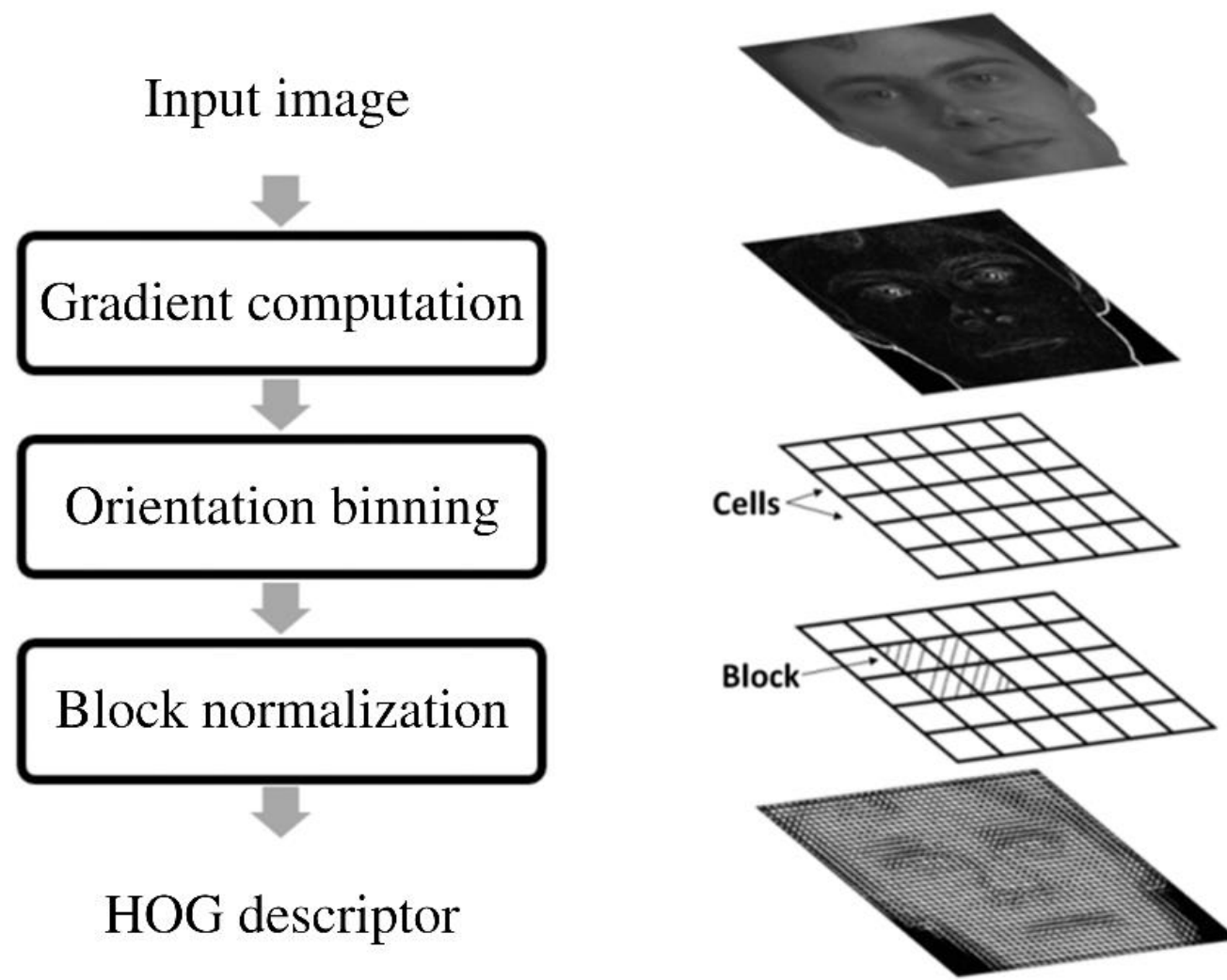


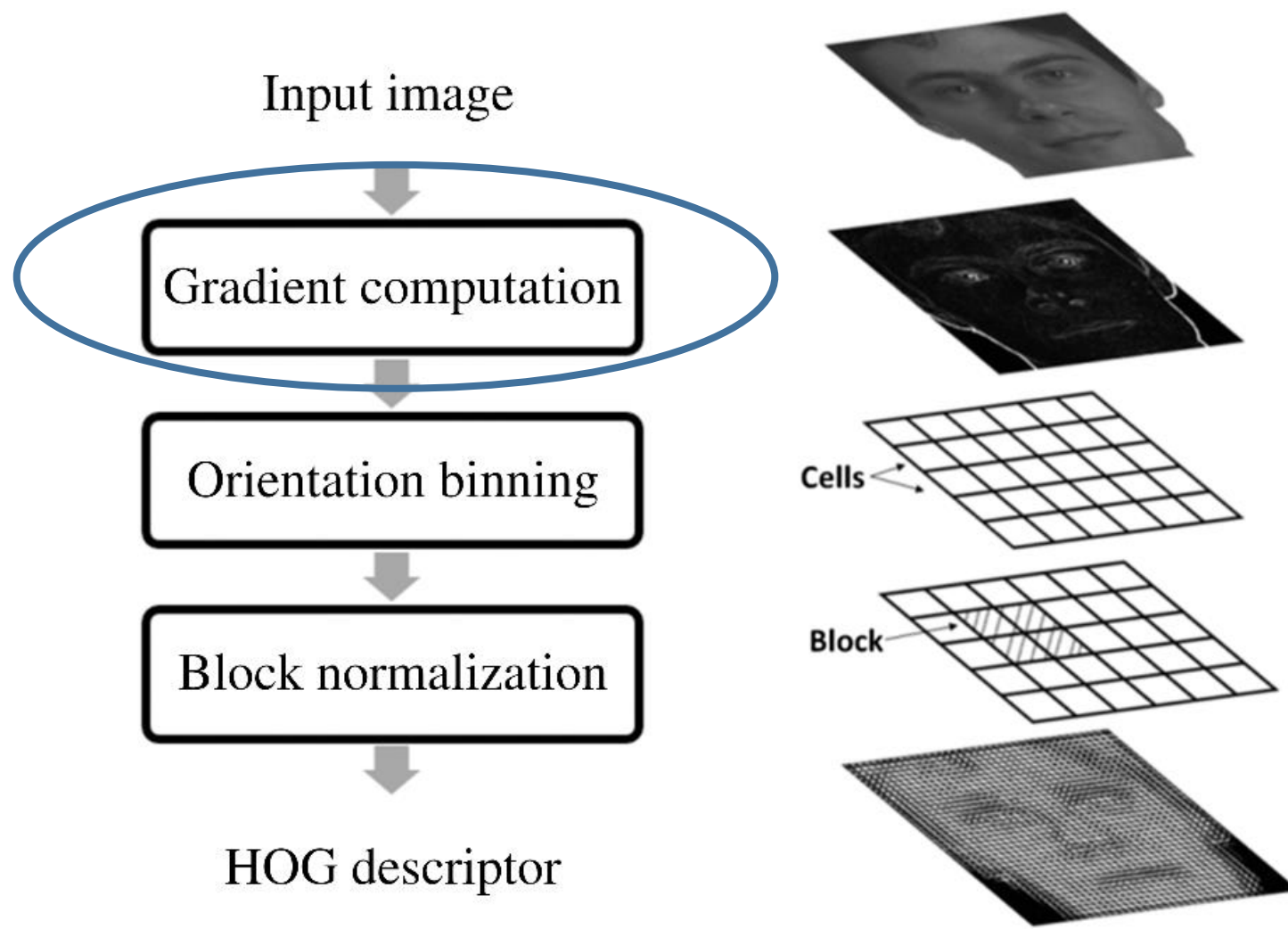
HOG

Histogram of oriented gradients

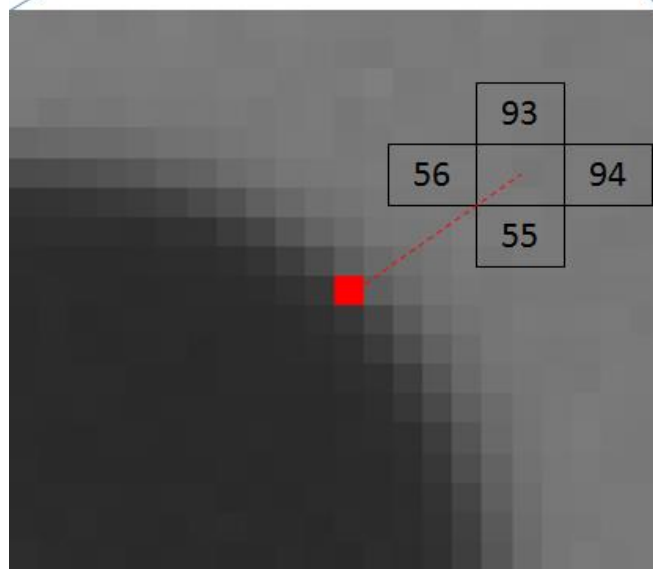
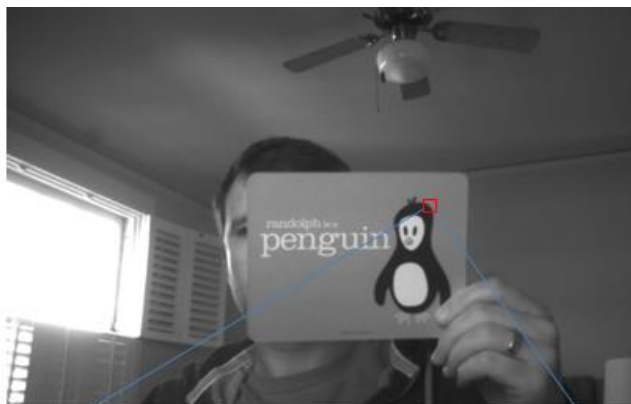
Računanje HOG deskriptora



Računanje HOG deskriptora (1)



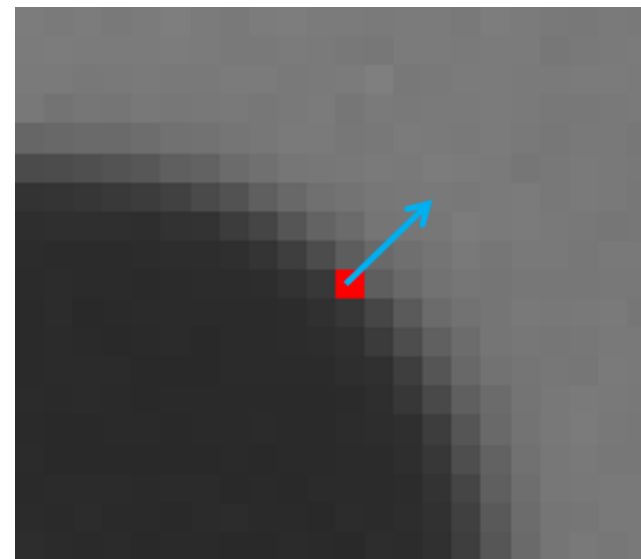
Računanje gradijenta vektora



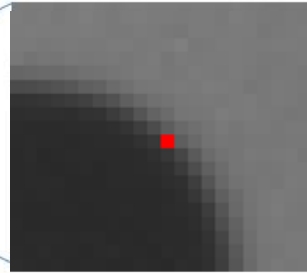
$\begin{bmatrix} 38 \\ 38 \end{bmatrix}$

$$\text{Magnitude} = \sqrt{(38)^2 + (38)^2} = 53.74$$

$$\text{Angle} = \arctan\left(\frac{38}{38}\right) = 0.785 \text{ rads} \\ = 45 \text{ degrees}$$



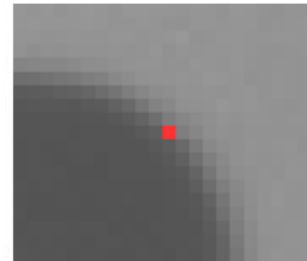
Normalizacija gradijenta vektora



	93	
56		94
	55	

$$\nabla f = \begin{bmatrix} 38 \\ 38 \end{bmatrix}$$

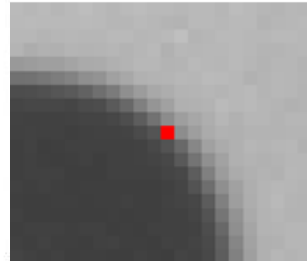
$$|\nabla f| = \sqrt{(38)^2 + (38)^2} = 53.74$$



	143	
106		144
	105	

$$\nabla f = \begin{bmatrix} 38 \\ 38 \end{bmatrix}$$

$$|\nabla f| = \sqrt{(38)^2 + (38)^2} = 53.74$$



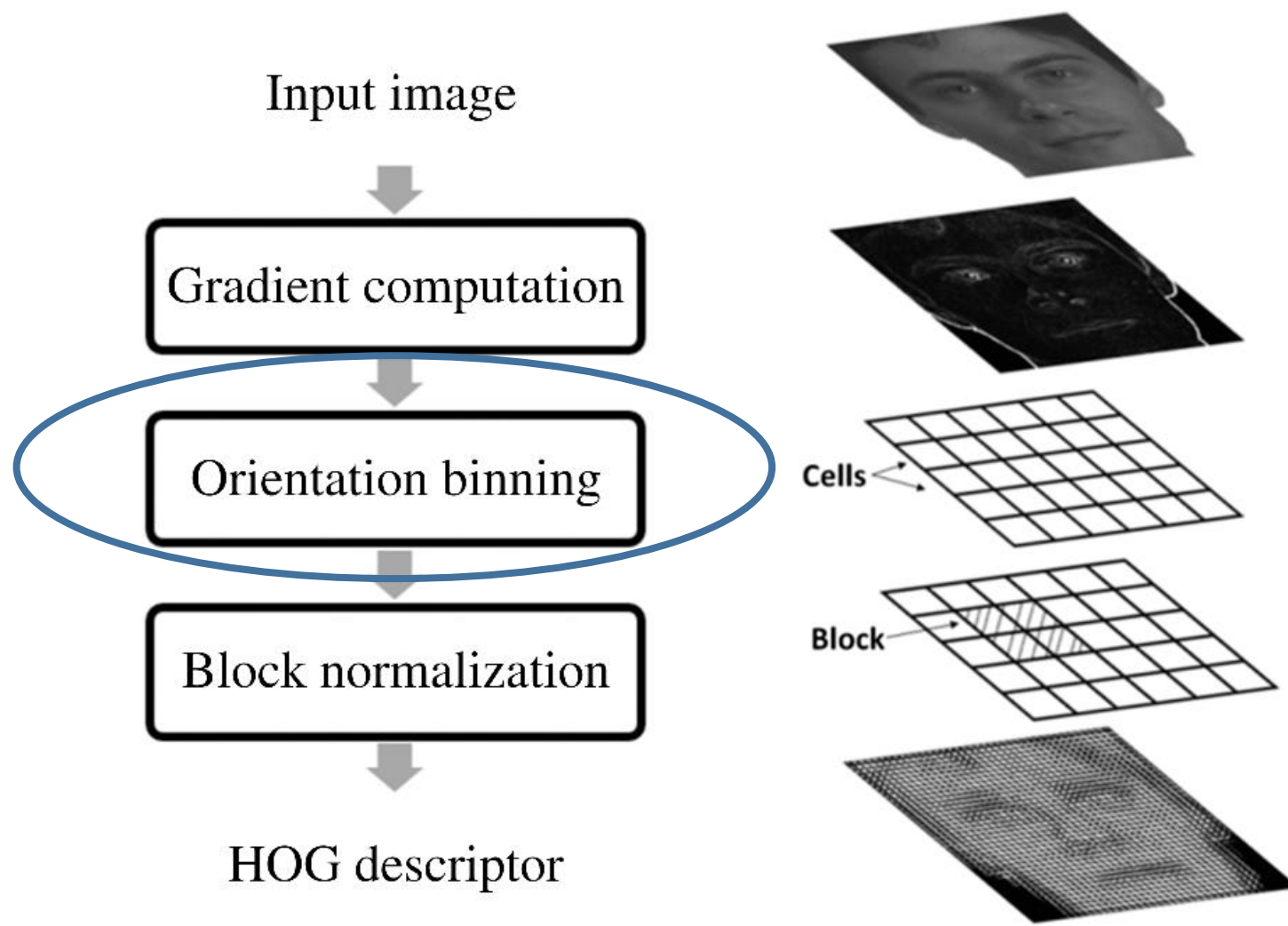
	140	
84		141
	83	

$$\nabla f = \begin{bmatrix} 57 \\ 57 \end{bmatrix}$$

$$|\nabla f| = \sqrt{(57)^2 + (57)^2} = 80.61$$

$$\delta f = \frac{\nabla f}{|\nabla f|} = \begin{bmatrix} 0.71 \\ 0.71 \end{bmatrix}$$

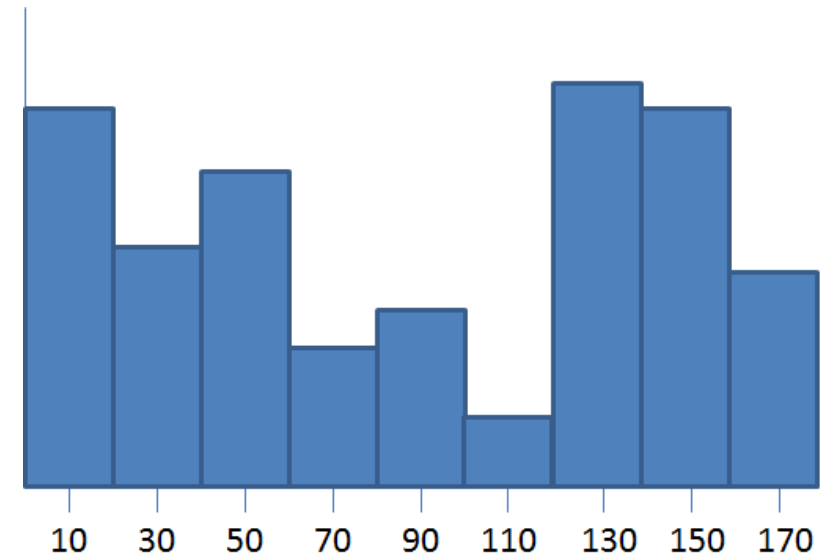
Računanje HOG deskriptora (2)



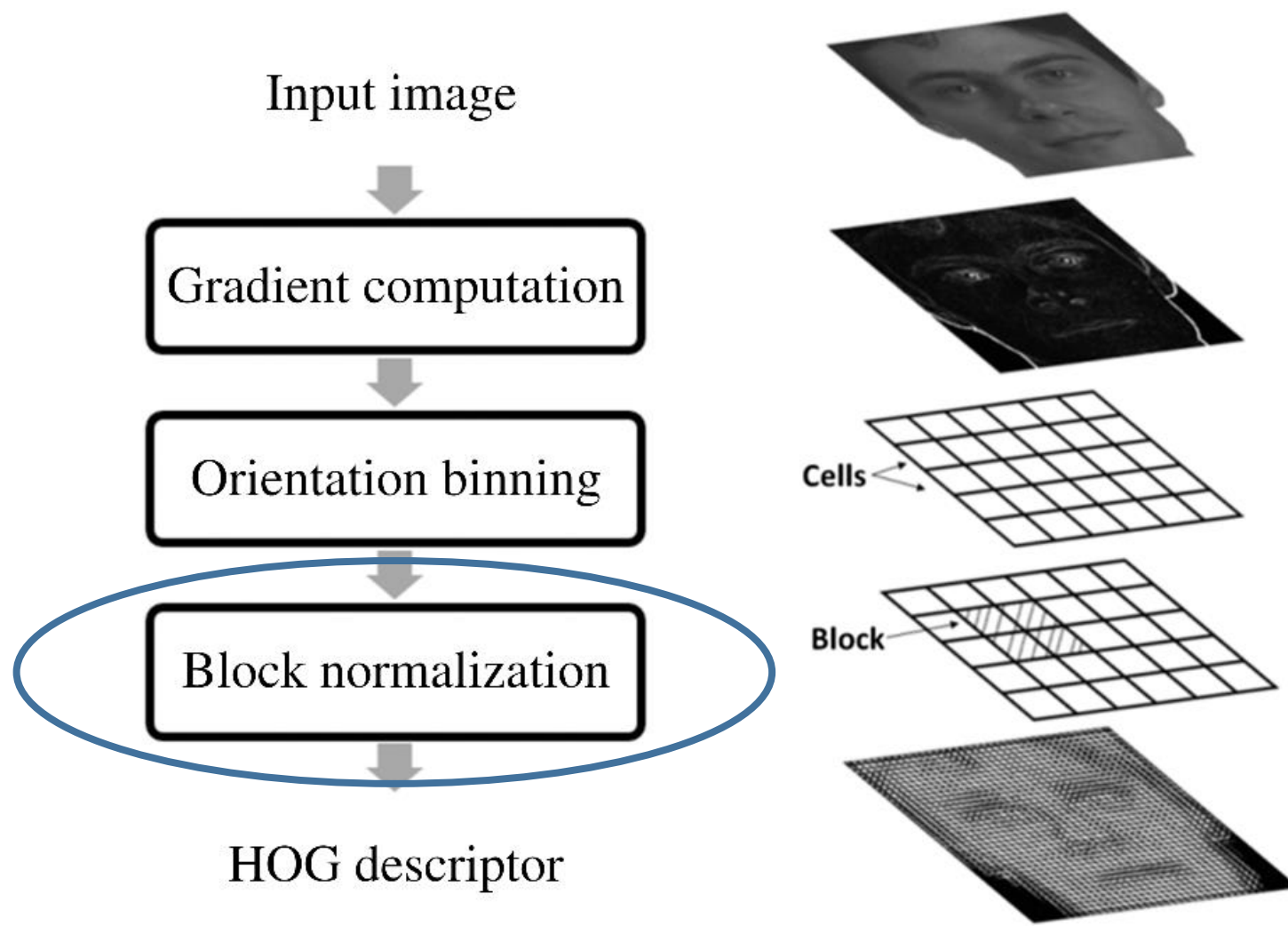
Histogram gradijenata



- ćelija npr. $8 \times 8 = 64$ piksela
- za sve piksele u ćeliji izračunaju se gradijenti
- napravi se histogram ovih gradijenata diskretizovanje u N binova, npr. $N = 9$
- Rezultat je histogram, tj. vektor od 9 elemenata



Računanje HOG deskriptora (3)

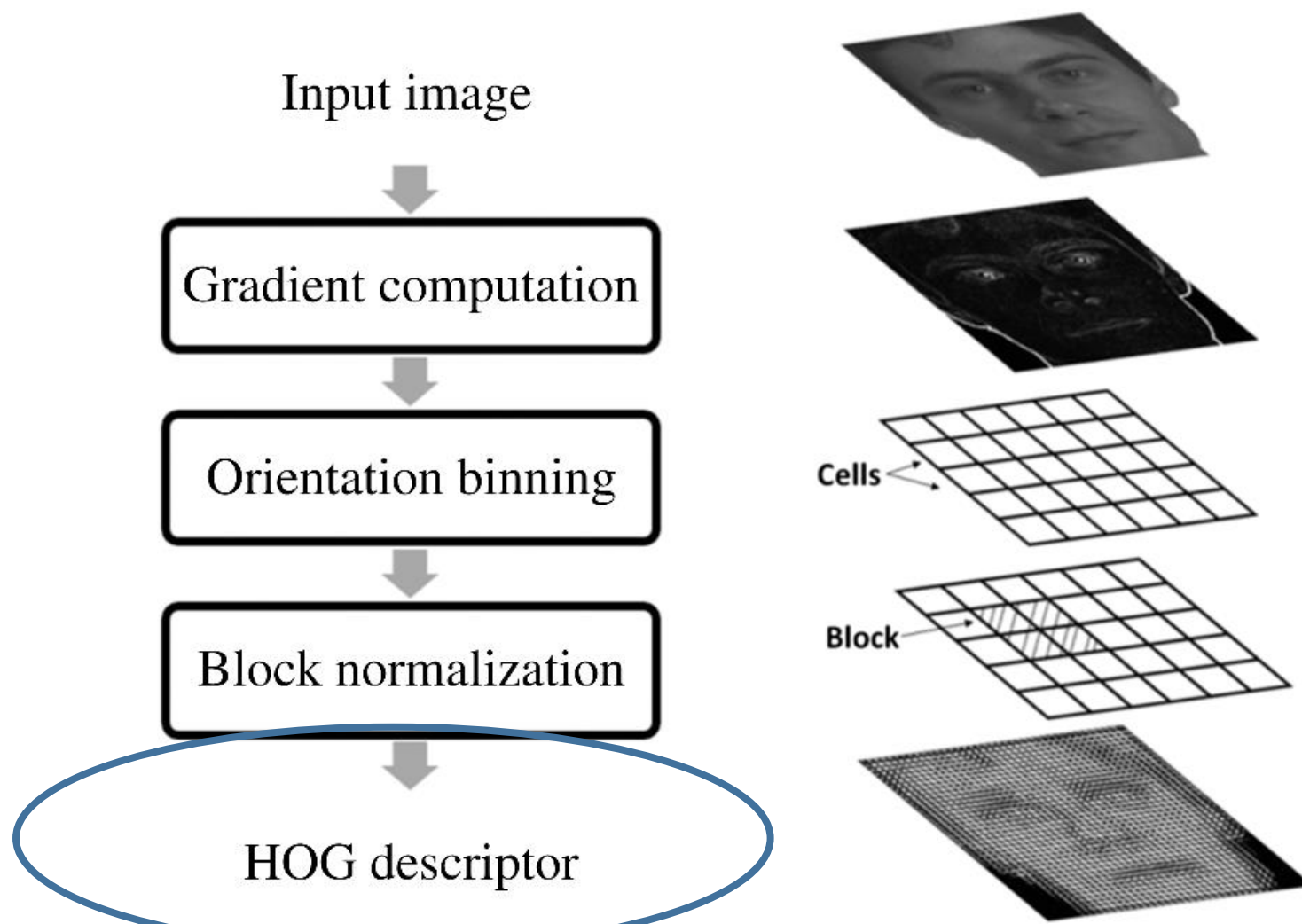


Normalizacija bloka

- Blok = npr. 2×2 ćelije = 4 ćelije
- Konkatenuiraju se svi histogrami iz ćelija
 - 4 histograma sa 9 binova = 4 vektora sa 9 elemenata
 - dobija se vektor sa $4 \times 9 = 36$ elemenata
 - zatim se ovaj vektor normalizuje
- Susjedni blokovi se „preklapaju“



Računanje HOG deskriptora (4)



Konačni HOG deskriptor

- Ako je slika 64x128 piksela
 - Ukupno $64 \times 128 \times 3$ (RGB) piksela = 24,576 vrednosti
- Ako je jedna ćelija 8x8 piksela
- Ako je jedan blok 2x2 ćelija = 16x16 piksela
 - Blok se pomera za po jednu ćeliju = 8 piksela
- Ukupno 7 x 15 blokova = 105 blokova
- Svaki blok rezultuje vektorom od 36 elemenata
- Konkatenuiraju se normalizovani vektori svakog bloka
 - **Konačni HOG deskriptor je vektor sa $36 \times 105 = 3,780$ vrednosti**