

Index

- activation function, 163, 166
- AdaBoost, 171
- alternate hypothesis, *see* hypothesis
- arithmetic mean, *see* mean
- artificial neural network, *see* neural network
- asymmetric Gaussian distribution, 189
- average, *see also* mean
 - arithmetic, 38
 - from scan, 131
 - weighted, 81, 88, 132
- bagging, 171, 181
- Bayes' theory, 21, 181
- Bayesian
 - classifier, 157, 175, 181
 - prior, *see* prior
 - statistics, 21, 110, 181
- Bessel correction factor, 40, 52
- binary threshold function, 163
- binomial distribution, 28, 57, 69, 79, 100, 125, 181, 187, 207
- binomial error, 79, 100, 125, 181
- bivariate normal (or Gaussian), 106
- blackjack, 29
- blind analysis, 84, 116, 182
- boat race, 125
- boosting, 171, 181
- Breit–Wigner, 182, 187
- χ^2 , *see* chi-square
- Cauchy distribution, 187
- central limit theorem, 72
- chi-square, 7, 67, 131, 134, 139, 140, 142, 182, 188, 215
- clinical test, 124
- coin, 28, 35, 57
- computational issues
 - binomial, 69, 187
 - factorial, 68
 - integration, 198
 - Poisson, 69
- confidence interval, 93, 142, 145, 148, 182
- confidence level, 94, 102, 105, 106, 110, 114, 120, 122, 132, 142, 145, 148, 182
- correlation, 45, 78, 89, 129, 144, 182
 - matrix, 45, 51, 52, 144, 182
 - Pearson, 45
 - removing, 49
 - Spearman, 47
 - uncertainties, 75, 78, 79, 81
- covariance, 44, 49, 52, 75, 78, 81, 86, 106, 135, 159, 182
- covariance matrix, 44, 49, 75, 79, 81, 135, 159, 182
- coverage, *see* confidence level
- curse of dimensionality, 155, 196
- cut-based selection, 154, 157, 163, 169, 182
- data, 12, 20, 21, 22
- decision tree, 169, 171, 176, 182
- degree of freedom, 56, 67, 133, 188, 215
- die (dice), 24
- eigenvalue equation, 51
- electron e/m , 84
- element, 12
- error, 40, 41, *see also* central limit theorem, *see also*
 - binomial error
 - χ^2 fit, 131
 - bar, 36
 - combination, 75, 78, 80, 86, 182
 - correlated, 78, 79
 - ellipse, 106
 - Gaussian, 73
 - in quadrature, 77
 - likelihood fit, 138
 - linear least squares, 135
 - on g (simple pendulum), 2
 - perceptron classification, 166, 168
 - Poisson, 98, 131
 - relative, 77, 184
 - scale with statistics, 74

- statistical, *see* statistical error
- systematic, *see* systematic error
- threshold, 169
- type I, 114, 175, 184
- type II, 115, 117, 175, 185
- error matrix, *see* covariance matrix
- event, 3, 12, 20
- evidence, 120
- expectation value, 57, 138, 183
- exponential distribution, 7, 188
- extended maximum likelihood, *see* fit
- false negative, *see* error, type I
- false positive, *see* error, type II
- Feldman–Cousins, *see* unified approach
- Fisher discriminant, 158, 176, 183
- fit, 7, 9, 128, 157, 165, 168, 174
 - χ^2 , 131, 134
 - bias, 139
 - constraint, 136, 139
 - extended maximum-likelihood, 137
 - least squares, 134, 183
 - maximum-likelihood, 136, 137, 138
 - penalty term, 139
 - template, 142
- frequentist, *see also* lower limit, *see also* probability, *see also* upper limit
 - statistics, 25, 109, 148, 183
- full width at half maximum, 43, 183
- FWHM, *see* full width at half maximum
- γ , *see* skew
- Gaussian distribution, 43, 65, 72, 73, 96, 106, 138, 149, 183, 189, 199, 210
- GOF, *see* goodness of fit
- goodness of fit, 67, 133, 183
- gradient descent, 129, 168, 183
- graph, 7, 36, 183
- H_0 , *see* hypothesis
- H_1 , *see* hypothesis
- half-life, 7
- histogram, 35, 37, 121, 183, 194, 196
- Hooke’s law, 152
- hyperbolic tangent distribution, 164
- hypothesis
 - alternate, 114, 126, 181
 - comparison, 117, 157
 - compatibility, 114, 119
 - null, 114, 184
 - testing, 60, 114
- independent events, 21, 28, 136
- invariant mass, 92, 122, 127
- kernal estimation, 195
- kurtosis, 44
- $\mathcal{L}$, *see* likelihood
- Lagrange multiplier, 139
- Landau distribution, 190
- learning rate, 167
- least squares, *see* fit
- likelihood, *see also* fit, 9, 27, 60, 63, 94, 100, 101, 183
 - ratio, 27, 102, 117
- limit, *see* lower limit *and* upper limit
- logistic function, *see* sigmoid distribution
- look elsewhere effect, *see* trial factor
- lottery, 28
- lower limit, 80, 95, 101, 110
- μ , *see* mean
- marginal distribution, 124, 147
- Mars climate orbiter, 42
- maximum likelihood, *see* fit
- mean, 38, 58, 60, 62, 63, 65, 72, 81, 94, 183
- measurement
 - combining, 81, 131, 140
 - presenting, 41
 - repeating, 74
 - total uncertainty, 79, 85
 - units, 41, 114
- median, 38, 183
- mode, 38, 148, 184, 188
- Monte Carlo, 105, 115, 169, 184, 194, 195, 198
 - limit, 95, 105, 109
- Monty Hall problem, 34
- multivariate normal, 106
- ν , *see* degree of freedom
- neural network, 162, 181
 - error threshold, 169
 - learning rate, 167
 - multi-layer perceptron, 165, 176, 184
 - perceptron, 162, 165, 166, 184
 - target type, 166, 168
 - training, 166, 184
 - validation, 168, 184
 - weight, 163, 165, 166, 168
- normal distribution, *see* Gaussian distribution
- nuisance parameter, 122
- null hypothesis, *see* hypothesis
- numerical integration, 66, 175, 187, 194, 198
- observation, 120
- Ohm’s law, 5
- optimisation, *see also* gradient descent, 128, 155, 157, 170, 184
 - step size, 129
- p -value, 116, 121, 122
- PDF, *see* probability density function
- penalty term, 139
- perceptron, *see* neural network
- Poisson distribution, 9, 62, 69, 98, 101, 109, 111, 123, 131, 137, 140, 184, 190, 209

- prior, 22
 - dependence, 24
 - uniform, 23, 94, 110, 118, 145, 148
- probability, 184
 - a priori, 22
 - Bayes, 21
 - frequentist, 25, 101, 109, 148
 - law of addition, 21
 - posterior, 22, 30, 117, 124, 145
 - prior, *see* prior
 - total, 21, 118, 136
- probability density function, 26, 37, 50, 57, 184, 186
 - χ^2 , 67, 188
 - binomial, 57
 - bivariate, 106
 - Breit–Wigner, 187
 - Cauchy, 187
 - exponential, 188
 - Γ , 67
 - Gaussian, 65, 189
 - histogram, 194
 - kernal estimation, 195
 - Landau, 190
 - multivariate, 106
 - Poisson, 62, 190
 - polynomial, 191
 - relativistic Breit–Wigner, 187
 - sigmoid, 192
 - step function, 192
 - uniform, 196
 - veto function, 192
- purity, 154
- ρ , *see* correlation
- radial distribution, 164
- radioactive decay, 7
- rain, 23, 30
- receiver operating characteristic, 172, 176
- rectangle rule, 184, 198
- relativistic Breit–Wigner distribution, 187
- residual, 40
- RMS, *see* root-mean-squared
- root-mean-squared, 40
- σ , *see* standard deviation
- σ^2 , *see* variance
- σ_{xy} , *see* covariance
- scan, 100, 129, 130, 131
- search, 95, 103, 108, 117, 121, 128, 155
- sensitivity, 95, 110
- separation, 154, 158, 173
- set, 12, 184
 - binary, 12
 - complement, 16
 - difference, 15
 - equivalence, 14
 - intersection, 15
 - subset, 14
 - superset, 14
 - union, 15
- SI units, 41
- sigmoid distribution, 164, 192
- significance, 121, 122, 132, 155, 156, 176
- simple pendulum, 1
- skew, 38, 43, 184, 189
- small angle approximation, 2
- SPAM filtering, 175
- standard deviation, 3, 4, 6, 40, 43, 58, 65, 73, 74, 77, 139, 160, 161, 184
- standard error on the mean, *see* standard deviation
- statistic, 41, 81, 128, 154, 184
- statistical error, 65, 73, 74, 85, 93, 96, 184
- systematic
 - bias, 82, 84, 139
 - error, 2, 82, 84, 85, 119, 139, 184, 187, 194
- tagging efficiency, 92
- test statistic, *see* statistic
- tracking, 86
- training, *see* neural network
- trapezium rule, 184, 199
- trial factor, 122
- triangulation, 142, 145
- type I error, *see* error, type I
- type II error, *see* error, type II
- uncertainty, 2, 6, 9, 36, 37, 41, 67, 72, 98, 108, 129, 131, 132, 134, 138, 140, 185, 187, 194
- unified approach, 101
- upper limit, 23, 38, 94, 98, 105, 108, 148, 185, 198
- validation, *see* neural network
- variance, 39, 40, 57, 58, 60, 62, 63, 72, 75, 81, 94, 96, 158, 185
- Venn diagram, 13, 185
- weather forecast, 23, 30
- weight, 35, 158, 163, 165, 166, 168, 170
- weighted average, 81, 88, 132, 135
- Wilks theorem, 139