Index

A
acoustic
impedance, 520
windows, 617
active appearance model, see active shape model
active contour, see deformable model, 1160, 1162, 1180
active shape model, 161–167
active appearance model, 165–166
point distribution model, 161, 162
adventitia, 764
affine transformation, 532
affinity, 898
airway analysis, 1017–1027
algebraic reconstruction technique, 47
aliasing, 533
alternative hypothesis, 585
Alzheimer’s disease, 1088
analysis
multicompartmental, 1144
multiple compartments, 1147
two compartments, 1144
analytic signal, 522
anatomical maps
variability, 1088
anatomical modeling, 1079, 1086
mesh models, 1086
anatomy
cardiac, 611
pulmonary, 1006–1007
angiography, 711–808
biplane, 750
3D geometry, 751
computed tomography, 899–900
coronary, 715–757
quantitative, 718
CT, 812
digital subtraction, 811, 883, 886
imaging, 715–750
magnetic resonance, 848–899
magnetic resonance, 812
x-ray, 811, 812, 878, 880, 884
aperture, 526
apodization, 528
area under the ROC curve (AUC), 575
arterial
remodeling, 713
arteries and veins
separation, 880
arteriography
coronary
quantitative, 718
artery
brachial, 812, 834–848
carotid, 812, 824–834
coronary, 900–901
femoral, 812, 886
iliac, 878, 886, 892
artificial neural network, 329, 331–333, 575
atherosclerosis, 713
coronary, 713
lesion, 713, 765
atlas-based segmentation, 88
atlases
deformable, 1077
model-based, 1084
probabilistic, 1086
atrium, 611
attenuation, 3
coefficient, 4

1203
correction factors, 3
map, 3
auto-correlation, 310

B
basis
expansion, 8
functions, 549
Bayes, 287, 291, 292, 305, 306
Bayesian
estimation, 690
image reconstruction, 12
methods, 547
Bayesian methods, 1071
beam hardening, 5
Beer’s law, 5, 57
bilinear interpolation, 25
biomechanical model, 693
biomechanics, 1155
black blood MRA, 860
blackboard control architecture, 1013
blank scan, 6
blob coloring, 100
Blob equations, 540, 543
block-iterative, 35
blood flow
distributions, 1038
transit times, 1038
border
detection, 93, 255
endocardial, 255, 656
epicardial, 255, 656
tracing, 88
brain
asymmetry
abnormal, 1108
changes, 1107
maps, 1107
atlases, 1064
average templates, 1101
deformable, 1068
deformable probabilistic, 1101
disease-specific, 1067
early templates, 1068
probabilistic, 1065
Talairach atlas, 1068
data
disease-specific, 1067
image analysis, 1114
imaging, 1061
structure
mapping differences, 1065
templates
adaptable, 1064
variation
encoding, 1101
shape differences, 1105
tensor maps, 1103, 1104
breast, 549
cancer, 276, 326, 334, 918–921
bright blood MRA, 861
bronchoscopic
imaging, 1010, 1042, 1047–1050
bronchoscopy
virtual, 1042–1050
C
calcification
coronary, 900
calibration
catheter-based, 732
cancer, 1132–1150
capillary permeability, 1147
cardiac
deformation, 676
image analysis, 255–260, 676–710
motion, 676
output, 615
cardiomyopathy, 635
catheter, 715–784
orientation
absolute, 779
relative, 777
path, 776
sheathed, 777
trajectory, 776
centerlines, 1025, 1046
cepstrum, 312–314, 318
cerebral cortex
  average templates, 1098
  averaging models, 1097
  covariant matching, 1096
  elastic matching, 1090
  modeling, 1090
  spherical maps, 1093
  variability, 1097
chemical shift, 551
  imaging, 553
cHEST
  radiograph, 1009, 1011
  wall, 1038
cine MRI, 867
circular Gaussian statistics, 522
classification, 101–119, 410, 958
  k-means, 105
  k-nearest neighbor, 109
  artificial neural network, 111
  artificial neural networks, 960
Bayesian, 108, 963
  contextual, 116
  decision tree, 110
fuzzy c-means, 108
  fuzzy c-means, adaptive, 109
  fuzzy logic, 412
linear discriminant analysis, 959
  maximum likelihood, 108
minimum distance, 104
MOGA, 965
  neural network, 411
  parallelepiped, 104
  parzen window, 109
  rule-based, 964
  statistical methods, 411
  thresholding features, 410
  using a knowledge base, 420
classifier-independent feature analysis, 287–291, 295–296
close-hole operator, 229, 233
  top-hat, 257
  top-hat, 221
  translation invariant, 190, 214
closing, 187, 214
  annular, 197
  area, 189, 215
  by reconstruction, 229, 233
  flat, 214
  structural, 188, 214
closing-by-reconstruction top-hat operator, 237
co-occurrence
  matrix, 1036
  co-occurrence, 278, 282, 284, 285, 309
  310, 317, 318
coherent scattering, 521
collimation, 5
color Doppler, 620
  complete data, 19
  compression, 744
Compton scatter, 5
computed tomographic angiography, 813
  computed tomography, 517, 813, 1009
  electron beam, 900
  helical, 899
  spiral, 899
  ultrafast, 900
computer aided diagnosis, 927–986
  evaluation of methods, 970
conditional operators
  dilation, 195, 223, 227, 232
  reconstruction, 229, 232
conflict resolution, 887
congenital heart disease, 635
conjugate gradient, 45
connected component labeling, 100
connectivity
  fuzzy, 896
content-based retrieval, 438
continuous-to-discrete transformations, 542
contour detection, 768
contrast, 945, 951, 1031
agents, 547, 859
microbubble, 660
medium
extravascular, 1145
gadolinium, 1145
intravascular, 1145
non-ionic, 1145
contrast-enhanced bright blood MRA, 868
convergence rate, 16
convex-NR-1 algorithm, 32
convex-PS algorithm, 34
convolution, 527, 552
coordinate ascent, 36, 39
Newton-Raphson, 37
core, 167, 879, 880
coronary
calcification, 900
calcium
score, 900
disease, 713
diffuse, 755
heart disease, 811
imaging
computed tomography, 900
correlation, 1031
correspondence
images, 1162, 1176
points, 1155, 1176, 1185
cortical anatomy
mapping variability, 1065
criterion function, 105
cross validation, 52, 583
CT, 1009
CTA, 813
curve evolution, see deformable model

D
data-weighted least-squares, 48
database, 973
deadtime, 6
decision boundary, 101
deconvolution, 1027, 1040
defeasible model, 129–174
active contour, 408
active shape model, see active shape model
bending force, 134
curve evolution, 146
damping force, 136
defeasible Fourier model, 155–157
defeasible superquadric, 159–161
distance potential force, 139
dynamic distance force, 141–143
dynamic force formulation, 136–138
elasticity force, 134
energy minimizing formulation, 134–136
external force, 131, 133, 136, 138–143
Gaussian potential force, 136–138
geometric deformable model, 132, 133, 146–154
gradient vector flow, 139–141
interactive force, 143
internal force, 131, 134, 136, 138
level set method, 146–150
modal analysis, 157–159
multiscale Gaussian potential force, 138
nonpotential force, 138
parametric deformable model, 132–146
potential force, 134, 136, 138
pressure force, 138–139
snake, 768
speed function, 146, 147, 149–
152
spring force, 143, 144
volcano force, 143
deformable superquadric, see deformable model
deformable templates, 54
deformation, 530
degree of freedom, 1175
densitometry, 728
density, 945
dephasing, 547
descent
iterative, 1157, 1166
detector efficiency, 5
diaphragm, 1038
mechanics, 1038
DICOM, 716–749, 783
digitization, 926
dilation, 179, 180, 182, 209
bounded space, 888
conditional, 195, 223, 227, 232
flat, 210
translation invariant, 180, 183, 210
discrete size transform, 201, 225
discriminant analysis, 291, 296, 301, 305
discriminant function, 101
displacement, 531
dissipation matrix, 540
distance
function, 237
transform, 238
distortion
geometric, 460–462, 741
pincushion, 741
distributed specularity, 523
Doppler, 619
dual energy, 53
dynamic brain maps, 1114
dynamic programming, 91, 768, 885
three-dimensional, 887

e
echocardiography, 609–674, 690, 698
intracardiac, 618
transesophageal, 618
detection
knowledge-based, 407
endpoints, 346
enhancement, 746
regular, 346
singular, 346
strength, 955
eigenanalysis, 544
eigenshape, 654
ejection fraction, 616, 784
elastic
deformation, 432
modulus, 535
elasticity, 1155, 1163
imaging, 530, 533
relative, 1188
EM algorithm, 18
EM-based surrogate function, 19
emission tomography, 49
endocarditis, 611
endoluminal rendering, 1048
endothelial function, 834
energy, 1031
enhancement
edge, 746
entropy, 1031
envelope, 522, 527, 529
epilepsy, 556
epipolar
constraint, 753
line, 757
plane, 753
erosion, 179, 180, 182, 209
flat, 210
translation invariant, 180, 182, 210
error
alpha, 585
<table>
<thead>
<tr>
<th>Term</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>beta, 586</td>
<td></td>
</tr>
<tr>
<td>consumer’s, 586</td>
<td></td>
</tr>
<tr>
<td>localization, 463, 467-473</td>
<td></td>
</tr>
<tr>
<td>mean relative, 571</td>
<td></td>
</tr>
<tr>
<td>MR gradient, 454, 462</td>
<td></td>
</tr>
<tr>
<td>producer’s, 585</td>
<td></td>
</tr>
<tr>
<td>rate, 589</td>
<td></td>
</tr>
<tr>
<td>apparent, 581</td>
<td></td>
</tr>
<tr>
<td>re-substitution, 581</td>
<td></td>
</tr>
<tr>
<td>reclassification, 581</td>
<td></td>
</tr>
<tr>
<td>registration, 452, 467-473</td>
<td></td>
</tr>
<tr>
<td>Type I, 585</td>
<td></td>
</tr>
<tr>
<td>Type II, 586</td>
<td></td>
</tr>
<tr>
<td>estimation, 8</td>
<td></td>
</tr>
<tr>
<td>expectation-maximization, 18, 78</td>
<td></td>
</tr>
<tr>
<td>bias field correction, 78, 86, 87</td>
<td></td>
</tr>
<tr>
<td>estimation of mixture parameters, 83</td>
<td></td>
</tr>
<tr>
<td>expert system</td>
<td></td>
</tr>
<tr>
<td>fuzzy, 424</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>false</td>
<td></td>
</tr>
<tr>
<td>negative, 571</td>
<td></td>
</tr>
<tr>
<td>positive, 571</td>
<td></td>
</tr>
<tr>
<td>positive fraction, 572</td>
<td></td>
</tr>
<tr>
<td>fast denominator, 44</td>
<td></td>
</tr>
<tr>
<td>feature</td>
<td></td>
</tr>
<tr>
<td>extraction, 409, 933</td>
<td></td>
</tr>
<tr>
<td>selection, 286, 292, 955</td>
<td></td>
</tr>
<tr>
<td>effect of finite datasets, 958</td>
<td></td>
</tr>
<tr>
<td>genetic algorithm, 956</td>
<td></td>
</tr>
<tr>
<td>one dimensional analysis, 956</td>
<td></td>
</tr>
<tr>
<td>stepwise, 956</td>
<td></td>
</tr>
<tr>
<td>space, 101, 103, 108</td>
<td></td>
</tr>
<tr>
<td>symbolic description, 420</td>
<td></td>
</tr>
<tr>
<td>vector, 101</td>
<td></td>
</tr>
<tr>
<td>filtered-backprojection, 3</td>
<td></td>
</tr>
<tr>
<td>finite element, 1155, 1164</td>
<td></td>
</tr>
<tr>
<td>algorithm, 534</td>
<td></td>
</tr>
<tr>
<td>implementation, 1165</td>
<td></td>
</tr>
<tr>
<td>mesh generation, 1171</td>
<td></td>
</tr>
<tr>
<td>method, 689, 695</td>
<td></td>
</tr>
<tr>
<td>model, 1170, 1176</td>
<td></td>
</tr>
<tr>
<td>modeling, 1153-1201</td>
<td></td>
</tr>
<tr>
<td>flat image operators, 218</td>
<td></td>
</tr>
<tr>
<td>flight-paths, 1044-1047</td>
<td></td>
</tr>
<tr>
<td>flow mediated dilatation, 836</td>
<td></td>
</tr>
<tr>
<td>flow reserve, 737</td>
<td></td>
</tr>
<tr>
<td>FMD, 836</td>
<td></td>
</tr>
<tr>
<td>fMRI, 538</td>
<td></td>
</tr>
<tr>
<td>foreshortening, 736, 756</td>
<td></td>
</tr>
<tr>
<td>form factor, 525</td>
<td></td>
</tr>
<tr>
<td>forward problem, 518</td>
<td></td>
</tr>
<tr>
<td>Fourier, 654</td>
<td></td>
</tr>
<tr>
<td>encoding, 855</td>
<td></td>
</tr>
<tr>
<td>sampling, 541</td>
<td></td>
</tr>
<tr>
<td>transform, 523, 527</td>
<td></td>
</tr>
<tr>
<td>local, 552</td>
<td></td>
</tr>
<tr>
<td>fractal, 278, 282, 284, 325, 327, 329, 331, 332</td>
<td></td>
</tr>
<tr>
<td>analysis, 1032-1034</td>
<td></td>
</tr>
<tr>
<td>dimension, 327-331, 1033</td>
<td></td>
</tr>
<tr>
<td>feature, 327, 329, 331-335</td>
<td></td>
</tr>
<tr>
<td>free-response ROC curve (FROC), 578, 590</td>
<td></td>
</tr>
<tr>
<td>frequency encoding, 542</td>
<td></td>
</tr>
<tr>
<td>Fresnel approximation, 527</td>
<td></td>
</tr>
<tr>
<td>full-width at half-maximum (FWHM), 1025-1027</td>
<td></td>
</tr>
<tr>
<td>function</td>
<td></td>
</tr>
<tr>
<td>activation, 112</td>
<td></td>
</tr>
<tr>
<td>objective, 105</td>
<td></td>
</tr>
<tr>
<td>ventricular, 627</td>
<td></td>
</tr>
<tr>
<td>diastolic, 632</td>
<td></td>
</tr>
<tr>
<td>systolic, 627, 628</td>
<td></td>
</tr>
<tr>
<td>fusion</td>
<td></td>
</tr>
<tr>
<td>angiography and IVUS, 776</td>
<td></td>
</tr>
<tr>
<td>fuzzy</td>
<td></td>
</tr>
<tr>
<td>connectedness, 407</td>
<td></td>
</tr>
<tr>
<td>connectivity, 896</td>
<td></td>
</tr>
<tr>
<td>sets, 417</td>
<td></td>
</tr>
<tr>
<td>defuzzification, 425</td>
<td></td>
</tr>
<tr>
<td>linguistic variable, 420</td>
<td></td>
</tr>
<tr>
<td>symbolic descriptions, 420</td>
<td></td>
</tr>
</tbody>
</table>
Index

G

Gating
- ECG, 771, 899
- Gauss-Markov theorem, 47
- Gaussian Random Fields, 1110
- Gaussian speckle, 521
- Generalized EM, 35
- Geodesic
distance, 244
transform, 244
SKIZ, 242
- Geometric deformable model, see deformable model
- Gibbs artifacts, 554
- Glagov effect, 758
- Gradient, 1032
  ascent, 27
  field transform, 718–726
  vector flow, see deformable model
- Graph searching, 89, 769
- Grassfire, 100
- Grouped coordinate ascent, 45
- Gyromagnetic ratio, 537

H

Hanging togetherness, 898
Harmonic imaging, 661
Hausdorff distance, 581
Heart
- Coronary occlusion, 695
failure, 635
- Ischemic heart disease, 677
- Hermitian operator, 544
- Hessian matrix, 13
- Histogram, 78, 278, 280, 281, 285, 309, 315, 316
- Hit-or-miss operator, 192
- Hough transform, 94, 1011
  generalized, 97

I

Image
- Artifacts, 593

- Correspondence, 1162
- Intensifier, 741
- Range, 1155, 1169
- Segmentation, 578
  performance of, 580

Imaging
- Analysis challenges, 1064
- Dynamic, 1136
- Dynamic contrast MRI, 1139
- Functional
  CT, 1142
  MRI, 1142
- Medical, 1155
- Modalities, 1009–1011
- Nuclear medicine, 1137
- Perfusion, 1137
  MRI, 1148
- PET, 1138
- Physiological, 1136
- Tumor, 1132
- Impulse response, 520
- IMT, 821
- Incoherent scattering, 521
- Inertia, 1031
- Inference
  max-min, 425
  intensity nonuniformity, 74
- Interpretation, 399–445
  atlas, 429–433
  high-level, 421
  rule-based, 422–426
  rule-based system, 417
  semantic network, 426–429
  systems, 423
- Intima, 764
- Intima-media thickness, 821
- Intra-patient variability, 317–319
- Intravascular ultrasound, 711–808
  catheter, 760
  twist, 771
  pullback, 770
  quantitative, 760
three-layer appearance, 765
inverse difference moment, 1031
inverse problem, 15, 518
iso-surface
curvature, 357
intensities, 349
iso-value, 349
polygonizing a cell, 349
iterative algorithm, 14

J
jack knife, 582
Jensen’s inequality, 20

K
k-distribution, 524
k-space, 545, 553, 857
keyframing, 1046
kidney, 535
knowledge
meta-level, 420
representation, 413
atlas, 416, 420
rule-based, 414
semantic network, 415, 426

L
Larmor frequency, 537
least-squares, 48
leave one out, 582, 831
level set method, see deformable model
likelihood, 10
limited angle tomography, 53
line integral, 6
linear array, 526
linear discriminant analysis, 411
linear imaging system, 519
linear vector space, 543
live wire, 94
local mean, 290, 298–299
local out-of-class mixture mean, 290–291, 298, 306
logistic regression, 329, 331
lumen, 764
lung, 1006
lobes, 1017

M
magnetic
resonance
angiography, 848–877
imaging, 812
magnetic field, 540
gradient, 541
magnetic resonance, 517, 536, 676, 690, 698
imaging, 1009
phase contrast, 679, 683
tagging, 679, 789
Mahalanobis distance, 105, 107, 299, 300, 321
majorization principle, 15
mammography, 915–926
asymmetry, 947
compression, 923
hardware, 924
image requirements, 921
technical performance, 923
MAP estimation, 12
margin strength, 945
Markov random field, 12, 439
material description of motion, 531
material properties
bone, 1176
integration, 1193
local, 1155
skin, 1161
soft tissue, 1176
mathematical morphology, 177
Matlab
generating speckle noise, 556
maximum intensity projection, 781, 880–886
maximum likelihood
classification, 108
estimation, 10
### Index 1211

- **estimator**, 533
- likelihood function, 82
- parameters estimation, 82
- maximum probability, 1031
- media, 764
- medial axis, 204, 1025, 1047
- medialness, 879, 880
- median filter, 185
- Metz, Charles, 590
- microcalcifications, 594
- minimum cost, 769
- Minkowski
  - addition, 183
  - subtraction, 183
- modal analysis, see deformable model
- model
  - biomechanical, 688
  - continuum mechanics
    - mathematical regularization, 704
    - myocardium, 688, 693
  - deformable, 681
  - mathematical, 518
  - mechanical, 688
  - multicompartamental, 1144
    - multiple compartments, 1147
    - two compartments, 1144
  - physical, 688
- monotonicity, 14
- morphological
  - filters, 199, 223
    - alternating, 199, 225
    - alternating sequential, 200, 225
  - gradient, 194, 221
    - external, 194, 221
    - internal, 195, 221
  - image analysis, 177–272
  - methods, 175–272
  - operators, 182–200, 206–225
  - reconstruction, 227–237
  - segmentation, 237–260
    - for grayscale images, 246
    - for nonoverlapping particles, 241
  - for overlapping particles, 245
  - skeleton, 205
  - software, 261
- morphometry
  - deformation-based, 1101
  - tensor-based, 1106
  - tissue distribution, 1109
  - voxel-based, 1109
- motion
  - analysis, 659, 1155
  - deformation, 1155
  - descriptors, 1155
  - estimation
    - non-rigid, 679
    - hand, 1155, 1160, 1174
  - modeling, 532
  - neck, 1156, 1173
  - nonrigid, 1156
  - parameters, 1155
  - skin, 1156, 1172
  - types, 1156
- MR, 1009
  - gradient
    - errors, 454, 462, 473
- MRA, 848
- multiple sclerosis, 556
- myocardial wall thickening, 616
- myocardium, 614

### N
- N3 algorithm, 76
- narrow beam, 5
- nearest-neighbor, 287, 298, 299, 306
- Newton-Raphson, 26, 41
- noise, 520, 534, 539
- non-Gaussian speckle, 523
- normal distribution, 586
- null hypothesis, 585, 588
- null space, 533, 544
- Nyquist limit, 620

### O
- object models, 520
opening, 187, 214
  annular, 195
  area, 189, 215
  by reconstruction, 229, 233
  flat, 214
  structural, 188, 214
  top-hat, 221
  translation invariant, 190, 214
opening-by-reconstruction top-hat operator, 235
optical flow
  regularization, 687
  variable brightness, 680
optimization transfer, 15
ordered subsets, 34, 43
over-segmentation, 579
overlapping veins
  suppression, 884
P
p value, 588
paired samples, 589
papillary muscles, 614
parabola surrogate, 17, 39
paraboloidal
  surrogate, 41
  coordinate ascent, 44
  function, 40
parameterization
  automated, 1082
parametric deformable model, see deformable model
parametric meshes, 1079
partial volume effect, 74
pattern
  recognition, 1028
  spectrum, 203, 226
PC MRA, 867
penalized-likelihood, 11
penalty function, 11
perfusion, 1006
  imaging, 1148
peripheral vascular disease, 811
permutation, 1111
PET, 3, 1009
phantom, 535
phase coherence, 314–319
phase encoding, 542
physically-based, 1155, 1159
pixel basis, 9
plaque, 713–776
point distribution model, 161
point spread function, 527
Poisson, 57, 58
positron emission tomography, 3
potential function, 12, 53
power spectrum, 1032, 1034
processing
  bottom-up, 401
  high-level, 400
  image-driven, 401
  low-level, 400
  model-driven, 401
  top-down, 401
Procrustes, 469, 654
PTCA, 713, 757
pulmonary, 1005–1060
  airway centerlines, 1025
  airway measurement, 1023–1027
  airway tree, 1017–1027
  airway tree geometry, 1025–1027
  airway tree measurement, 1023–1027
anatomy, 1006–1007
  applications, 1007–1008, 1028–1050
blood flow, 1038–1040
  chest radiograph, 1034
disease, 1006
fissures, 1017
  function, 1038–1042
  imaging, 1006–1011
mechanics, 1038
microvascular blood flow, 1040
MRT segmentation, 1013–1017
nodules, 1035
perfusion, 1038–1040
radiograph segmentation, 1011–
1013
segmentation, 1011–1027
shape descriptors, 1034–1035
system, 1006
tissue analysis, 1028–1038
tissue density, 1028–1032
tissue density frequency analysis,
1031–1032
tissue fractal analysis, 1032–1034
tissue texture, 1029–1031, 1035–
1038
vascular tree, 1017, 1027
ventilation, 1042
X-ray CT segmentation, 1013
pulse
echo, 520
models, 526
sequence, 538, 540

Q
quadratic penalty, 13
quadtree, 99
quality control, 838
quasi-Newton, 46

R
radiograph, 1011
radiography, 1009
radionuclide imaging, 1009
random coincidences, 6, 49
Rayleigh probability density, 522
receiver operating characteristic, 323,
330, 332
curve, 573
receiver-coil sensitivity, 541
reconstruction
3D, 750, 755
region, 275, 276, 278, 282, 283, 286
growing, 98
splitting and merging, 99
registration, 447–505
definition, 449
intensities, 487–504
2-D-to-3-D registration, 504
atlas registration, 502
capture range, 497–498
correlation coefficient, 489
CT and PET, 501
information theory, 492–493
interpolation, 498, 500
joint entropy, 493–495
MR and CT, 500–501
MR and PET, 501
mutual information, 495–496, 501
nonrigid, 501–502
normalized mutual information,
496
optimization, 496–498
Partitioned Intensity Uniformity,
491, 501
Ratio-Image Uniformity, 490
serial MR registration, 499–500
similarity measures, 488–496
subtraction, 488–489
subvoxel registration, 498
interpatient, 449
intrapatient, 449
methods, 462–504
classification, 450
nonrigid, 430, 432
points, 463–477
curved transformations, 476–477
fiducial, 463, 464, 466
fiducial localization error, 463–
468, 481
fiducial registration error, 467–
474, 476
FLE, 463–468, 481
FRE, 467–474, 476
nonrigid, 473–477
perspective, 474–476
rigid, 469–472
scaling, 473–474
target registration error, 468, 469, 471–472
TRE, 468, 469, 471–472, 486
two-dimensional, 474–477
rigid, 429, 430
surfaces, 477–486
disparity functions, 478–482
distance definitions, 482–483
distance transform approach, 483–484
example, 479
head and hat algorithm, 482
iterative closest point algorithm, 484–485
to an atlas, 1067
weighted geometrical features algorithm, 485–486
regularization, 11
parameter, 52
regurgitation, 611
aortic, 642
relative feature importance, 290–291, 296, 298–301, 304, 306
relaxation
labeling, 116
parameters, 538
respiratory system, 1006
restenosis, 713
reweighted least squares, 49
RF inhomogeneity, 74
RF signal, 309, 312, 313, 315, 317–319, 325
rib cage, 1011, 1038
Rician probability density, 523
rotation
proper, 452, 470
specification, 452–453
round robin, 582
run length, 1036
matrix, 1031
S
sample mean, 586
sampling, 548
scatter, 6, 49
matrices, 290, 296–297, 299–302, 304, 305
plot, 101
scatterers, 312–316
scattering, 308, 309, 311–316, 318, 319
schizophrenia, 1090
score
coronary calcium, 900
scoring, 974
screening, 276–277, 279, 334, 335
active contour, see deformable model
airway tree, 1020–1023
algorithms, 404
anatomic knowledge, 1011–1013
breast, 929
chest radiographs, 1011–1013
correct, 579
defformable model, see deformable model
edge-based, 404
interactive, 691
knowledge-based, 405, 1011–1013, 1022–1023
lesion, 932
model-based, 1013–1017
MRI, 1013–1017
myocardium, 681
pattern recognition, 1011
pulmonary, 1011–1027
region-based, 404
region-growing, 1022
semi-automatic, 1025–1026
snake, see deformable model
thresholding, 1013
X-ray CT, 1013, 1017
self-similarity, 1034
sensitivity, 572
  analysis, 331
  function, 519, 530, 539
separability, 291–296, 304–307
separable
  function, 24, 31, 42
  paraboloidal surrogates, 43
sequential update, 40
shading artifact, 74
shape, 275, 277, 278, 281, 282, 290,
  325, 329, 335, 940
shape analysis, 1109, 1112
shape descriptors, 1034–1035
signal modeling, 515–565
simultaneous update, 40
single photon emission computed tomography, 3
singular value decomposition, 554
sinogram, 7
size, 954
skeleton, 204
  by influence zones, 240
SKIZ, 240
slice selection, 542
snake, see deformable model
spatial
  encoding, 855
  resolution, 11, 52, 855
specificity, 572
specular, 516, 556
SPECT, 3, 1009
spectroscopy, 550
spiculation, 933
spin density, 538
spin-echo imaging, 540
spline, 348, 459–460, 476–477
  basis function, 369
  control vertex, 348
  cubic, 369, 476–477
  tensor product, 369
  thin-plate, 459–460, 477
standard deviation, 586
standard error of the estimate, 586
state vector, 37
statistical
  models, 418
  validation, 663
statistical flattening, 1111
statistics
  first-order, 1036
  steepest ascent, 14
stenosis
  aortic, 638
  valve, 638
stenting, 713
stochastic relaxation, 118
strain, 693, 1155, 1163
  cardiac, 678, 696
  distribution, 1157
  image, 535
  imaging, 530
  levels, 1172, 1173
stress, 1163
  repetitive, 1155, 1158
stroke, 556, 811, 821, 825
stroke volume, 615
structuring element, 183
  cross, 195
  disk, 240
  reflected, 183
  square, 221
  symmetric, 195
structuring function, 210
  flat, 210
  reflected, 210
support, 519, 543
surface, 343–398
  apparent contour, 383
  center of curvature, 358
  curvature, 357
  principal curvatures, 358
  principal directions, 358
  curved surfaces, 348
deformable, 368
edge contraction, 377
error value, 380
error volume, 377
focal surface, 358
from contours, 360
growing, 94
iso-surface, 348
normal section, 357
point set, 345
principal curvatures, 358
principal directions, 358
projection, 387
representation, 345
rib lines, 358
simplification, 376
smoothing, 373
spline, 348
topology, 346
triangular mesh, 346
umbilic point, 358
vertex, 345
surrogate function, 15
susceptibility, 538, 547
synthetic imaging, 546
tissue
abnormal, 1155, 1173
burn scar, 1155, 1157, 1161
characterization, 437, 515–565
human, 1155
properties, 1176
skin movement, 1168
soft, 1155
tensile characteristics, 1168
TOF MRA, 861
tomographic, 3
tracking, 1155
grid, 1180
hand, 1176
intensity-based, 686
shape-based, 685, 692
transformation
geometrical, 451–462
B-spline, 459, 476–477, 502
camera, 456–457, 475–476
curved, 455, 457–460
nonrigid, 454–462
perspective, 456–457, 474–476, 504
projective, 455
rectification, 460–462
rigid, 452–453
thin-plate spline, 459–460
image
atlas to brain, 1068
transit time
mean, 1040
transitive closure, 101
transmission
scan, 3
tomography, 4
transverse magnetization, 540
tree
growing, 880, 881
intracerebral, 883
root, 882
vasculature, 881

T
tagging, 789
texture, 275, 278, 282, 284–287, 309–311, 318, 409, 945, 1029–1032, 1035–1038
thinning, 1046
three-dimensional echocardiography, 620
threshold decomposition, 207
thresholding, 78
iterative computation of, 79
optimal, 79
non-parametric, 79
parametric, 80
shape-based, 78
time-frequency analysis, 516
time-intensity curve, 1040
vessel, 881
triangle, 346
compactness, 366
fan, 346
visible, 383
triangular mesh, 346
boundary, 346
guard, 346
manifold, 346
smooth, 374

true
negative, 571
positive, 571
positive fraction, 572
tumor
analysis, 1132–1150
classification, 1033
imaging, 1131–1151	
treatment planning, 1132–1150

U
ultrasonic beam formation, 526
ultrasound, 516, 813, 1009
A-mode, 815–817
artifacts, 762, 818
B-mode, 527, 814, 816, 817, 820,
821, 823, 824, 830, 835–837
backscatter, 761
brachial, 834–848
carotid, 821–834
imaging, 814–821
interfaces, 765, 820
intravascular, 757–784
quantitative, 760
M-mode, 618
physics, 814
under-segmentation, 579
unsharp masking, 749

V
validation, 698
angiography, 729
fusion, 781
implanted markers, 703
synthetic images, 703
techniques, 567–607
valve
aortic, 614
mitral, 611, 645
pulmonic, 614
regurgitation, 642
tricuspid, 611
valves, 611
valvular heart disease, 635
variable projection method, 554
vascular
analysis, 811–905
disease, 848
imaging, 811–905
reactivity, 834
vein
femoral, 889
iliac, 889
ventilation, 1006
ventricle, 611
left, 611
right, 611
ventricular
chamber volume, 615, 785
shape, 633
ventriculography
left, 784
quantitative, 791
vertex, 346
regular, 346
singular, 346
virtual
bronchoscopy, 1042–1050
dentistry, 1042
viscous fluid deformation, 433
volume
cell, 349
polygonizing, 349
decomposition
hexahedral, 349
tetrahedral, 350
regular, 349
voxel, 349
coding, 1084
VRML, 780

W
wall motion, 630, 788
warping, 533
  acceleration, 1075
  algorithms, 1069
  continuum-mechanical, 1072
  fluid, 1074
  intensity-driven, 1069
  Navier-Stokes equations, 1073
  neural nets, 1076
  polynomial mappings, 1072
wash-in curve, 1042
wash-out curve, 1042
watershed transform, 241
  for grayscale images, 246
  for nonoverlapping particles, 241
  for overlapping particles, 245
wavelets, 549

X
x-ray
  angiography, 812
x-ray computed tomography, 3, 812
x-ray CT, 1009–1011
xenon-enhanced CT, 1042

Z
zero-filling interpolation, 872