

Index

Symbols

- χ -chromaticities, 183
- χ^2 -divergence measure, 278, 287

A

- absorbance characteristic, 10
- absorbance curves, 71
- absorbance of light, 39
- achromatopsia*, 26
- adaptation, 84, 205
- additive color generation, 68
- additive color model, 68
- adjusting saturation, 248
- akinetopsia*, 26
- amacrine cell, 14
- analog computation, 240
- analog photography, 41
- anisotropic diffusion*, 257
- anisotropic local space average color, 255
- anti curl backing, 41, 43
- anti halation layer, 41, 43
- area of support, 229, 258
- artificial retina, 241
- artificial evolution, 198
- artificial neuron, 194
- artificially illuminated, 202

B

- back-propagation, 195
- backlight, 69
- Bayer pattern*, 46
- bias, 240, 252

bidirectional reflectance distribution function (BRDF), 52

- bilinear interpolation, 260
- binarized shadow image, 215
- biological neural network, 194
- bipolar cell, 9, 14
- bit string, 199
- black and white film, 41
- black-body radiator, 45, 56, 58, 126, 136, 140, 175
- blind spot, 16
- blob*, 20
- border of color space, 248
- border of image, 157, 262
- border pixels, 262
- brain, 9

C

- calibrated color space, 87
- canonical gamut, 116, 117
- capacitor, 234
- capacity, 234
- cathode-ray tube, 69
- cell potential, 208
- center-surround characteristic, 14
- centered moment, 280
- changing illumination, 279
- chroma, 91, 93, 99, 101
- chromaticities, 75
- chromatopsia, 24
- CIE, 69
- classification, 205
- cloudy day illumination, 56
- CMY color space, 93
- color blindness, 10, 13

- color by correlation, 191
 - color classification, 209
 - color cluster rotation, 128, 195
 - color constancy, 1
 - color constancy measure, 295
 - color constant descriptors, 290, 324
 - color correction using filters, 45
 - color distribution, 276
 - color film, 42
 - color gamut, 69, 77
 - color histogram, 111, 275, 276, 279, 280, 282
 - color image enhancement, 170
 - color in perspective, 121
 - color interpolation, 46
 - color opponent cell, 30, 208, 326
 - color opponent mechanism, 16
 - color perception, 32
 - color pigment, 93
 - color print, 44
 - color ratios, 280
 - color reproduction, 67
 - color reversal film, 43
 - color sensation, 70
 - color shift, 241
 - color space of analog and digital video, 99
 - color spaces, 87
 - color temperature, 45
 - color transform, 79
 - committee-based color constancy, 197
 - component motion, 26
 - comprehensive color normalization, 129
 - computational theory of color constancy, 327
 - computational theory of color vision, 324
 - concentration gradient, 235
 - cone, 9
 - cone damage, 11
 - consumer photography, 3, 66, 67, 275, 327
 - continuity equation, 235
 - convergence, 132, 196, 208, 227–230, 236, 261, 267
 - convex hull, 116
 - convolution, 153, 155, 166, 169, 194, 220, 233, 236
 - corpus callosum, 26, 35
 - coupler compounds, 43
 - covariance matrix, 129, 180, 280
 - crossover, 202
 - cube root relationship, 32
 - current, 230
 - curvature, 264
 - curved line, 264
- D**
- developer, 43
 - diagonal color transform, 84
 - diagonal map, 116, 126
 - dichromatic line, 136
 - dichromatic reflection model, 134
 - diffusion coefficient, 235
 - diffusion process, 235
 - digital camera, 46
 - digital photography, 46
 - Dirac delta function, 54, 62, 64, 83, 103, 104, 106, 116, 241, 322, 329
 - display device, 67, 68, 77, 79, 81–83
 - double opponent cell, 22, 30, 206, 208, 209
 - dye, 43
 - dynamic range compression, 169
 - dyschromatopsia*, 26
- E**
- eigenvectors for object recognition, 280
 - elementary function, 200
 - emulsion, 43
 - emulsion layer, 41
 - energy minimization, 210
 - enlarger light, 44, 215
 - estimating the illuminant locally, 219, 239
 - evaluation of color constancy algorithms, 275, 282
 - evolution, 198, 205
 - evolution strategy, 199
 - evolutionary algorithm, 198
 - evolving color constancy, 198
 - evolving computer programs, 198

executable program, 200
 expected value, 109
 experimental psychology, 303
 exponential kernel, 221, 230
 extended light source, 53
 eye, 9
 eye movements, 205
 eyeball, 9

F

filling in derivatives, 215
 film, 41
 film development, 41
 film exposure, 41
 finite set of basis functions, 63, 84, 210
 firing rate, 208
 fitness function, 205
 fixation, 42
 flat panel display, 69
 fluorescent illuminant, 176
 flux, 47
 Fourier transform, 170, 232, 233, 282
fovea, 13
 frequency domain, 233
 frequency space, 170

G

gamma correction, 79, 81, 240
gamut of display device, 68
 gamut-constraint method, 115
 ganglion cell, 9
 gap junction, 14
 Gaussian, 5, 137, 169, 170, 210, 215,
 220, 236, 241, 324
 gelatin, 41
 genetic material, 198
 genetic operator, 198, 202
 genetic programming, 198
 geometry factor, 61
 global motion, 26
 gray vector, 30, 94, 116, 128, 129, 196,
 205, 241, 242, 246, 248,
 250
 gray world assumption, 106, 108, 109,
 114, 132, 133, 211, 220, 221,
 229, 239, 241, 251, 257

Green's function, 155
 grid of processing elements, 221, 233

H

heuristics based algorithm, 191
 hidden layer, 195
 hippocampus, 29
 histogram, 105
 histogram-based object recognition, 275
histogram intersection, 276
 homogeneous color space, 92
 homogeneous diffusion, 236
 homomorphic filtering, 170
 horizontal cell, 14
 HSI color space, 93
 HSL color space, 96
 HSV color space, 96
 hue, 75, 91, 93, 94, 96, 205
 human color constancy, 324, 327
 human eye, 9
 human visual system, 9, 174

I

illuminance, 331, 332
 illuminants, 56
 illumination gradient, 194, 258
 image boundary, 229
 image sequence, 188
 imaging chip, 217, 241, 244
 impulse, 154
 inferior temporal cortex, 27, 29
 inheritable trait, 198
 inner nodes, 200
 input layer, 195
 integrated reflectance, 2, 32
 intensity, 75, 87, 91, 93–95
interblob region, 20
 International Commission on
 Illumination (CIE), 59, 70
 interpolation methods, 259
 intrinsic image, 175, 185, 213
 invariant direction, 180
 iris, 9
 irradiance, 47, 332
 isotropic local space average color, 258

J

Jacobi's method, 160

K

kernel, 220

Kirchhoff's law, 163, 230

L

Lab color space, 92

Lambertian radiator, 58

Lambertian surface, 54, 106

Laplace operator, Laplacian, 113, 154,
157, 190, 213, 281

latent image, 41, 43

lateral geniculate nucleus, 18, 21, 22

learning, 196

learning a linear filter, 193

learning algorithm, 195

learning color constancy, 193

lens, 9, 45

light adaptation, 16

light sensitive emulsion, 42

lighting matrix, 64

lightness, 31, 93, 154

lightness constancy, 16

line of constant illumination, 257

linear filter, 193

liquid crystal display (LCD), 69

local space average color, 219

locally estimating the illuminant, 219

log-chromaticity difference space, 180

logarithm, 113, 115, 153, 154, 157, 166,
170, 172, 174, 175, 177, 179,
189, 214, 281

logarithmic receptors, 148

logarithmic relationship, 32

luma, 99

luminance, 74, 80, 90, 99, 331, 332

luminous energy, 332

luminous exitance, 331, 332

luminous flux, 72, 332

luminous intensity, 331, 332

Luv color space, 89

M

Macbeth color checker, 237

Mach band, 153

magnocellular (M) cell, 18

matte object, 39

maximum deviation, 253

mesh of processing elements, 221

metamers, 35, 78

model image, 288

monitor, 69

monochromatic colors, 75, 77

monochromatic primaries, 69, 70

morphological operator, 214

motor neuron, 194

multi-dimensional histogram, 278

multiple illuminants, 109

multiple light sources, 53

multiple local light sources, 219

multiple scales, 169

Munsell book of colors, 33, 151, 303

mutation, 202

N

narrow band filter, 33, 34, 78

narrow band sensor, 64, 84, 103, 172,
175, 280, 282

nature, 205

negative image, 43

neighborhood, 220

neighbors, 224

network of resistors, 163

neural architecture, 206, 210

neural network, 194

neural network model, 208

neurons, 9

neutral-density filter, 37, 151

node, 194, 230

nonlinear change of illuminant, 255

nonlinear signal, 99

nontrivial output, 275

nonuniform illuminant, 219, 240

nonuniform illumination, 143

normalized color, 75

normalized color shift, 246

normalized histogram, 276

normalized space average color, 246

number of iterations, 229

O

object recognition, 1, 3, 26, 29, 65, 185,
205, 275, 279, 282, 327
observed gamut, 116
ocular muscles, 9
ocular dominance column, 19
off-center cell, 14
on-center cell, 14
on-off ganglion cell, 14
on-off response, 14
opsin, 13
optical axis, 52
oscillatory behavior, 225
outer nodes, 200
output layer, 195

P

parallel architecture, 200
parallelization, 221
parameter optimization, 199
parietal cortex, 26
parse tree, 200
parvocellular (P) cell, 18
parvocellular-blob pathway, 27
parvocellular-interblob pathway, 27
perpendicular component, 242
phenomenological descriptions, 324
phosphor, 69, 79
photographic paper, 44
photometric units, 331
photometry, 331
photon, 10
photopic luminous efficiency function,
73, 74
photopic vision, 10, 70
photopigment, 10
photoreceptor, 13
plastic film base, 41, 43
point light source, 53
point of equal energy, 75
Poisson equation, 155, 161, 215
population, 198
positive image, 43
posterior parietal cortex, 27
power, 332
primaries, 69

primary color, 68
primary intensities, 69
principal axis, 196
principal component, 128, 129
principal component analysis, 63
printing, 68
processing element, 200, 222, 255
professional photographer, 45
projected coordinate, 179
pupil, 9
purple line, 75

R

radiance, 48, 332
radiant energy, 332
radiant exitance, 332
radiant flux, 72, 332
radiant intensity, 332
radiometry, 47, 331
radiosity, 48
radius of curve, 265
random path, 149
ratio, 144
receptive field, 14
receptor, 9
recognition rate, 288
reflectance, 2, 3, 13, 31
reflectance models, 52
reflected light, 39
refraction, 39
reproduction, 198, 202
resistance, 230, 231
resistive grid, 166, 167, 217, 230, 231,
244
resistor, 230
response characteristic, 62
response of photoreceptors, 326
resting potential, 208
retina, 2, 9
retinex theory, 143
RGB color space, 87
rod, 9
root mean squared error, 32, 197, 263,
282, 284, 299
rotated coordinates, 260

S

saturation, 75, 91, 93, 94, 96, 137, 170, 216, 248
 scaling input values, 239
 scaling of color channels, 64, 205
 scanner, 46
 scotomas, 23
 scotopic vision, 10, 70
 scratch resistive coating, 41
 secondary color, 68
 selection, 198
 self-luminous colors, 90
 sensor array, 46, 51
 sensor response, 60
 sensor sharpening, 62, 83
 sequential product, 146
 sequential sum, 148
 shadow, 184, 190, 213
 shadow brightening, 213, 215
 shadow edge, 190, 214
 shadow removal, 213
 sharpening, 175
 shifted white point, 248
 shiny object, 39
 sigmoidal function, 195, 227, 253, 284
 silver halide crystals, 41
 single instruction multiple data (SIMD), 201
 single-lens reflex camera, 46
 sky, 53
 smoothly changing illuminant, 255
 smoothly varying illuminant, 219
 Snell's law, 40
 solid angle, 48, 53
 spatial domain, 233
 spatially varying illuminants, 219
 spotlight, 258, 263, 284
 square root relationship, 32
 sRGB color space, 87, 240
 standard observer, 70
 standardized color space, 67
 sub-tree, 202
 subtract space average color, 251
 subtractive color generation, 68
 subtractive color model, 68

successive over-relaxation (SOR), 160, 229, 261
 surface colors, 92
 symbolic expression, 200

T

temporal visual cortex, 26
 terminal symbols, 200
 test image, 287
 theoretical models, 320
 theory of evolution, 198
 threshold, 149, 152, 158, 159, 195, 240
 threshold operation, 113, 150, 159, 213
 threshold operator, 154
 training vectors, 193
 tree structure, 200
 tree-based genetic programming, 200

U

uniform coordinate system, 92
 uniform illumination, 103

V

V1, 19, 21, 23–27, 29
 V2, 23–25, 27, 36
 V3, 23–26
 V3A, 25
 V4, 23–26, 29, 36, 324
 V5, 23, 26, 27
 variant of Horn's algorithm, 113
 variation, 198
 video color space, 99
 visual cortex, 3, 6, 16, 35
 visual system, 9
 voltage, 231
 von Kries coefficients, 83, 84, 322

W

weight, 194
 white balance, 2, 105, 110
 white patch retinex algorithm, 104, 165, 251

X

XYZ color space, 70