Index

acausal, 126
adaptive spike coding, 42
affinity-based models, 157
attention, 103
attention, Bayesian model of, 253
average cost per stage, 277

Bayes filter, 9
Bayes Rule, 83
Bayes rule, 240, 302
Bayes theorem, 6, 78, 84
Bayesian, 75
Bayesian decision making, 250
Bayesian estimate, 8, 9
Bayesian estimator, 118
Bayesian inference, 239, 240
Bayesian network, 13
belief propagation, 13, 239
belief state, 289
bell-shape, 115
Bellman equation, 271
Bellman error, 276
bias, 117
bit, 6
boundary-sharpening, 165
cascade model, 27
causal, 126
coding, 116
Conditional order statistics, 80
conditional probability, 4
continuous-time Riccati equation, 285
contraction mapping, 272
contrasts, 96
control gain, 286
convolution code, 123
convolution decoding, 125
convolution encoding, 123
correlation, 5
costate, 278
covariance, 4
covariance analysis, 30
Cramér-Rao bound, 117, 119
Cramér-Rao inequality, 11
cross-validation, 65
curse of dimensionality, 276
decision theory, 299
decoded, 72
decoder, 81
decoding, 53, 76, 80, 81, 116
decoding basis function, 125
decoding, linear, 26
deconvolution, 124
differential dynamic programming, 287
direct encoding, 121
discounted cost, 277
discrete-time Riccati equation, 286
discrimination threshold, 120
distributional codes, 261
distributional population code, 121
doubly distributional population code, 125, 262
Dynamic Causal Modeling (DCM), 104
dynamic programming, 270
economics, 299
EEG, 93
efficient coding, 145
encoding, 19, 25, 116
entropy, 7, 19
estimation-control duality, 291
Euler-Lagrange equation, 282
evidence, 12
expectation, 4
Index

expectation-maximization, 125
extended Kalman filter, 289
extremal trajectory, 279

feedback, 162
figure enhancement, 169
figure-ground segregation, 169
filter gain, 288
firing rate, 116
first order statistics, 78, 83
Fisher Information, 11
Fisher information, 119
fMRI, 93
Fokker-Planck equation, 290

gain of population activity, 122
Gaussian derivative operators, 163
general linear model, 93
generalized linear model (GLM), 60
g graphical model, 13, 240, 242
grouping, 145

H1 motion-sensitive neuron, 22, 44
Hamilton equation, 282
Hamilton-Jacobi-Bellman equation, 275
Hamiltonian, 279
happiness factor, 175
hemodynamic response function, 94
hidden Markov model, 242, 289
hierarchical inference, 262
high-resolution buffer, 162
hyperparameter, 12
hypothesis, 6

illusory contour, 164
importance sampling, 289
independence, 5
influence function, 281
information, 6, 20, 39
information filter, 288
information in spike sequences, 22
information in spikes, 21
information state, 289
information theory, 72
inhomogeneous Poisson process, 82
integrate-and-fire model, 247
integrate-and-fire model, generalized, 62
integrate-and-fire neuron, 28, 34
integrate-and-fire neuron, generalized, 29
iterative LQG, 286
Ito diffusion, 273
Ito lemma, 275

joint probability, 4

Kalman filter, 9, 287
Kalman smoother, 289
Kalman-Bucy filter, 288
kernel function, 123
KL divergence, 8
Kolmogorov equation, 290
Kullback-Leibler divergence, 8

Lagrange multiplier, 280
latency, 76
law of large numbers, 122
Legendre transformation, 282
likelihood, 6
linear-quadratic regulator, 285
linear/nonlinear model, 27
log posterior ratio, 252
loss function, 118

MAP, 8
marginal likelihood, 12
marginalization, 12
Markov chain Monte Carlo (MCMC), 158
Markov decision process, 273
Markov random fields, 147
mass-univariate, 93
maximum a posterior estimate, 8
maximum a posteriori estimator, 67
maximum a posteriori estimator, 291
maximum entropy, 126
maximum likelihood, 29, 55, 72, 118
maximum likelihood estimate, 8
maximum likelihood Estimator, 118
maximum principle, 278
MDL, 149
mean, 4
MEG, 93
Mexican hat kernel, 124
minimal variance, 118
minimum-energy estimator, 291
MLE, 8
model selection, 12
model-predictive control, 280
motion energy, 122
multiplicity, 125
mutual information, 7, 20

neural code, 72, 75
neural coding problem, 17, 53
nonlinear diffusion, 153
nucleus magnocellularis, 37

optimal coding, 43
optimality principle, 270
optimality value function, 270
order statistic, 82
order statistics, 77, 83

particle filter, 9, 263, 289
perceptual pop-out, 176
Poisson, 76
Poisson distribution, 116
Poisson noise, 119
Poisson process, 56, 76
policy iteration, 271
population code, 115, 262
population codes, 88, 115
population vector, 117
posterior distribution, 118
posterior probability, 6
posterior probability mapping (PPM), 101
predictive coding, 147
preferred orientation, 115
PrimerMarginal, 12
prior distribution, 118
prior probability, 6
prior probability distribution, 79
probabilistic population code, 122
probability, 3
probability density, 3
probability distribution, 3
product of expert, 126

random field, 126
random field theory (RFT), 101
Rauch recursion, 289
recurrent network, linear, 244
recurrent network, nonlinear, 246
redundancy, 23
region competition, 156
regularization, 12

reverse correlation, 39, 56
rollout policy, 280

segmentation, 145
shape-from-shading, 159
spike count, 116
spike density function, 82
spike timing, 76
spike-triggered average, 26
spike-triggered average (STA), 56
spike-triggered covariance (STC), 58
spiking neuron model, 28, 33, 247
square-root filter, 288
statistical parametric mapping (SPM), 101
stimulus decoding, 117
stimulus encoding, 116
stochastic, 75, 76
surprise, 175
synergy, 23
synthesis, 157
temporally changing probability, 126
time-rescaling, 53
timing code, 19
tuning curve, 115, 118

unbiased, 118
unbiased estimate, 119
uncertainty, 7, 120, 122, 124, 239, 299
unscented filter, 289
utility, 299
value iteration, 271
variance, 4, 117
variance adaptation, 44
variance components, 100
visual attention, 253
visual motion detection, 248
Viterbi algorithm, 291

weak-membrane, 149

Zakai’s equation, 290