Index

A

Adapted clusterings, transversal voxel layer, 147
Adaptive clustering method, IMRT plan optimization, 133
American Cancer Society (ACS), 25, 27
Antiepileptic drugs (AEDs), 328, 329
Artificial neural networks (ANN), 401
Automated Seizure Warning System (ASWS), 331

B

Beam's-eye view (BEV) approach, 57
Blind Source Separation (BSS), 254
Brain chaos, EEG time series
  electrode sites, 332–333
  pre-seizure patterns, 331
  sequential epochs, 332
Breast cancer screening, optimization models
  ACS policy recommendations, 49
  clinical symptoms and treatments, 26
  cost-effectiveness of, 27
  decision process, 46–47
  disease development and progression
    Markov assumptions, 44
    non-invasive *vs.* invasive, 45
    state transition diagram for, 44–45
  lumpectomy and mastectomy, 46
  mammogram recommendations
    potential benefits and risks, 30
    for women, increased risk, 29
  mammography techniques
    efficacy and mathematical, 28–29
    malignant cancer cells, 27
    in situ and invasive, 28
  patient condition monitoring
    Bernoulli distributions parameters, 46
    and decision making, 45
  policy and quality of, 48
  and treatments, 47

C

Cardiovascular diseases, 26
Chebyshev approximation problem, 94
Classification and regression trees (CART), 419
  nearest-neighbor methods, 419
Clinical breast exam (CBE), 45, 46
Clustering via concave quadratic programming (CCQP)
  advantages of, 347–348
  QIP problem, 347
Clustering via MIP with quadratic constraint (CMIPQC), 348
Cold ischemia time (CIT), 2, 15, 16
Complexity theory
  insertion supernode/substitution supernode, 312
  3-layer supergraph, 313
  $\Sigma-$cross, 312
Conformal radio therapy, 169
Convex hull of individual minima (CHIM), 143

D
DAMIP model, Mixed-integer programming (MIP), 405, 418–419
Data mining (DM), 326, 333
  microarray data analysis, 359, 360, 372–375
Data representations, optimization techniques
  applications
    mixed signals and normalized scatterplot, 276–277
    original source and mixed signals, 278
    SCA to fMRI data, 279–287
    subspace clustering algorithm, 276–278
  independent component analysis (ICA)
    BSS linear, separability, 259–263
    fixed point algorithm, 258–259
    global Hessian diagonalization, kernel-based density, 263–266
    infomax algorithm and Kullback –Leibler divergence, 267
    log-likelihood, 266
    natural gradient algorithm, 267–269
    network entropy, 266–267
    non-Gaussianity maximization, 254–258
  sparse component analysis and blind source separation, 269–272
    mixing matrix identification, algorithm, 272
    orthogonal m-planes clustering algorithm, 275–276
    sources identification, 272–273
    subspace clustering algorithm, 273–274
Directed acyclic graph (DAG), 401
Direct kidney exchange, 20
Divide and Conquer algorithm, 394
Dose-volume (DV)
  conditions, 104
  constraints, 102
Dose-volume histograms (DVHs), 53, 71
  control techniques
    3DCRT and, 67
    norms, choice of, 67
    NP-hard problem, 66
    OAR and, 69
    parameters, 68, 70
    PTV and, 67–68
    wedges, 69, 71
  curve, 135
  dose distribution, 135–136
  requirements and techniques, 103
  treatment plan, 66
Ductal carcinoma *in situ* (DCIS), 44–45
Dynamic index policy, 18–19
Dynamic multileaf collimator (DMLC), 171

E
Electroencephalograms (EEGs)
  events and signals, 329, 332
  pre-seizure and normal, 340
  recordings and samples, 330, 332
  seizure development process, 326
  seizures prediction, 329–330
Epilepsy, optimization and data mining
  brain functions, 326
  electrode selection and detection, 349–350
  epileptic brain clustering
    CCQP, 347–348
    CMIPQC, 348
  false-positive rate, 350
  neurologic dysfunctions, 325
  normal and epileptic EEGs
    entropy three-dimensional plots, 334
    multiclass problems, 333
  novel techniques, 348
  real seizure precursors, 349
  repetitive and predictive patterns, 33
  seizure precursor detection
    epileptogenesis process, 340
    FSMC, 344–346
    FSMQIP, 343–344
    FSQIP, 341–343
    Ising model, 341

support vector machines (SVM), 338–340
TSSNNs, 334–338
Equivalent uniform dose (EUD), 134–135, 157–158, 160
functions and constraints, 106
models and concepts, 105
Niemierko's concept, 136
predicted and resulting changes of, 113–114
Euler–Lagrange equations, 247
Evolutionary trees
cluster analysis, 293–294
neighbor joining
Expectation-maximization (EM) algorithm, 306
Extreme compromises, scalar problems, 139–140

F
Feature selection via maximum clique (FSMC)
brain connectivity and graphs, 344–345
clique problem, 345–346
eigenvalues, 346
electron, prediction performance, 345
Feature selection via multi-quadratic integer programming (FSMQIP)
mathematical model for, 343
seizure precursor patterns, 344
Feature selection via quadratic integer programming (FSQIP)
brain network, 341
branch-and-bound method, 342
epileptic seizures predictability analysis, 343
T-index curve, 342–343
fMRI analysis, 266
fastICA result, 284, 286
non-independent and *non-sparse* source signals, 279
orthogonal m-planes clustering algorithm, 285
setting, 282
Sparse Component Analysis (SCA) application in
real data, 281–287
toy data, 279–281

G
General linear model (GLM), 279
General multiple function classification (GMFC), 396
General single function classification (GSFC), 396, 409
Gene regulation matrix (GRM), 371
Genetic Algorithms (GA), 306
Genomics analysis algorithms
DNA sequence
base pairs, 292
nucleotides, 291
Multiple sequence alignment (MSA) and, 300–307
novel graph-theoretical–based, 307–308
complexity theory, 311–316
conflict graph, construction, 310–311
errors, 308
evolutionary distance problem, 308–309
integer programming formulation, computational model, 316–318
MWCMS model, 307, 316
sequencing by hybridization, 308
phylogenetic analysis
evolutionary tree, 292
maximum likelihood methods, 298–300
pairwise distance based methods, 293–295
parsimony methods, 295–296
tree terminology, 293
Gibbs sampler approach, MSA, 306
Gross tumor volume (GTV), 113

H
Helical tomotherapy, 170–171
Hidden Markov model (HMM), 306
Human Iteration Loop
scalarization, 129–130

I
Image registration, energy minimization
  Gauss maps, 214–215
  image sequences process
    fixed boundary conditions, 225–226
    pairwise procedures, 226
    transformations in, 225
  intensity scaling, 229–230
  magnetic resonance and computed tomography, 213–214
  numerical methods
    boundary value problems, 226
    geometric multigrid formulation, 227
    nested finite elements spaces, 227–228
  optimality conditions
    Eulerian and Lagrangian fashion, 223
    finite displacements, 224
    landmark constraints, 224–225
    Lebesgue square integrable derivatives, 222
  raw magnetic resonance, 231
  registering and interpolating methods, 214
  regularity measures
    non-linearized elastic potential, 221
    plate spline functions, 220
  scaling functions, 215
  similarity measures
    finite displacements, 217–218
    joint entropy, 219
    optical flow equations, 218
    parametric registration, 220
    squared differences, 217
  transformation, 230
  variational framework
    curvilinear coordinate system, 216
    optical flow field, 217
    rectangular spatial coordinates, 215–216
Image segmentation, energy minimization
  edge detection and multiscale principle, 232
    variational methods, advantages of, 231
  geodesic active contours, 235
  level-set method
    advantages, 235
    Hamilton–Jacobi equation, 237
    topological changes, 235–236
    zero-level set of, 236
  region and edge growing
    hybrid growing methods, 232
    traveling salesman problem, 233
  snake model
    drawbacks of, 234
    edge detector, 234
Incentive-compatibility (IC), 20
Increasing failure rate (IFR), 8, 9, 11
Independent Component Analysis (ICA), 253
Indirect kidney exchange, 21
Integer programming (IP), 304, 317, 318, 395
Intensity modulated proton therapy (IMPT)
  approaches and algorithms, 110–112
  passive scattering techniques, 109
  spot scanning (SC) technique, 109–110
  treatment planning tools, 110
Intensity modulated radiation therapy (IMRT), 54–56
  asymmetry property, 123
  beam setup and intensity maps, 160–161
  compensator-based, 170
  database, navigation, 148
    decision-making, 156–157
    ideal point, minimum values, 150–151
    nadir point, maximum values, 151–152
    possible extensions, 154
    restriction mechanism, 149
    selection mechanism, 152–154
    user interface, 154–156
  head-and-neck cancer
    locking an organ, 160
    navigation screens, 159
    salivary glands and, 158

multicriteria optimization
inverse treatment planning problem, 134–136
multiobjective linear programming, 134
Niemierko's EUD concept, 136
Pareto boundary, approximation, 140–144
Pareto solutions and planning domain, 136–137
prostate case, 133
solution strategies, 138–140
weighted sum method, 134
numerical realization, 144
adaptive clustering method, 145–147
beamlets, 145
cluster hierarchy, 146
intensity map, 145
inverse treatment planning problem, asymmetry, 147–148
transversal voxel layer, hierarchical clustering, 146
prostate cancer, 157
EUD target, standard deviation, 158
research topics, 161–162
tomotherapy based, 170–171
treatment planning problem
beam arrangement and orientation, 124, 126
forward treatment planning, 127
gantry movement, 124
intensity maps, 126
radiotherapy, 123
setup geometry optimization, 125
treatment planning process, 171
virtual engineering process, optimization
boundary shape, convey methods, 131
concept, 128
design problem, spaces, 128
linear programming, asymmetry, 132–133
multicriteria optimization problem, 129–130
parameters, 132
Pareto optimal, 129

Intensity modulated radiotherapy (IMRT) treatment planning
applications and algorithms of, 112
concepts and algorithms, 90–91
convex problems, 91
3D spot scanning technique, 87
EUD predicted changes, 113
inverse approaches for, 84, 89
optimization models
barrier-penalty multiplier method, 106
beamlet weights, 84
BFGS method, 99
dose bound constraints, 91–93
dose-volume histogram function, 99
DV constraints and conditions, 103–105
elastic constraints, 93–94
HYPERION software, 107
linear approximation, 94–95
MILP programs, 103
multicriteria, 86, 98–100
nonlinear conditions, 100–107
Pareto minimal point, 98
partial volume conditions, 102–105
piecewise models and extensions, 95–98
probability functions and, 101–102
solution and goals, 100
uniform dose conditions, 105–106
pencil beam kernels, 88
radiation field and body, 87
sensitivity analysis
lagrange multipliers, 108
multicriteria approaches, 108–109
optimization tool, 107
techniques of, 90
tools for, 86
Invasive ductal carcinoma (IDC), 45

J
JADE algorithm, 266
Jukes–Cantor distance, 293

K
Kidney
allocation system
cadaveric classes, 3

Kidney (*Continued*)
optimization, 16–22
zero-antigen mismatch, 3–4
transplantation and optimization
increasing failure rate (IFR), 8
Markov decision process (MDP) model, 8–9
optimal stopping problem, 7–8
Kuhn–Tucker theorem, 36
Kullback–Leibler divergence, 267

L
Lagrange equation, 258
Lexicographic max-ordering problem, 140
LINDO optimization software, 389
Linear discriminant function (LDF), 389
Linear programming (LP), 75
techniques, 339
Linear programming (LP) models
dose bound constraints
inverse approaches, 91
normal-tissue volumes, 92
problems and treatments, 93
elastic constraints
Chebyshev approximation problem, 93–94
treatment goals, 93
partial-volume constraints, 94
Linear programming (LP) models classification models
multigroup
disease diagnosis and, 393
error-minimizing separation, 392
single discriminant function, 391
two-group
applications of, 390
binary digits cell representing, 391
computational studies, 387
multiple solutions, 389
normalization approach, 388
Linear program with equilibrium constraints (LPEC), 398
Liver
allocation system
factors for, 4–5
MELD system, 5–6
schematic representation, 6–7
transplantation and optimization
living-donor, 10
Markov decision process (MDP) model, 11–12
optimal stopping problem, 9–10
Longest common subsequences (LCS), 316–317
complete paths, 310–311
Lymphoepithelioma, 158

M
Magnetic resonance imaging (MRI), 29
Mammography screening optimization models
applications of, 48–49
breast cancer treatments, 48
cost-effectiveness of, 30, 49
limitations of, 32
machine-learning techniques, 33
Markovian stochastic process, 31–32
and treatment policies, 30
tumor growth rates, 31
Marcinkiewics's theorem, 261
Markov decision process (MDP) model, 8, 11
Mathematical programming approaches
Bayesian inference and classification
prior probability distribution, 384
treatments, 383
classification models, 386
linear programming, 387–393
mixed-integer programming, 393–397
nonlinear programming, 397–399
progress, 420–422
support vector machine (SVMs), 399–401
discriminant functions
Bayes decision rules, 386
homoscedastic model, 385
parameter values, 384
learning, training, and cross-validation
attributes for, 382–383
classification matrix and rules, 383
quantitative measurements, 382

pattern recognition, discriminant analysis, and statistical, 382
support vector machines, 386
Mathematical programming (MP), 372
Maximum Clique Problem (MCP), 345
Maximum likelihood (ML)
evolution model, 298
hill-climbing algorithm, 300
tree likelihood, 298
conditional likelihood, 299
simple tree, 299
Microarray data analysis, mathematical programming approaches
biology and
cDNA and oligonucleotide microarrays, 358
genetic information, expression stages, 357
empty spaces, feature selection, 366–367
gene expression data
clustering and classification, 359–360
mathematical programming formulations, 360–363
multiclass support vector machines, 363–365
tissue classification, 360
gene selection and tissue classification, 368–369
e-constraint method, 368
mixed integer (non) linear optimization, 368
large-scale mixed-integer (non)linear optimization theory, 372
regulatory networks
generic network modeling, multicriteria optimization, 371–372
mixed-integer formulations, 370–371
research
biological constraints incorporation, 373
empty spaces analyzation and uncertainty considerations, 374
global optimization, 373–374
interpretation and visualization, 375
large-scale combinatorial and multiobjective optimization, 373
mixed-integer dynamic optimization, 374–375
multiclass problems, 374
reformulations, 375
support vector machines (SVMs) and, 362–363, 365–367
tissue classification, 359
Minimizing the maximum deviation (MMD), 387–389
Minimizing the sum of deviations (MSD), 387–390
Minimizing the sum of interior distances (MSID), 289, 387
MINSEPARATION algorithm, 178–181
MIN-TNMU algorithm, 209–210
Mixed-integer linear programming (MILP)
binary variables, 85
leaf sequencing, 86
Mixed-integer programming (MIP), 63, 71–73, 78
algorithm, upper and lower bounds, 75
Mixed-integer programming (MIP) classification models
Bayes optimal rule, 401–402
DAMIP model, 405, 418–419
discrete support vector machine predictive models
model variations, 406–409
novel classification model, features, 402
reserved judgment region modeling, 403
validation and computational effort, 409
medical and biological applications
biomarker analysis, atherosclerosis, 415–416
cell motility and morphology data, human lung carcinoma, 413
drug delivery, ultrasonic-assisted cell disruption, 414

Mixed-integer programming (MIP) classification models (*Continued*)
erythemato-squamous disease, determination, 410–411
fingerprinting native and angiogenic microvascular networks, 416–417
heart disease, prediction, 411–412
human cancer, CpG island methylation, 411–413
protein localization sites, prediction, 417–418
sarcoma, tumor shape and volume, 414–415
soil types determination, 418
misclassified observations, 393
multigroup
misclassifications, 396
parametric procedures, 397
SVM predictive models, 402–409
two-group
binary variables, 393
discriminant function, 395–396
procedures and algorithms, 394
Mnimum weight common mutated sequence (MWCMS), 309, 310, 315
Model for End Stage Liver Disease (MELD), 5, 6
Molecular Phylogenetics, 293
Monitor units (MUs)
left and right leaves, 174–175
Multileaf collimators (MLCs), 83, 124–125, 144, 161
beam angles and parameters, 85
field shapes, 89
limitaitons, 106
tungsten leaves, 88
uses of, 84
Multileaf collimators sequencing, algorithm
dynamic multileaf collimator (DMLC)
multiple leaf pairs, 191–195
single leaf pair, 188–191
field splitting with feathering
field matching problem, 202
hot and cold spot, 203
profile splitting, 204–206
split point, 203
field splitting without feathering
multiple leaf pairs, optimal, 199–201
one leaf pair, optimal, 196–199
models and constraints
dynamic multileaf collimator (DMLC), 172
leaves cross section, 172–173
segmental multileaf collimator (SMLC), 171–172
problem description, 169–171
segmental multileaf collimator (SMLC)
multiple leaf pairs, 177–188
single leaf pair, 173–177
segments minimization, 206
Engel algorithm, 209–210
Langer algorithm, 207–209
MULTIPAIR algorithm, 177–178, 184
Multiple sequence alignment (MSA)
alignment approaches, 301–303
dynamic programming, 301
graph-based algorithms
Eulerian path approach, 305
maximum-weight trace, 304–305
minimum spanning tree and traveling salesman problem, 305
iterative algorithms, 305
deterministic, 307
probabilistic, 306
progressive algorithms
schema, 303
shortcomings of, 303–304
scoring alignment
independent columns, 301–302
scoring matrices, 302
sequence analysis problems, 300
Multi-Quadratic Integer Programming (MQIP) problem, 341
CPLEX and XPRESS-MP solvers, 344
Multisurface method tree algorithm (MSMT), 390, 392
Mumford–Shah functional approaches
approximation techniques, 247
Edge detector–based segmentation, 246

image segmentation model, 245
level-set method, 246–247
Newton-type methods, 248

N
Nadir point
convex maximization problem, 151–152
Neighbor Joining (NJ)
general schema of, 295
modified distance matrix, 294
NMR brain imaging techniques, 279
Nonlinear programming classification models, 398–399
Nonlinear programming (NLP) method, 95
Normal tissue complication probability (NTCP), 54, 65, 136
Normal tissue control probability (NTCP), 101

O
One-against-all (OAA) classifier, 363, 365
One-against-one (OAO) classifier, 364–365
Organ allocation and acceptance, optimization
kidney
classes of, 3
zero-antigen mismatch, patient and, 3–4
liver, 4
adult and pediatric patients, 4
schematic representation of, 6–7
UNOS Status 1 and Model for End Stage Liver Disease (MELD) scores, 5
patients
kidney transplantation, 7–9
liver transplantation, 9–12
societal
kidney, 16–22
Markov chain, 13
Poisson process, 12–13
Organ Procurement Organizations (OPOs), 2–4, 15–17, 19
Organs-at-risk (OARs), 53, 55, 66, 83, 84, 87, 88, 92, 99, 102, 104–107, 110, 112, 113
DVH control, 69
Ovarian cancers, 26

P
Panel-reactive antibody (PRA), 3, 4
Panning target volume (PTV), 83, 84, 87, 88, 91, 92, 96, 99, 101, 102, 104, 105, 107, 111–114
Pap smears prostate tests, 26
Parametric misclassification minimization (PMM) procedure, 398
Pareto set, Intensity modulated radiation therapy (IMRT), 129
Parkinson's disease, 329
Parmigiani
disease-associated factors, 42
transition probabilities, 41
Parsimony methods, tree building
score computation, 296–297
tree topologies, 297–298
Partial differential equation (PDE), 237
Partially observable Markov decision process (POMDP), 34
Partial volume (PV) constraint, 85, 104, 106, 108, 112
Paul Scherrer Institute (PSI), 110
Payback debt, 3–4
Person years of life lost (PYLL), 33
4D-Planning, organ geometry, 161
Planning target volume(s) (PTVs), 83, 84, 87, 88, 92, 99, 104, 105
Poisson process, 8, 12
Prostate cancer
and Intensity modulated radiation therapy (IMRT), 157–158
PTV (Planning Target Volume), 59–61, 64–65, 69–74
DVH control, 67–68
isodose lines and, 76–77

Q
Quadratic discriminant function (QDF), 389

Quadratic programming (QP) problems, 95–98, 101
Quality-adjusted life expectancy (QALE), 8–9
Quality-adjusted life years (QALYs), 16, 17
Quality of life (QOL), 17

R
Radiation therapy treatments
  computed tomography and medical tools, 83
  forward and *inverse* approach, 84
  linear accelerator, 84
RAGNU software package, 389
Randomized control trials (RCTs), 27, 30
Reformulation-linearization techniques (RTLs), 341
Robust linear programming (RLP), 390

S
Scientific Registry of Transplant Recipients, 2
Screening examination models
  Kirch and Klein
    age-specific incidence rates, 37
    disease detection point, 35
  Ozekici and Pliska
    age of detection, 41
    dynamic programming, 39
    Markov decision chain, 40
  Shwartz
    lymph-node involvement levels, 37
    policy evaluation, 39
    risks in, 38
    tumor growth rate, 38–39
  Zelen
    possible states, 42
    screening programs, 43
    stable disease, 44
Segmental multileaf collimator (SMLC), 171
  algorithms for, 173–188
  leaf trajectory, 174
  multiple leaf pairs
    optimal algorithm with inter-pair minimum separation constraint, 178–181
    optimal schedule, without minimum separation constraint, 177–178
    tongue-and-groove effect, elimination, 181–188
  single leaf pair
    leaves movement, 174–175
    optimal unidirectional algorithm, 175–177
Seizure prediction
  clinical syndromes, 326
  epileptogenesis mechanisms, 328
  onset and spread of, 327
  research motivations
    diagnosis and treatment, 328–329
    intracranial electrodes, 329
    phase synchronization measure, 330
    respective surgery, 328
    temporal changes and properties, 331
  types of, 327
Sequential Quadratic Programming (SQP) method, 101
Shape optimization
  edge detector–based segmentation
    Eulerian semiderivative, 240
    Hadamard–Zolesio structure theorem, 242
    perturbation vector fields, 243
    sensitivity analysis, 238
    technical assumptions, 241
  level-set–based descent framework
    Armijo-type line search procedure, 245
    zero-level set band, 244
  Mumford–Shah functional approaches, 245–248
Shortest common supersequences (SCSQ), 316, 317
Shortest common superstring (SCST), 316, 317
Simulated Annealing (SA), 306
SINGLEPAIR algorithm, for SMLC, 175–177
Skitovitch–Darmois theorem, 254

Sparse Component Analysis (SCA), 253
in fMRI toy data, 279
analysis, 282
denoised source signals, 281
NMR brain imaging techniques, 279
non-independent and *non-sparse* source signals, 279–280
recovered source signals, 280–281
in real fMRI data
Blind Signal Separation, 282–283
recovered source signals, ICA, 282
Spot scanning (SC), 86, 87, 109, 110
Spread-out Bragg peak (SOBP), 109
Successive linearization algorithm (SLA), 399
Support vector machines (SVMs)
data points, 400–401
EEG classification framework, 338–340
gene selection
heat maps, 367
recursive feature elimination procedure, 367–368
Lagrange multiplier, 400
microarray data, classification
gene functionality, 365–366
molecular cancer, 365
misclassification errors, 339
multiclass classifiers
OAA and OAO, 363–365
procedure of, 338
regularization theory and, 362

T

Tchebycheff problem, 139, 144, 148
Three-dimensional Conformal Radiation Treatment (3DCRT), optimization, 55
beam
angles, 61–62
shape generation and collimator, 57
weights, 59–61
external-beam radiation treatments
dose-based and biological models, 54
machine, 54
hot and cold spots, 55
IMRT plan optimization and, 56
multiple beams, effect of dosage distribution, 56
radiation therapy, 53
radiation treatment procedure, 58
solution quality
Dose-volume histogram (DVH), 65–66
solution time reduction techniques
isodose plots, 77
normal tissue voxel reduction, 72–73
three-phase approach, 73–77
treatment planning process, 58
input data, 59
upper bounds on beam weights, computation, 65
stringent bound, calculation, 64
wedge filters
heel and toe, 57
universal wedge, 58
wedge orientations, 62
algorithm, 62
postprocessing technique, 63
Time series statistical nearest neighbors (TSSNNs)
abnormal activity and seizure pre-cursors, 338
classification results of, 336–338
EEG epoch, seizure classifications, 335–336
TONGUEANDGROOVE algorithm, 184–187, 201, 209
Top Trading Cycles and Chains (TTCC) mechanism, 21
Total number of monitor units (TNMU), 210
admissible segmentation pair, 210
I complexity C(I), 209
Traveling Salesman Problem (TSP), 305
Treated cancer-free (TrNC), 47
Tumor control probability (TCP), 54, 65, 101, 136

U

United Network for Organ Sharing (UNOS), 1–6, 9, 17, 19

Unweighted Pair Group Method using Arithmetic averages (UPGMA), 294

V
Virtual engineering, 123, 127–129, 132, 133
Volumes of interest (VOIs), 133, 142, 144, 155, 158, 160
  biological impact, 136
Voxels, 135

W
Wedge filters, 57–58