

Index

A

A* algorithm, 71
Abstract architecture, 58
Accelerated non-linear dynamic sampling, 97
Accumulating sampling, 172
Ackley function, 27
Action, 58
Active inequality constraints, 5
Agent, 57
Aging, 171
Ahrens and Dieter method, 193
Approximate pareto front, 261
Artificial neural networks, 73
Attractiveness, 313
Auction, 78
Autonomy, 61
Average path traversed, 223
Average total path deviation, 223, 225
Average uncovered target distance, 226

B

Bayesian frequent data mining, 135
Behavioral modules, 64
Belief–desire–intention, 64
Bergmann multiple pair-wise comparisons, 217
Best first search, 71
BFGS algorithm, 9
Binomial crossover, 24, 176
Binomial distribution, 24
Bio-geography based optimization, 135
Bonferroni post-hoc analysis, 209
Box-Muller method, 193
Box-pushing, 247
Breadth-first search, 71

C

Cauchy noise, 193
Cauchy noise model, 148
Centralized planning, 78, 220
Centroid fitness estimation, 125
Chaotic logistic map, 137
Characteristic behavior, 58
Chromosomes, 12, 13
Cognitive map, 72
Combined non-linear dynamic sampling, 98
Communication protocols, 74
Competition, 75
Competitive sampling, 96
Condition-action rules, 68
Confidence-based dynamic resampling, 115
Constrained optimization, 2
Continuous environments, 62
Contract net, 77
Controlled randomization, 136
Convergence model, 134
Cooperation, 75
Cooperative planning, 78
Coordination, 57
Correlated equilibrium, 79
Cost function, 1
Coupled sampling, 96
Covariance matrix adaptation, 140
Critic, 73
Crossover, 11, 23, 249
Crossover probability, 17
Crossover rate, 24
Crossover site, 17
Crowding, 175
Crowding distance, 38, 39, 248

Cumulative probabilities, 16

D

D* algorithm, 71
 Darwinian principle of the survival of the fittest, 11
 Decelerated nonlinear dynamic sampling, 97
 Decentralized planning, 78
 Decision variables, 1
 Deduction rules, 63
 Delayed trigonometric noise model, 154
 Deliberate agents, 63
 Deliberation, 65
 Depth-first search, 71
 Design parameters, 1
 Deterministic environment, 62
 DFP algorithm, 9
 Difference vectors, 23
 Differential evolution, 20, 136, 176
 Differential evolution for multi-objective optimization, 247
 Dijkstra's algorithm, 71
 Direct planning, 71
 Direct search, 135
 Discrete environment, 62
 Distance-based dynamic sampling, 113
 Distributed artificial intelligence, 74
 Distributed data and control, 76
 Distributed planning, 78, 221
 Divergence model, 134
 Dominance-dependant lifetime, 141
 Dominate, 38
 Dominating sets, 318
 Domination strength-based sampling, 100
 Donor vector, 22, 176
 Dynamic environments, 62
 Dynamic optimization, 91
 Dynamic sampling, 94

E

Effective fitness estimation, 122, 123, 179
 Elitism, 38
 Empirical cumulative distribution, 150
 Employed bee, 310, 315
 Episodic environment, 62
 Equality constraint, 1
 Equilibrium, 79
 Error ratio, 45, 151, 263
 Estimation-of-distributed algorithm, 131
 Estimator, 219
 Euclidean norm, 314
 Evolutionary algorithms, 10
 Evolutionary gain, 131
 Evolutionary loss, 131

Evolutionary progress principle, 130
 Evolutionary strategy, 129, 140
 Expected run-time, 149
 Experiential-learning-directed perturbation, 133
 Explicit memory, 126
 Exponential crossover, 24, 176
 Exponential noise, 193
 Extended averaging, 244
 Extended exploration, 136

F

Feasible search space, 1
 Finner post-hoc analysis, 209
 Firefly algorithm, 313
 Firefly algorithm with non-dominated sorting, 317
 First-order predicate logic, 63
 Fitness, 10, 90
 Fitness approximation, 91
 Fitness-based dynamic resampling, 106
 Fitness estimate in local neighborhood, 183
 Fitness inheritance, 127
 Fitness samples, 93
 Fitness variance adaptive mutation, 181
 Fitness variance in local neighborhood, 110, 184
 Footprint of uncertainty, 125
 Friedman aligned test, 212
 Friedman test, 202, 274
 Fully observable environment, 62
 Function error value, 44, 195

G

Gamma noise, 193
 Gaussian noise model, 148
 Gene adaptation selection strategy, 134
 Genetic algorithm, 12
 Genetic operators, 12
 Global best, 29, 313
 Goal-based agent, 70
 Golden selection search, 137
 Gradient, 2
 Gradient descent algorithm, 5
 Grid formation, 316

H

Hebbian learning, 72
 Hessian matrix, 7
 Hierarchical task networks, 78
 Hill climbing, 137
 History of search, 126
 Hochberg post-hoc analysis, 209
 Holland post-hoc analysis, 209

Holm multiple pair-wise comparisons, 217
 Hommel post hoc analysis, 209
 Horizontal layering, 67
 Hybrid sampling, 109
 Hypervolume ratio, 45, 151, 263
 Hypothesis test, 194

I

Iman-davenport test, 209, 274
 Implicit averaging, 128
 Independent sampling, 94
 Index set, 5
 Individual sampling, 97
 Information gathering, 61
 Initial population, 11
 Interaction protocols, 74
 Internal architecture, 63
 Internal sampling, 129
 Internal state, 69
 Interval type-2 fuzzy set, 125, 173
 Inverse transform sampling, 193
 Inverted generational distance, 44, 150, 261
 Iterative deepening, 71

J

Jacobian matrix, 3

K

Kalman-extended genetic algorithm, 140
 Karush–Kuhn–Tucker theorem, 5
 Khepera-II, 222, 292
 Knuth method, 193

L

Lagrangian function, 4
 Lagrangian multiplier vector, 3, 5
 Lagrange's theorem, 3
 Layered architecture, 66
 Learning, 57, 61, 71
 Learning agent, 73
 Learning element, 73
 Likelihood correction, 148
 Linear congruential pseudo random number generator, 193
 Linear programming, 2
 Li post-hoc analysis, 209
 Local model-based search, 138
 Local neighborhood formation, 183
 Local optimum, 2
 Local planning and merging, 79
 Logical deduction, 63
 Logical formulae, 63
 Logic-based architecture, 63
 Logic-based reasoning, 64

Logistic growth, 98
 Logistic-growth noise model, 152
 Long-term memory, 65
 Lower membership function, 126

M

Machine intelligence, 64
 Market mechanism, 77
 Market simulation and economics, 78
 Maximum-likelihood gaussian model, 131
 Maximum stagnation interval, 137
 Mean fitness estimate, 93
 Means-end reasoning, 65
 Measurement, 243
 Measurement noise, 83
 Mediator function, 67
 Memory-based fitness evaluation, 126
 Meta-model, 90
 m-level dynamic resampling, 104
 Model-based reflex agent, 69
 Modified probabilistic crowding, 189
 Monte Carlo integration, 93
 Moving average, 136
 Multi-agent coordination, 75
 Multi-agent environment, 62
 Multi-agent learning, 79
 Multi-agent planning, 77, 78
 Multi-agent Q-learning, 80
 Multi-agent system, 74
 Multi-objective genetic algorithm, 43
 Multi-objective optimization, 35
 Multi-objective particle swarm optimization algorithm, 316
 Multi-objective sampling, 95
 Multi-robot path-planning, 217
 Mutation, 11, 176, 248
 Mutation probability, 18
 Mutation site, 19
 Mutation strength, 129
 Mutation strength adaptation, 134

N

Nash equilibrium, 79
 Negotiated planning, 78
 Negotiation, 75
 Neighborhood restriction parameter, 142, 255
 Nemenyi multiple pair-wise comparisons, 217
 Newton's method, 7
 Niche pareto genetic algorithm, 43
 Nicheing, 175
 Noise analysis selection, 117
 Noise strength, 129
 Noisy ambience, 307
 Noisy optimization problems, 89

- Noisy single-objective optimization problem, 171
- Non-dominated sorting bee colony, 315
- Non-dominated sorting genetic algorithm-ii, 38
- Non-monotonism, 64
- Nonuniform fitness interval, 124

- O**
- Objective function, 1
- Offspring, 17
- Omniscience, 61
- One-shot sampling, 95
- Onlooker bee, 311, 316
- Opposition-based learning, 173
- Optimal computing budget allocation, 118
- Optimal solution, 1
- Optimization, 1
- Organizational structure, 77
- Orthotopes, 136

- P**
- Parametric constraints, 33
- Parent, 17
- Parental selection, 175
- Pareto archived evolution strategy, 43
- Pareto co-ranking, 143, 255
- Pareto fronts, 38, 249
- Pareto optima, 38
- Partial global planning, 79
- Partially observable environment, 62
- Particle swarm optimization, 27, 311
- Pattern search, 129
- Penalty coefficient, 34
- Penalty function, 34
- Penalty methods, 34
- Percept, 59
- Perception, 57, 59
- Performance element, 73
- Performance measure, 61
- Personal best, 29, 312
- Phenotype, 133
- Planning, 57
- Planning by learning, 71
- Poisson noise, 193
- Population, 10
- Population diversity, 152
- Possibilistic archiving, 134
- Possibility and necessity, 134
- Probabilistic dominance, 144
- Probabilistic pareto ranking, 244
- Probabilistic truncation of extended population, 146
- Problem generator, 73
- Progress-based dynamic sampling, 112
- Progress coefficient, 130
- Progress factor, 112
- Purely reactive, 58

- Q**
- Quade test, 209
- Quad tree, 71
- Quantification of uncertainty, 140
- Quartile skewness, 147
- Quasi-Newton methods, 8

- R**
- Random noise, 193
- Rank-based sampling, 101
- Rank-based selection, 140
- Rank-one correction, 9
- Rastrigin function, 20
- Rational, 61
- Rationality, 61
- Rayleigh noise, 193
- Reasoning, 57, 64
- Rechenberg's 1/5-th success rule, 35
- Reference point based non-dominated sorting genetic algorithm-ii, 112
- Regular points, 3, 5
- Reinforcement learning, 80, 177
- Repository, 316
- Restricted Boltzmann machine, 148
- Reward/penalty, 187
- Ring topology, 138
- Robust optimization, 90
- Rolling tide, 141
- Rom post-hoc analysis, 209
- Roulette wheel strategy, 15

- S**
- Sample size, 91, 93
- Sample standard deviation, 93
- Sampling, 91
- Scale factor, 23
- Scale factor local search, 136
- Scout bee, 311, 316
- Selection, 89
- Selection probability, 14
- Self confidence, 30, 312
- Sensing, 57
- Sequential environment, 62
- Sequential sampling, 95
- Shaffer multiple pair-wise comparisons, 217
- Short-term memory, 65
- Side constraints, 1, 33
- Simple reflex agent, 68
- Simulated annealing, 172
- Simulation temperature, 94

- Single-agent environment, 62
 - Single-objective sampling, 95
 - Single-track dominator, 141
 - Sociability, 75
 - Social term, 30, 312
 - Spacing, 45, 151, 261
 - Sphere function, 12
 - Standard error, 93
 - Standard error dynamic resampling, 102
 - State-action table, 185
 - Static environment, 62
 - Static sampling, 94
 - Steepest descent algorithm, 6
 - Step size, 6
 - Stochastic environment, 62
 - Stochastic learning automata, 171, 174
 - Stochastic learning automata-induced adaptive sampling, 183
 - Stochastic optimization, 12
 - Stochastic selection, 173
 - Strength Pareto evolutionary algorithm, 43
 - STRIPS, 71
 - Student t-distribution, 143
 - Subsumption architecture, 63
 - Subsumption hierarchy, 64
 - Successful runs, 44, 195
 - Success performance, 44, 196
 - Supervised learning, 73, 80
 - Swarm confidence, 30, 312
- T**
- Target vectors, 21
 - Taylor series, 6
 - Theorem proving, 63
 - Threshold acceptance, 129
 - Time-based sampling, 98
 - Torque, 246
- Tournament selection, 16
 - Transmission control protocol-internet protocol, 75
 - Trial solutions, 10, 89
 - Trial vector, 23
 - Trigonometric noise model, 153
- U**
- Uncertainty handling, 140
 - Uncertainty treatment, 140, 172
 - Unconstrained optimization, 2
 - Uniform fitness interval, 123
 - Uniform noise model, 149
 - Unsupervised learning, 72, 80
 - Upper membership function, 126
 - Utility-based agent, 71
 - Utility function, 71
- V**
- Variance dependent sampling, 94
 - Vector evaluated genetic algorithm, 43
 - Vertical layering, 67
 - Voronoi diagrams, 71
- W**
- Weibull distribution, 98
 - Weighted sum approach, 36
 - Welch confidence interval, 116
 - Welch's t-test criterion, 143
 - Wilcoxon and median tests, 143
 - Working memory, 65
- Z**
- Zero-mean Gaussian noise, 195
 - Ziggurat method, 193