

List of Symbols

Conventions

a, b, \dots A, B, \dots	identifiers
x, y, \dots A, B, \dots	scalar variables (italic, lower-case, sometimes capital letters)
$\mathbf{x}, \mathbf{y}, \dots$ $\mathbf{A}, \mathbf{B}, \dots$	vectors (bold, lower-case, sometimes capital letters)
$\mathbf{A}, \mathbf{B}, \dots$	matrices; points (bold, capital letters)
$\mathcal{A}, \mathcal{B}, \dots$	sets
$\mathcal{A}\{\cdot\},$ $\mathcal{B}\{\cdot\}, \dots$	operators
a, b, \dots	random variables (typewriter font)

Operators

\dot{f}	derivative of the function f with respect to the time t	27
\downarrow	reduction step (multiresolution analysis)	724
\uparrow	expansion step (multiresolution analysis)	725
$\lfloor x \rfloor$	greatest integer $\leq x$	479
$\lceil x \rceil$	smallest integer $> x$	479
g^*	complex conjugation of g	388, 689, 729
$\overline{f(t)}$	temporal averaging	33, 47
$\angle \cdot$	argument (phase angle) of a complex-valued quantity or direction of a two-dimensional vector	384, 565
$ \cdot $	absolute value of a real-valued or complex-valued quantity	73, 384
$\ \cdot\ $	norm of a vector	27

$*$	convolution of one-dimensional signals	381, 401
$**$	convolution of two-dimensional signals	406
$\overset{x}{*}$	one-dimensional convolution of multi-dimensional signals with respect to the variable x	497
$g(x) \circ \bullet G(f)$	correspondence of the one-dimensional Fourier transform	383
$g(\mathbf{x}) \circ \bullet G(\mathbf{f})$	correspondence of the two-dimensional Fourier transform	402
$\mathbf{x}_1 \leftrightarrow \mathbf{x}_2$	corresponding image points	287
$\mathbf{a} \perp \mathbf{b}$	vector \mathbf{a} is orthogonal to vector \mathbf{b}	28
\propto	proportionality	60
$\mathbf{a} \sim \mathcal{P}$	random variable \mathbf{a} is distributed according to \mathcal{P}	64, 436
$\langle \cdot, \cdot \rangle$	inner product	691, 733
$\stackrel{!}{=}$	is supposed to be equal	392, 447
$a \in \mathcal{A}$	a is element of the set \mathcal{A}	10
$\mathcal{A} \cap \mathcal{B}$	intersection of \mathcal{A} and \mathcal{B}	130
$\mathcal{A} \cup \mathcal{B}$	union of \mathcal{A} and \mathcal{B}	555
$\mathcal{A} \setminus \mathcal{B}$	difference of the sets \mathcal{A} and \mathcal{B}	78, 595, 611
\subset, \subseteq	subset	10, 611
\emptyset	empty set	481
$\bar{\mathcal{G}}$	complement of the point set \mathcal{G}	611
\mathcal{G}^R	reflection of the point set \mathcal{G}	610
$(\mathcal{G})_{\mathbf{z}}$	shift of the point set by the vector \mathbf{z}	610
\oplus	direct sum of vector spaces	735
\oplus	morphological dilation	611, 637
\ominus	morphological erosion	611, 637
\circ	morphological opening	620, 641
\bullet	morphological closing	620, 641
\otimes	morphological hit-or-miss operator	626

\ominus	morphological thinning	627
\odot	morphological thickening	629
$\mathbf{0}$	zero-vector: $\mathbf{0} := (0, 0, \dots, 0)^T$	105
$1(x)$	function equal to 1: $1(x) \equiv 1$	52, 403
$\mathbf{1}$	$\mathbf{1} := (1, 1, \dots, 1)^T$	674
$\Delta \mathbf{F}$	Laplace operator, applied to a vector field \mathbf{F}	26, 580, 645
\forall	universal quantifier ('for all ...')	177
$\mathcal{A}\{\mathbf{G}\}$	focused optical imaging of the point \mathbf{G} by the optical system \mathcal{A}	9, 99
$\arg \min$	argument of the minimum	232
$\frac{df}{dx}$	derivative of the function f with respect to the variable x	27
$\frac{\partial f}{\partial x}$	partial derivative of the function f with respect to the variable x	25
$\text{DFT}\{g_{mn}\}$	two-dimensional discrete Fourier transform of the discrete image signal g_{mn}	401
$\text{div } \mathbf{F}$	divergence of the vector field \mathbf{F}	25
$\text{E}\{\cdot\}$	expected value	61, 434, 654, 665
\exists	existential quantifier ('there exists a ...')	616
$\mathcal{F}\{g(\mathbf{x})\}$	Fourier transform of the function $g(\mathbf{x})$	51
$\text{grad } g(\mathbf{x})$	gradient of the function $g(\mathbf{x})$	564
$\Im\{\cdot\}$	imaginary part of a complex number	237
\max	maximum of a set or of a function	301
\min	minimum of a set or of a function	196
$\text{Pr}\{\cdot\}$	probability	61
$\mathcal{R}\{g(\mathbf{x})\}$	Radon transform of the image $g(\mathbf{x})$	699
$\Re\{\cdot\}$	real part of a complex number	29
$\text{rot } \mathbf{F}$	curl of the vector field \mathbf{F}	25
$\text{span}\{\cdot\}$	spanned vector space	653, 734

$\text{supp}\{\cdot\}$	support $\text{supp}\{G(\mathbf{f})\} := \{\mathbf{f} \mid G(\mathbf{f}) > 0\}$	481, 653
$\mathcal{T}\{\cdot\}$	morphological top surface operator	636
$\mathcal{U}\{\cdot\}$	umbra operator	636
$\text{Var}\{\cdot\}$	variance	61, 434, 654

Greek symbols

α	quantum efficiency of an image sensor	63
α	half of the lens' angular aperture	114, 121
$\Gamma_{p,\nu}$	wavelet coefficients	733, 738
$\Gamma_{\psi}(s, \tau)$	continuous wavelet transform	729
γ_{mn}	region of a two-dimensional signal in vector notation	664
δ	penetration depth of electromagnetic waves in a conducting medium	78
δ	optical path difference between the polarization components of an electromagnetic wave	32
$\delta(\cdot)$	Dirac delta function (Dirac distribution)	378
δ_i^k	Kronecker symbol: $\delta_i^k := \begin{cases} 1 & \text{if } i = k \\ 0 & \text{if } i \neq k \end{cases}$	27
δ_{mn}	two-dimensional, spatially discrete Dirac delta function	419
δ_n	one-dimensional spatially discrete Dirac delta function	419
ε	diameter of the blur disk in the image plane	119
ε	permittivity	25
ε_0	permittivity of the vacuum (electric field constant), $\varepsilon_0 \approx 8,854 \cdot 10^{-12} \frac{\text{As}}{\text{Vm}}$	26
ε_r	relative permittivity	26
ζ	length of the reference path of an interferometry setup	310
H	entropy	459

η	light yield	83
η	attenuation factor of electromagnetic waves in a conducting medium	77
$\theta(\mathbf{x})$	gradient direction at the pixel \mathbf{x}	589, 676
θ_1	angle of incidence	67
θ	triangulation angle	259
θ_{1B}	Brewster's angle	74
θ_{1C}	critical angle of incidence	75
θ_2	refraction angle	69
θ_e	angle between the emitted light and the surface normal	152
θ_i	angle of incidence of the illuminating ray	152
θ_r	emergent angle for specular reflection	67
$\Lambda\left(\frac{x}{B}\right)$	triangle function: $\Lambda\left(\frac{x}{B}\right) := \begin{cases} 1 - \left \frac{x}{B}\right & \text{if } x < B \\ 0 & \text{otherwise} \end{cases}$	480
λ	wavelength of the light	23, 29
λ_{mn}^ν	image signal on the ν th level of the Laplacian pyramid	726
μ	magnetic permeability	25
μ_0	permeability of the vacuum (magnetic field constant), $\mu_0 = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}}$	26
μ_r	relative permeability	26
ν	frequency of an electromagnetic wave (light wave) in Hz	23, 29
ν	shift parameter in multiresolution analysis	732
ν_{21}	frequency of the light emitted during a transition from energy level E_2 to energy level E_1	90
$\Delta\nu$	frequency bandwidth	44, 91
ρ	reflection factor	152
ρ	electric charge density	25

Σ	set of structuring elements	627
σ	specific electrical conductance	25, 76
σ^2	variance	600, 664
τ	shift parameter of the continuous wavelet transform	729
Φ	radiant flux	145
Φ_1	luminous flux	83, 145
φ	phase of an electromagnetic wave	29
φ	normal angle of a line	673, 699
$\varphi_{p,\nu}(x)$	scaling function of the multiresolution analysis	734
φ_x, φ_y	phase shift of an electromagnetic wave	31
χ	ellipticity angle of the polarization ellipse	32
ψ	angle of the direction of the polarization ellipse	32
$\psi_{p,\nu}(x)$	wavelet function of the multiresolution analysis	733
$\psi_{s,\tau}(x)$	wavelet function of the continuous wavelet transform	729
Ω	solid angle	145
Ω_g	domain of the image g	10, 609
Ω_t	domain of the texture $t(\mathbf{x})$	672
ω_i	segment of an image	555
ω	angular frequency of an electromagnetic wave	29

Latin symbols

A	area of a pixel	63
$A(\mathbf{p})$	accumulator of the Hough transform	710, 711
$A_{\text{Col}}(\lambda)$	spectral absorption of a colorant layer	173
\mathbf{A}	transformation matrix for a linear color space transformation	176, 194

a	absorption coefficient of electromagnetic waves in a conducting medium	77
a^*	red-green chromaticity coordinate of the CIELAB color space	185
$a_{\text{Col}}(\lambda)$	constant of absorption of a colorant	173
a_{kl}	coefficient of the AR model	664
\mathbf{a}	vector of AR coefficients	664
$\mathbf{a}_1, \mathbf{a}_2$	alignment of a structural texture	653
B	image size	109
B_{CIE}	color value with respect to the blue CIE primary color	175
$B_{\mathbf{d}}(g, r)$	entry in the run-length histogram with respect to the direction \mathbf{d} , the gray value g and the the run-length r	677
B_s	blue coordinate of the linear sRGB color space	194
B'_s	blue coordinate of the gamma-corrected sRGB color space	195
\mathbf{B}	image point	109
\mathbf{B}	magnetic flux density	25
$BRDF$	bidirectional reflectance distribution function	152
b	image distance	61, 101, 109
$\bar{b}(\lambda)$	color value function of the blue CIE primary color	175
b^*	yellow-blue chromaticity coordinate of the CIELAB color space	185
C	cyan color value in the CMYK color space	197
ΔC	difference of chroma	189
C_{ab}	chroma, based on the CIELAB color space	185
C_B	blue-yellow-chrominance in the $Y C_B C_R$ color space	197
$C_{p,\nu}$	coefficients of the rough structure in multiresolution analysis	734, 738

C_R	red-green-chrominance in the $YC_B C_R$ color space	197
C_d	co-occurrence matrix	673
C_{gg}	covariance matrix	456
\mathbb{C}	set of complex-valued numbers	77
c	speed of light in a vacuum, $c = 299\,792\,458$ m/s	23, 28
$c_{d,ij}$	entry of the co-occurrence matrix C_d	673
c_{Col}	concentration of a colorant	173
const.	arbitrary, but fixed constant	27
D	aperture diameter (more precisely: diameter of the entrance pupil)	61, 103, 110, 117
\mathbf{D}	diffusion tensor	579
\mathbf{D}	electric flux density	25
d	negative imaginary part of the complex refraction index	77
d_K	coherence length	44
d_{Col}	thickness of a colorant layer	173
$d_p(x)$	detail signal in multiresolution analysis	736
\mathbf{d}	shift vector of the co-occurrence matrix	673
$\det \mathbf{A}$	determinant of the matrix \mathbf{A}	288
E	amplitude of the electric field strength	27
E	energy	63
E	irradiance	148
E_1	illuminance	148
ΔE	color distance	189
$E\{\cdot\}$	energy functional	588
E_{0x}, E_{0y}	amplitude of the polarized electromagnetic wave in x -direction and y -direction	31
E_i	i th energy level of an atom	90
E^s, E^p	electric field strength perpendicular or parallel to the incidence plane	71

\mathbf{E}	electric field strength	25
\mathbf{E}	Jones vector	43
$\underline{\mathbf{E}}(\mathbf{x}, t)$	complex wave function of the electric field	29
$\mathcal{E}(\omega)$	uniformity criterion for segments	555
\mathbf{e}_{mn}	zero-mean, weakly stationary noise signal in the AR model	664
\mathbf{e}_φ	two-dimensional unit vector in the direction of φ : $\mathbf{e}_\varphi = (\cos \varphi, \sin \varphi)^T$	407, 699
$\mathbf{e}_{\varphi\perp}$	two-dimensional unit vector perpendicular to \mathbf{e}_φ : $\mathbf{e}_{\varphi\perp} = (-\sin \varphi, \cos \varphi)^T$	407
$\mathbf{e}_x, \mathbf{e}_y, \mathbf{e}_z$	standard basis vectors	30
$\exp(x)$	exponential function, $\exp(x) = e^x$	80
\mathbf{F}	fundamental matrix of a stereo camera setup	287
\mathbf{F}	force	588
f	focal length	106, 108
$f_\gamma(\cdot)$	gamma correction	193
$f_{\gamma, I_0}(\cdot)$	modified gamma correction	193, 195
G	object size	109
G_{CIE}	color value with respect to the green CIE primary color	175
G_{kl}	two-dimensional discrete Fourier transform of the discrete image signal g_{mn}	416
G_s	green coordinate of the linear sRGB color space	194
G'_s	green coordinate of the gamma-corrected sRGB color space	195
\mathcal{G}	point set of a binary image	609
\mathbf{G}	object point	109
g	object distance	109
Δg	depth of field	120

$g(\mathbf{x})$	scalar image, e.g., gray-scale image	10, 63
$g(x; p)$	approximation of the signal $g(x)$ on level p on the multiresolution analysis	734
$\bar{g}(\lambda)$	color value function of the green CIE primary color	175
$\tilde{g}(u, \varphi)$	Radon transform of the image $g(\mathbf{x})$	699
g_{mn}^{ν}	image signal on the ν th level of the (Gaussian) pyramid	723
$\mathbf{g}(\mathbf{x})$	multi-channel image, e.g., color image	10
\mathbf{g}_{mn}	discrete image signal	10, 373, 664
H	radiant exposure	149
H_1	luminous exposure	149
ΔH	difference of hue	189
$H(x)$	Heaviside function	380
H_{HSI}	hue in the HSI color space	196
$H_{\theta}(k)$	histogram of oriented gradients	677
\mathbf{H}	magnetic field strength	25
$\underline{\mathbf{H}}(\mathbf{x}, t)$	complex wave function of the magnetic field	29
h	height difference, layer thickness	230, 260
h	Planck's constant, $h \approx 6,626 \cdot 10^{-34}$ Js	23, 63
Δh	difference of hue angle	190
$h(\mathbf{x})$	background signal in the image	666, 687
h_{ab}	hue angle in the CIELAB color space	185
h_{ν}	impulse response of the low-pass filter in the multiresolution analysis	733, 739
$h_{\sigma}(\mathbf{x})$	Gaussian low-pass	500, 570
I	intensity of electromagnetic radiation	31
I	number of segments of an image	555
I	electric current	83, 210
I	radiant intensity	146

I_l	luminous intensity	146
$I_A(\lambda)$	spectrum of the CIE standard illuminant A (incandescent lamp)	187
$I_{D65}(\lambda)$	spectrum of the CIE standard illuminant D65 (daylight)	187
$I_E(\lambda)$	spectrum of the CIE standard illuminant E (constant intensity)	175
I_{HSI}	intensity in the HSI color space	196
$J_n(z)$	Bessel function of the n th kind	56
J	Jones matrix	43
J	electric current density	25
j	imaginary unit	29
K	number of quantization steps of the image signal	10, 446
K	dimension of the feature space \mathcal{M}	556
K	black color value in the CMYK color space	197
K_m	constant of the photometric base system, $K_m = 683 \frac{\text{lm}}{\text{W}}$	166
k	wave number	29
k	Boltzmann constant, $k \approx 1,38 \cdot 10^{-23} \text{ J/K}$	80
k	scaling factor for the calculation of the normalized color values	178
$k(\mathbf{x})$	result of a (detection) filter	492, 688
k_ν	impulse response of the high-pass filter in multiresolution analysis	735, 739
k	wave vector	29
L	radiance	80, 147
L_l	luminance	147
ΔL^*	difference of brightness	189
$L^2(\cdot)$	space of the quadratically integrable functions	595, 736
L_{LQ}^i	radiance emitted by a light source	151

L_{OF}^j	radiance emitted by the object surface (light field, plenoptic function)	151
L^*	brightness coordinate of the CIELAB color space	185
$l(\mathbf{x}^T \mathbf{e} - d)$	line as an element of a texture	663, 667
M	width of the image (number of columns)	10
M	magenta color value in the CMYK color space	197
\mathbf{M}	Mueller matrix	36
\mathcal{M}	feature space	556
m_1	empirical average	672
$\mathbf{m}(\mathbf{x})$	feature vector for the segment classification at the image point \mathbf{x}	556
(m, n)	discrete image coordinates	10
N	height of the image (number of lines or rows)	10
$N_4(\mathbf{x}),$ $N_8(\mathbf{x})$	4-neighborhood, respectively, 8-neighborhood	599
N_i	occupation number of the energy level E_i	90
\mathbb{N}	set of natural numbers (non-negative integers)	386
NA	numerical aperture	121
n	photon count	63
n	refraction index (real-valued)	28, 68
\underline{n}	complex refraction index	77
\mathbf{n}	normal vector of a surface	67
$\mathcal{N}(\mu, \sigma^2)$	(Gaussian) normal distribution with expected value μ and variance σ^2	436
O	f-number	61, 117
$O(\mathbf{f})$	Fourier transform of the object signal	689
$\mathcal{O}(f(N))$	function class of asymptotic upper bounds (Big O notation): $\mathcal{O}(f(N)) := \{g(N) \mid \exists c > 0, N_0 > 0 \forall N \geq N_0 \ g(N) \leq c \cdot f(N)\}$	568, 723
$o(\mathbf{x})$	object signal in the image	687

P	electric power	83
$\underline{P}(x, y)$	complex aperture function	49
\hat{P}_i	entry of the histogram	467, 560
\mathbf{P}	projection matrix of the camera model	104
\mathbf{P}	Poynting vector of an electromagnetic wave	30
p	scale parameter in multiresolution analysis	732
p	degree of polarization of an electromagnetic wave	35
Q	number of image channels	10
Q	radiant energy	149
Q_1	luminous energy	149
$q(\mathbf{x})$	texel	653
R	surface roughness	61
R	ohmic resistance	89, 210
R_{CIE}	color value with respect to the red CIE primary color	175
R_i	region in the feature space	556
R^{ij}	reflection function of the object surface	151, 186
R_s	red coordinate of the linear sRGB color space	194
R'_s	red coordinate of the gamma-corrected sRGB color space	195
R_{12}^s, R_{12}^p	Fresnel reflectance for light polarized perpendicularly or parallel to the incidence plane	73
$\mathbf{R}_{\mathbf{nn}}$	correlation matrix	544
\mathbb{R}	set of real-valued numbers	10
$\bar{r}(\lambda)$	color value function of the red CIE primary color	175
$r_{gg}(\tau)$	autocorrelation function of the stationary stochastic process $g(\mathbf{x})$	437
$r_{gk}(\mathbf{x}, \tau)$	cross-correlation of the stochastic processes g and k	435

r_{12}^s, r_{12}^p	Fresnel coefficients of reflection for light polarized perpendicularly or parallel to the incidence plane	72
$\text{rect}\left(\frac{x}{\varepsilon}\right)$	rectangular function: $\text{rect}\left(\frac{x}{\varepsilon}\right) := \begin{cases} 1 & \text{if } x < \frac{\varepsilon}{2} \\ 0 & \text{otherwise} \end{cases}$	52, 379
$\text{rnd}(\cdot)$	rounding to the next integer	710
$S_{\text{Col}}(\lambda)$	spectral scatter of a colorant layer	173
$S_{gg}(\mathbf{f})$	power spectral density of the stationary stochastic process $g(\mathbf{x})$	438
S_{HSI}	saturation in the HSI color space	196
S	point set of a binary structuring element	610
S_{ER}	point set of the binary cross	610
\mathbf{S}	Stokes vector, Stokes parameters: $\mathbf{S} = (S_0, S_1, S_2, S_3)^T$	33
SNR	signal-to-noise ratio	64, 492, 691
$\text{trace}(\mathbf{A})$	trace of the matrix \mathbf{A} (sum of the diagonal elements)	340
s	scale parameter of the continuous wavelet transform	729
$s(\mathbf{x})$	structuring element in gray-scale morphology	636
s^2	empirical variance	672
$\text{sinc}(\cdot)$	cardinal sine function: $\text{sinc}(x) := \frac{\sin(\pi x)}{\pi x}$	52, 390
$\text{sgn}(\cdot)$	sign function: $\text{sgn}(x) := \begin{cases} 1 & x > 0 \\ 0 & x = 0 \\ -1 & x < 0 \end{cases}$	705
T	exposure time	63
T	temperature	80, 83
T_{12}^s, T_{12}^p	Fresnel transmittance for light polarized perpendicularly or parallel to the incidence plane	73
t	time	25

$t(\mathbf{x})$	image of a texture	653
t_{12}^s, t_{12}^p	Fresnel coefficients of transmission for light polarized perpendicularly or parallel to the incidence plane	72
U	blue-yellow-chrominance in the YUV color space	197
U	electric voltage	83, 210
U_N	nominal voltage	83
\mathcal{U}	umbra	634
\mathcal{U}	neighborhood of the origin	485, 664, 693
$u(\mathbf{x}, t)$	diffused image signal	580
V	magnification of an optical imaging	101
V	contrast (visibility) of an interference pattern	48
V	red-green-chrominance in the YUV color space	197
$V(\lambda)$	luminosity function of the human eye for photopic vision	165, 177
$V'(\lambda)$	luminosity function of the human eye for scotopic vision	165
$V(\mathbf{f})$	transfer function of a detection filter	689
V_p	function space in multiresolution analysis	734
v	propagation velocity (phase velocity) of an electromagnetic wave	27, 68
$v(\mathbf{x})$	impulse response of a detection filter	688
$\mathbf{v}(s)$	active contour as a parametric curve	588
W_p	wavelet space	735
$w(\cdot)$	two times differentiable function in the solution of the wave equation	27, 29
$w(\mathbf{x})$	whitening filter	692
X	CIE tristimulus value with respect to the virtual primary color X	176
\mathbf{X}_{prim}	basis vector of the virtual primary color X	178

x	normalized color value x in the CIE chromaticity diagram	179
$\bar{x}(\lambda)$	CIE color matching function of the virtual primary color X	176
\mathbf{x}	three-dimensional position of an electromagnetic wave	27
\mathbf{x}	continuous image coordinates: $\mathbf{x} = (x, y)^T \in \mathbb{R}^2$	10
\mathbf{x}'	homogeneous coordinates: $\mathbf{x}' = (x'_1, \dots, x'_N, w)^T$	102
\mathbf{x}_c	camera coordinates: $\mathbf{x}_c = (x_c, y_c, z_c)^T$	101
\mathbf{x}_w	world coordinates: $\mathbf{x}_w = (x_w, y_w, z_w)^T$	103
Y	CIE tristimulus value with respect to the virtual primary color Y	176
Y	yellow color value in the CMYK color space	197
Y'	gamma-corrected brightness in technical color spaces	197
\mathbf{Y}_{prim}	basis vector of the virtual primary color Y	178
y	normalized color value y in the CIE chromaticity diagram	179
$\bar{y}(\lambda)$	CIE color matching function of the virtual primary color Y	176
Z	CIE tristimulus value with respect to the virtual primary color Z	176
Z	durability of a light source	83
Z	wave impedance	27
\mathbf{Z}_{prim}	basis vector of the virtual primary color Z	178
\mathbb{Z}	set of integers	10
z	CIE normalized color value z	179
$z(\mathbf{x})$	surface relief	263
$\bar{z}(\lambda)$	CIE color matching function of the virtual primary color Z	176

List of Abbreviations

ACF	autocorrelation function	434
A/D	analog/digital	205
AR	autoregressive	480, 663
ARMA	autoregressive moving average	480
AS	aperture stop	110, 114
BP	band-pass	506
BRDF	bidirectional reflectance distribution function	152
BS	band-stop	506
CCD	charge coupled device	211
CCF	cross-correlation function	435
CCT	confocal chromatic triangulation	307
CIE	Commission Internationale de l'Éclairage	173
CMOS	complementary metal oxide semiconductor	213
CT	computed tomography	329, 700
CW	continuous wave	334
DFT	discrete Fourier transform	396
DoG	difference of Gaussians	574
EM	expectation-maximization	560
EnP	entrance pupil	115
EnW	entrance window	115
ExP	exit pupil	115
ExW	exit window	115
FDM	finite difference method	591
FEM	finite element method	591
FFT	fast Fourier transform	400
FIR	far infrared	217
FS	field stop	114

GVF	gradient vector flow	591
HDRC	high dynamic range CMOS	214
HP	high-pass	506
IC	integrated circuit	213
IFFT	inverse fast Fourier transform	400
IR	infrared	24
JPEG	Joint Photographic Experts Group	195
KLT	Karhunen-Loève transform	456
LBP	local binary pattern	680
LED	light emitting diode	86
lidar	light detection and ranging	308
LoG	Laplacian of Gaussian	573
LP	low-pass	425
LSI	linear, shift-invariant	382
LWIR	long-wavelength infrared	217
MA	moving average	480
MLA	micro-lens array	292
MRF	Markov random field	480
MRT	magnetic resonance tomography	329, 555
MSE	mean squared error	544
MWIR	medium-wavelength infrared	217
NA	numerical aperture	121
Nd-YAG	neodymium-doped yttrium aluminum garnet	92
NETD	noise equivalent temperature difference	217
NIR	near infrared	217
OCT	optical coherence tomography	330
OLED	organic light emitting diode	87
OTF	optical transfer function	406
PCA	photoconductive antenna	334

PCA	principal component analysis	456
PCB	printed circuit board	133
PDF	probability density function	449
PSD	position sensitive detector	210
PSF	point spread function	406
QWP	quarterwave plate ($\frac{\lambda}{4}$ -retardation plate)	39
radar	radiowave detection and ranging	308
SAR	synthetic aperture radar	705
SIFT	scale-invariant feature transform	744
SNR	signal-to-noise ratio	64, 492, 691
SURF	speeded up robust features	744
SWIR	short-wavelength infrared	217
TCS	telecentric stop	280
THz	terahertz	24, 332
UV	ultraviolet	24
VFC	vector field convolution	593
WLI	white light interferometry	313
w.l.o.g.	without loss of generality	31
WP	waveplate / retardation plate	40

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Symbols

δ -function *see* Dirac delta function
 $\frac{\lambda}{4}$ -plate 39
 4-connected neighborhood 599
 8-connected neighborhood 599

A

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