

Index

- R*-transform, **123**
- S*-transform, **123**
- α - β random kernel, **222**, 236, 249
- β -ensembles, **126**
- “Valid” Stieltjes transform pair, **50**

- Additive model, 114
- Adjacency matrix, **337**
- Approximate message passing (AMP), 332
- Auto-regressive process, 74

- Bethe Hessian matrix, **356**
- Bi-correlated model, **74**
- Block matrix inversion, **45**
- Burkholder inequality, **49**

- Cauchy’s integral, **38**
- Co-resolvent, **44**
- Community detection, **337**
- Compressive sensing, 17
- Concentration of measure, 28, 30, **130**, 152
- Convex concentration, 139
- Convex Gaussian min-max theorem (CGMT), **331**
- Covariance distance, 173
- Curse of dimensionality, 2, 5, 7

- Debiasing, **323**
- Degree-corrected SBM (DC-SBM), **347**
- Dense graph, 337
- Deterministic equivalent, 15, **40**, 42, 152
- Distance random kernel, **217**
- Double descent, **284**, 298

- Echo-state neural network (ESN), **300**
- Eigenspace, **39**
- Elliptical distribution, **185**
- Empirical risk minimization, **313**
- Empirical spectral distribution, *e.s.d.*, 4, 13, **36**
- Empirical spectral measure, **36**
- Erdős-Rényi graph, **337**
- Euclidean (distance) matrix, 22, **213**
- Exponential concentration, 136

- Feature centering, **217**
- Free additive convolution, **123**
- Free multiplicative convolution, **123**
- Free probability, 13, **122**
- Full circle law, **126**

- G-MUSIC, **168**, 170
- Gaussian kernel, 9, **208**
- Gaussian method, **61**
- Gaussian mixture model (GMM), **210**
- Gaussian Orthogonal Ensemble (GOE), 107, 112, **126**
- Gaussian Symplectic Ensemble (GSE), 112, **127**
- Gaussian Unitary Ensemble (GUE), 112, **126**
- Generalized likelihood ratio test (GLRT), 155, 156
- Generalized linear classifier, 314
- Generative adversarial network (GAN), 365, **367**
- Gradient descent, **294**

- Haar measure, **119**

- Information-plus-noise model, 114, 115, 118
- Inner-product random kernel, **221**
- Interpolation trick, **64**
- Inverse Stieltjes transform, **37**

- Joint fluctuation, 112

- Kernel, **207**
- Kernel ridge regression, **265**
- Kernel spectral clustering, **242**

- Label, **210**
- Laplacian matrix, **244**, 245
- Least-squares support vector machine (LS-SVM), **265**
- Limiting spectrum, 81
- Linear concentration, 137
- Linear Discriminant Analysis (LDA), **159**, 161
- Linear eigenvalue statistics, **39**, 88
- Linear spectral statistics, **39**
- Lipschitz concentration, 138
- Logistic regression, **309**, 313, 322
- Long short term memory (LSTM), 301
- Loss function, 313
- Loss landscape, **309**

- M-estimator, **185**
 Manifold learning, **254**
 Marčenko–Pastur law, **4, 50**
 Memory depth, **305**
 Modularity matrix, **245, 338**
 MUSIC, **168, 169**
- Nash–Poincaré, **63, 121**
 Neural network, **277**
 Neural tangent kernel (NTK), **308, 375**
 No eigenvalue outside the support, **86**
 Non-asymptotic random matrix theory, **17**
 Non-backtracking matrix, **355**
 Non-trivial classification, **6, 209**
- PageRank, **254**
 Phase retrieval, **333**
 Phase transition, **95, 104, 110, 286, 322, 344, 353**
 Properly scaling random kernel, **228, 249**
- Quadratic Discriminant Analysis (QDA), **159, 166**
- Random feature maps, **279**
 Random Fourier features, **310**
 Random Matrix Theory (RMT), **13**
 Random neural network, **277, 278**
 Recurrent neural network, **300**
 Reproducing kernel Hilbert space (RKHS), **23**
 Reservoir computing, **300**
 Resolvent, **15, 36**
 Resolvent identity, **43**
 Robust statistics, **185, 190**
- Sample covariance model, **2, 68, 77, 117, 120, 144**
- Scatter matrix, **185**
 Semi-supervised learning, **252**
 Semicircle law, **65**
 Separable covariance model, **74, 75**
 Sherman–Morrison, **46**
 Sparse graph, **354**
 Sparse kernel, **273**
 Spectral initialization, **333, 333**
 Spike, **103**
 Spiked eigenvector alignment, **107**
 Spiked model, **14, 102, 113, 151, 170, 190**
 Statistical physics, **17**
 Stein’s lemma, **61, 121**
 Stieltjes transform, **13, 37, 148**
 Stochastic block model (SBM), **337, 339**
 Subspace method, **96, 101, 168**
 Support vector machine (SVM), **326**
 Sylvester’s identity, **44**
- Ternary kernel, **241**
 Trace lemma, **48, 120, 141**
 Tracy–Widom, **111, 112, 158**
 Tyler’s estimator, **194, 202**
- Universality, **5, 18, 26, 65, 112, 239, 240, 364**
- Variance profile, **79**
 Vitali’s convergence theorem, **40**
- Wasserstein distance, **174, 182, 200**
 Weyl’s inequality, **47**
 Wigner matrix, **13, 65, 79, 116, 119, 225, 337**
 Wishart matrix, **13, 107, 110, 112**
 Woodbury, **45**