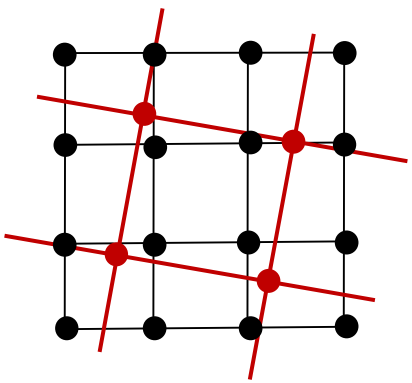
Rééchantillonnage

pierre-louis.frison@u-pem.fr

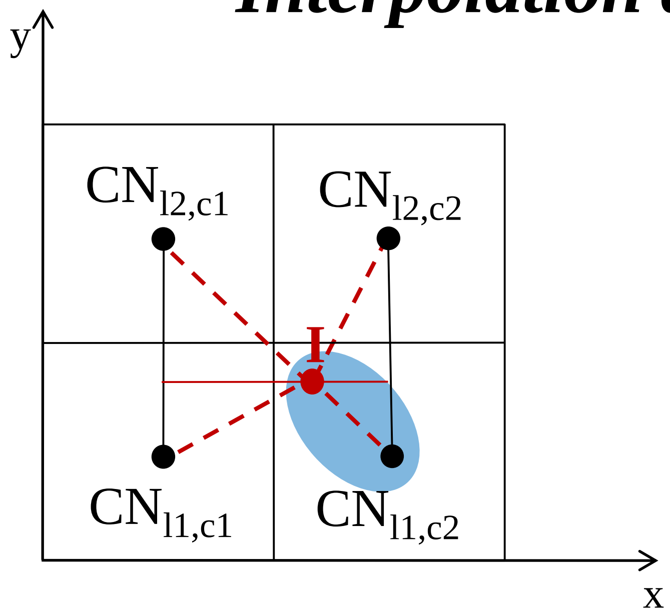
Université Gustave Eiffel

Rééchantillonage: Passage d'une grille à une autre



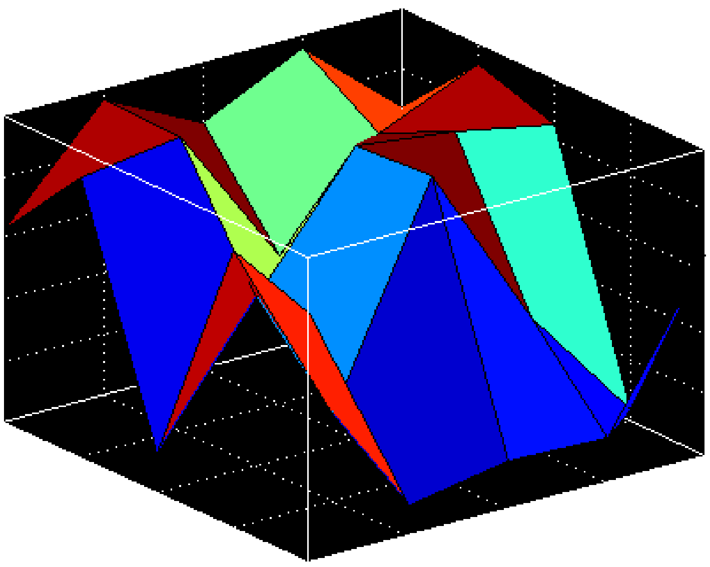
- Interpolation du ***plus proche voisin***
- Interpolation ***bilinéaire***
- Interpolation ***bicubique***

Interpolation du plus proche voisin

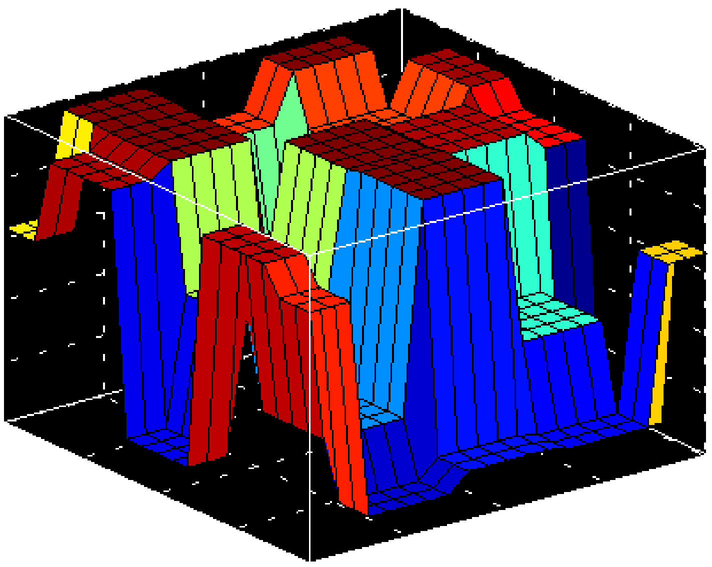


$$\mathbf{I = CN_{l1,c2}}$$

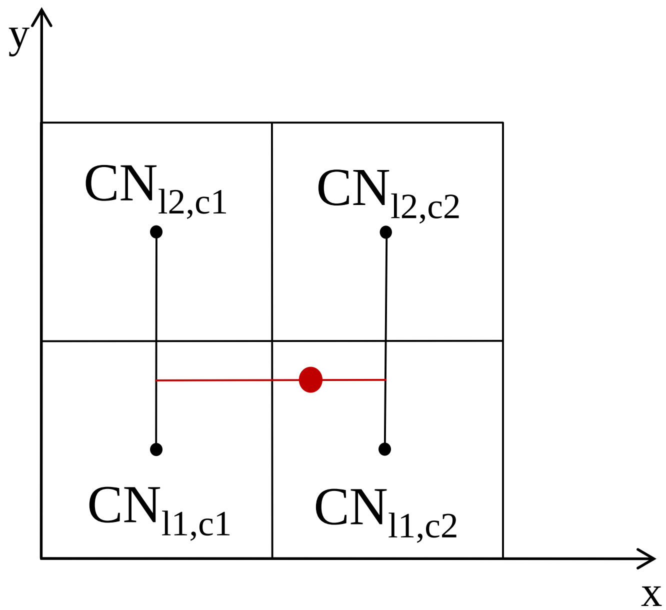
Surface originale

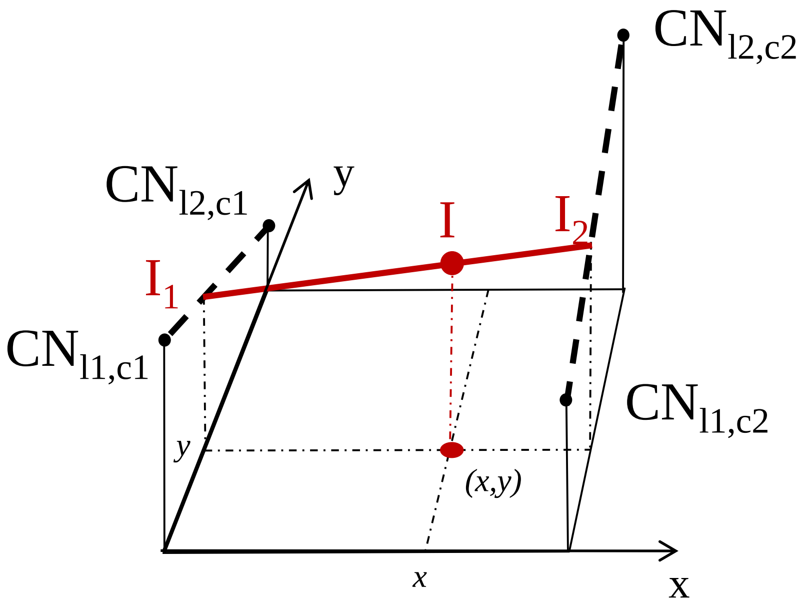


Interpolation plus proche voisin

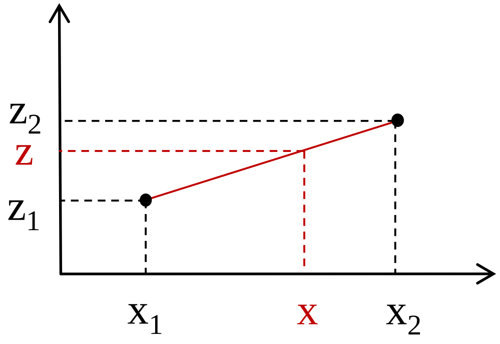


Interpolation bilinéaire





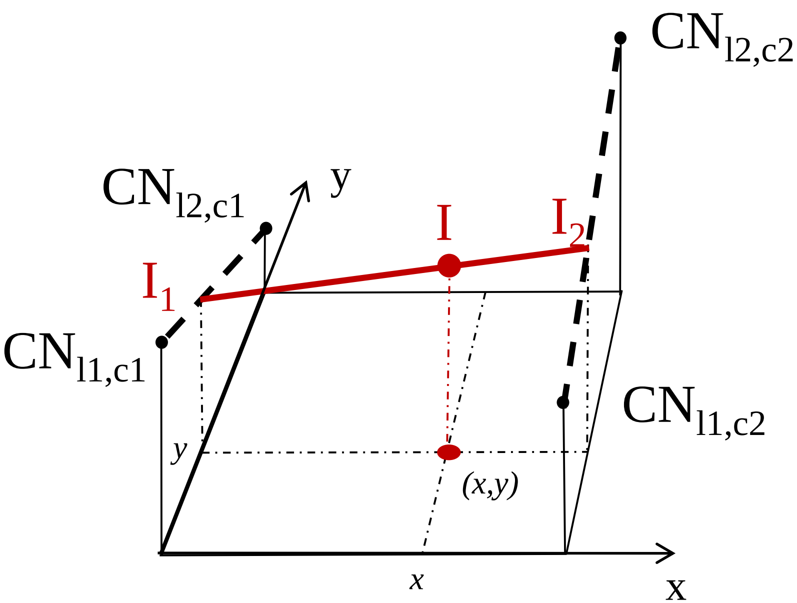
Cas à une dimension



$$z = \frac{z_2 - z_1}{x_2 - x_1}.\left(x - x_1\right) + z_1$$

z = A . x + B

Interpolation bilinéaire



$$I_1 = A_1 \,.\, y + B_1$$

$$I_2 = A_2 \,.\, y + B_2$$

$$\begin{cases} A_1 = \dfrac{CN_{l2,c2} - CN_{l1,c2}}{l_2 - l_1} \\ B_1 = CN_{l1,c2} - \dfrac{CN_{l2,c2} - CN_{l1,c2}}{l_2 - l_1} \,.\, l_1 \end{cases}$$

$$I = A_3 \,.\, x + B_3$$

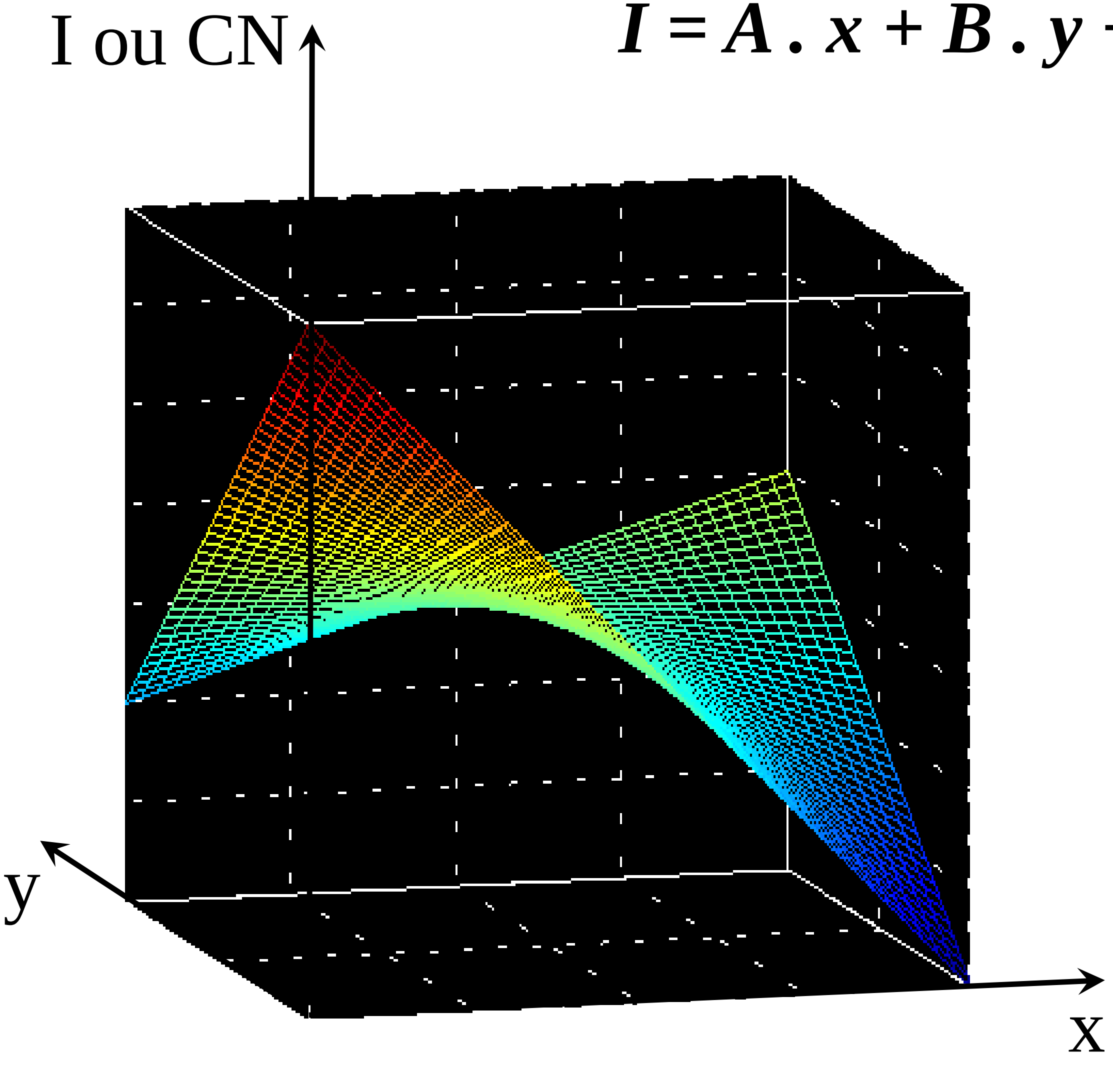
$$\begin{cases} A_3 = \dfrac{I_2 - I_1}{c_2 - c_1} = D_1 \,.\, y + E_1 \\ B_3 = I_1 - \dfrac{I_2 - I_1}{c_2 - c_1} \,.\, c_1 = D_2 \,.\, y + E_2 \end{cases}$$

==> $I = (D_1 \,.\, y + E_1) \,.\, x + (D_2 \,.\, y + E_2)$

$$\boldsymbol{I = A \,.\, x + B \,.\, y + C \,.\, x\,y + D}$$

Interpolation bilinéaire

$$I = A . x + B . y + C . x y + D$$

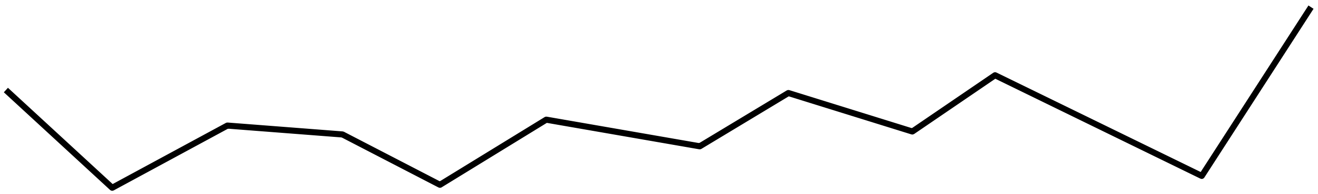


$$\begin{cases} A x_1 + B y_1 + C x_1 y_1 + D = CN_1 \\ A x_2 + B y_2 + C x_2 y_2 + D = CN_2 \\ A x_3 + B y_3 + C x_3 y_3 + D = CN_3 \\ A x_4 + B y_4 + C x_4 y_4 + D = CN_4 \end{cases}$$

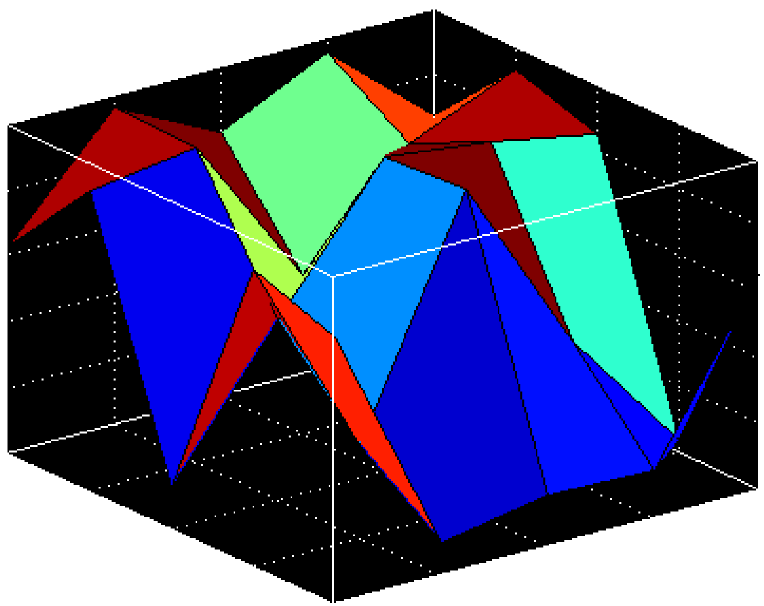
Interpolation bilinéaire

Inconvénients: ***Arêtes!***

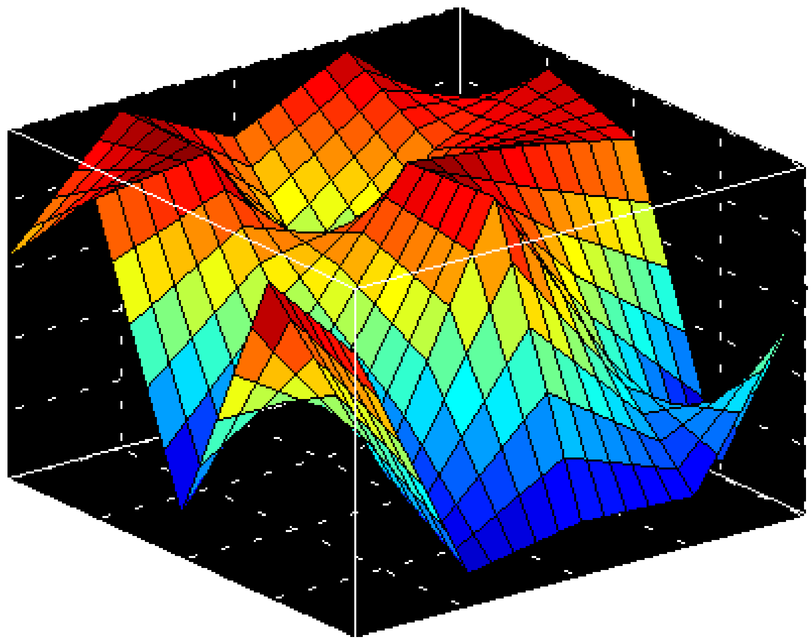
2-D



3-D



surface originale



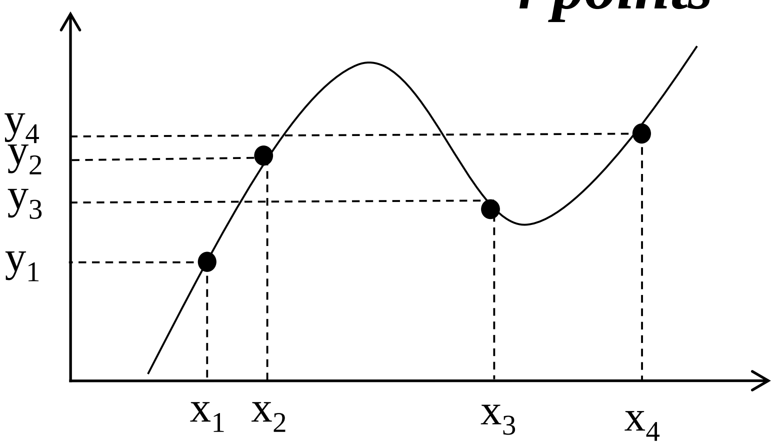
surface interpolée

Interpolation bicubique

Cas à une dimension

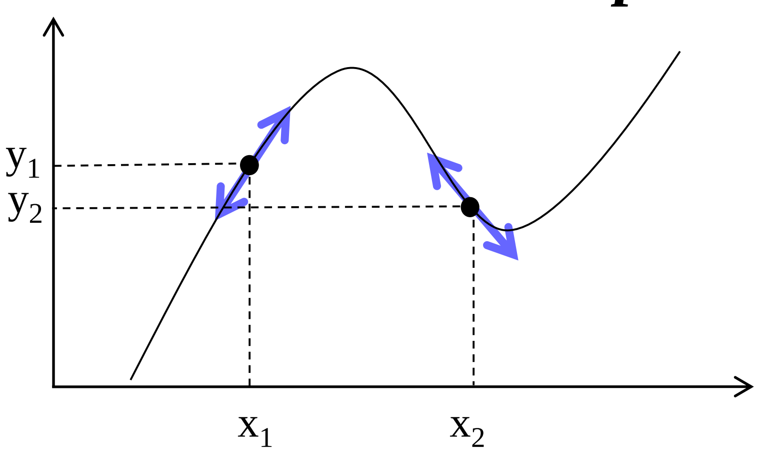
Polynome de degré 3: $y = Ax^3 + Bx^2 + Cx + D$

4 points



$$\begin{cases} Ax_1^3 + Bx_1^2 + Cx_1 + D = y_1 \\ Ax_2^3 + Bx_2^2 + Cx_2 + D = y_2 \\ Ax_3^3 + Bx_3^2 + Cx_3 + D = y_3 \\ Ax_4^3 + Bx_4^2 + Cx_4 + D = y_4 \end{cases}$$

2 points + 2 dérivées



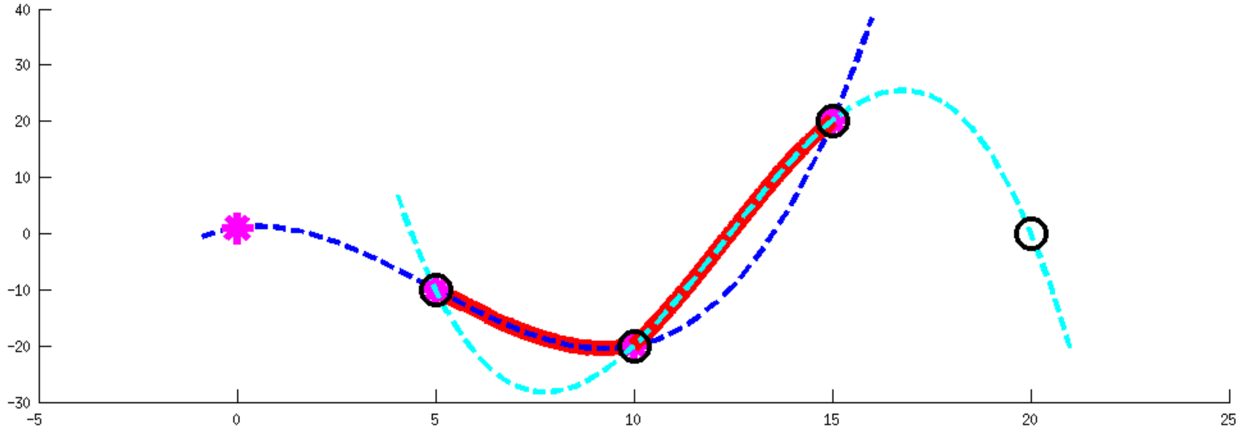
$$\begin{cases} Ax_1^3 + Bx_1^2 + Cx_1 + D = y_1 \\ Ax_2^3 + B\ x_2^2 + Cx_2 + D = y_2 \\ 3Ax_1^2 + 2B\ x_1 + C = y'_1 \\ 3Ax_2^3 + 2B\ x_2^2 + C = y'_2 \end{cases}$$

Interpolation bicubique

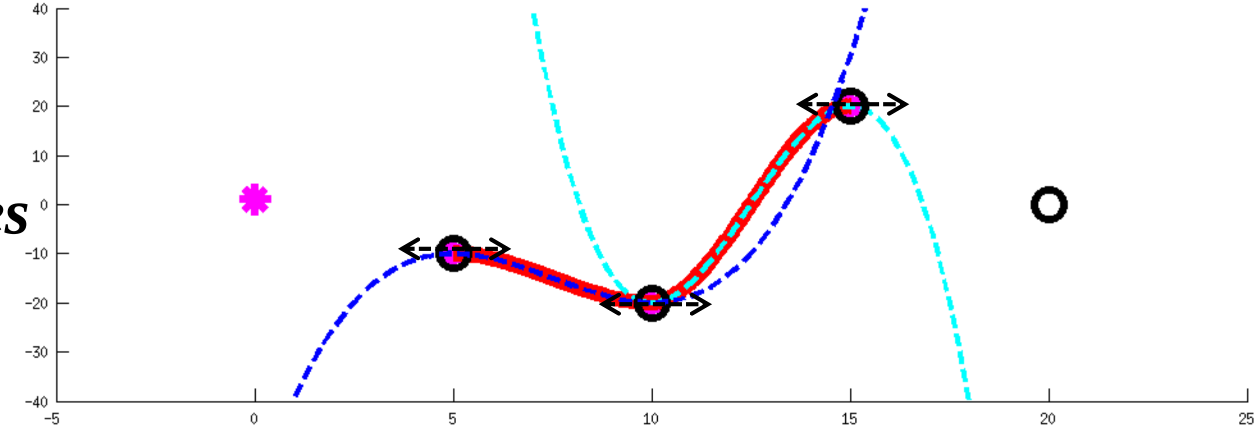
Cas à une dimension

Polynome de degré 3: $y = Ax^3 + Bx^2 + Cx + D$

4 points



2 points + 2 dérivées

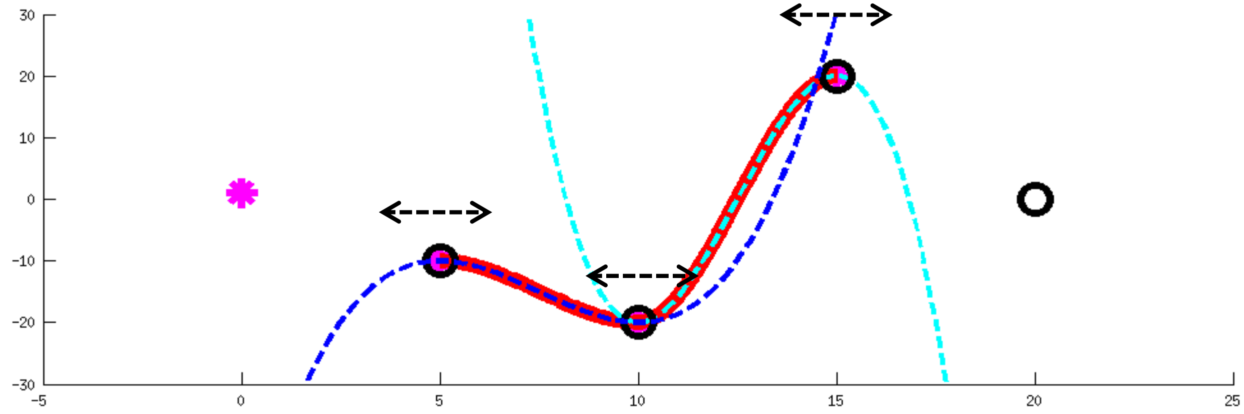


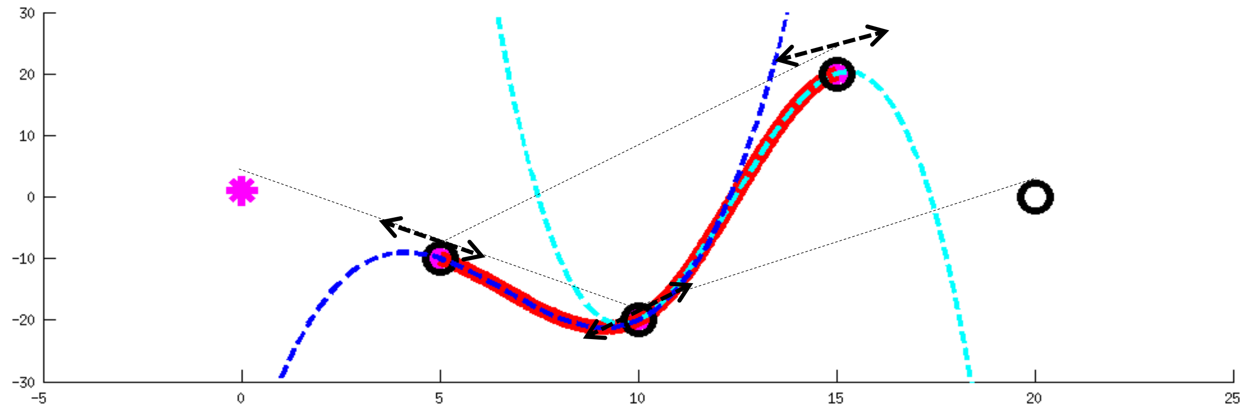
Interpolation bicubique

Cas à une dimension

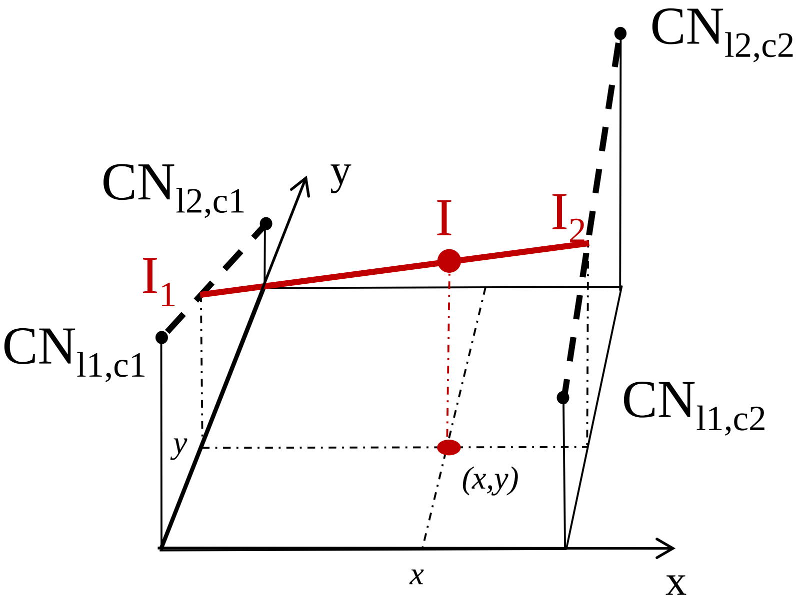
Polynome de degré 3: $y = Ax^3 + Bx^2 + Cx + D$

2 points + 2 dérivées





Interpolation bilinéaire (rappel)



$I_1 = A_1 . y + B_1$

$I_2 = A_2 . y + B_2$

$$\begin{cases} A_1 = \dfrac{CN_{l2,c2} - CN_{l1,c2}}{l_2 - l_1} \\ B_1 = CN_{l1,c2} - \dfrac{CN_{l2,c2} - CN_{l1,c2}}{l_2 - l_1} . l_1 \end{cases}$$

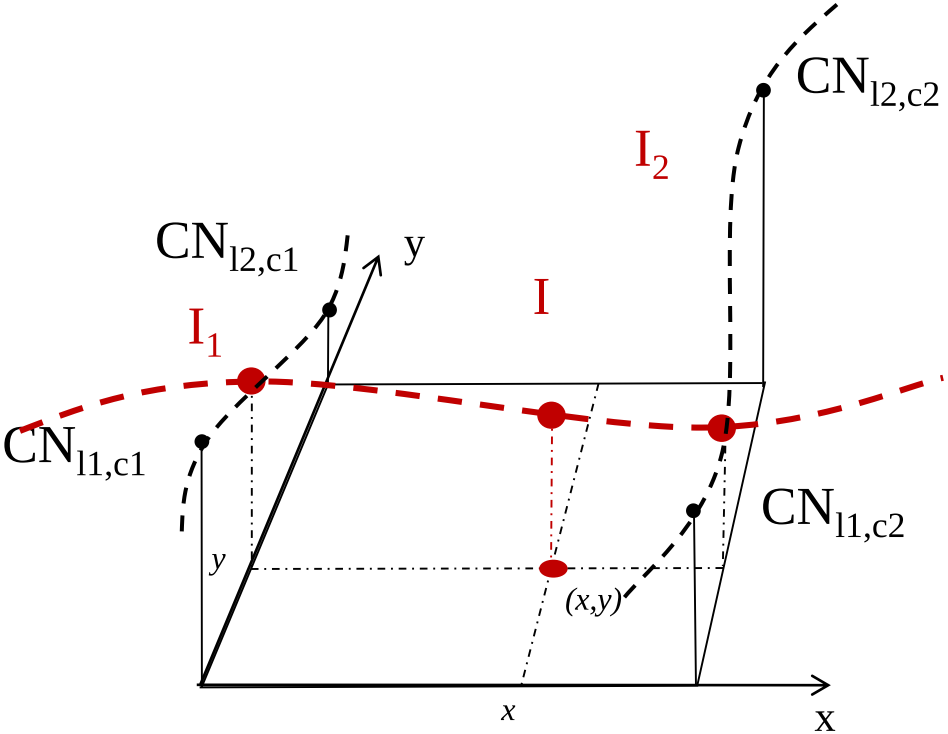
$I = A_3 . x + B_3$

$$\begin{cases} A_3 = \dfrac{I_2 - I_1}{c_2 - c_1} = D_1 . y + E_1 \\ B_3 = I_1 - \dfrac{I_2 - I_1}{c_2 - c_1} . c_1 = D_2 . y + E_2 \end{cases}$$

==> $I = (D_1 . y + E_1) . x + (D_2 . y + E_2)$

$$\boldsymbol{I = A . x + B . y + C . x y + D}$$

Interpolation bicubique



$$I_1 = A_1 \,.\, y^3 + B_1 \,.\, y^2 + C_1 \,.\, y + D_1$$

$$I_2 = A_2 \,.\, y^3 + B_2 \,.\, y^2 + C_2 \,.\, y + D_2$$

$$\begin{cases} A_1, B_1, C_1, D_1, = f(CN_{l1,c1}, CN_{l1,c2}, l_1, l_2) \\ A_2, B_2, C_2, D_2, = f(CN_{l2,c1}, CN_{l2,c2}, l_1, l_2) \end{cases}$$

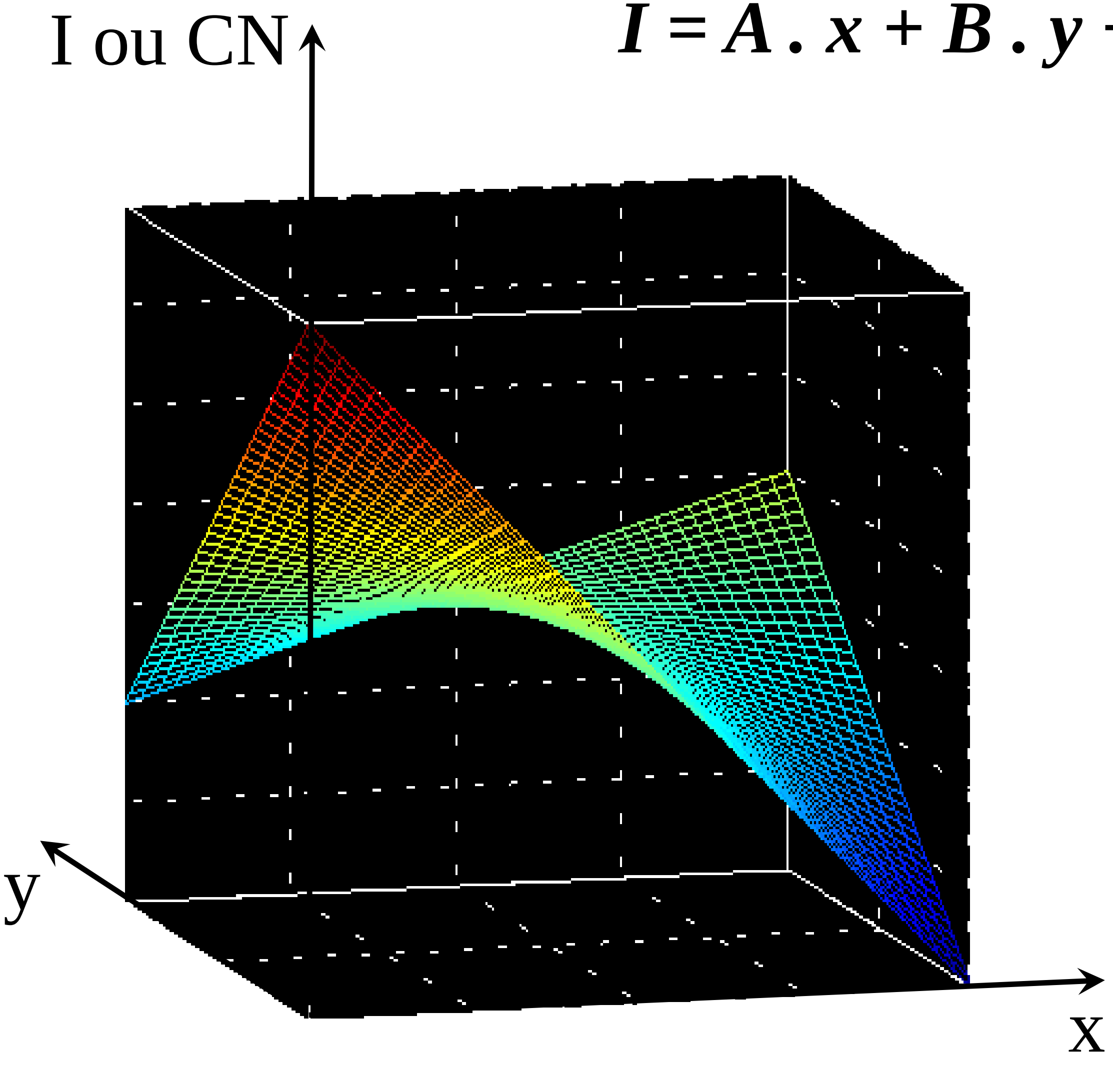
$$I = A_3 \,.\, x^3 + B_3 \,.\, x^2 + C_3 \,.\, x + D_3$$

$$A_3, B_3, C_3, D_3, = f(I_1, I_2, c_1, c_2)$$

$$I = \sum_{i=0}^{3} \sum_{j=0}^{3} a_{ij} x^i y^j$$

Interpolation bilinéaire

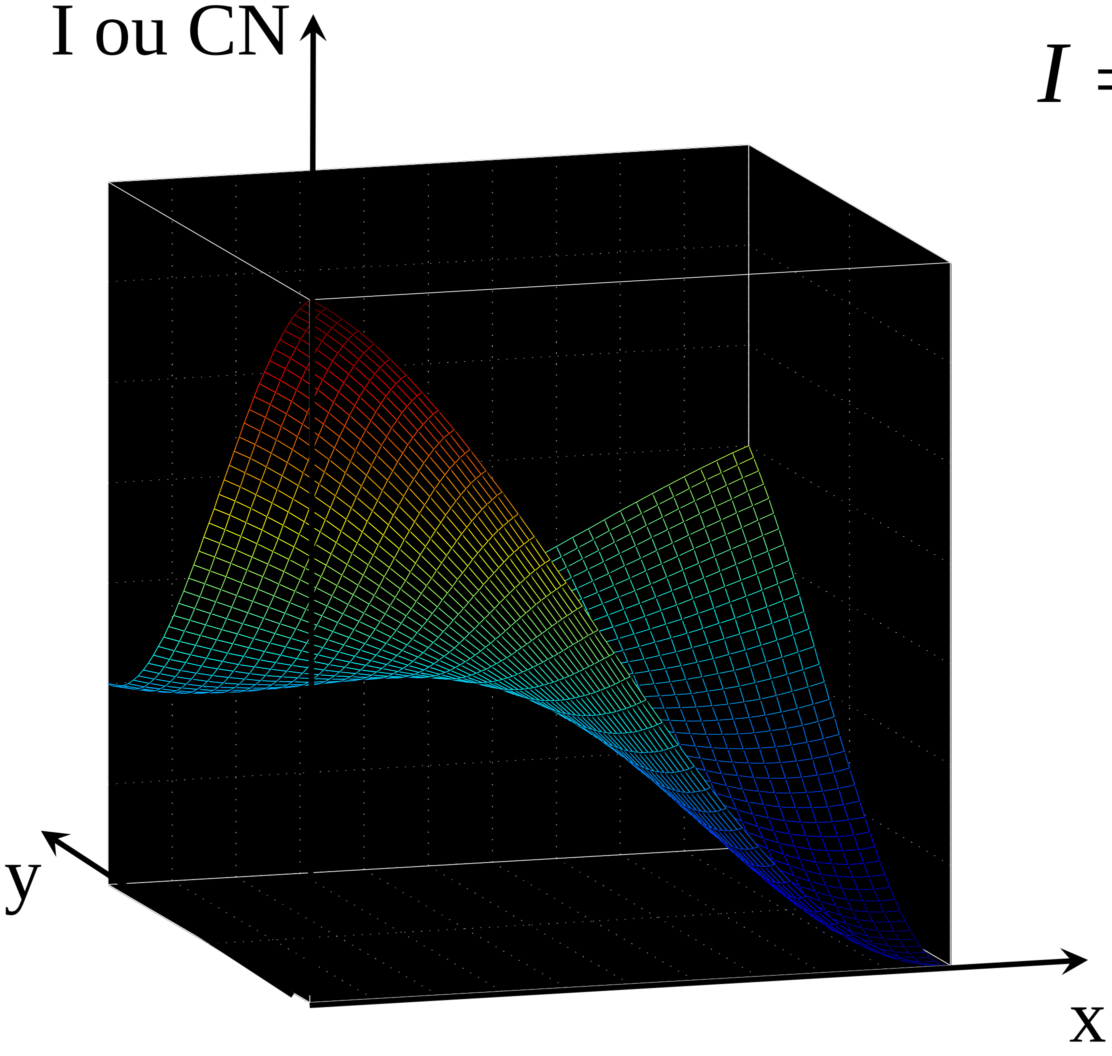
$$I = A\,.\,x + B\,.\,y + C\,.\,x\,y + D$$



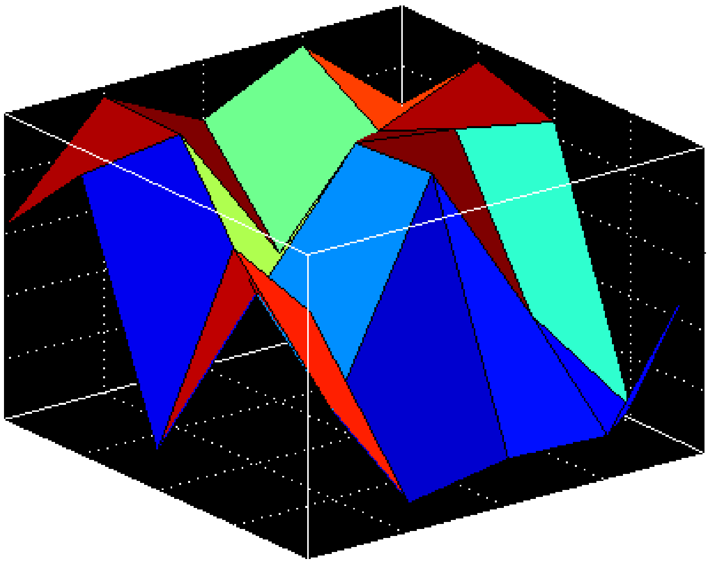
$$\begin{cases} A x_1 + B y_1 + C x_1 y_1 + D = CN_1 \\ A x_2 + B y_2 + C x_2 y_2 + D = CN_2 \\ A x_3 + B y_3 + C x_3 y_3 + D = CN_3 \\ A x_4 + B y_4 + C x_4 y_4 + D = CN_4 \end{cases}$$

Interpolation bicubique

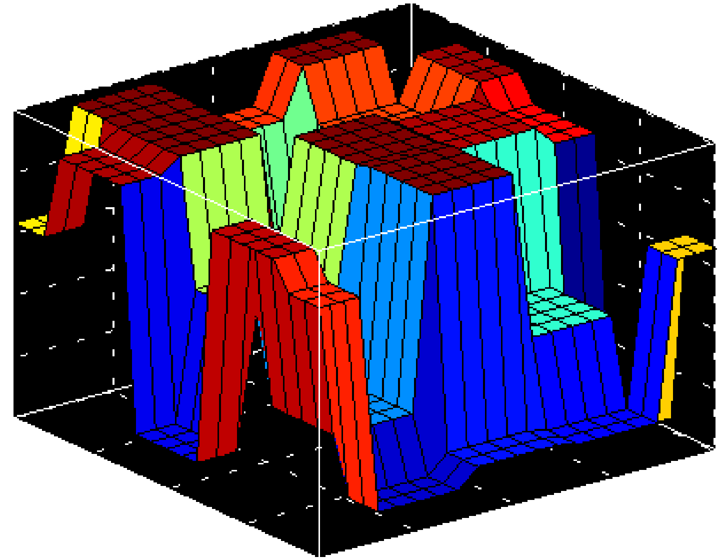
$$I = \sum_{i=0}^{3} \sum_{j=0}^{3} a_{ij} x^i y^j$$



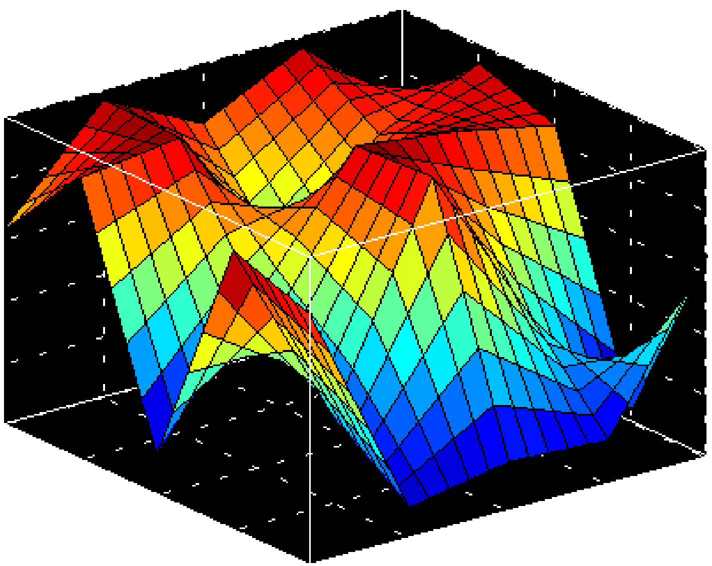
Surface originale



Interpolation plus proche voisin



Interpolation bilinéaire



Interpolation bicubique