

Index

- χ^2 -squared, 369, 374
- absolute fit evaluation, 402
- absorptance, 10
- action policy, 170, 173
- activation-suppression race, 359–362, 364, 366–368, 370, 371, 374, 375, 377–380
- graphical model, 364
- activity profile, 432, 435, 436, 442
- actor–critic model, 194
- alpha function, 197
- anticipated response inhibition, 349
- attribute, 386
- attribute joint distribution, 392
- autofocus, 7
- automaticity, 202–203
- backpropagation, 168, 181
- balloon model, 440
- basal ganglia, 193–199
- Bayes, 2, 23, 24, 26, 28, 31, 32, 34
- likelihood, 24–26, 32–34
- posterior, 24–26
- prior, 24–26, 31–34
- Bayesian, 358, 362, 394
- approximate methods, 359–364, 366, 367, 374, 378, 381
- approximate posterior, 363
- conjugate priors, 358
- hierarchical, 357, 366, 367, 372, 374
- model, 358
- modeling, 357
- population Monte Carlo, 364, 367, 372–375, 381
- probability density approximation, 364, 367, 374, 376–378, 380, 381
- rejection, 364, 367, 370–372, 374, 378, 381
- Bayesian learning models, 168, 176–180
- Bayesian methods, 434, 455, 463–465
- behaviorism, 219
- Boole’s inequality, 56
- cancel time, 336
- Carathodory theorem, 129
- categorization task, 281–282, 286–289
- identification-confusion matrix, 286
- Cauchy sequence, 119
- CDM types, 387
- cerebellum, 199–202
- chain, 94
- length of, 96
- minimizing vector, 130
- chain-on-net, 110
- channel response
- compressive nonlinearity, 428
- channel tuning function, 425, 435, 436, 451, 452
- Cholesky factorization, 297
- classical conditioning, 164, 173–175
- coactivation models, 67
- cognitive diagnostic computerized adaptive testing, 410
- color matching, 3
- functions, 13
- composite face effect, 284
- computational cognitive neuroscience, 169, 197, 424, 463
- computational model, 7, 9, 12, 17, 18, 22, 31, 357
- computational observer, 30
- cone
- density, 20
- fundamental, 11, 12
- mosaic, 8
- outer segment, 11
- configural perception, 284
- conflict task, 359–361
- Eriksen flanker, 360
- Simon, 360
- Stroop, 360
- sTROOP, 360
- confusion matrix, 148, 281–282, 293–300
- context independence, 319
- context invariance, 50, 56
- contiguity effect, 234

- continual distractor free recall, 234
- contrast sensitivity, 23, 27–29
- convergence
 - to a path, 111, 117
- convex
 - combination, 127
 - hull, 129
 - subset, 129
- convolution, 16, 17
- copula, 345
 - countermonotonicity, 348
 - Farlie–Gumbel–Morgenstern (FGM), 346
- countermanding, 333
- coupling, stochastic, 49
- COVIS, 195–199, 302
- criterial noise, 289
- crossmodal, 45
- crossmodal response enhancement (CRE), 45
 - detection accuracy, 58
 - diffusion model, 69
 - on distributions, 73
 - Poisson superposition model, 68
 - reaction times, 46, 54
 - signal detection, 59
 - spike numbers, 46, 50
 - TWIN model, 71
- da Vinci, 5
- decision bound models, 287
- decisional separability (DS), 282, 284, 289
 - testing for, 290
- decoding methods, 447–455
 - cross-decoding, 454
 - stimulus decoding, 453, 455
- deconvolution, 433
- deep neural network, 444, 455
- delta rule, 168, 181
- dependent censoring, 346
- derivative, 22, 23, 27, 34
- dichromatic, 20
- diffusion, 359, 362
- diffusion coefficient, 68
- diffusion model, 68
- DINA model, 388
- DINO model, 388
- display, 7, 8, 14, 17, 25, 32
- dissimilarity cumulation
 - in discrete spaces, 103
 - in Euclidean spaces, 120
 - in path-connected spaces, 110
- dissimilarity function, 81, 95, 98, 101, 106–108, 110, 113, 147, 148, 151, 152
 - corrected, 107
 - quasimetric, 96, 100
- distance, 362–365, 369, 370, 372–374, 378, 381
- Kullback–Leibler, 374, 381
- distribution
 - ex-Gaussian, 322
 - exponential, 325
 - inverse Gaussian (Wald), 330
 - Weibull, 326
- divisive normalization, 429
- dopamine, 184–185, 190–199
- dopamine active transporter, 185
- drift rate, 68
- drift-diffusion model, 278–280, 300–301
 - parameter estimation, 279
- dual-controller model, 176
- dynamic causal modeling (DCM), 423, 437, 440
- dynamic encoding models, 436–440
- dynamical system, 180
- EEG, 303
- empirical applications, 397
- encoding independence, 303
- encoding separability, 303
- encoding/decoding observer models, 458–461
- enhancement
 - auditory, 60
 - visual, 60
- episodic memory, 234
- Euclidean space, 120
- Euler homogeneity, 123, 126, 153
- examinee classification, 405
- exploratory cognitive diagnosis models, 411
- facilitation, 44
- feature fallacy error, 445, 453
- feature space, 443–446
- Fechnerian distance, 97
- Fechnerian scaling, 64, 81, 82, 95, 97, 103, 148–150, 153
 - ultrametric, 151
- filtering task, 291
- Finsler geometry, 120, 152
- Fisher information, 459
- Floyd–Warshall algorithm, 106, 146
- fMRI, 303
- focused attention paradigm, 54
- Fourier, 2, 36
- fovea, 19, 20, 33, 34
- Fréchet inequalities, 51
- free energy, 178, 180
- function
 - radius-vector, 124
 - unit vector, 126
- functional magnetic resonance imaging (fMRI), 422–466
 - BOLD response, 429, 432–440
 - encoding versus decoding, 422
 - multivoxel pattern analysis (MVPA), 422, 433

- rapid event-related design, 433
- TR (repetition time), 424
- voxel, 424, 432
- G-DINA model, 389
- G-DINA model extensions, 390
- Gabor, 2
- Gauss–Markov theorem, 434
- Gaussian, 14, 15, 25, 31–33
- general linear classifier, 287
- general linear model (GLM), 423, 430, 432–434, 440, 463
- general recognition theory, 265, 280–303
 - decision rule, 288
 - decisional separability, 291
 - Gaussian model, 293–300
 - hierarchical model fitting, 289
 - model identifiability, 289–291
 - neuroscience extensions, 302
 - response time models, 300–301
 - summary statistics approach, 289, 291–293
- Gibbs sampling, 328, 372, 394, 405
- global learning rule, 168
- go task, 312
- goal-directed learning, 176
- gradient-descent learning algorithms, 168, 181
- Grassmann, 3
- greedy action policy, 175
- GRT-wIND, 290, 298
- habit, 164, 176
- Hebbian learning, 166, 185–190, 202–203, 225–227
- Helmholtz, 4, 22, 23
- hemodynamic response function (hrf), 438
- hierarchical Gaussian filter, 178–180
- hippocampus, 188–190
- holistic perception, 284–285
- ideal observer, 26–30
- identification task, 281–282, 293–300
 - 2 × 2 factorial identification task, 281, 282, 295, 301
- i.i.d., 358, 363
- image reconstruction, 31, 34
- implementational models of learning, 169–170, 183–184
- importance weight, 364, 365, 372, 373
- independent components analysis, 2
- indicatrix, 124
- inequality
 - triangle, 96, 98, 100, 101, 106–109, 114, 115, 117, 118, 146, 148, 151
 - ultrametric, 151
- information theory, 2
- inhibition, 44
- inhibition function, 314
- instrumental conditioning, 164, 177
- integration efficiency (IE), 61
 - d*-prime, 62
 - detection rate, 62
 - Fechnerian scaling, 65
- integration method, 323
- inverse effectiveness, 47, 61, 68
- irradiance, 3, 4, 7, 8, 14, 22, 23
- iso-sensitivity curve, see ROC curve, 271
- iterative sample mean, 171, 178
- Izhikevich spiking model, 196–197
- judgment of recency, 252
- kernel, 370, 374, 376
 - transition, 370, 372, 374, 376
- Laplace transform
 - approximate inverse via Post approximation, 247
 - memory for time of past events, 245
 - relationship to temporal context, 245
- latent classes, 387
- LATER model, 329
- law of effect, 164, 192
- leaky competing accumulator, 359
- leaky competing accumulator model, 334
- learning curve, 204
 - backward, 205
 - exponential, 204
 - forward, 204
 - incremental versus all-or-none, 205
- least squares, 358
- least squares – separate (LSS), 433
- light field, 5, 6
 - incident, 5–8
- light ray, 4, 6
- likelihood, 358–365, 367, 374, 376, 378, 380, 381, 394, 405
- linear method, 2, 4
- linear regression with basis functions, 424, 435, 436, 442, 446
- linear system, 9, 10, 14, 16
 - homogeneity, 9
 - superposition, 9, 10
- linear–nonlinear cascade, 2
- linear-operator model, 165
- linearized encoding model, 424, 430, 431, 442, 446, 464
- linking proposition, 337
- local learning rule, 168
- logarithmic temporal memory, 248
 - optimality, 249
- long-term recency effect, 234
- long-term depression (LTD), 165, 166, 185, 185

- long-term potentiation (LTP), 165, 166, 184–185
- long-term store, 232
- Luce–Shepard choice model, 299–300
- machine learning, 3, 27, 34
- marginal response invariance, 291
- marginal RT invariance, 292
- marginalized maximum likelihood estimation, 394
- Markov chain, 369
- Markov chain Monte Carlo, 328, 359, 360, 366, 368–372, 376, 378, 380, 381, 394
- Markov chain Monte Carlo estimation, 394
- Markov decision process, 170
- Markov process, 359
- maximal negative dependency, 52
- maximum likelihood, 357, 366
- maximum likelihood estimation, 296–297, 395
- maximum *a posteriori* probability, 405
- Maxwell, 13
- mean method, 323
- measurement of learning, 411
- Menger convexity, 119
- metric, 64, 81, 96, 106, 118, 148, 151
 - Euclidean, 120
 - Fechnerian, 97
 - intrinsic, 117, 137, 139
- Metropolis–Hastings, 366, 370, 376
- microlens, 7
- model
 - blocked-input, 338
 - diffusion-stop, 342
 - DINASAUR, 338
 - pause-then-cancel, 352
- model identifiability, 396
- model inversion, 447–455
- model mimicry, 421, 446, 452, 458, 465
- model-based fMRI, 422, 424, 458, 461–463
- multicollinearity, 445
- multidimensional scaling (MDS), 147
 - metric, 148
 - nonmetric, 148, 149
- multiple learning systems, 166–167
- multiple-look experiments, 277
- multisensory integration (MI), 42, 48
 - audiovisual speech identification, 59
 - definition, 43
 - in focused attention paradigm, 57
 - in redundant signals paradigm, 54
 - in single neurons, 49
- measure based
 - on accuracy, 58
 - on modeling of RTs, 67
- measure of, 44
- rules of, 46
- spatial rule, 46
- temporal rule, 47
- multisensory neuron, 53
- multitrace models, 251
- net, 110
 - mesh of, 110
- neural channel, 424, 429, 444
- neural contiguity effect, 240
- neural network, 2, 34
- neural network models, 359
- neural recency effect, 240
- neurons, 220
- Newton, 3
- NMDA receptors, 184, 186, 190, 198
- noise, 2, 14, 15, 25, 30
- nonconstant self-dissimilarity, 143
- nonparametric methods, 397
- nonstationary, 359
- normative learning models, 167
- observation area, 87, 88, 92, 104, 106, 140, 153
- operant conditioning, 164
- optics, 2, 4, 8, 16, 17, 28, 31
 - cornea, 12, 14, 18, 19
 - lens, 2, 8, 14, 18, 19
- Ornstein–Uhlenbeck process (OUP), 69
- outer product association, 225
- overtraining, 177
- parameter-space partitioning, 204
- particle filtering, 372, 378, 381
- patch
 - near-smooth, 146
 - typical, 144
- path, 110
 - D-length of, 111
 - G-length of, 113
- path connectedness, 120
- perceptron, 199
- perceptual independence (PI), 282
- perceptual integrality, 284
- perceptual interactions, 282
- perceptual separability (PS), 282, 284
- phosphene, 5
- photocurrent, 10
- photodetector, 7
- photon, 6
- photopigment, 3, 4, 8, 10, 13
 - excitation, 10, 12, 20
- photoreceptor, 4, 7, 8, 17, 19
 - cone, 8
 - rod, 9
- pigment
 - inert, 3
 - macular, 8, 11
- pinhole camera, 5, 6
- plenoptic, 6

-
- point of subjective equality (PSE), 89
 point spread function, 16–21, 30
 Poisson, 6, 14, 15, 27, 31, 32
 Poisson superposition model, 67
 population encoding model, 425
 population receptive field, 440–443
 population response, 425–429, 431, 442,
 448–453
 posterior distribution, 358, 359, 362–368,
 370–372, 374, 376–381, 408
 maximum *a posteriori* probability, 366, 370,
 372
 mode, 366
 proper, 366
 prelabeling model of integration (PRE), 62
 principal components, 2
 principle of univariance, 10
 prior distribution, 358, 364–366, 370–374,
 376–378, 394
 diffuse, 367, 370
 improper, 364, 366, 367, 376
 proactive inhibition, 342
 probability density function, 358
 probability summation (PS), 43, 49
 in spike numbers, 49
 hypothesis, 50
 in reaction times, 55
 in redundant signals paradigm, 55
 maximal negative dependence, 52, 53
 process models of learning, 167
 proposal distribution, 364, 370, 374, 381
 psychological equality, 87
 psychometric function, 82, 89, 97
 pupil, 6, 8, 14, 19
 Q learning, 175–176, 194
 Q-matrix, 386
 Q-matrix construction, 398
 Q-matrix empirical validation, 399
 quasi-ultrametric, 151
 quasimetric, 96
 race assumption, 319
 race model, 55, 71
 dependent, 332
 diffusion, 330
 ex-Gaussian, 326
 exponential, 325
 general, 318
 Hanes–Carpenter, 329
 independent, 56, 320
 interactive, 334
 nonparametric independent, 324
 perfect negative dependency, 348
 semi-parametric, 345, 346
 race-model inequality (RMI), 56
 radial basis function, 428
 radiance, 7, 22, 24–26
 recency effect, 231
 redundant signals paradigm, 54
 regular minimality, 93, 144, 148
 regularization, 434, 445, 446, 464
 reinforcement learning, 168, 170–177, 192, 193,
 195, 202–203
 model-based, 171, 176–177
 model-free, 171–176
 off-policy algorithms, 175
 relative fit evaluation, 404
 reliability assessment, 406
 report independence, 293
 representational drift in cortex, 230
 representational similarity analysis (RSA), 422,
 455–458
 crossnobis distance, 457
 Mahalanobis distance, 457
 one-minus-Pearson dissimilarity, 457
 representational dissimilarity matrix (RDM),
 456–457
 Rescorla–Wagner model, 165
 response bias, 279–280
 response inhibition, 312
 retinal image, 3, 4, 8, 16, 17, 20, 23
 reward devaluation, 177
 reward prediction error (RPE), 172, 174, 191,
 193–194
 ROC curve, 271–276
 area under the ROC (AUC), 276
 concave, 273–276
 confidence ratings, 272
 guessing, 271
 payoffs, 271
 RT-distance hypothesis, 292, 300
 Rushton, 10
 saccadic inhibition, 338
 same–different judgments, 92, 143
 scree plot, 150
 selective stop paradigm, 349
 semicontinuity
 lower, 117
 sequential effects, 350
 serial position effects, 358
 Shepard symmetrization (SS), 148
 shift-invariance, 16, 17
 short-term store, 231–234
 signal detection theory, 265–280, 460–461
 β , 273
 d' , 270, 276, 278
 applications, 276–278
 assumptions, 266
 confusion matrix, 270
 decision rule, 269, 272, 273

- signal detection theory (Cont.)
 - false alarm, 270
 - history, 266–267
 - hit, 270
 - identification vs. categorization, 281
 - impact, 267
 - likelihood ratio, 276
 - multidimensional generalization, 280
 - normal, equal-variance model, 269–278
 - normal, unequal-variance model, 274, 274
 - optimality, 272
 - payoffs, 273
 - receiver operating characteristic, 271
 - relations to Type I and Type II errors, 266
 - response criterion (X_C), 270, 278
 - response time models, 278–280
 - technological precedents, 266
 - two-stimulus identification, 268
 - YES–NO detection task, 269
- signal detection theory (SDT), 58
- signal-respond RT, 316, 319
- software, 393
- sorites paradox, 140
- soritical sequence, 141
- spike numbers, 46
- spike-timing-dependent plasticity, 187, 188
- SSD invariance, 319
- statistical decision theory, 265–304
- statistical facilitation effect, 71
- stimulus onset asynchrony (SOA), 54
- stimulus space, 81, 82, 87, 91, 95, 98, 106, 143
 - D-complete, 119
 - discrete, 103
 - in canonical form, 91, 97, 98, 106
 - well-matched, 142
 - with intermediate points, 118
- stimulus-sampling theory, 164, 229
- stochastic independence, 320
- stop-change paradigm, 348
- stop-signal
 - delay, 312
 - paradigm, 312
- stopping time, 68
- stress measure, 148
- submetric function, 81, 122–124, 133, 136, 155
 - convex, 134
 - minimal, 130, 132, 133, 135, 155
- sufficiency principle, 363
- summary statistic, 363–365
 - sufficient, 363, 369, 370, 372, 381
- superadditivity, 61, 65
- supervised learning, 168, 180–183, 199–202
- symmetry in the small, 99
- synapses, 220
- tangent
 - bundle, 121
 - space, 121
- temporal context cells, 255
- temporal context model, 235
 - contextual drift, 236
 - contiguity effect, 238
 - item-to-context matrix, 237
 - neuropsychological evidence, 239
 - recency effect, 237
- temporal discounting, 171
- temporal order judgment (TOJ), 72
- temporal-difference learning, 173–175, 194
- three-factor learning, 185, 190–199, 202–203
- threshold, 26, 28, 31
- Thurstonian model, 143
 - well-behaved, 145
- time cells, 254
- time-window-of-integration (TWIN) model, 69
- timed marginal response invariance, 292
- timed report independence, 293
- Toeplitz matrix, 439
- tolerance, 369, 370, 372–374, 378, 381
- transfinite induction, 147
- trichromatic, 8, 20
- trigger failures, 349
- two-alternative forced-choice task, 266, 267, 276
- two-factor learning, 185–190, 202–203
- uniform continuity, 99
- unisensory imbalance, 47
- unsupervised learning, 168
- validity assessment, 408
- value function, 170, 171
- vector
 - affinely dependent, 128
 - maximal production, 130
 - space, 127
- visuomotor adaptation, 180–183
- volatility, 180
- von Kries, 2, 22
- voxel-based encoding model, 424–446
 - measurement model, 424, 429–440, 443, 445, 454, 464
- Weber–Fechner law, 249
- Wiener process, 68
- YES–NO detection task, 269, 271, 276
- Young, 3, 12