$$d_A(r,s) = \sum_{(i,j)\in R} \left| I(r+i, s+j) - R(i,j) \right|$$

$$d_M(r,s) = \max_{(i,j)\in R} \left| I(r+i, s+j) - R(i,j) \right|$$

$d_A(r,s)$: Summe der Differenzbeträge

$d_M(r,s)$: Maximaler Differenzbetrag

$R(i,j)$: Bildpunkt des *Templates*

(17) Ähnlichkeitsmaße

$$d_E(r,s) = \left[\sum_{(i,j)\in R} \big(I(r+i, s+j) - R(i,j) \big)^2 \right]^{1/2}$$

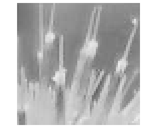
$$d_E^2(r,s) = \sum_{(i,j)\in R} \big(I(r+i, s+j) - R(i,j) \big)^2$$

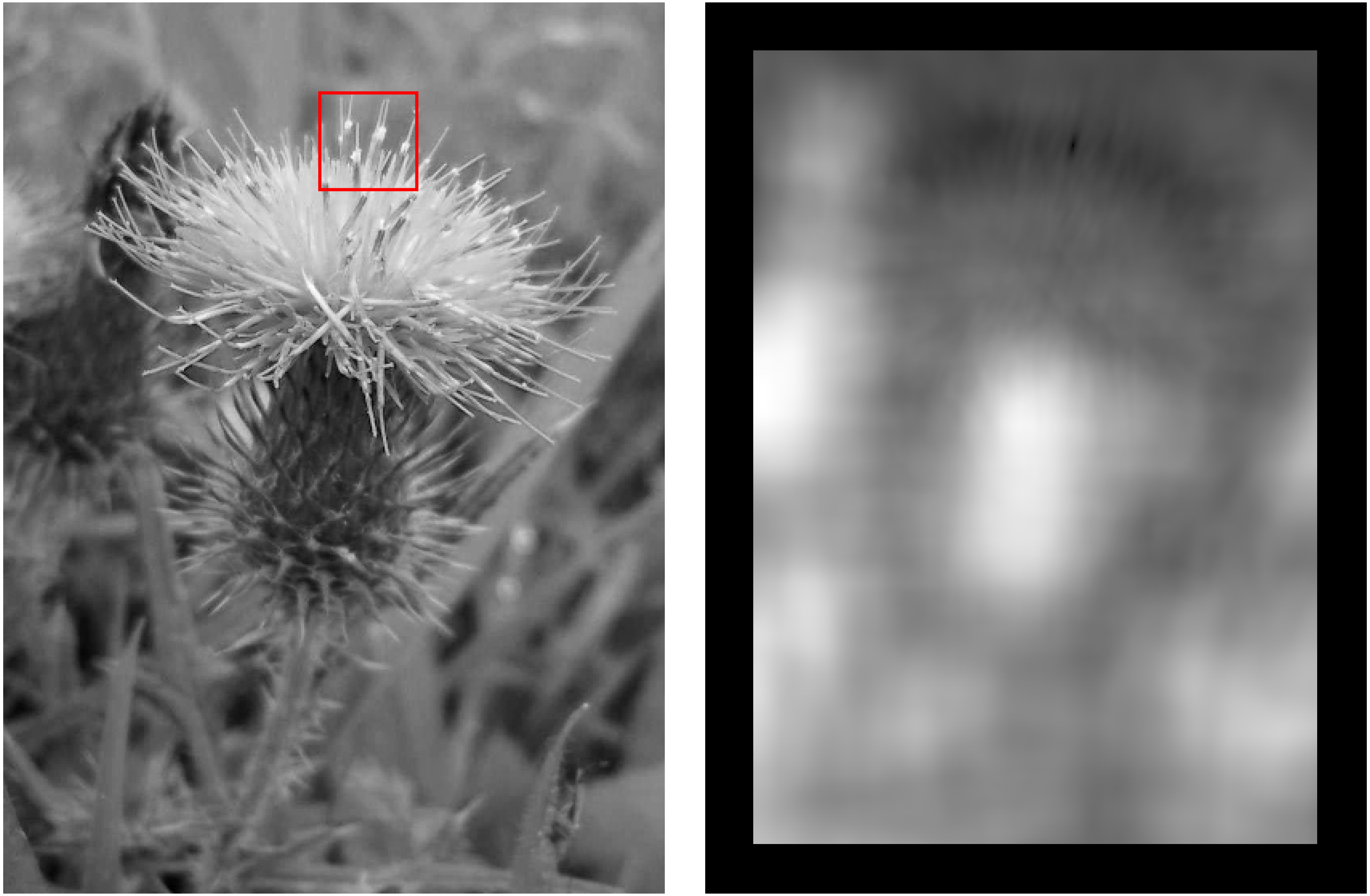
$d_E(r,s)$: Wurzel der Summe der quadratischen Abstände

$d_E^2(r,s)$: Summe der quadratischen Abstände

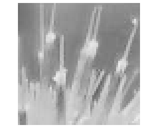
$R(i,j)$: Bildpunkt des *Templates*

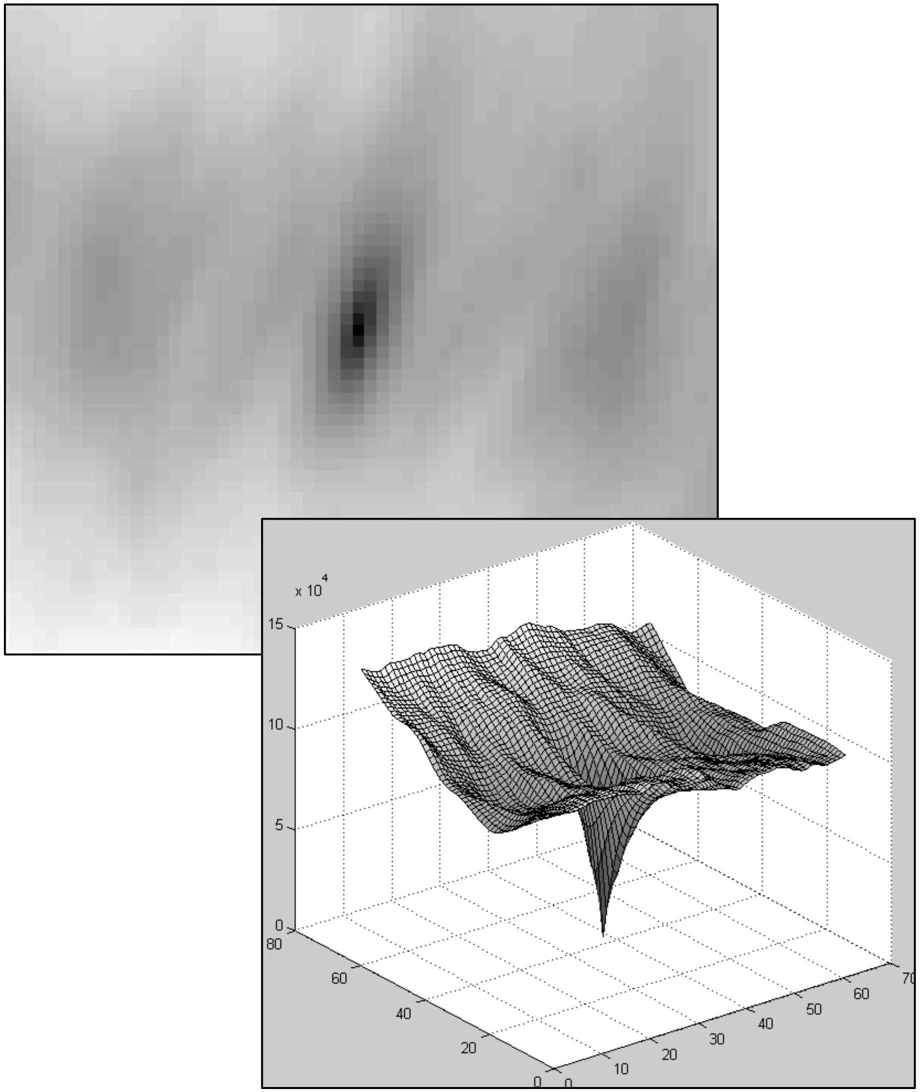
(17) Ähnlichkeitsmaße

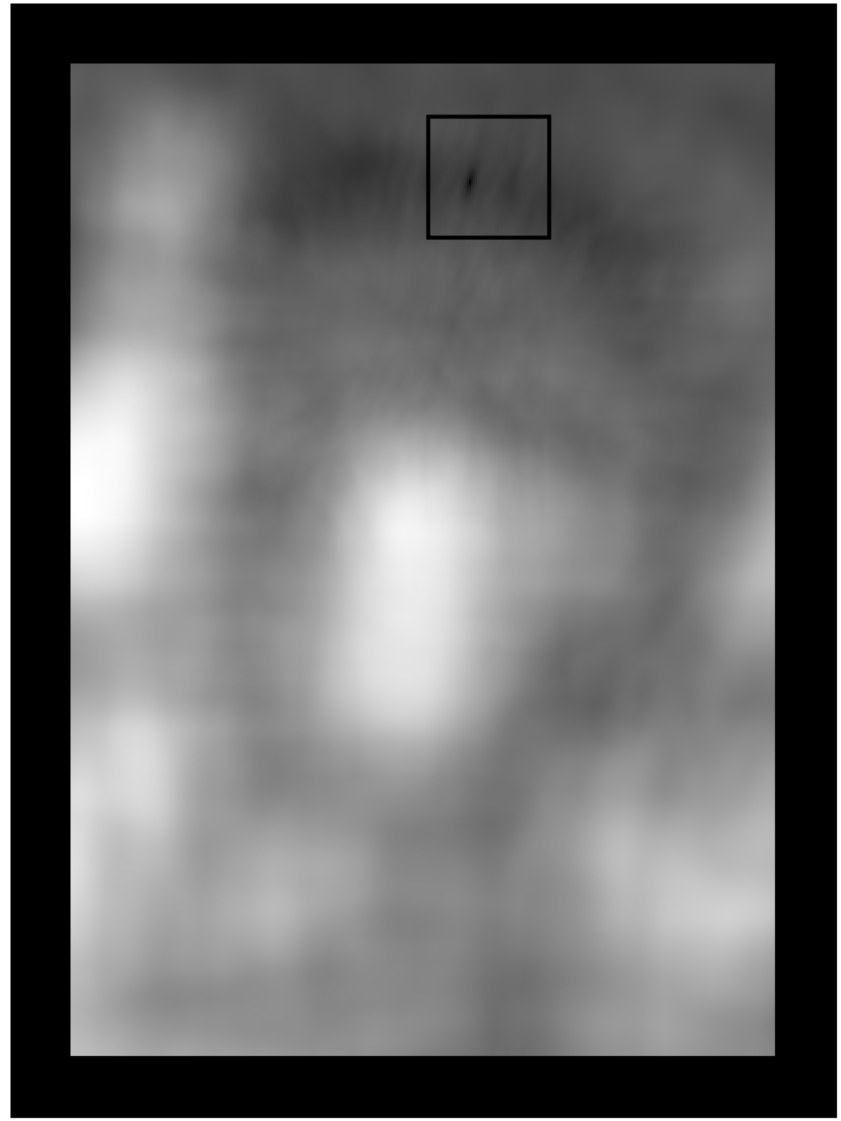




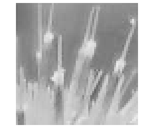
(17) Summe der Differenzbeträge

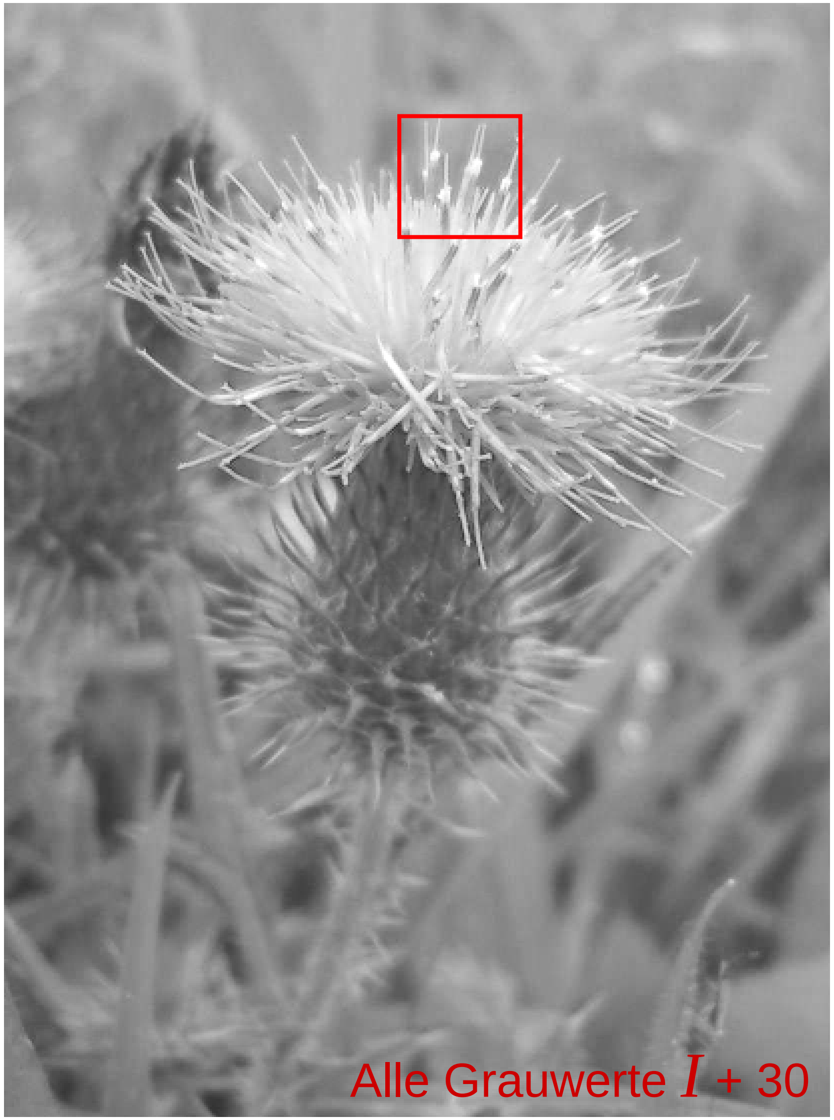


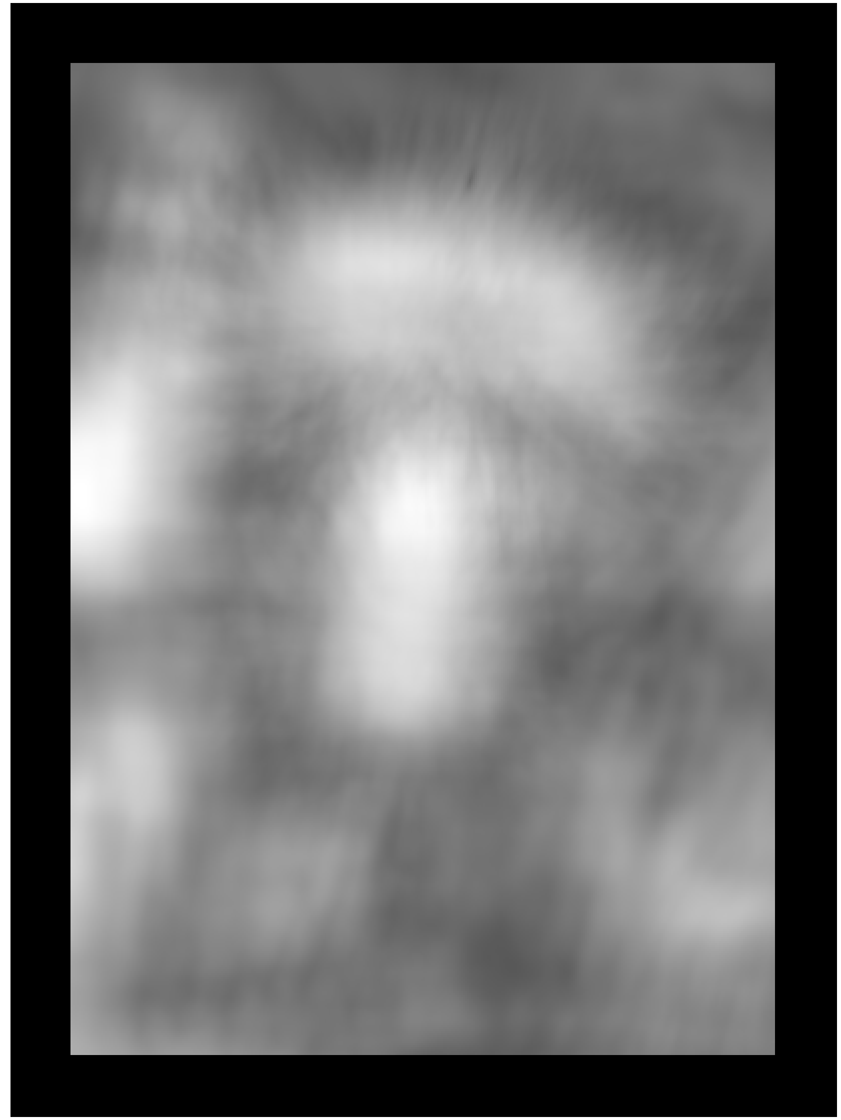




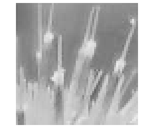
(17) Summe der Differenzbeträge

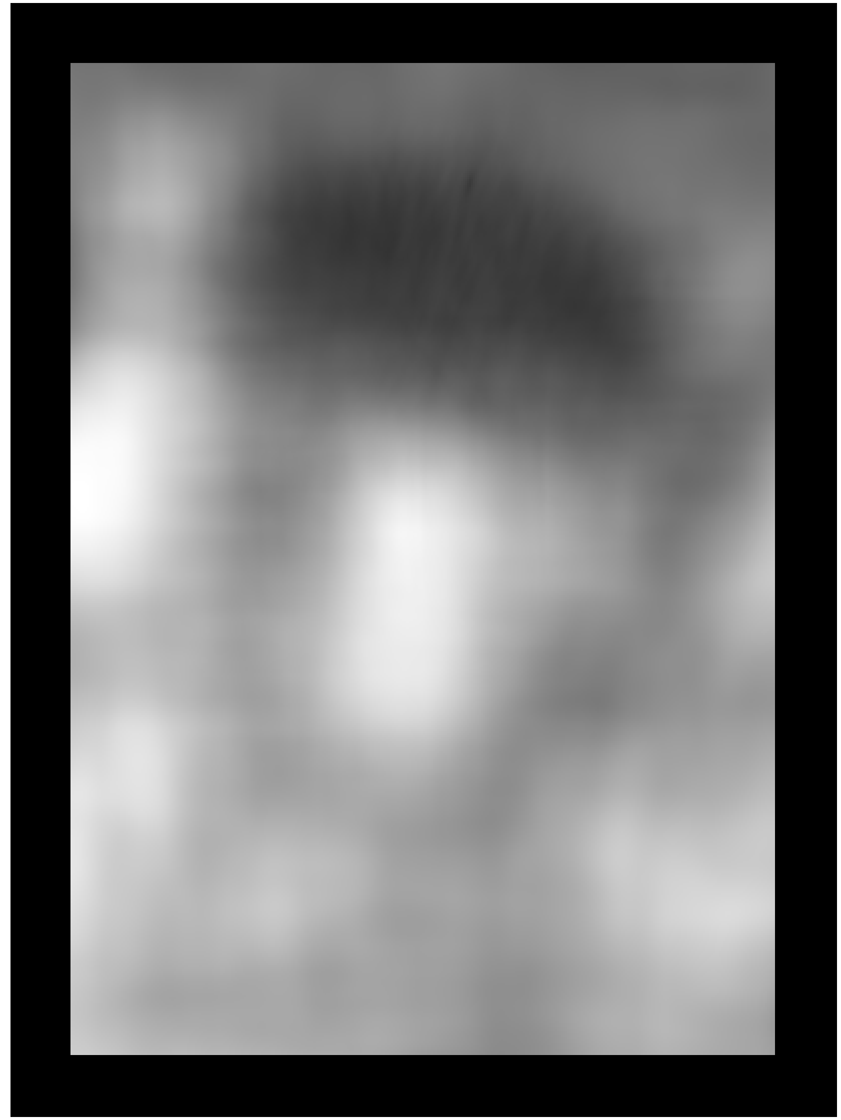




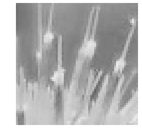


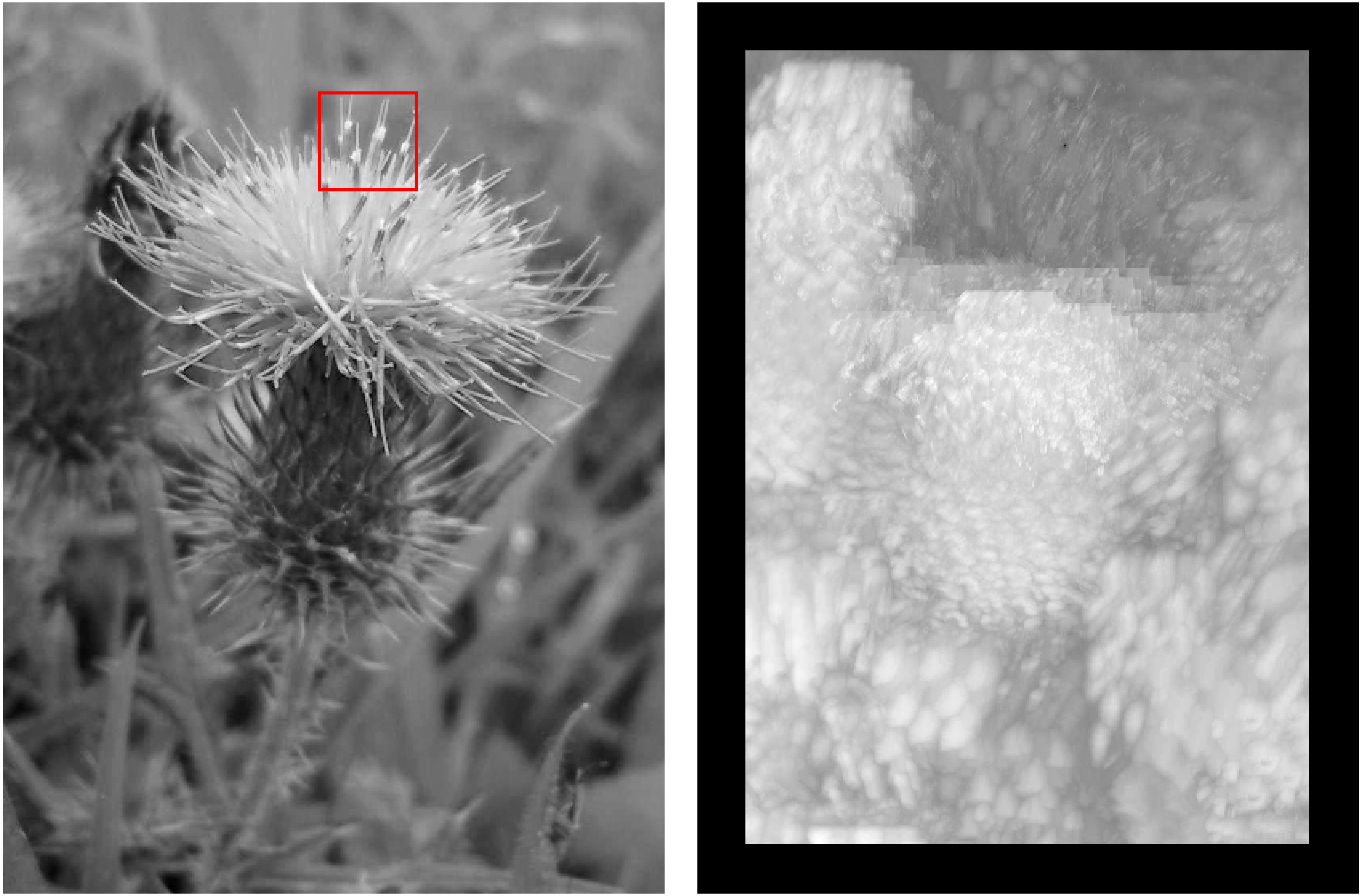
(17) Summe der Differenzbeträge



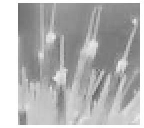


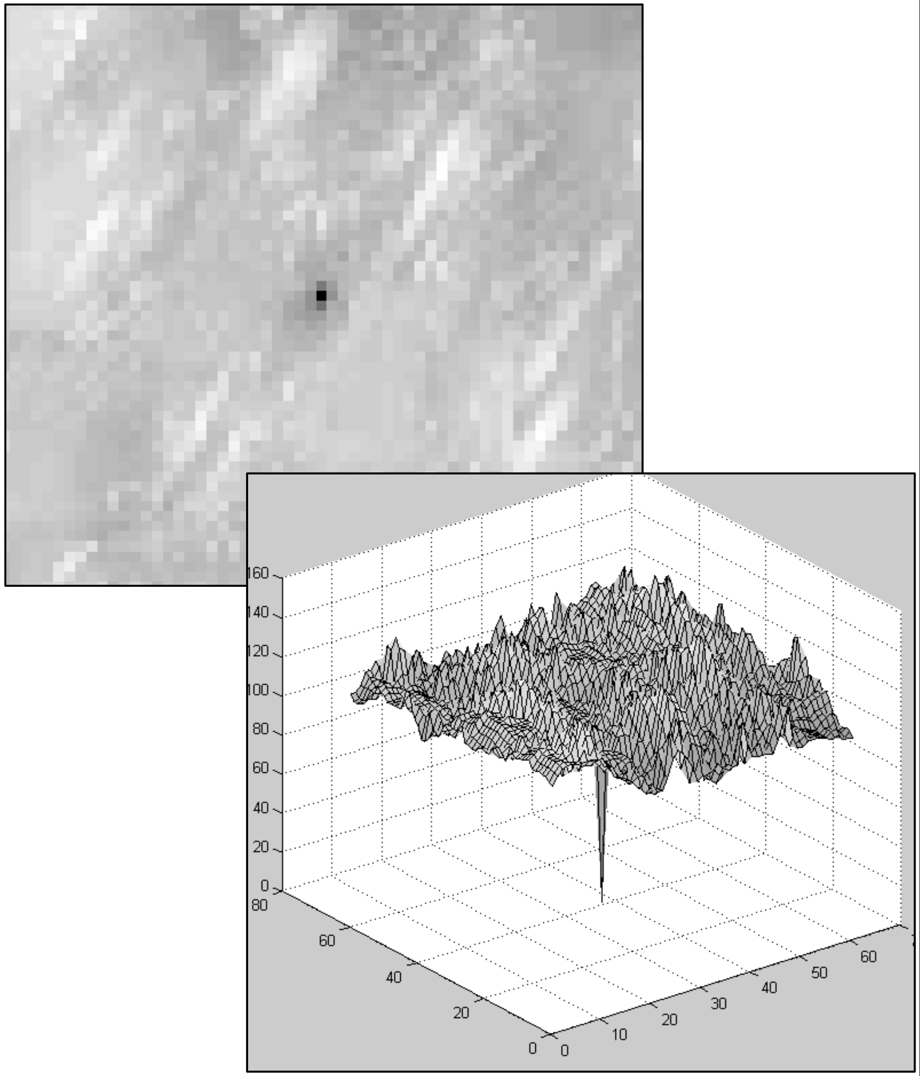
(17) Summe der Differenzbeträge

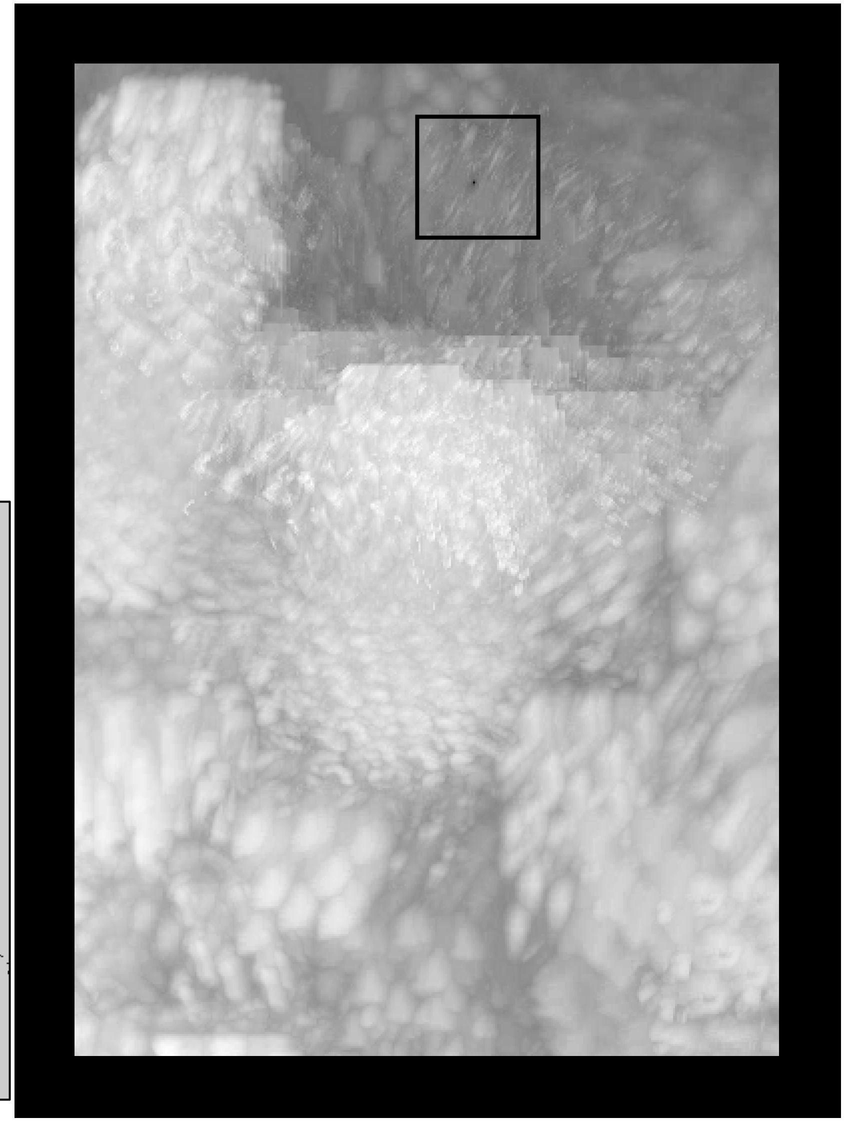




(17) Maximum der Differenzbeträge

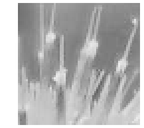


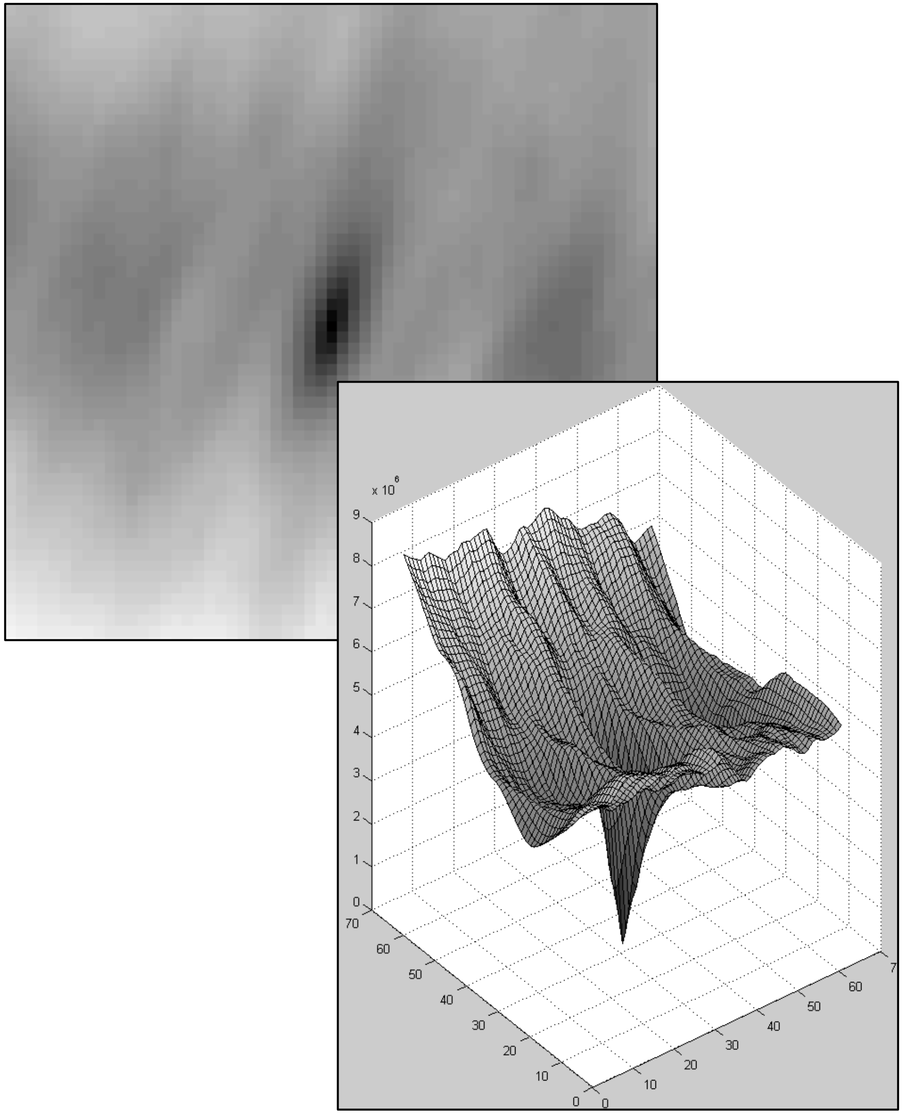


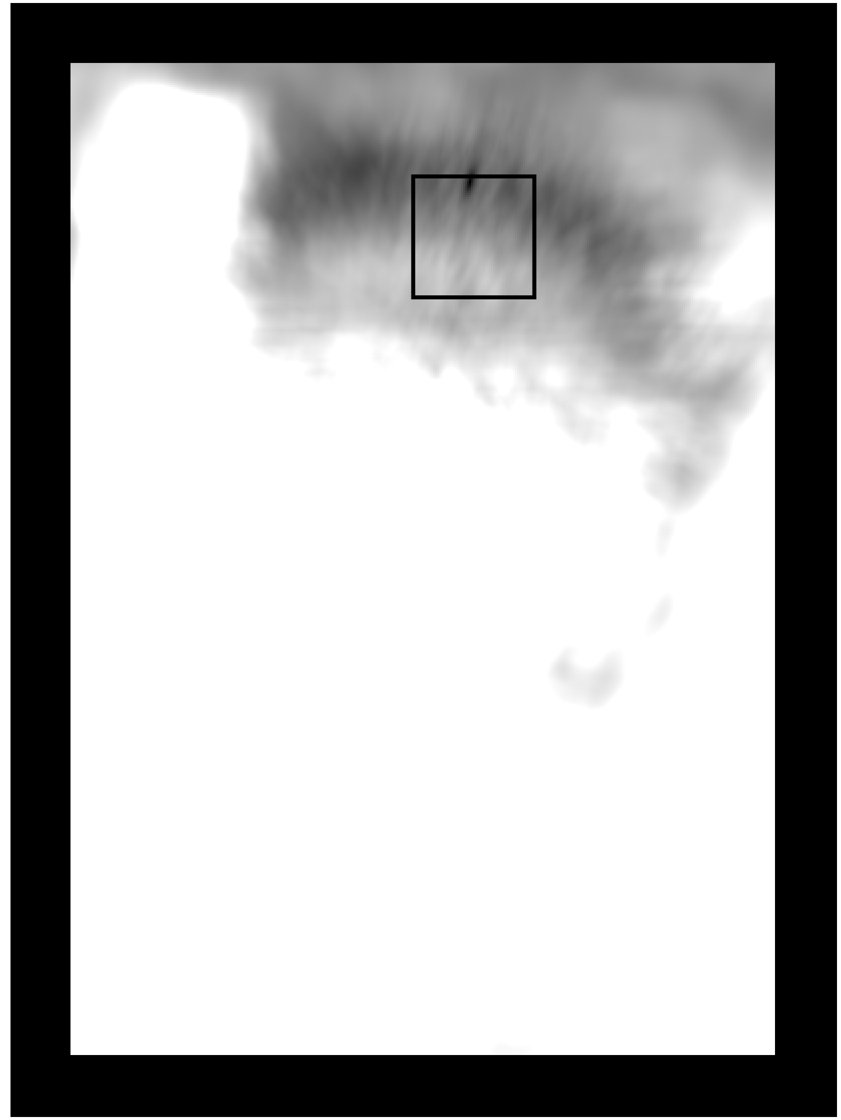


(17) Maximum der Differenzbeträge

(17) Summe der quadratischen Distanzen







(17) Summe der quadratischen Distanzen

$$d_E^2(r,s) = \sum_{(i,j)\in R} \big(I(r+i, s+j) - R(i,j)\big)^2$$

$$= \underbrace{\sum_{(i,j)\in R} I^2(r+i, s+j)}_{A(r,s)} + \underbrace{\sum_{(i,j)\in R} R^2(i,j)}_{B} - 2 \underbrace{\sum_{(i,j)\in R} I(r+i, s+j) \cdot R(i,j)}_{C(r,s)}$$

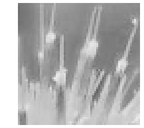
$A(r,s)$: Quadratische Summe der Grauwerte des Bildausschnitts

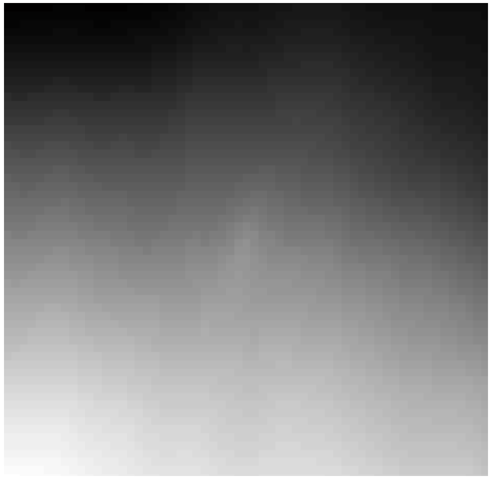
B : Konstanter Ausdruck

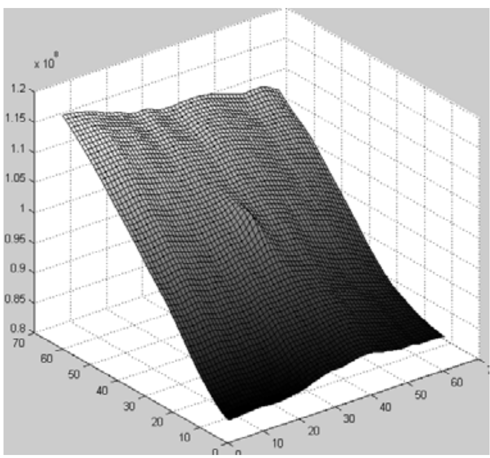
$C(r,s)$: Lineare Kreuzkorrelation (entspricht einer linearen Faltung)

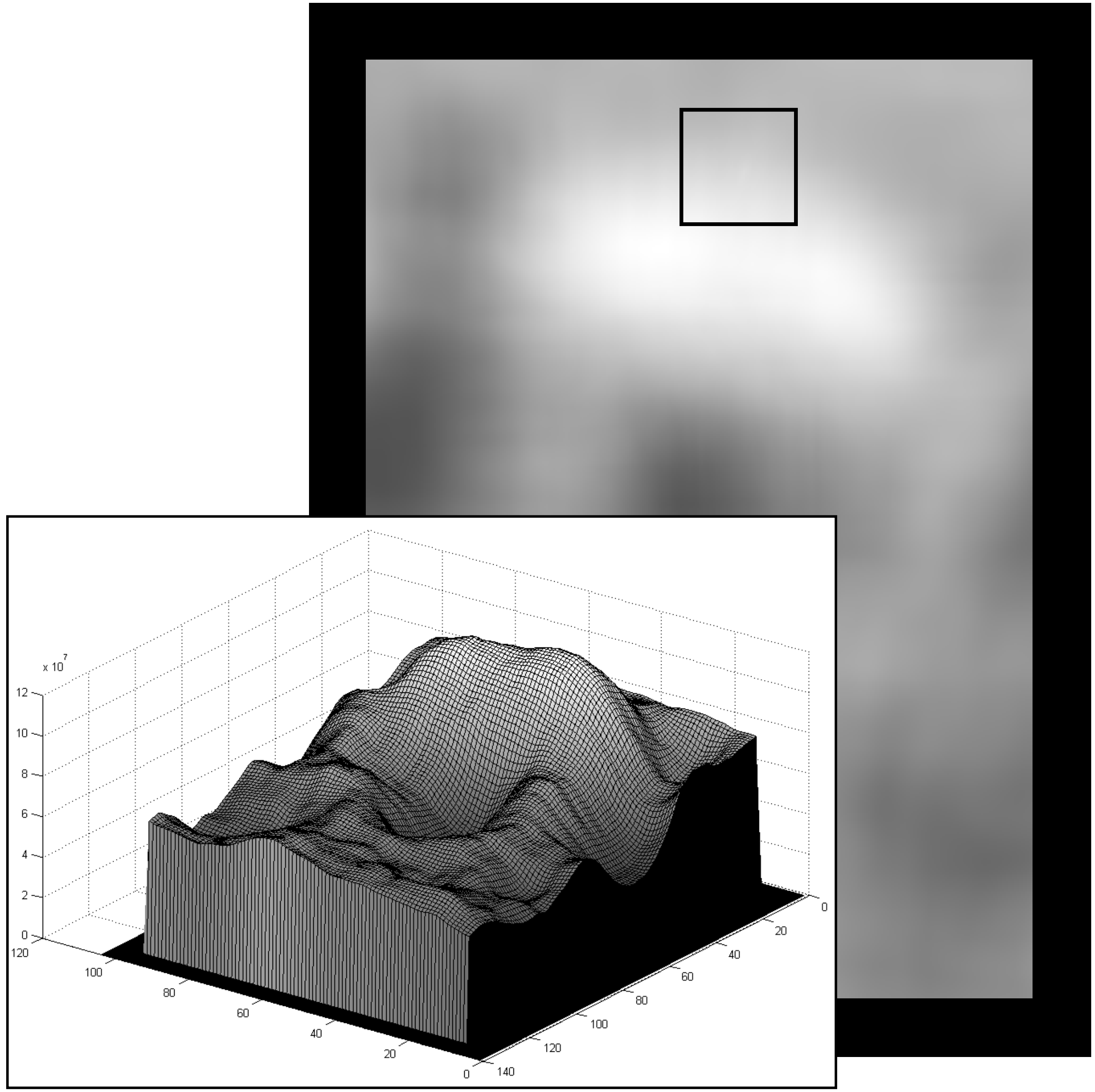
$R(i,j)$: Bildpunkt des *Templates*

(17) Kreuzkorrelation









(17) Kreuzkorrelation

$$C_N(r,s) = \frac{C(r,s)}{\sqrt{A(r,s)\cdot B}} = \frac{C(r,s)}{\sqrt{A(r,s)}\cdot\sqrt{B}}$$

$$= \frac{\sum_{(i,j)\in R} I(r+i,s+j)\cdot R(i,j)}{\left[\sum_{(i,j)\in R} I^2(r+i,s+j)\right]^{1/2}\cdot\left[\sum_{(i,j)\in R} R^2(i,j)\right]^{1/2}}$$

$A(r,s)$: Quadratische Summe der Grauwerte des Bildausschnitts

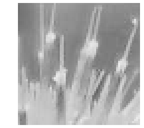
B : Konstanter Ausdruck

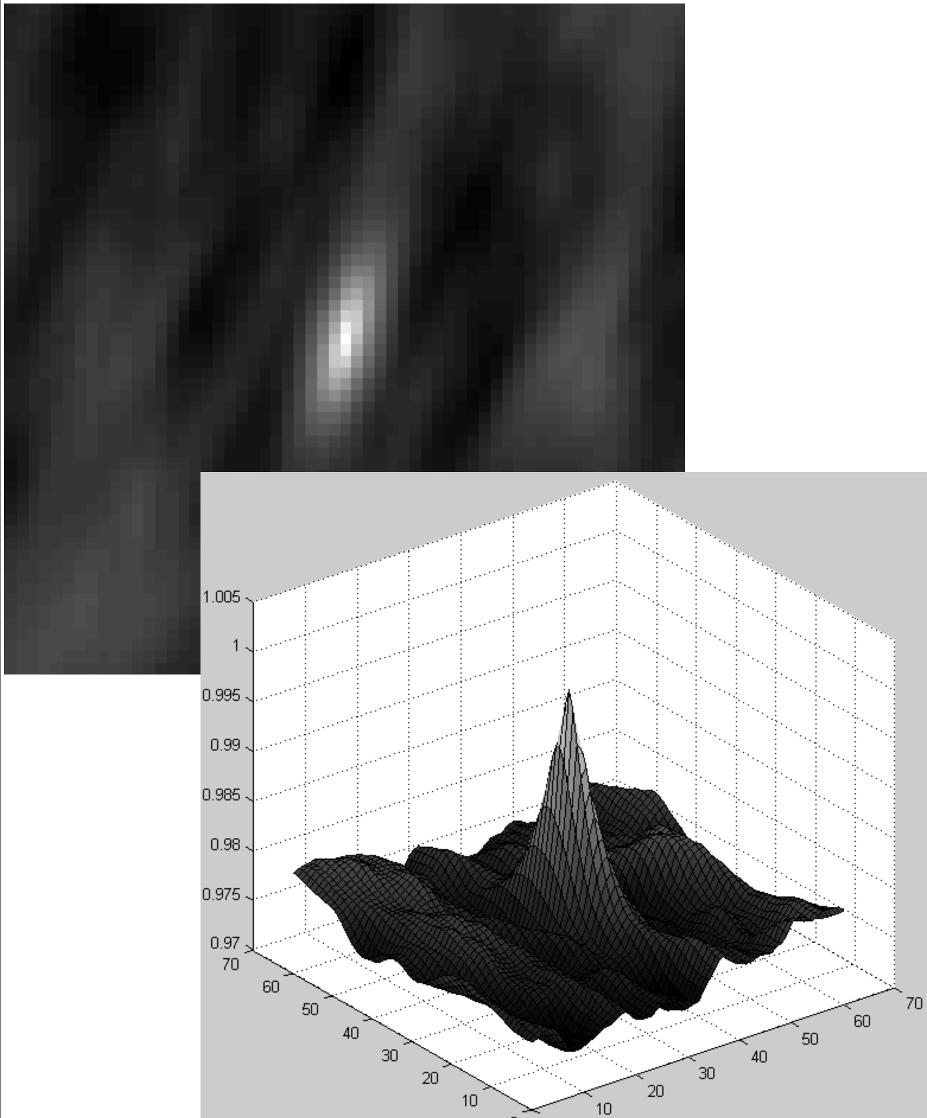
$C(r,s)$: Lineare Kreuzkorrelation (entspricht einer linearen Faltung)

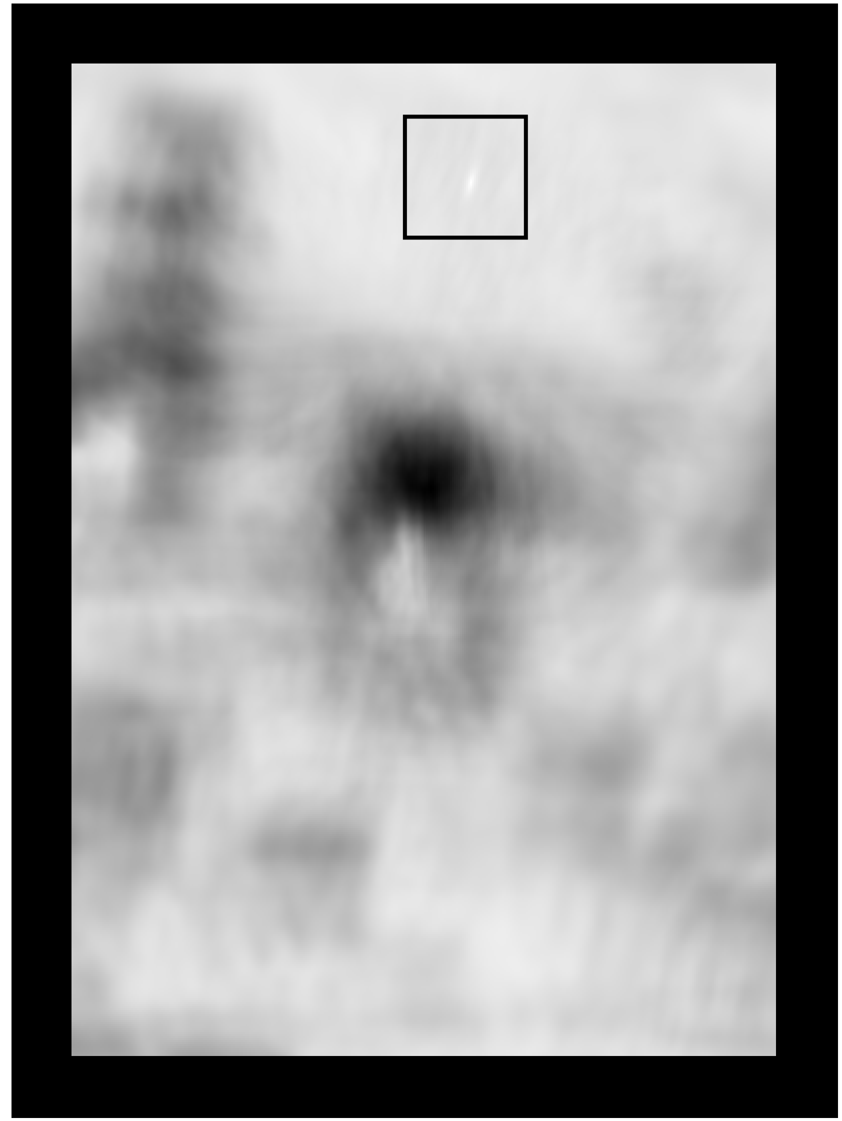
$R(i,j)$: Bildpunkt des *Templates*

(17) Ähnlichkeitsmaße - Normalisierte Kreuzkorrelation

(17) Normalisierte Kreuzkorrelation







(17) Normalisierte Kreuzkorrelation

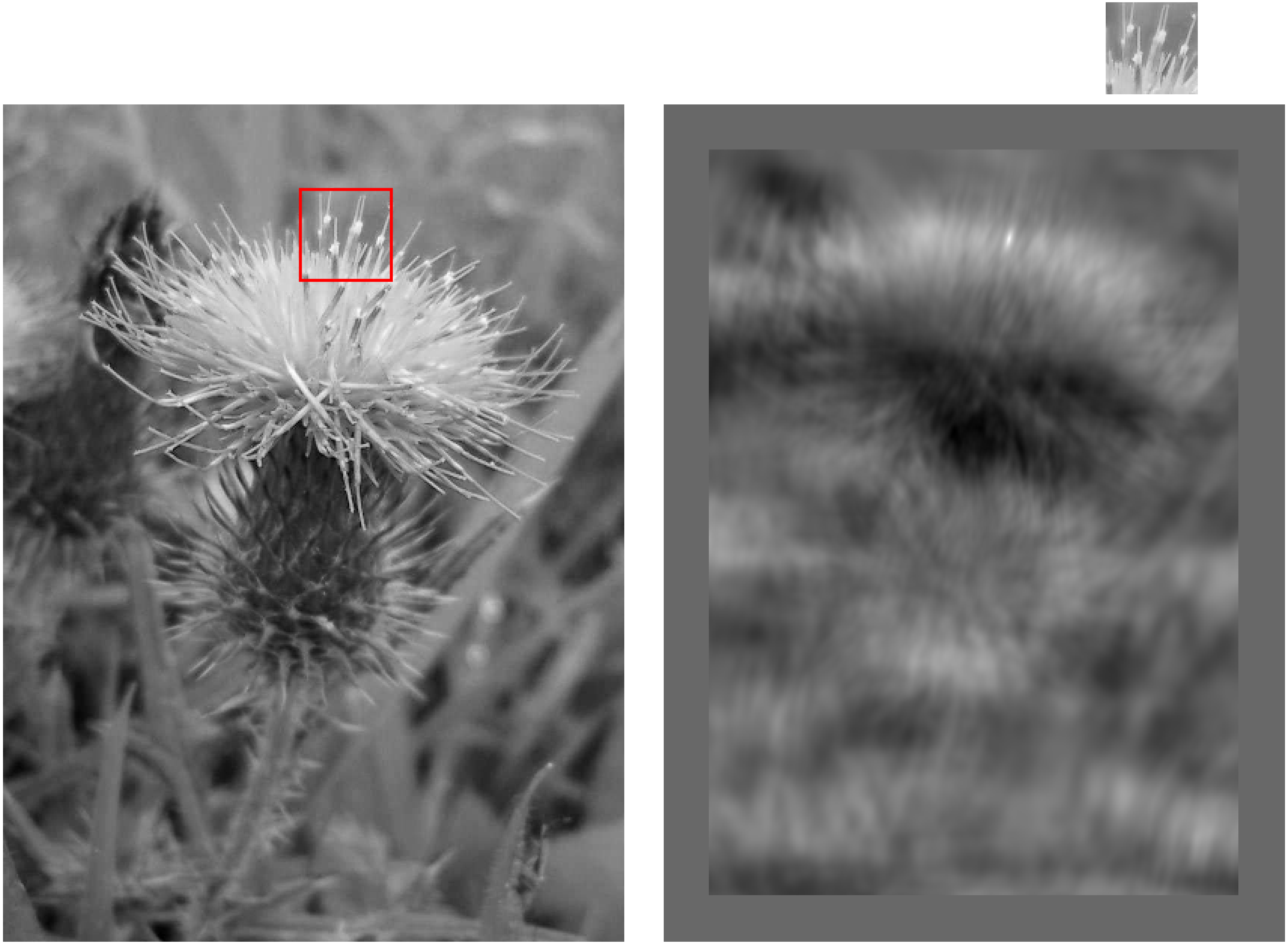
$$C_L(r,s) = \frac{\overbrace{\sum_{(i,j)\in R} \left(I(r+i, s+j) - \bar{I}(r,s)\right) \cdot \left(R(i,j) - \bar{R}\right)}^{\text{Kovarianz des Bildausschnitts und der Maske } \cdot N}}{\underbrace{\left[\sum_{(i,j)\in R} \left(I(r+i, s+j) - \bar{I}(r,s)\right)^2\right]^{1/2}}_{\text{Varianz des Bildausschnitts } \cdot N} \cdot \underbrace{\left[\sum_{(i,j)\in R} \left(R(i,j) - \bar{R}\right)^2\right]^{1/2}}_{\text{Varianz der Maske } \cdot N}}$$

$\bar{I}$: Mittlerer Grauwert des Bildausschnitts

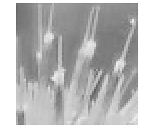
$\bar{R}$: Mittlerer Grauwert des *Templates*

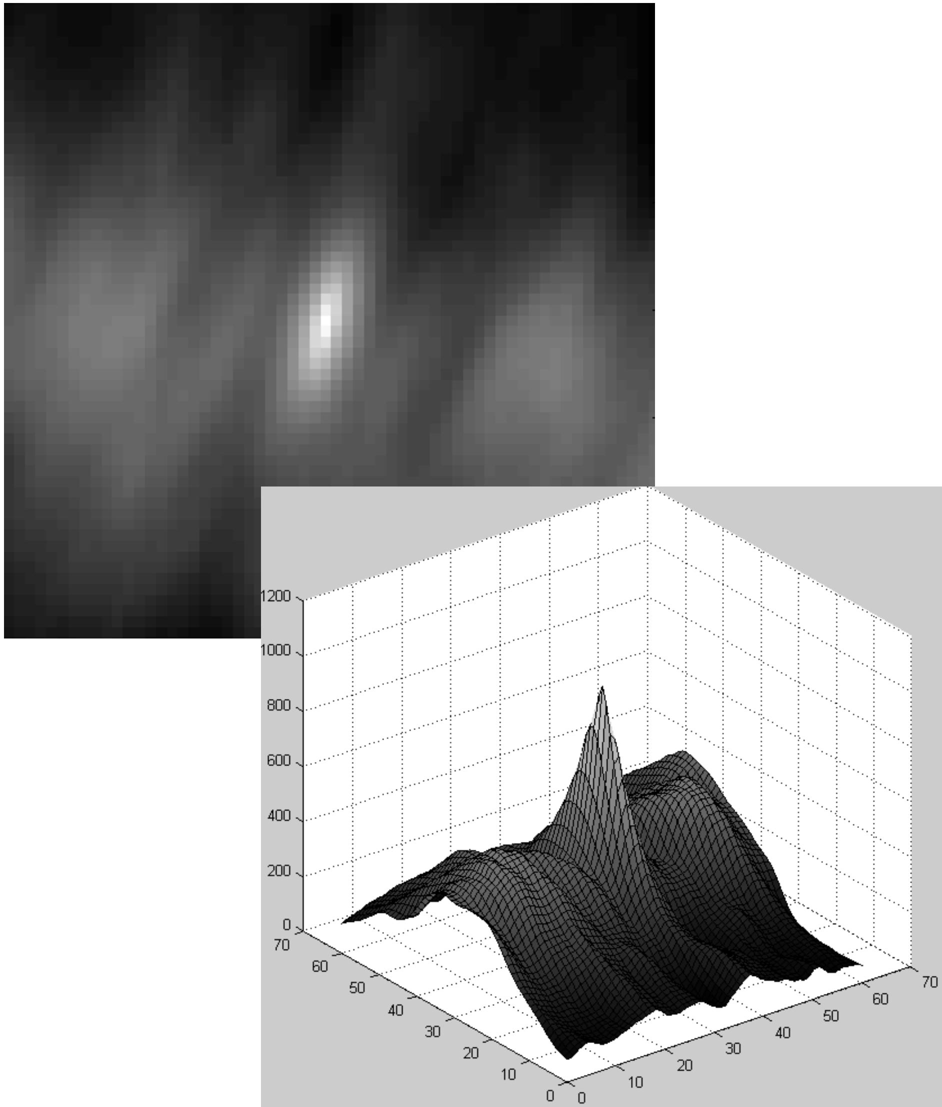
$R(i,j)$: Bildpunkt des *Templates*

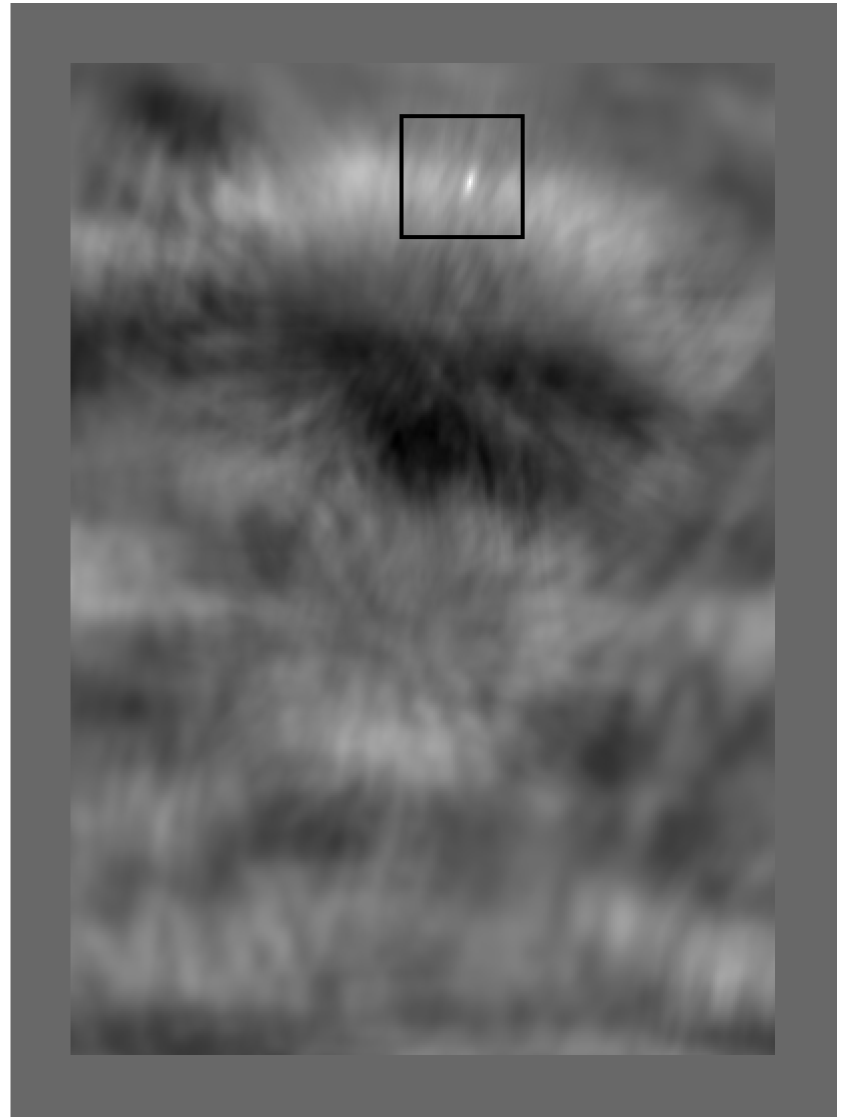
(17) Ähnlichkeitsmaße - Korrelationskoeffizient



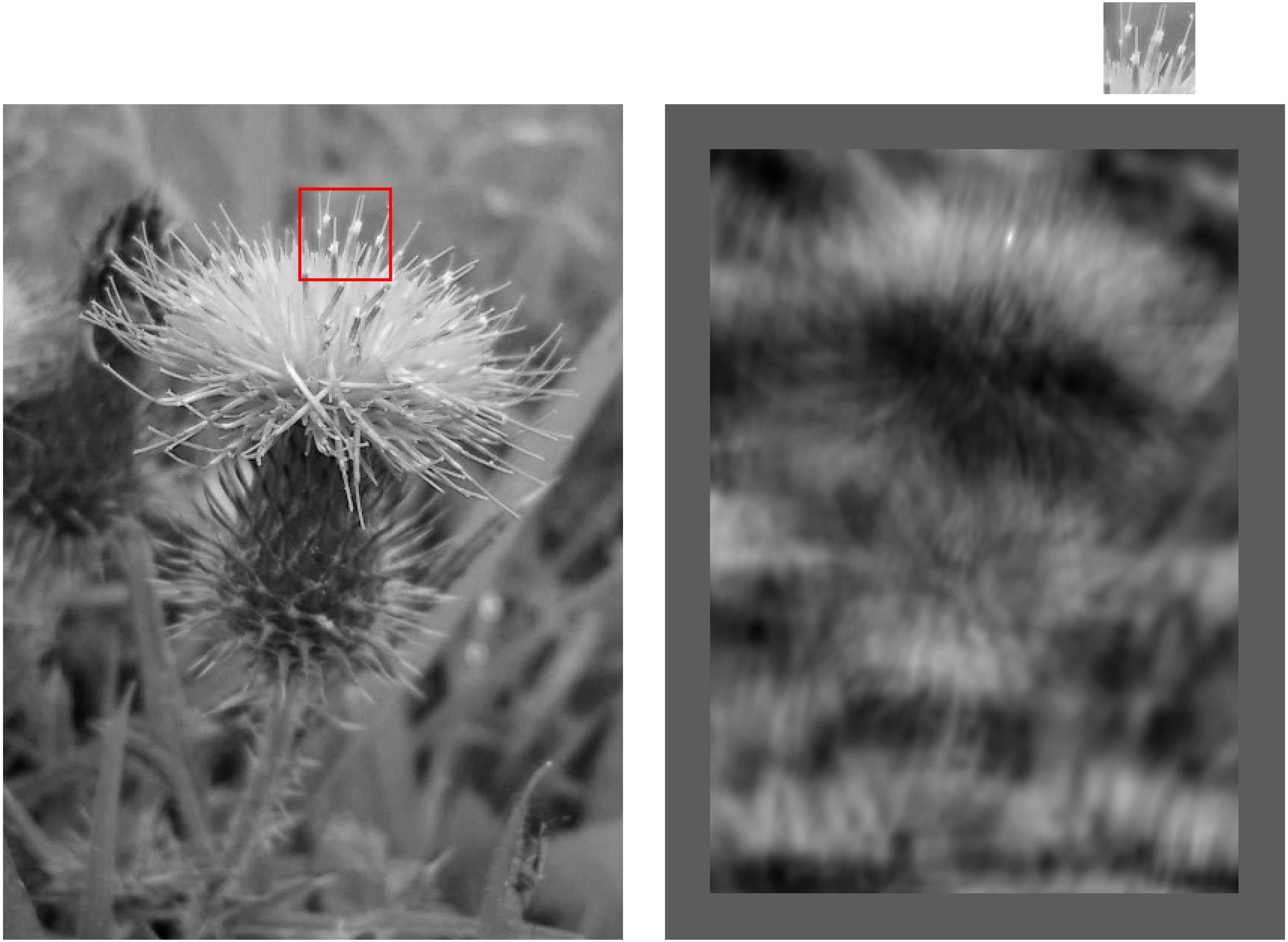
(17) Kovarianz



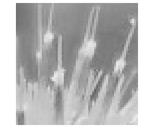


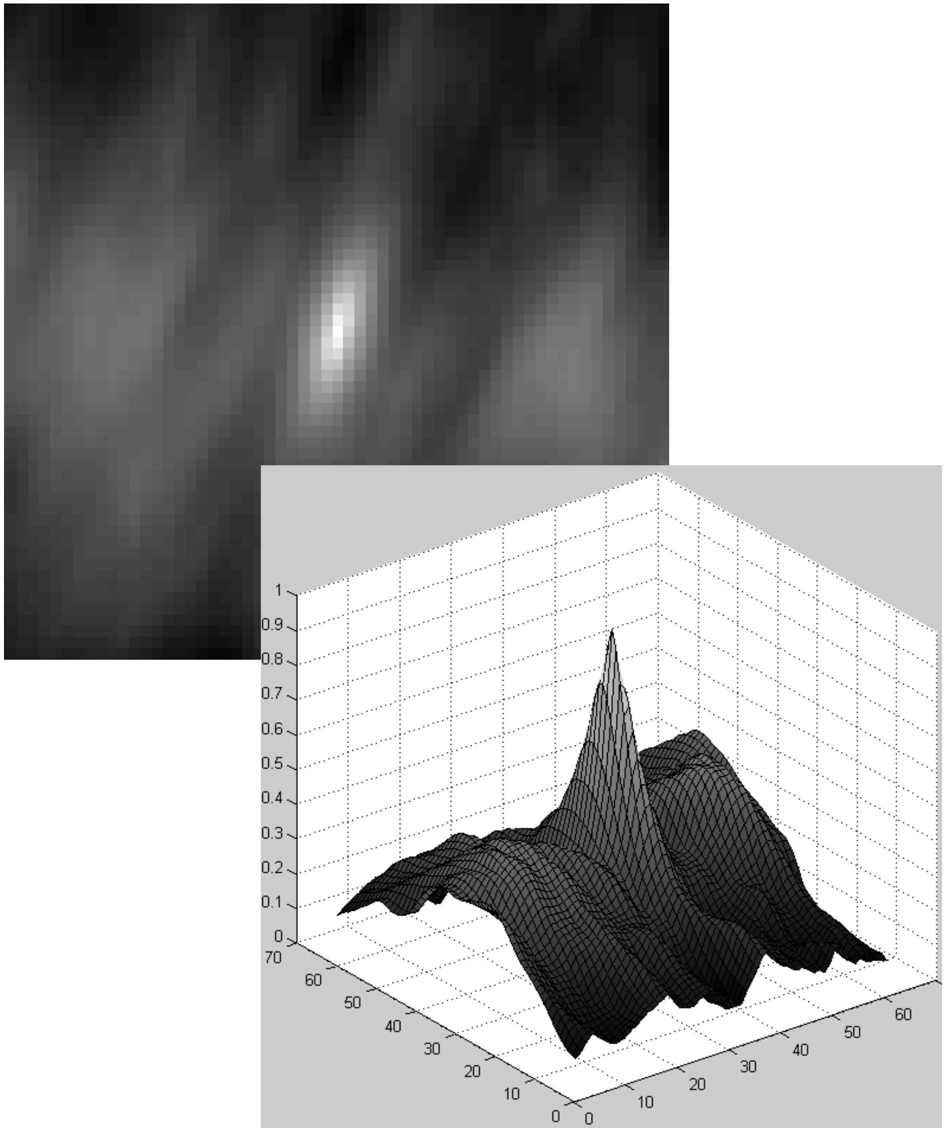


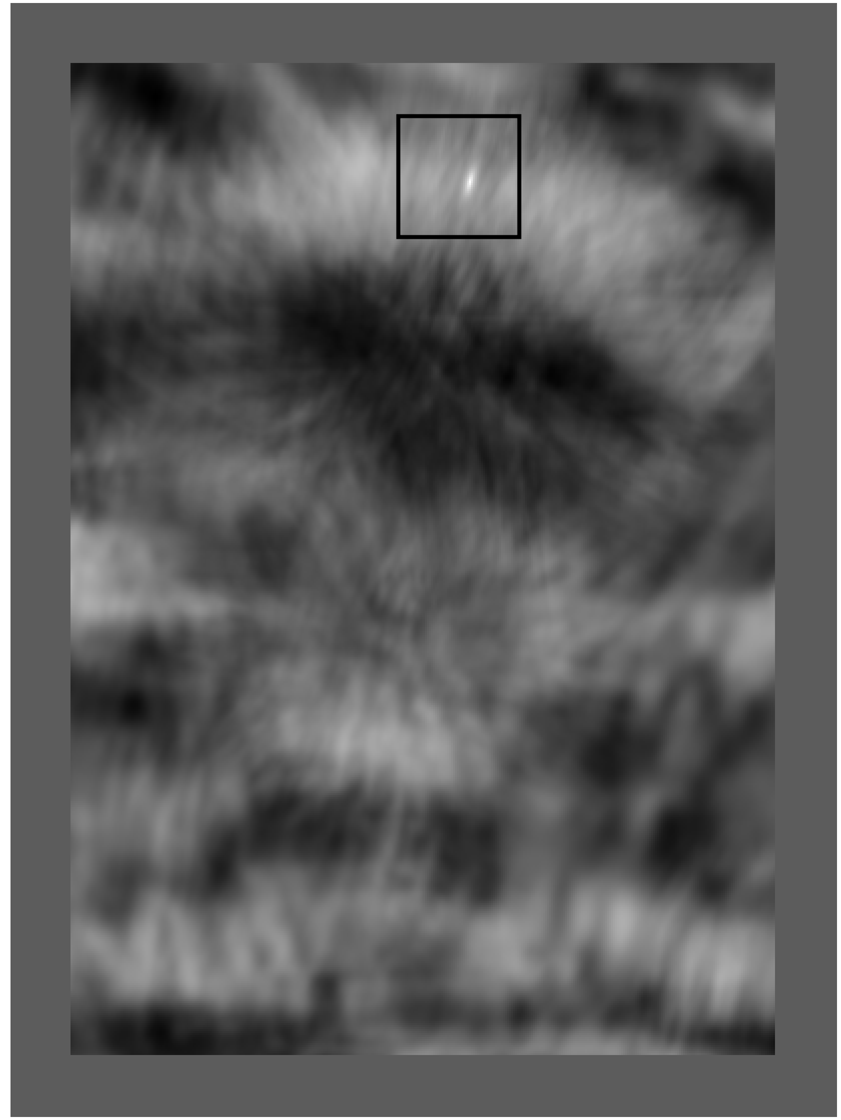
(17) Kovarianz



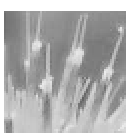
(17) Korrelationskoeffizient

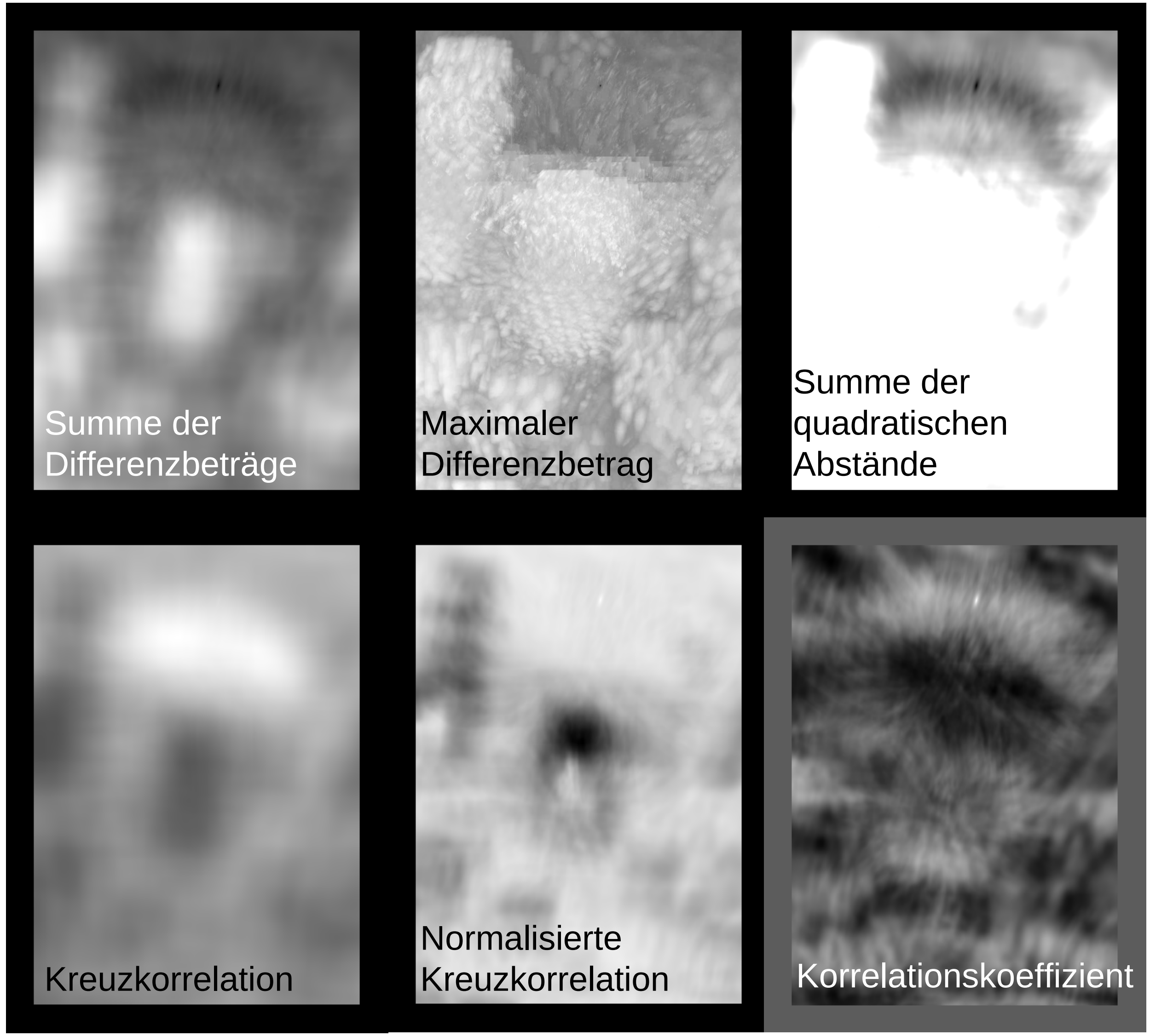






(17) Korrelationskoeffizient





(17) Ähnlichkeitsmaße

$$d_E(p,p') = \|p - p'\| = \sqrt{(u - u')^2 + (v - v')^2} \in R^+$$

$$d_M(p,p') = |u - u'| + |v - v'| \in N_0$$

$d_E(p,p')$: Euklidische Distanz

$d_M(p,p')$: Manhattan-Distanz (auch *city block distance*)

$p = (u,v)$: Bildpunkt (Pixel)

$$M^{L} = \begin{bmatrix} m_2^L & m_3^L & m_4^L \\ m_1^L & \times & \\ & & \end{bmatrix} \qquad M^{R} = \begin{bmatrix} & & \\ & \times & m_1^R \\ m_4^R & m_3^R & m_2^R \end{bmatrix}$$

$$M_M^{L} = \begin{bmatrix} 2 & 1 & 2 \\ 1 & \times & \\ & & \end{bmatrix} \qquad M_M^{R} = \begin{bmatrix} & & \\ & \times & 1 \\ 2 & 1 & 2 \end{bmatrix}$$

(17) Distanztransformation mit dem *Camfer*-Algorithmus; Masken

$$Q(r,s) = \frac{1}{K} \sum_{(i,j)\in FG(R)} D(r+i, s+j)$$

R	: Binäres *Template*
$FG(R)$	: Vordergrundpixel des *Templates*
K	: Anzahl der Vordergrundpixel des *Templates*
D	: Distanztransformation des Bildes

(17) *Chamfer-Matching*