

Index

- Accuracy, 365
- Adjacency matrix, 34, 39, 330
- Adjusted AIC (AICc), 372
- Akaike’s Information Criterion (AIC), 371, 372, 379
- Anderson–Darling (AD) test, 355, 357
- Annualized volatility, 316
- Autocorrelation, 139, 141, 157, 161, 304, 311
- Bandwidth, 236, 248, 269, 354
- Bayes theorem, 87, 104, 292, 372, 376
- Bayesian information criterion (BIC), 372
- Bayesian Network, 217
- Bayesian parameter estimation, 246
- Berry–Esseen Theorem, 52
- Betweenness centrality, 39
- Bias, 17, 26, 271, 360, 383
- Bias-variance tradeoff, 26, 360
- Bipartite graph, 34, 43, 193
- Black box, 395
- Body and tail of the distribution (see also fat-tail), 59, 68, 250, 253, 256, 258, 305
- Bonferroni correction, 351
- Bootstrapping, 310, 351, 382
- Box counting fractal dimension, 146
- Cauchy Distribution, 69
- Causal network, 341
- Causality, 139, 167, 169, 178, 201, 341, 381
- Central limit theorem, 51, 150, 228, 284
- Central moments, 17, 152, 223
- Centrality and peripherality, 39
- Chain rule, 110
- Characteristic equation, 312
- Characteristic function, 53, 85
- Chebyshev’s inequality, 61, 226, 379
- Chi-squared distribution, 67, 370
- Chordal graph, 44, 194, 207, 335
- Clique expansion, 191, 194, 196, 213
- Complementary cumulative distribution function (CCDF), 11, 242, 252, 357
- Conditional entropy, 109, 172
- Conditional expected value, 23, 129
- Conditional independence, 201, 329, 337
- Conditional probability, 87, 93, 113, 167, 217, 366, 368
- Conditional probability formula, 88, 113, 122, 173, 207
- Conditional transfer entropy, 174, 344
- Confidence interval, 15, 307, 370, 377
- Configurational model, 184
- Confusion matrix, 364
- Consensus dyanamic, 43
- Correlation, 81
- Correlation matrix, 82, 406
- Correlation ratio, 128, 360
- Covariance, 81
- Covariance matrix, 81, 105, 120, 175, 209, 267, 271, 290
- Cross-entropy, 107, 109, 210, 238, 366
- Cross-validation, 26, 238, 249, 299, 373, 383
- Cumulative distribution function (CDF), 11, 52, 80, 142, 229, 256, 352, 354, 355
- Curse of dimensionality, 19, 267, 276, 342, 406
- Data augmentation, 384
- Decision trees, 408
- Degree, 35, 192, 197, 335
- Degree distribution, 35, 184
- Degrees of freedom, 66, 85, 106, 171, 273, 370
- Dependence, 4, 82, 113, 126, 167, 210, 268, 269, 331, 380
- Dickey–Fuller test, 313
- Differential entropy, 100
- Directed acyclic graphs (DAG), 44
- Double descent, 29, 297
- Early stopping, 299
- Efficient frontier (see also Markowitz’s portfolio theory), 125, 288
- Eigenvector centrality, 39
- Elliptical distribution, 83, 90, 106, 160, 362
- Empirical mode decomposition (EMD), 319
- Entropy, 99, 104, 115, 202, 214, 232, 358
- Excess entropy, 138
- Excess kurtosis, 18, 49
- Expectation maximization (EM), 258, 275, 299, 410
- Expected value, 15, 151, 222, 223
- Explained sum of squares (ESS), 360
- Exponential smoothing, 314
- F-Distribution, 67

- F1 score, 365
- Fat-tail, 35, 60, 69, 90, 127, 151, 221, 248, 258, 274
- Fat-tailed distribution, 59
- Feature extraction, 281, 406
- Feature selection, 170, 281
- Fitness model, 184
- Fourier transform, 53
- Fréchet distribution, 74
- Fractal dimension, 145, 151, 158
- Frobenius norm, 277
- Gamma distribution, 65, 67, 73, 262, 412
- General linear models, 116
- Generalized central limit theorem, 58, 150
- Generalized dependency measure, 127, 361
- Generalized extreme value distribution, 74
- Generalized Hurst exponent, 155, 306
- Generalized pareto distribution, 71
- Genus, 193, 333
- GLASSO, 297
- Glivenko–Cantelli theorem, 229
- Goodness of classification, 364
- Goodness of models, 347
- Goodness of regression, 357
- Gradient boosting, 409
- Granger causality (see also Wiener–Granger causality), 167, 170, 176
- Graph (see also Network), 33, 183, 201, 329
- Graphical models, 202, 207
- Gumbel distribution, 74
- Hölder exponent, 155
- Hasse diagram, 198
- Higher-order interactions, 135, 196, 203, 206
- Higher-order network, 44, 196, 213, 343
- Histogram, 231, 234, 267, 373
- Hurst exponent, 152, 304, 306
- Hyperparameter, 25, 368, 369, 385
- IFN probability decomposition, 207, 336
- Independent and identically distributed (i.i.d.), 50, 148, 224, 226, 279
- independent and identically distributed (i.i.d.), 245
- Independent variables, 50, 114, 117, 132
- Information filtering networks, 185, 203, 299, 329, 333
- Interaction information, 135
- Inverse covariance, 83, 122, 209, 290
- Jackknife, 351, 383
- Joint probability, 19, 79, 113, 116, 132, 159, 207, 291, 341, 385
- k-gamma distribution, 66, 73, 262
- k-means, 323
- Katz’s centrality, 39
- Kendall- τ correlation, 131
- Kernel density estimator (KDE), 235, 249, 269
- Kernel function, 236
- Kolmogorov–Smirnov (KS) test, 304, 354, 357
- Kruskal’s algorithm, 187
- Kullback–Leibler divergence (KLD), 107, 132, 173, 202, 248, 284, 367
- Kurtosis, 18, 50, 244, 305
- Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test, 312, 314
- L_0 , L_1 , L_2 , and L_n -norms, 277, 292, 294, 297
- Lévy alpha-stable distribution, 56, 150
- Lagged correlation, 169
- Lagged correlations, 139
- Lagrange multiplier, 124, 126, 288, 404
- Laplacian, 38
- Law of large numbers, 51, 102, 202, 224, 369
- Light-tailed distribution, 59
- Likelihood, 88, 90, 201–203, 216, 238, 244, 245, 368
- Likelihood ratio, 370
- Linear dependence, 81, 82, 116, 171, 212, 272, 331
- Location-scale family distributions, 71, 160
- Log return, 142
- Log-likelihood, 90, 202, 245
- Log-Normal Distribution, 64
- Logarithmic binning, 234
- LoGo, 209, 299
- Mahalanobis distance, 84, 91
- Map color theorem, 193
- Marčenko–Pastur, 279
- Marginal probability, 79, 113, 116, 132
- Markov chain, 43, 149, 217
- Markowitz efficient frontier, 125
- Markowitz portfolio theory, 123, 126, 287, 288
- Matthews correlation coefficient (MCC), 366
- Maximally filtered clique forests (MFCF), 194, 212, 334
- Maximum entropy, 104, 248
- Maximum likelihood estimation (MLE), 275
- Maximum spanning tree, 186, 210, 333
- Mean absolute deviation (MAD), 361
- Mean absolute percentage error (MAPE), 361
- Mean of absolute error (MAE), 361
- Method of moments, 243
- Minimum spanning tree (MST), 186, 210, 333
- Mixture distributions, 72
- MLE (MLE), 244
- Moments of a distribution, 17
- Moving average, 314
- Multifractal, 154, 155
- Multilinear regression, 92, 120, 286, 297
- Multiplication rule, 88, 113, 122, 173, 207, 208
- Multiscaling, 154, 310
- Multivariate normal distribution, 83, 93, 105, 109, 122, 176, 209, 271, 274, 284, 293, 337, 362

- Multivariate Student t-distribution, 84, 94, 106, 275, 339
- Mutual information, 132, 203, 210, 270, 337, 362
- Nested models, 363
- Network (see also graph), 33, 183, 201, 329
- Network geometry with flavor (NGF), 196
- Network representation, 136, 201, 299, 329
- Nonparametric estimation, 221
- Norm, 277
- Normal distribution, 49
- NP-complete problem, 188
- NP-hard problem, 207
- Null model, 348
- O-information, 138
- Omori law, 158
- P-value, 349, 379
- Parametric estimation, 241
- Pareto distribution, 70
- Parsimony, 394
- Partial correlation, 122
- Pearson's correlation, 81
- Pearson's correlation estimator, 272
- Pearson's covariance estimator, 271
- Planar maximally filtered graphs (PMFG), 189
- Poset, 198
- Posterior probability, 88, 108, 247, 376
- Precision, 365
- Precision matrix, 83, 122
- Prim's algorithm, 187
- Principal component analysis (PCA), 406
- Prior probability, 88, 104, 108, 246, 267, 292, 376
- Probability, 10
- Probability decomposition, 207, 336
- Probability density function, 12
- Probability mass function, 12
- Probability-probability (P-P) plot, 353
- Quantile binning, 234
- Quantile-quantile (Q-Q) plot, 352
- Quantiles, 14
- R-square, 358, 360, 362
- Rényi entropy, 111
- Rényi's generalized dependency measure, 127
- Random forest, 409
- Random variable, 10
- Random walk, 42, 148, 313
- Rank correlations, 130
- Rank frequency plot, 230
- Ranking, 130
- Receiver operating characteristic (ROC), 367
- Redundancy, 136, 137, 342
- Regression, 22, 113, 115, 170, 357
- Regularization, 29, 291, 336
- Reinforcement learning, 23
- Relative Likelihood, 370
- Residual, 115
- Residual entropy, 138
- Residual sum of squares (RSS), 360
- Resampling, 382
- Return, 142, 150
- Ridge regression, 296
- Rolling windows, 314
- Sample p -Values, 379
- Sample central moments, 223
- Sample correlation, 272
- Sample mean, 222
- Sample moments, 223
- Sample variance, 223, 228
- Scale-free, 35
- Scaling & scaling law, 143, 301
- Scientific method, 391
- Self-affine process, 152
- Sensitivity, 365
- Shannon entropy, 99, 132, 172, 232, 248, 269
- Shannon–Khinchin axioms, 110
- Shrinkage, 267, 290, 297
- Shuffling, 310, 378
- Simplex, 45, 105, 196, 212, 336
- Simplicial complexes, 45, 333
- Skewness, 18
- Sparse inverse covariance, 209, 297, 339
- Spearman- ρ correlation, 131
- Specificity, 365
- Stable distribution, 56, 150
- Stable random variable, 56
- Standard deviation, 18
- Standard score (or z-score), 379
- Stationarity, 141, 312
- Stirling approximation, 102
- Stochastic process, 141, 159, 301
- Stretched exponential, 60
- Student t-distribution, 59, 68, 73, 84, 94, 100, 106, 160, 244, 262, 273, 338, 412
- Supervised Learning, 22
- Synergy, 136, 137, 342
- Tail exponent, 57–59, 69, 75, 127, 151, 156, 243, 250, 310
- Tail exponent estimators, 252
- Tail of the distribution, 59
- Test set, 25
- Thresholding, 185, 329
- Time clustering, 322
- Time series, 301
- Topological regularization, 299, 336
- Total correlation, 138
- Total sum of squares (TSS), or sum of square total (SST), 359
- Total variance, 121
- Total variation distance, 108
- Training set, 25, 287, 360
- Transfer entropy, 172, 341, 381

Tree and forests, 44
Treewidth, 192
Triangulated maximally filtered graphs
 (TMFG), 190, 209, 334
Tsallis entropy, 111
Uniscaling, 152, 304, 309
Unsupervised learning, 22
Validation set, 25
Value at risk, 14
Variance, 18, 26, 49, 106, 123, 150, 171, 223,
 244, 288, 322, 358
Vector of random variables, 18
Viterbi path, 324
Weibull distribution, 74
Weighted graphs, 35
Wiener process, 149
Wiener–Granger causality, 167, 170, 172, 176
XGBoost, 409
z-score, 379
Zipf-Mandelbrot law, 71