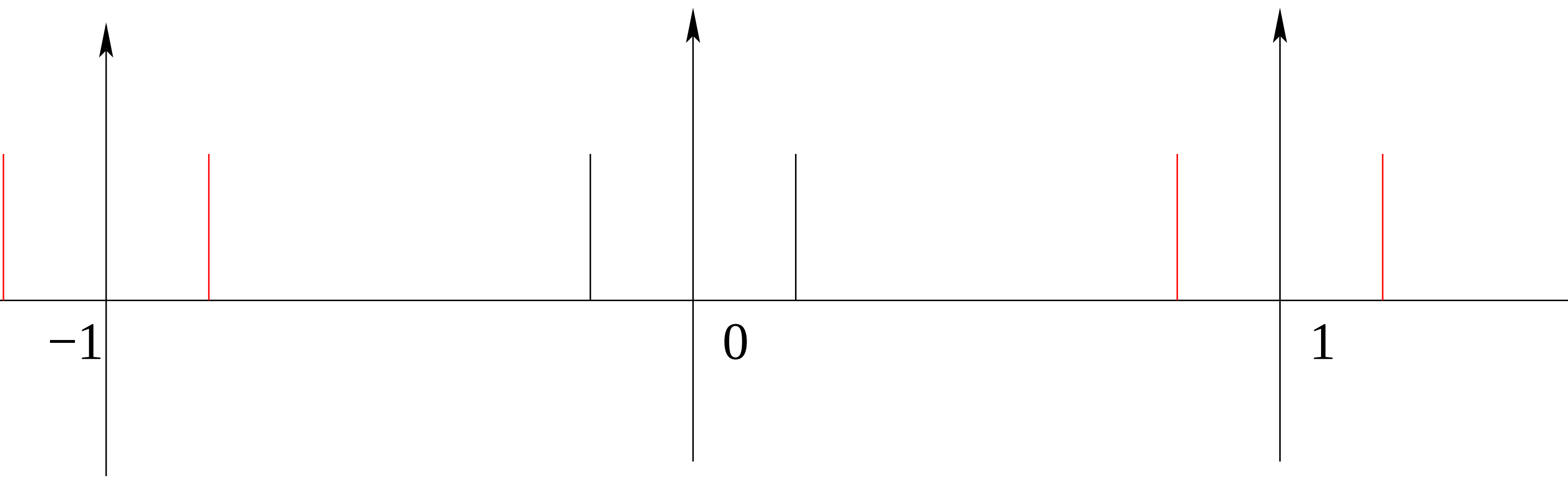
$*$

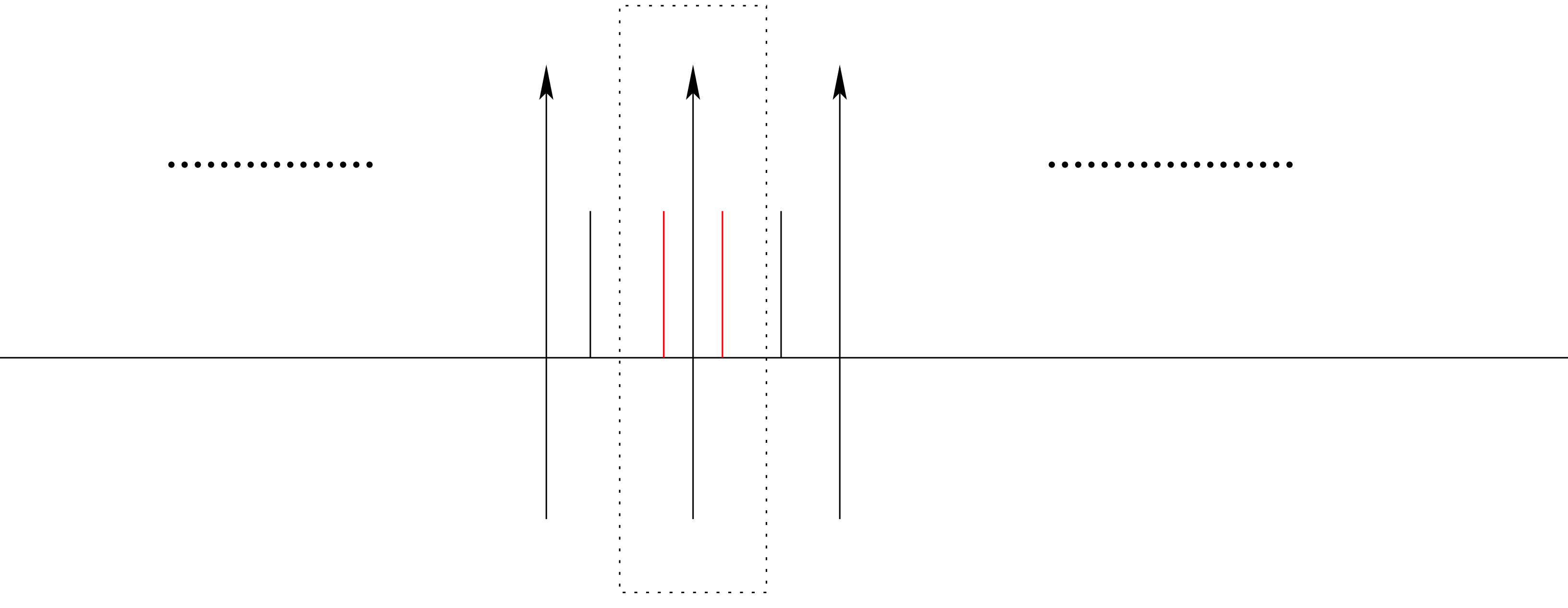
En utilisant la TFD





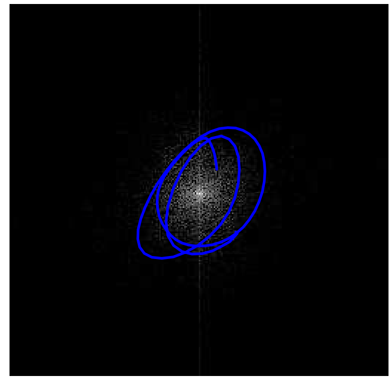
TP1
Sous-Échantillonnage

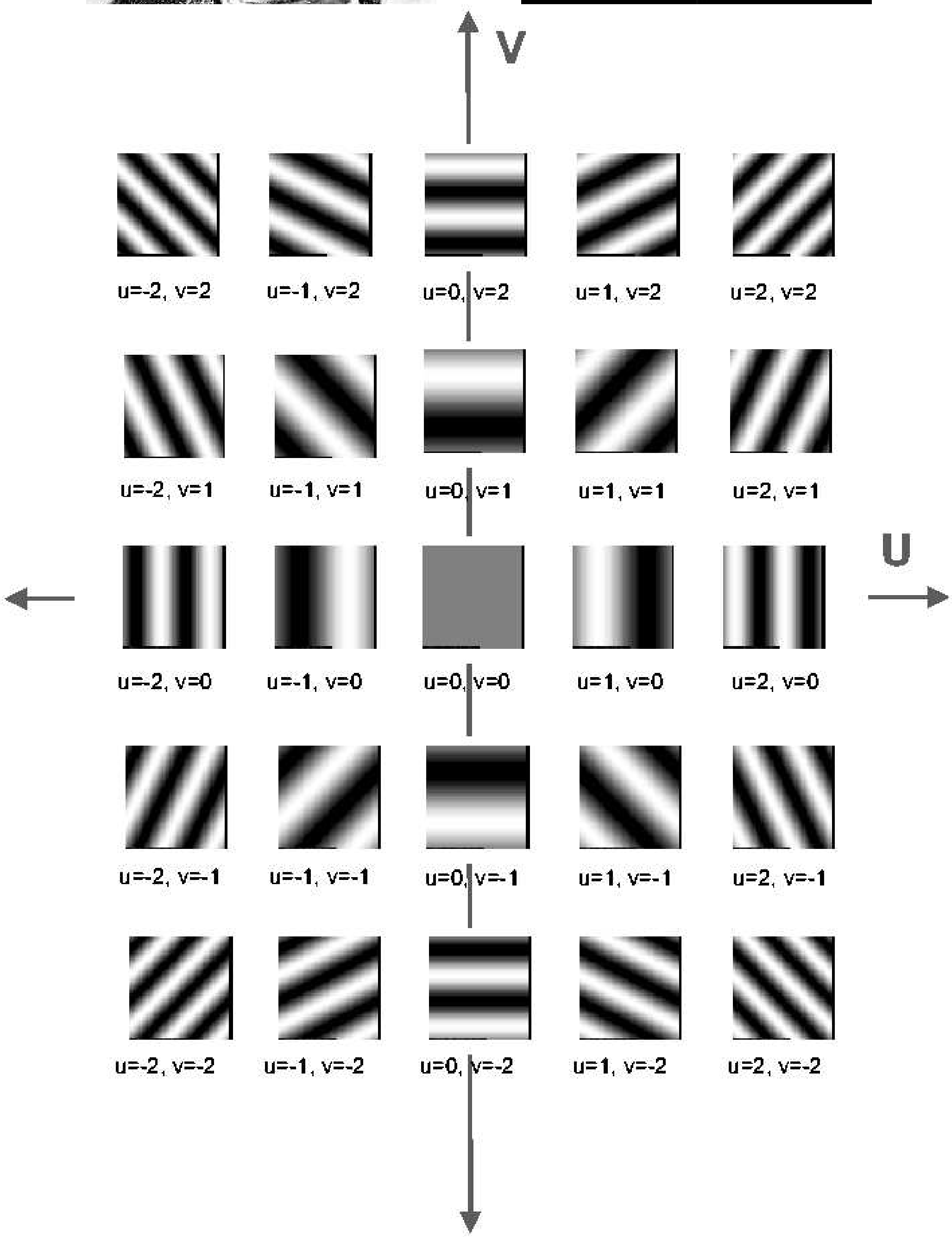




TF DISCRÈTE

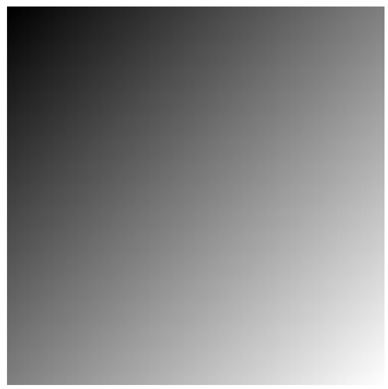
TF discrète 2D (Interprétation)



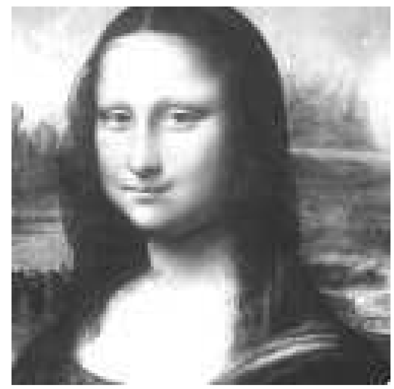


$$f(x,y) \quad = \quad i(x,y) \quad \cdot \quad r(x,y)$$

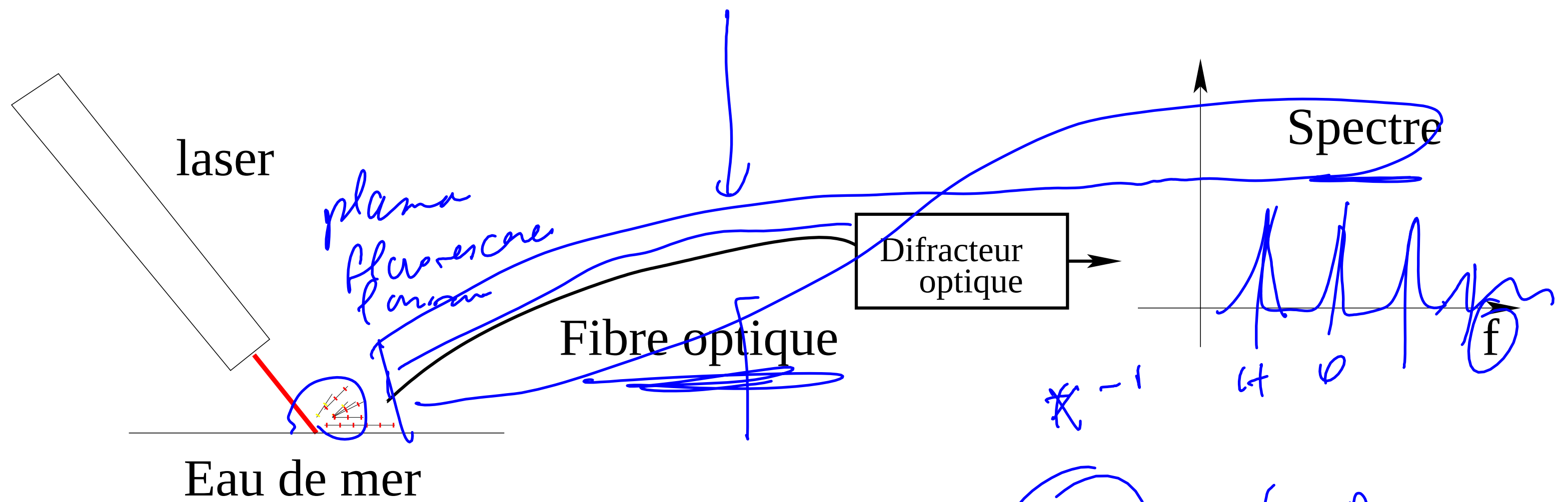
$=$

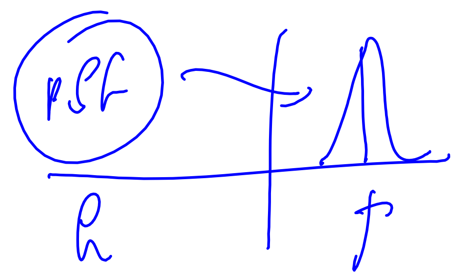


$\times$



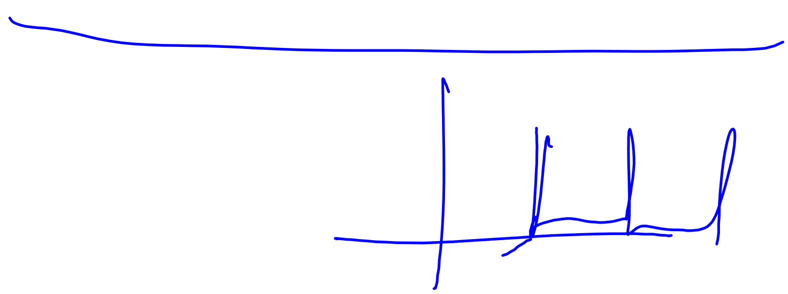
LOE (Ifremer)





1993

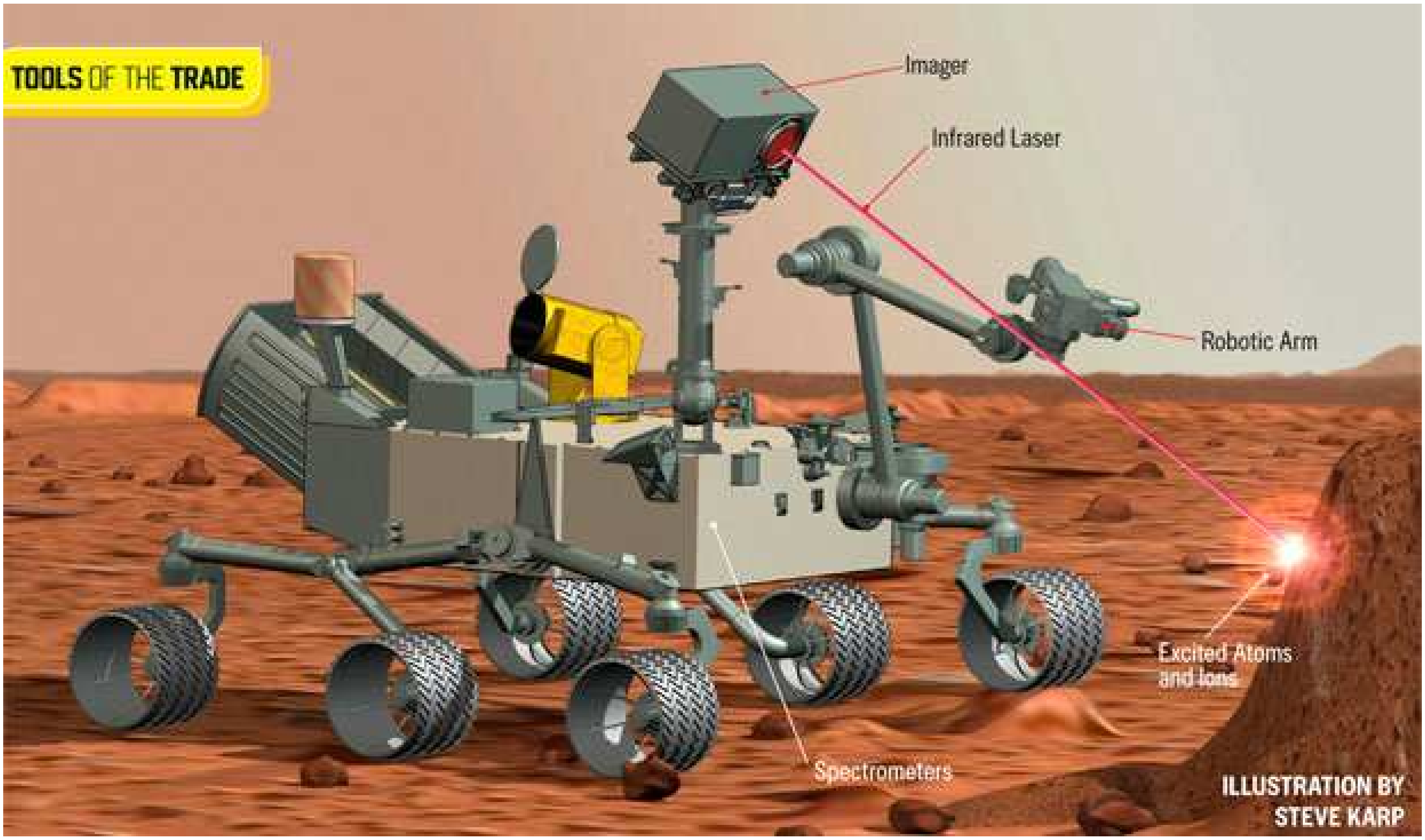
2003



RESTAURATION

Mars Curiosity

Mars Pathfinder



RESTAURATION
Estimation de la PSF

psf

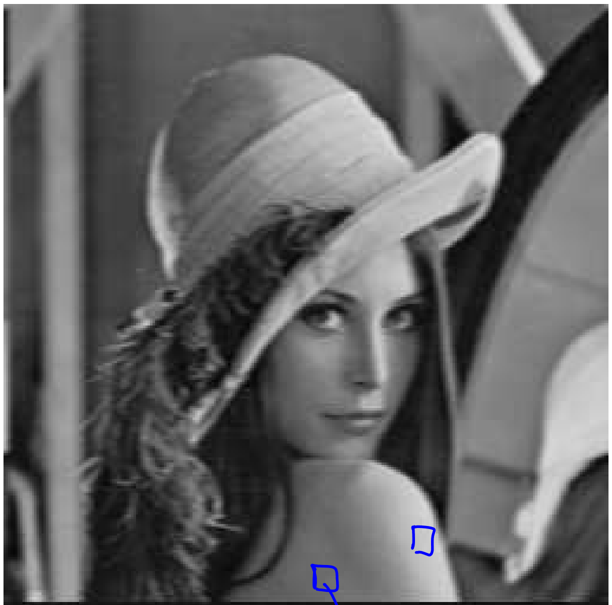
mot

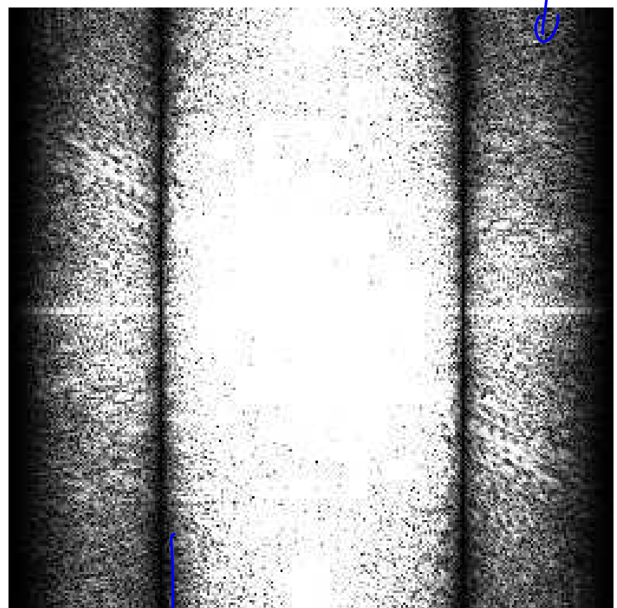
6 pixel

$$* \underbrace{\frac{1}{6} \boxed{1 \mid 1 \mid 1 \mid 1 \mid 1 \mid 1}}_{psf}$$

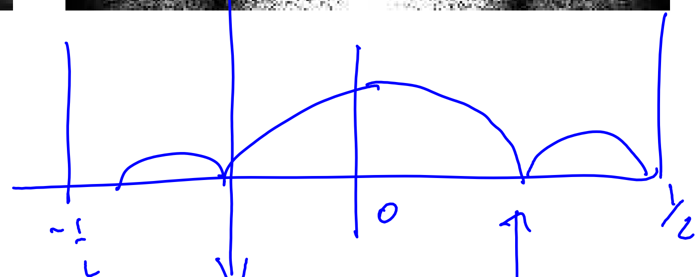
RESTAURATION

Estimation de la PSF





flou



$\nu = \frac{1}{l}$

$* \, \Pi\left(\frac{x}{l}\right) \rightleftharpoons l \, \frac{\sin \pi \nu l}{\pi \nu l}$ $\quad \frac{1}{l}$

$\frac{2}{l} = \frac{1}{2}$

$* \, \frac{1}{4} \, [\,1 \,|\, 1 \,|\, 1 \,|\, 1\,]$

$\frac{l}{2} = 2$

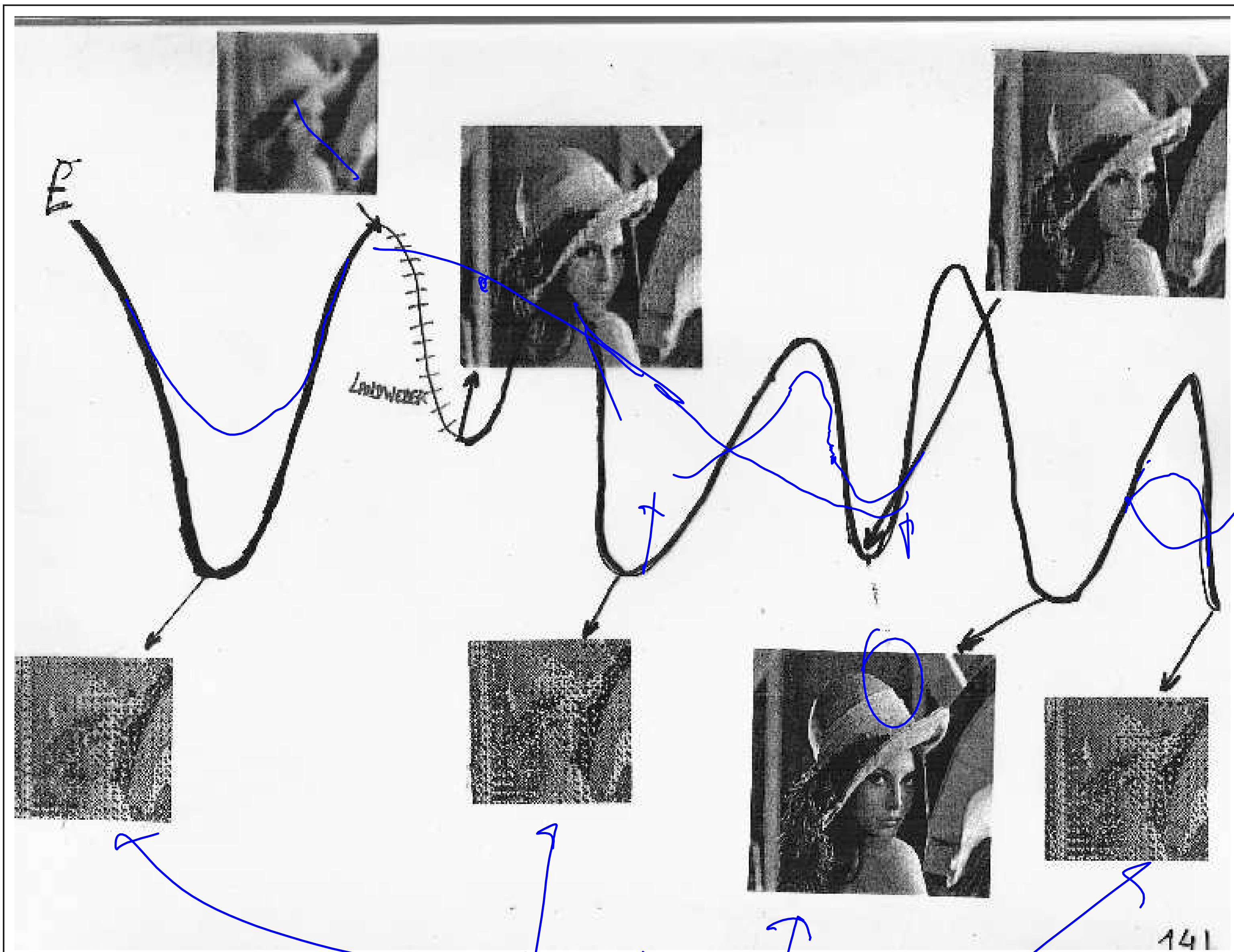
$l = 4$

Méthodes Itératives & Problèmes Inverse Mal-Posés

Fonction de coût :

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

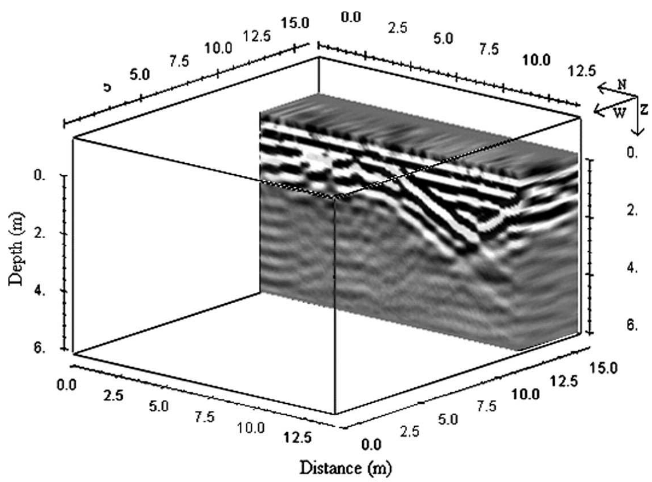
$$\hat{f}(x,y) = \arg\min_{f} \left\{ \| g(x,y) - h(x,y) * \hat{f}(x,y) \|^2 \right\}$$



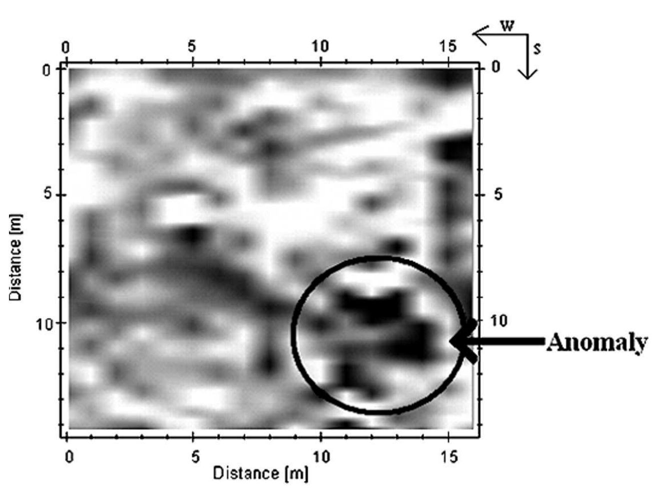
TOMOGRAPHIE
Applications (1)

Reconstruction faciale de l'interieur d'une momie

Detection de chambre mortuaires

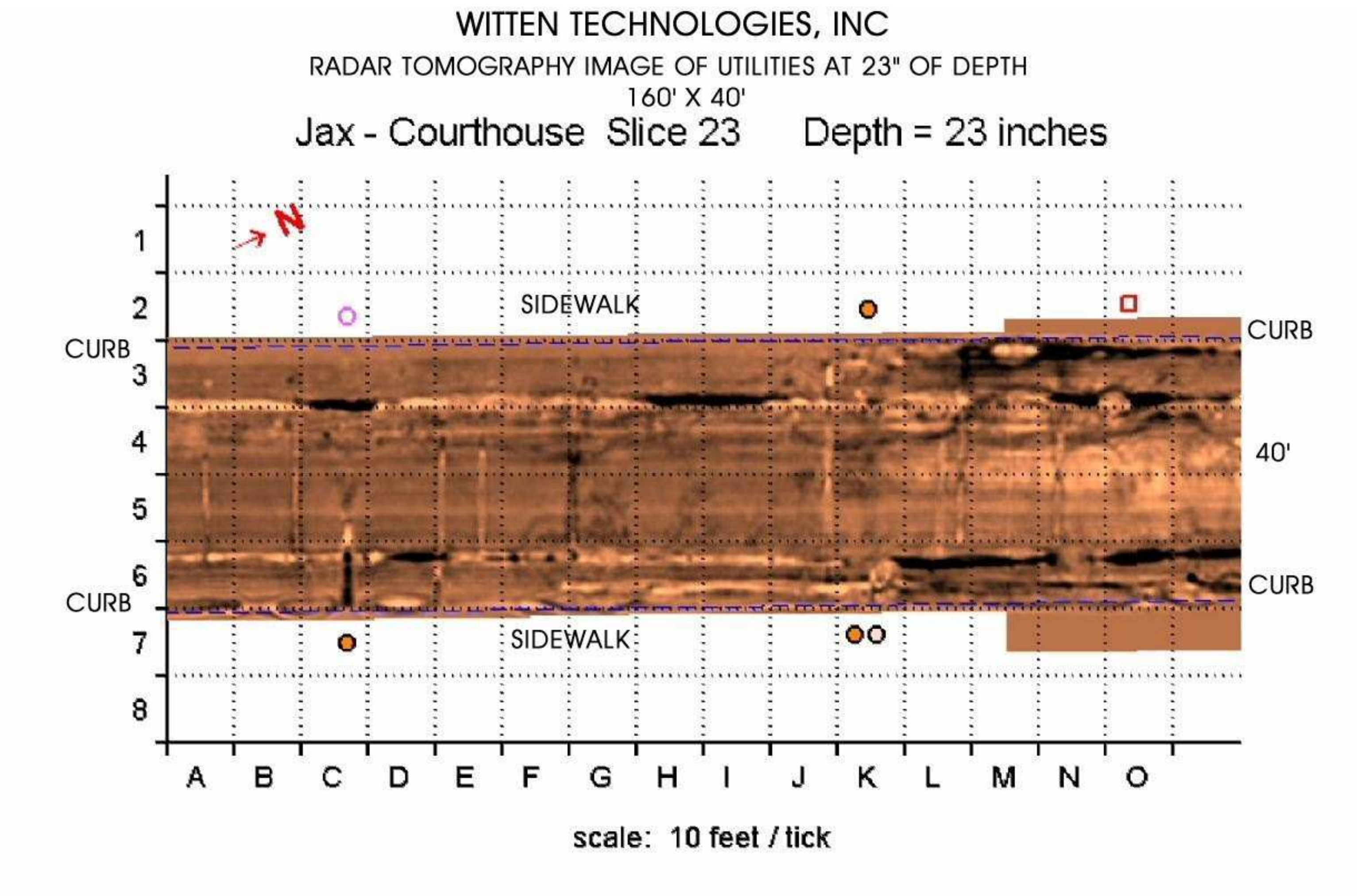


a.



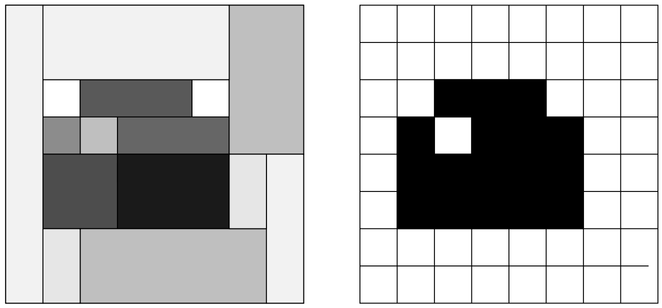
b.

Tomographie Radar des sols

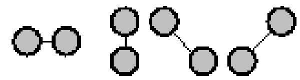


ICM : Exemple de Calcul

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



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**

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

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

- **VRAISSEMBLANCE**

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

- $y_s = 160 \triangleright$

- $y_s = 155 \triangleright$

SEGMENTATION D'IMAGES

RS : Effet de la Température

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

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

T=1 ▷

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

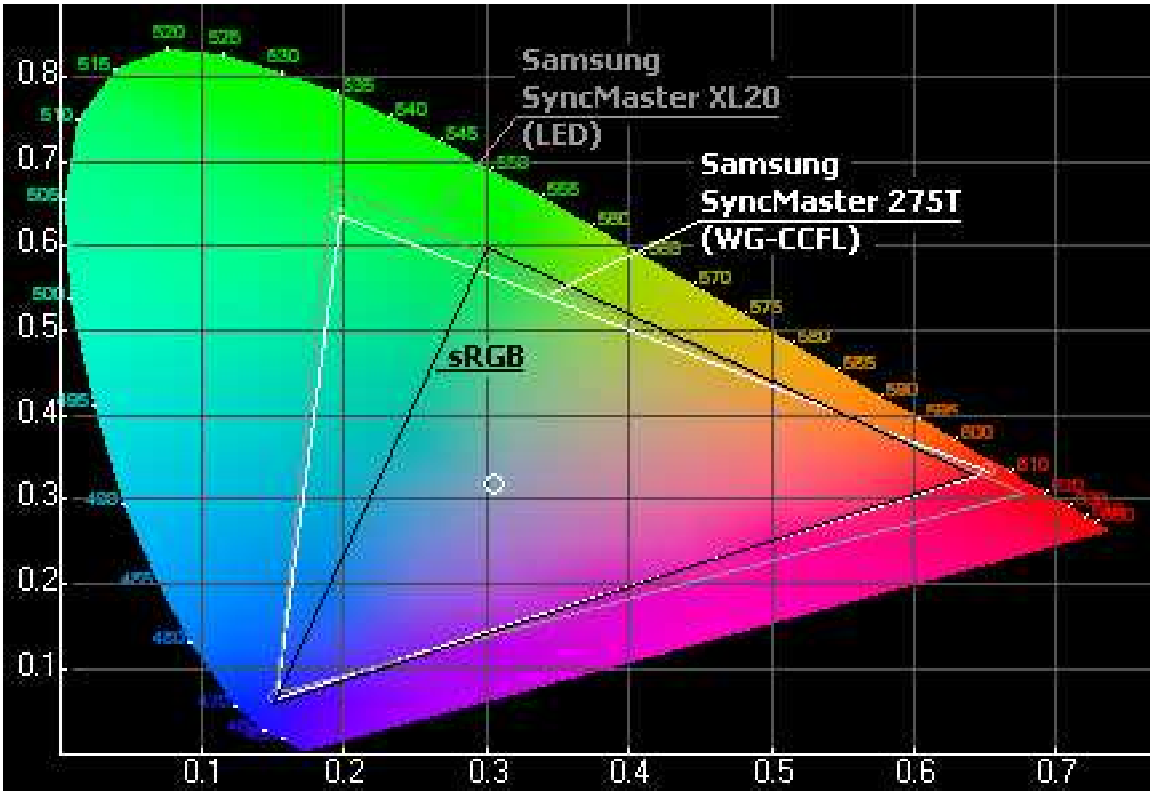
T=10 ▷

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

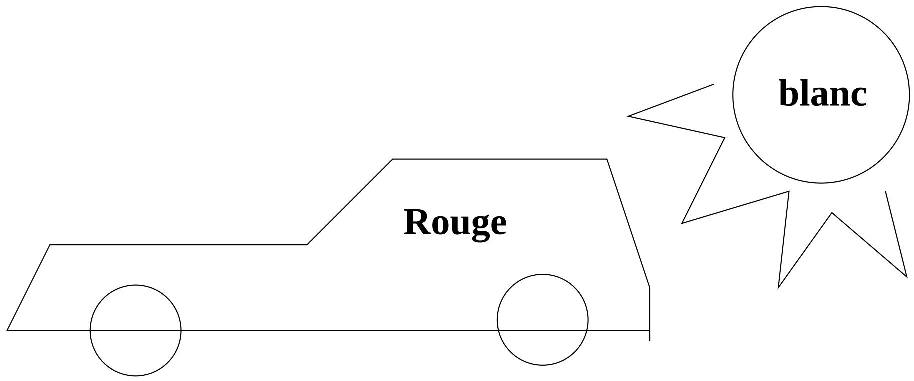
T=0.1 ▷

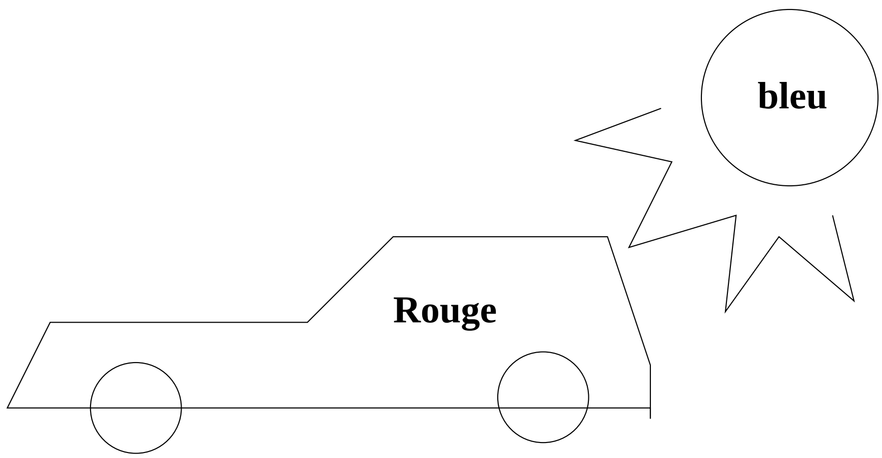
$$P(\blacksquare/y_s) = \frac{e^{-0.85/0.1}}{e^{-0.85/0.1} + e^{-0.15/0.1}} = \qquad P(\square/y_s) = \frac{e^{-0.15/0.1}}{\mathcal{D}} =$$

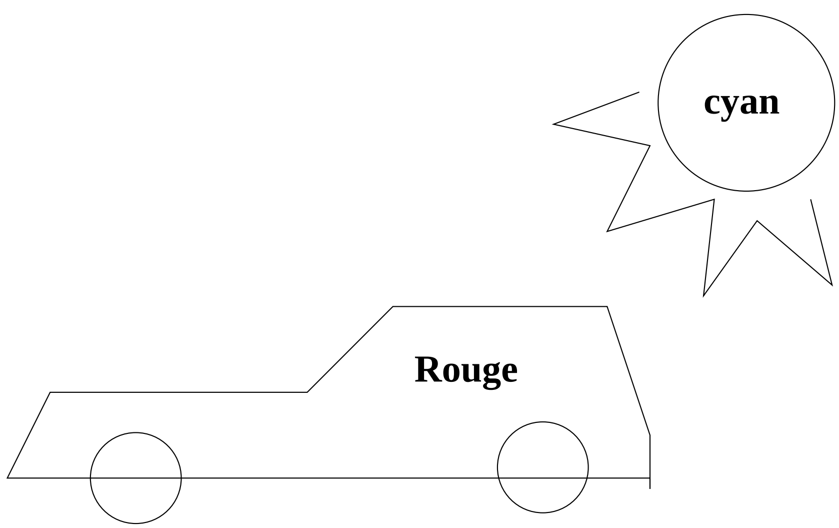
COULEURS
GAMUT



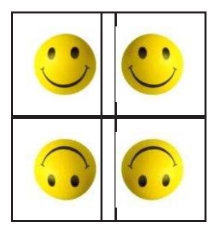
COULEURS
CUBE RGB



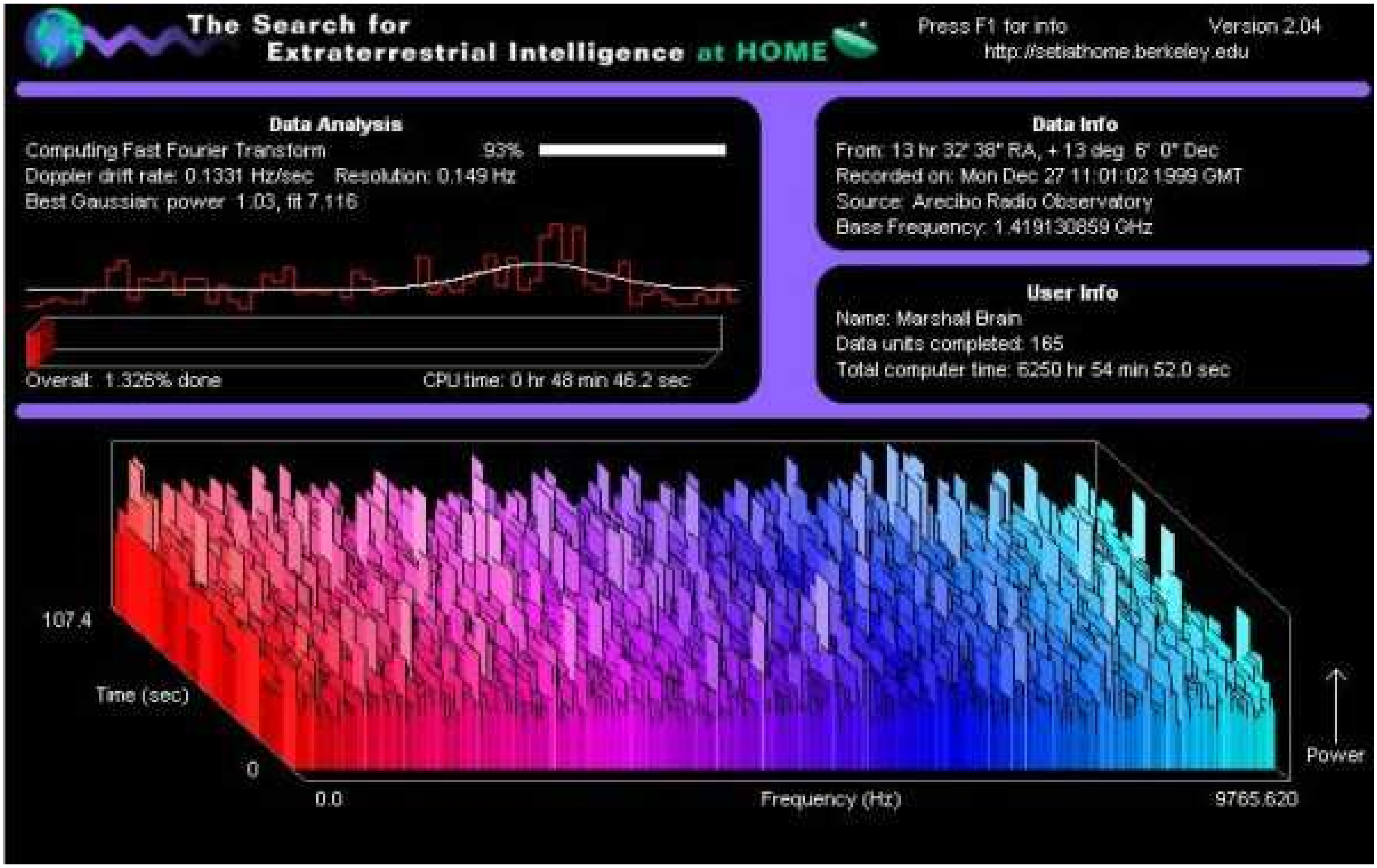


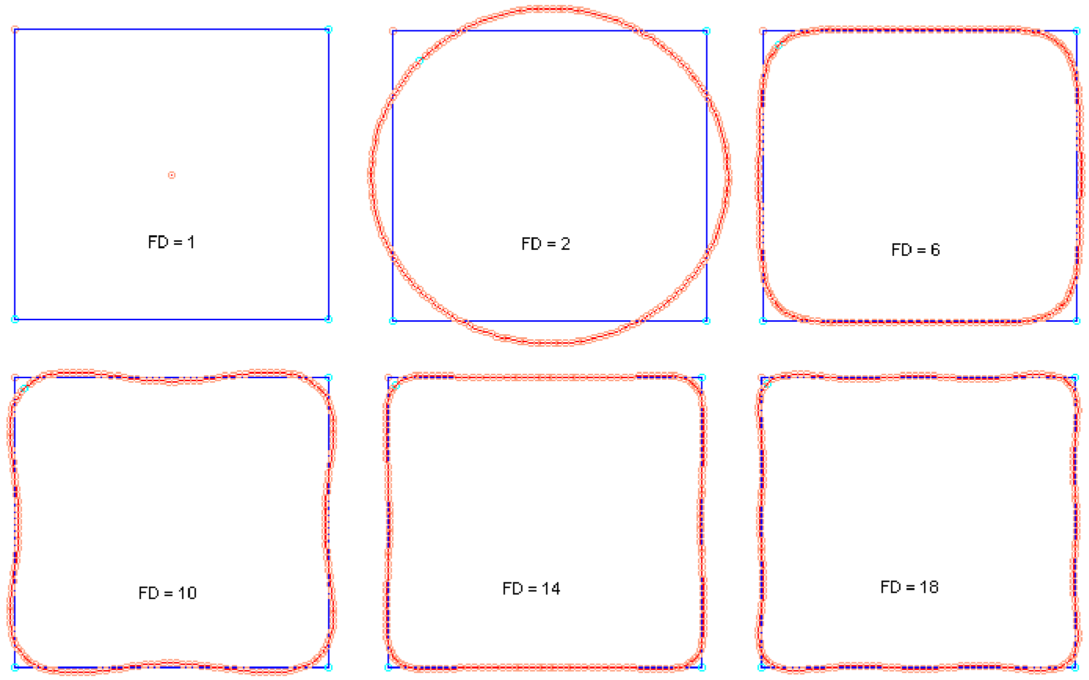


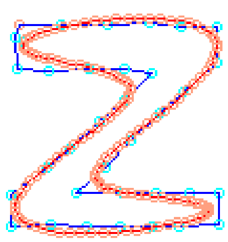
COMPRESSION
DCT

TCD () = TFD {  }

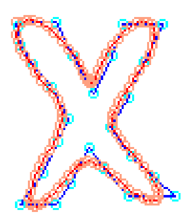
RECONAISSANCE DES FORMES
PROJET SETI



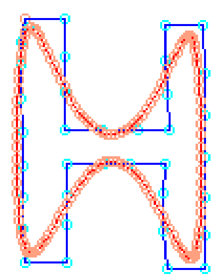




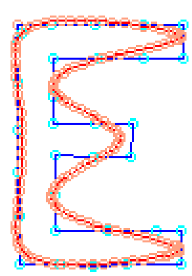
Number of FD: 6



Number of FD: 10



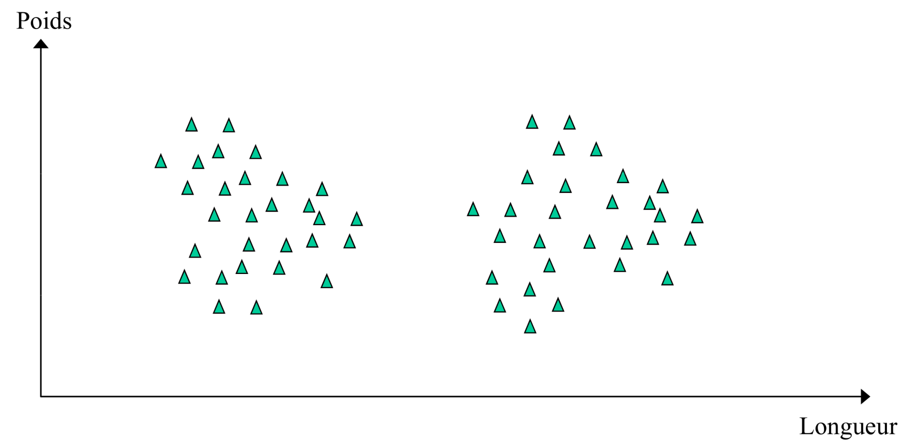
Number of FD: 8



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 ?

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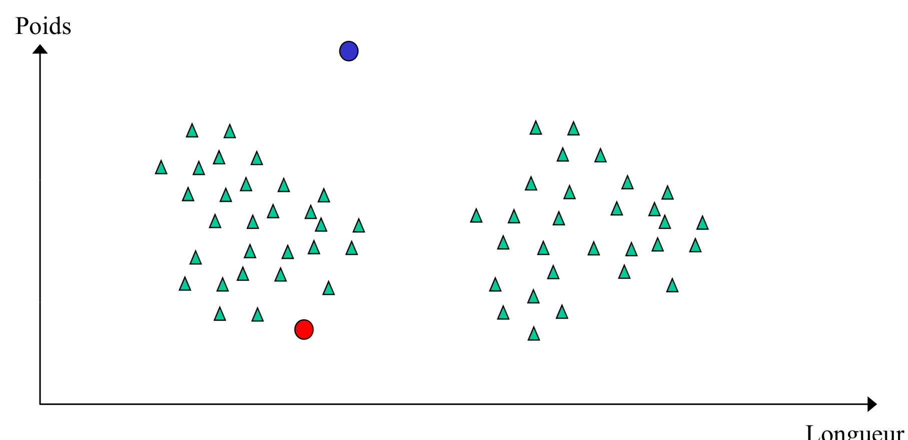
Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



On initialise le centre des deux classes au hasard

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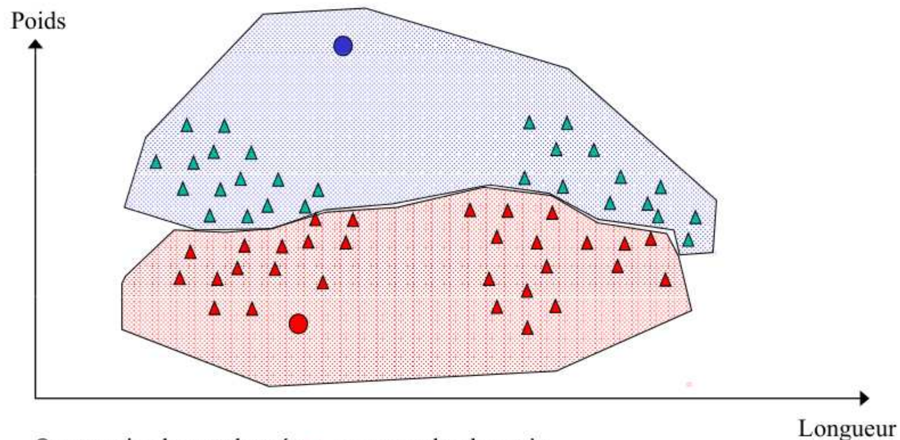
Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



On associe chaque donnée ▲ au centre le plus près

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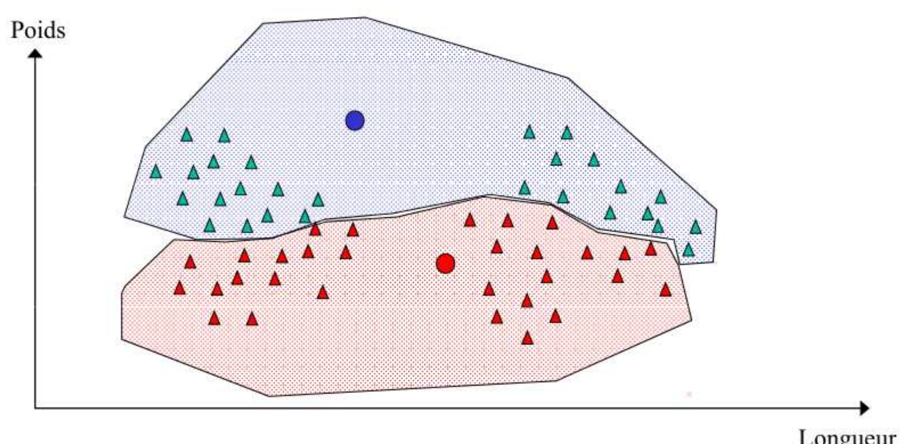
Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



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

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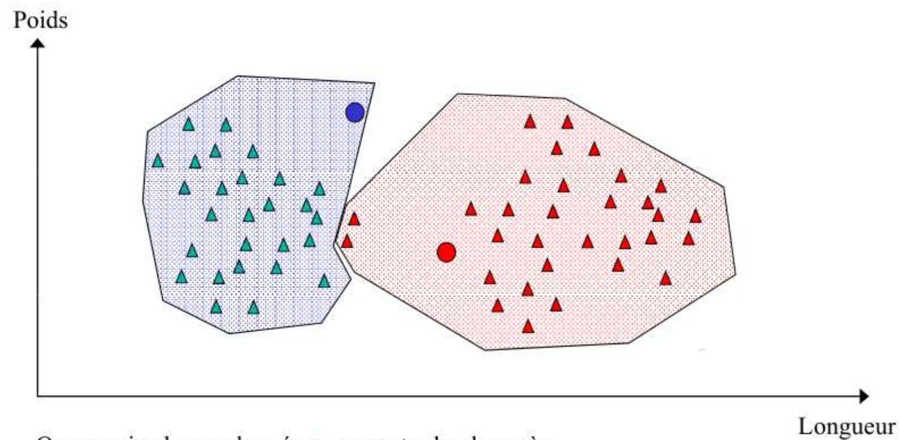
Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



On associe chaque donnée ▲ au centre le plus près

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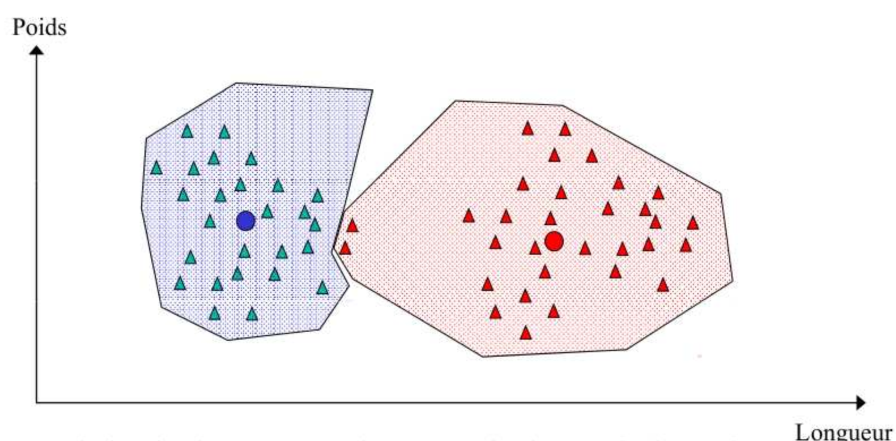
Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



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

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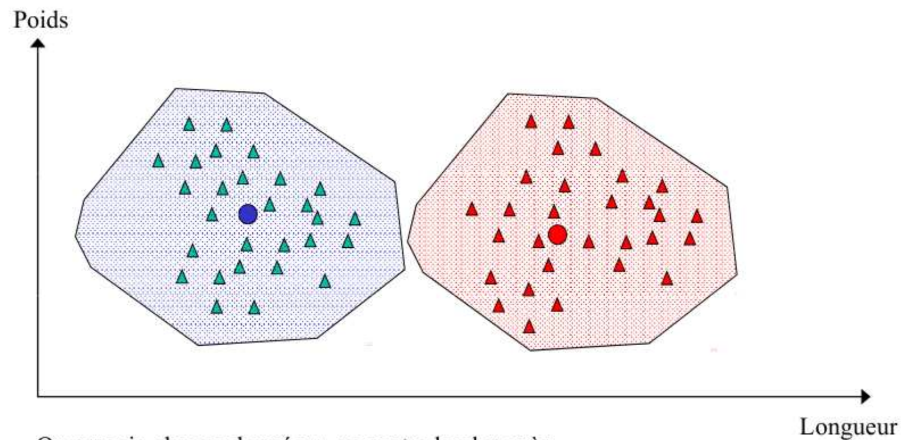
Algorithme des K-moyennes (*K-means*)

Exemple schématique de l'algorithme des K-moyennes



On associe chaque donnée au centre le plus près

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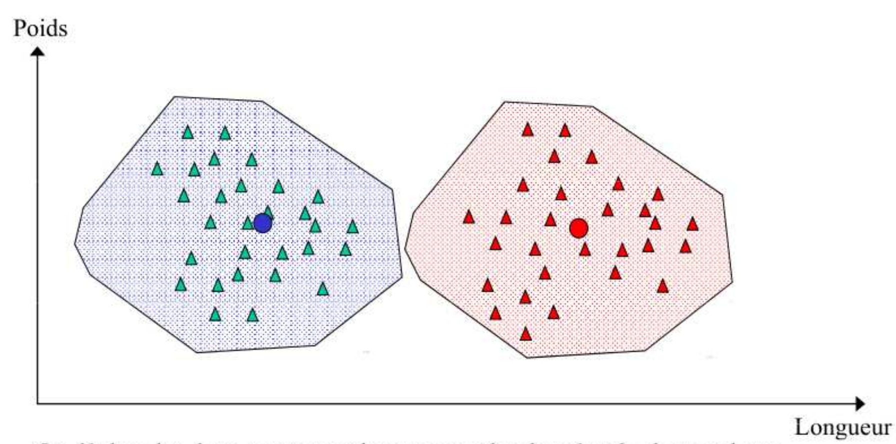
Algorithme des K-moyennes (*K-means*)

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**

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