

Index

- ACM–SIGKDD Innovation Award, 762
- activation functions, 837–842
- actual and predicted profit values, 325
- adjusted R-squared (adjusted R^2) method, 298–299
- agglomerative clustering
 - AGNES, 648
 - average linking, 653
 - bottom-up approach, 648
 - clustering of data points, 654
 - clustering of students record, 663–675
 - complete linkage, 652
 - distance matrix, 656–658
 - and divisive clustering, 648–649
 - graphical representation, 653–654
 - HCA diagram, 650–651
 - over supermarket dataset, 659–663
 - process, 649–650
 - single linkage, 651–652
 - weaknesses of, 675
- AGglomerative NESTing (AGNES), 648
- aggregation, 138
- Alexa Purchase Problem, 554
- all possible models, 297
- Anaconda Navigator
 - Jupyter, 61–62
 - Spyder, 60
- ANN model
 - compilation, 875–876
 - initialization, 872
 - input and first hidden layer, 872–873
 - libraries, 871–872
 - output layer, 874–875
 - second and third hidden layer, 873–874
 - training set, 876–878
- applications of ML
 - bioinformatics, 7
 - chatbots, 4
 - dynamic pricing, 3–4
 - handwritten text recognition, 5
 - healthcare and pharmaceuticals, 6
 - image recognition, 2–3
 - machine translation software, 5
 - malware detection, 2–3
 - online fraud detection, 6
 - online video streaming platforms, 4
 - product recommendations, 6
 - search engines, 7
 - self-driving cars and autonomous drones, 7
 - smart home assistants, 2–3
 - social media services, 5
 - spam emails, 2–3
 - speech recognition, 2–3
 - traffic prediction with Google Map, 4–5
 - video surveillance, 5–6
- Apriori algorithm
 - candidate 1-itemsets C_1 of database, 763
 - confidence of all possible rules, 768

1086 Machine Learning with Python

- frequency of candidate item pairs, 766
- frequent 1-itemsets, 764–765
- frequent itemsets identification, 769–770
- frequent 1-itemsets L1, 764–765
- inventors, 760–762
- limitations of, 797
- phases, 762
- property, 781–791
- sample transaction database, 775
- TID, 795–800
- transactional database, 760, 763
- architecture of basic CNN model, 905–914
- architecture of RNN
 - compilation, 1026
 - 3D structure, 1033–1036
 - first layer of LSTM, 1024–1026
 - Keras libraries and packages, 1022–1024
 - output layer, 1026
 - test dataset, 1029–1033
 - training set, 1027–1029
- artificial intelligence (AI), 46–47
- artificial neural network (ANN). *See also* role of
 - weights
 - architecture of, 972
 - deep learning neural network, 829
 - durability and access time of some storage techniques, 823
 - flow of information, 829
 - history of storage cost, 822
 - layer structure, 828
 - multiple input values, 831–833
 - processing capacity of computers, 823
 - squashing, 972
 - technology, 822
 - temporal lobe and, 971
 - working of, 829–831
- artificial neuron, 827
- association rule mining, 24, 26. *See also* Naive
 - algorithm
 - advantages of, 743
 - antecedent and consequent, 744
 - confidence, 747–749
 - defined, 743
 - implementation, 807–819
 - lift, 748–752
 - need for, 739–740
 - rule-based technique, 739
 - sale of beer and diapers, 740–742
 - sales database, 744–745
 - support, 745–746
- astronomical data analysis, 26
- autonomous drones, 7
- average linking, 653
- average pooling technique, 919–920
- backpropagation through time (BTT), 985
- backward elimination method, 293–295
- backward propagation process, 845, 860
- bi-directional elimination method, 296–297
- bioinformatics, 7
- biological neuron, 827
- Brute-force approach, 852–853
- cancer dataset, 866
- candidate 1-itemsets C1 of database, 763
- casting, 68–69
- categorical attributes, 275, 318
- categorical data
 - city and purchased variables, 168
 - dummy variables, 150
 - label-encoded data, 149
 - labeling, 148
 - processed data, 150–151
 - separate attributes, 149
- categorical variables, 168–169
 - nominal, 14
 - ordinal, 15
- cell state, 999–1000
- chatbots, 4
- Chebyshev distance, 620–621
- Chervonenkis, Alexey, 506
- Chi-square distribution table, 284–292
- city variable, 168
- classification. *See also* decision tree classifier
 - binary and multi-class, 361
 - building classifier, 365–366
 - decision tree classifier, 364
 - defined, 360

- examples of regression, 360–361
- input and output attributes, 362–363
- lazy and eager learner classifiers, 367
- multi-label, 361
- posteriori, 362
- priori, 362
- training and testing sets, 365–366
- training dataset, 367
- two-step process, 363
- classification algorithms
 - decision tree classifier, 544–554
 - pre-processing data template, 534–544
 - stepwise approach, 534–535
- classification of ML algorithms
 - supervised learning, 15–23
 - unsupervised learning, 23–26
- classifiers of SVMs
 - history of, 506
 - linear SVM classifier, 506
 - non-linear SVM classifier, 507
- closed and maximal itemsets, 791–795
- clustering. *See also* distance metrics; partitioning
 - clustering
 - applications of, 613–614
 - characteristics of, 612
 - defined, 611–612
 - methods/algorithms, 621–622
 - model, 612
 - properties, 614–615
 - values of attributes, 612
- clustering/outlier analysis, 136
- ColumnTransformer constructor, 319
- comment in Python, 65
- compilation of CNN, 946–947
- complete linkage, 652, 655, 658
- complex curves, 309–310
- concept hierarchy generation, 142
- confusion matrix, 480–481, 484–485, 547–548, 557–559, 880–883
- continuous variables, 15
- contour plots
 - after taking tiny step, 210
 - analysis of cost function, 207–208
 - color ring, 205
 - cost function and parameters, 204
 - defined, 204
 - gradient descent, 214
 - hypothesis plot, 205
 - local minima for same plot, 212
 - minimum value of, 206
 - with one parameter, 213
 - slope of curve, 219–224
 - slope of line, 214–219
- converting image to numbers, 893–896
- convolutional neural network (CNN), 889
 - computer perceives image, 904
 - convolution layer, 906–914
 - 2D array, 904
 - 3D array, 905
 - occipital lobe and, 971
 - pixel matrix representation, 905
 - typical image classification task, 903
 - convolution layer, 906–914
 - CNN model, 941
 - input image processing, 941
 - and max pooling layer, 954–957
 - process, 942
- cost function
 - contour plots, 204–208
 - defined, 198
 - 3D graph of, 203
 - with one parameter, 199–203
- covariance matrix, 144–145
- customers of mall clustering
 - customer's Annual Income and Spending Score, 701
 - dataset, 700–701
 - dendrogram, 712–714
 - elbow method, 704–707
 - k-means, 707–709
 - libraries and dataset, 702–704
 - SuperDataScience dataset, 701
 - visualization, 709–712
- data cleaning
 - data inconsistency, 137
 - description, 130
 - missing values, 130–133

- noisy data, 133–137
- dataframe dataset, 245
- data integration
 - description, 137
 - metadata, 138
 - redundancy of data, 138
- data mining process, 45
- data pre-processing. *See also* data cleaning; data integration; data reduction; data transformation
 - garbage in and garbage out, 128–129
 - house price prediction, 125–126
 - precision agriculture applications, 127–128
 - stages of, 129
- data reduction
 - feature extraction, 143
 - feature selection, 143
- data science, 45
- dataset and pre-processing
 - categorical data, 869–870
 - dependent and independent variables, 867–869
 - feature scaling, 871
 - libraries, 866–867
 - training and testing, 870
- data transformation
 - aggregation, 138
 - concept hierarchy generation, 142
 - discretization, 142
 - feature scaling, 138–140
 - feature selection, 140–142
- data types in Python, 67
- decision tree classifier. *See also* information gain; random forest classification model; SVM linear model
 - accuracy, 548–549
 - advantages and disadvantages, 445
 - building, 370
 - classification model and predictions, 544
 - comparative analysis, 592–594
 - confusion matrix, 547–548
 - correlation of, 368
 - if–then statements, 369
 - information theory, 370–373
 - performance metrics and visualization, 546–547
 - precision, 549
 - prediction of, 369
 - recall, 549–550
 - root nodes, 373–374
 - structure of, 367–368
 - test set prediction, 545–546
 - training set, 544–545
 - visualization of test results, 553–554
- deep learning neural network, 45, 829
- definitions of ML, 10–11
- dendrogram, 648
 - description, 712
 - mall customers, 712–713
 - optimal number of clusters, 713–714
- density-based clustering
 - arbitrary shapes and noise, 681–682
 - border data point, 684
 - core data point, 683
 - core point, 683–684
 - DBSCAN, 682
 - density-connectivity, 687–688
 - directly density-reachability, 685
 - indirectly density-reachability, 685–686
 - k-means, 681
 - MinPts, 682–683
 - neighborhood (ϵ), 682
 - noise data point/outlier, 684
- Density-Based Spatial Clustering of Applications with Noise (DBSCAN)
 - algorithm, 688–689
 - defined, 682
 - disadvantages, 690–692
 - strengths of, 690
- density-connectivity concept, 687–688
- directly density-reachability, 685–686
- discrete variables, 15
- distance matrix, 675–679
- distance metrics
 - Chebyshev distance, 620–621
 - Euclidean distance, 615–617
 - Manhattan distance, 618–619
 - Minkowski distance metric, 619–620
 - proximity measure, 615
- Dlvisive ANALysis (DIANA), 649

- divisive clustering
 - dendrogram of, 680
 - DIANA, 649
 - distance matrix, 676–679
 - HCA diagram, 675
 - record of students' performance, 675–676
 - top-down approach, 649, 675
- document analysis, 613
- Dog–Cat classifier
 - CNN model, 940–941
 - convolution layer, 941–943
 - description, 938
 - directory structure, downloaded, 938
 - flattening, 944–945
 - full connection, 945–946
 - keras library and packages, 940
 - phases of CNN model, 939
 - pooling, 943–944
 - training and testing set, 939
- double-point crossover, 1068–1071
- dummy variables, 150
 - Boolean indicator, 271–272
 - explanation of, 320
 - multiple linear regression, 272, 274
 - and nominal attribute, 273
 - nominal attribute replacement, 272
 - populated table, 273
- dynamic pricing, 3–4
- eigenvectors and eigenvalues, 145–147
- elbow method, 646–647
 - KMeans() constructor, 705
 - number of clusters, 706
 - optimal number of clusters, 704–707
- elitism
 - defined, 1076
 - and elitism ratio, 1077–1079
 - working of operators, GA, 1075–1076
- elitism ratio, 1077–1079
- epoch, 845
- error of prediction, 196
- estate price prediction problem, 846, 848
- Euclidean distance, 178, 615–617
- fake news identification, 614
- feature extraction, 143
- feature scaling
 - attributes/columns, 178
 - Euclidean distance, 178
 - normalization, 179–181
- feature selection, 143
 - customer dataset, 141
 - defined, 140
 - dropping columns, 141
 - filters, 141–142
 - wrappers, 141
- features of Python, 54–55
- feed-forward networks
 - classification at time, 975
 - image classification, 975
 - prediction of, 976
- 50-degree polynomial regression plot, 342
- filters, 141–142
- fine-tuning weights, 924
- fit() method, 249–250
- fitness function, 1053–1054
- flattening operation, 920–922, 944–945
- forget gate, 997–998
- for loop, 107–110
- forward propagation process, 843, 859–860
- forward selection method, 295–296
- fraud detection, 613
- frontal lobe and RNN, 971
- full connection, 922–923, 945–946
- gamma parameter, 526–527
- Gaussian Kernel Function, 516–519
- general AIs, 47
- generation of synthetic data, 897–898
- genetic algorithm (GA). *See also* elitism; role of
 - recombination
 - advantages, 1079
 - applications, 1080
 - chromosome, 1049
 - constraints, 1050
 - Darwin's theory, 1042–1043
 - description, 1041
 - disadvantages, 1080
 - fitness function, 1053–1054
 - gene, 1049

1090 Machine Learning with Python

- gradient descent algorithm, 1042
 - mutation process, 1046–1049
 - natural selection, 1041, 1043–1044
 - objectives, 1050–1051
 - population, 1049
 - recombination/crossover process, 1044–1046
 - representation, 1052–1053
 - search space, 1051–1052
 - variables, 1050
- Gini index, 408–444
- Godfathers of Deep Learning, 829
- Google live albums, 891
- Google Neural Machine Translation (GNMT), 5
- Google Photos app, 891
- gradient descent algorithm, 853–856, 1042
 - basic idea, 208–209
 - 3D plot, cost function, 209
 - initialization of parameters, 209–210
 - values of parameters, 229–235
- graphical user interface (GUI), 60
- handwritten digit classifier, 958–965
- handwritten text recognition, 5
- hidden layer neurons, 851, 945
- hierarchical clustering algorithms (HCA)
 - agglomerative clustering. *See also* agglomerative clustering
 - defined, 648
 - dendrogram, 648
 - density-based clustering. *See also* density-based clustering
 - divisive clustering. *See also* divisive clustering
- history of ML
 - contemporary phase (post 2000), 10–11
 - foundational phase (before 1940), 8
 - phases of development, 7–8
 - transitional phase (1940–2000), 9
- history of Python, 55–56
- Horizontal storage, 758–759
- human brain. *See also* artificial neural network (ANN); convolutional neural network (CNN); recurrent neural network (RNN); three-step learning process
 - biological and artificial neuron, 827
 - identification of images, 900–903
 - input attributes, 828
 - network of neurons, 825–827
 - processing signals, 824
 - structure of, 970
 - training of neural network, 842–852
- hyperbolic tangent function, 840–842
- hyperparameter (σ), 519–520
- hyperplane, 499–503
 - Euclidean spaces, 514
 - maximized margin, 504
 - positive and negative hyperplane, 505–506
 - support vectors, 504
- hypothesis/function, 194
- identifiers in Python, 63
- if* statement, 102–105
- i*loc (Pandas selection and indexing), 245–246
- image augmentation, 947–951
- image recognition, 2–3, 889–892
- implementation of RNN
 - data pre-processing
 - dataset reshaping, 1020–1022
 - data structure, 1015
 - DelhiDieselPrice dataset, 1008–1009
 - downloaded dataset, 1009
 - feature scaling, 1013–1014
 - histogram, 1010–1013
 - independent variables, 1016–1017
 - training and testing data, 1010
- indentation in Python, 64
- independent rank and dependent salary variable, 331
- indirectly density-reachability, 685–686
- information gain
 - “age” attribute, 376–377, 383–384, 388–389
 - check trend of profit as up or down, 375–376
 - “competition” attribute, 377–378, 381–382
 - “credit rating” attribute, 386–387, 390–391
 - defined, 374
 - Gini index, 408–444
 - “income” attribute, 384–385, 389–390, 392–408

- “mid” attribute, 380–381
- “new” attribute, 380
- “old” attribute, 379
- “student” attribute, 385–386
- “type” attribute, 378–379
- “yes” attribute, 387–388
- information theory, 370–373
- input and output attributes, 362–363
- input dimension of images, 953
- input gate, 998–999
- installation of Python, 56–57
- institutional position dataset, 301
- insurance policy-holders, 613
- integrated development environment (IDE), 60
- intelligent personal assistants, 2–3
- interactive mode programming, 58
- interactive Python, 62
- IPython notebook, 62
- Iris dataset, 729–735
- Iterative Dichotomiser 3 (ID3), 370
- joining tuples, 87
- Jupyter IDE, 62
- keras library and packages, 940
- kernel trick
 - defined, 515
 - 3D perspective, 521–524
 - multiple kernels to dataset, 525–526
 - RBF/Gaussian kernel function, 516–519
- keywords in Python, 63–64
- k-means clustering algorithm
 - customers of mall, 700–719
 - database after first iteration, 626–627
 - database after initialization, 625
 - database after second iteration, 628–630
 - data plot, 630
 - defined, 699–700
 - Euclidean distance, 637–640
 - example database, 624, 625
 - final allocation, 644–645
 - first iteration–allocation, 642
 - flowchart for, 624
 - implementation, 630–633
 - implementation and issues, 647–648
 - input records, 622–623
 - intra cluster distance, records in cluster, 645
 - Mall–Customer dataset, 633–634
 - optimal number of clusters, 646–647
 - record of students’ performance, 641
 - second iteration–allocation, 643–644
 - seed records, 634–635, 641
 - Spyder IDE, 700
 - updated centroids, 643
 - visualization, 716–719
 - working of, 623
- k-Nearest Neighbor Algorithm, 467–470
- k-NN model, 567–574
- knowledge-based method, 293
- Laplace estimator, 466–467
- lazy and eager learner classifiers, 367
- L1-distance/taxicab norm, 618–619
- learning rate α , 224–229
- level plots, 204
- limitations of RNN
 - long-term dependencies, 984–985
 - short-term dependencies, 983–984
- linear regression with one variable, 195
- linear SVM classifier, 506
- logistic regression classifier model, 470–478, 574–581
- long short-term memory (LSTM)
 - caption generation from image, 1001–1002
 - cell, 995–996
 - cell state, 999–1000
 - classification of DNA sequence, 1002–1003
 - defined, 989
 - forget gate, 997–998
 - gated units, 990
 - hidden state flow between cells, 991–992
 - input gate, 998–999
 - machine-readable vectors, 991
 - machine translation, 1002
 - named entity recognition, 1002
 - online review of laptop, 990
 - output gate, 1000–1001
 - sentiment classification, 1003

1092 Machine Learning with Python

- sigmoid activation function, 996–997
- speech recognition, 1002
- tanh activation function, 993–995
- text generation/language modeling, 1001
- time series analysis, 1003
- video activity recognition, 1002

- machine-readable vectors, 991
- machine translation software, 5
- Mall–Customer dataset, 633–634
- Manhattan distance, 618–619
- market basket analysis, 807
- market segmentation, 25
- Markov’s decision process, 34–35
- mathematical modeling and RNN, 980–983
- Matplotlib, 2D plotting library, 158
- “Maximal Margin Classifier” model, 506
- maximized margin hyperplane, 504–506
- max pooling technique, 916–919
- mean absolute error (MAE), 257–258, 325
- mean squared error (MSE), 198, 258–259, 325
- mini-batch method, 858–859
- Minkowski distance metric, 619–620
- Min–Max scaling, 139, 179
- missing values, 166–168
 - mean/median/mode, 131–132
 - observation, 133
 - prediction of, 132–133
 - rows/columns deletion, 130–131
- Mitchell, Tom M., 11
- MNIST dataset, 958–965
- Modified National Institute of Standards and Technology (MNIST) dataset, 892–893
- multiple input values, 831–833
- multiple linear regression
 - dataset of companies, 268–269
 - dependent and independent variables, 269–270
 - instance of 50_AdAgency, 314–316
 - simple and, 267, 268
- multiple regression model, 275–278
 - dependent variable, 276
 - garbage in–garbage out, 277
 - selection of attributes, 277
 - too complex model, 277
- mutation process
 - abnormalities, 1048
 - defined, 1046
 - effect on human beings, 1047
 - mathematical modeling, 1072–1074
 - natural selection and recombination, 1047
 - probability of mutation, 1074–1075
- naive algorithm
 - limitations of, 755–756
 - non-zero frequencies transaction dataset, 756–757
 - sale record of grocery store, 753
 - working of, 753–755
- naive Bayes classifier model
 - Alexa Purchase Problem, 561
 - classification model and predictions, 562–563
 - performance metrics and visualization, 563–565
 - visualization of test set, 566–567
 - visualization of training, 565–566
- naive Bayes method
 - for classification, 451–466
 - defined, 448
 - Laplace estimator, 466–467
 - manufactured screws, 449–451
 - ML and AI classification, 448
- named entity recognition, 1002
- National Institute of Industrial Engineering (NITIE), 761
- natural selection, 1041, 1043–1044
 - Roulette wheel working, 1054–1061
- noisy data
 - clustering/outlier analysis, 136
 - data cleaning tasks, 133
 - regression, 136–137
 - smoothing/binning methods, 133–135
- nominal attributes, 318
 - handling, 270–271
 - separate, 271
 - with three values, 273
- nominal variables, 14
- non-linear SVM classifier, 507

- non-linear data, 508
- non-linearly separable data, 507–508
- one-dimensional (1D) dataset, 509–513
- TRIANGLES and PENTAGON classes, 508–509
- two-dimensional (2D) dataset, 513–514
- non-linear SVM linear model, 587–592
- normalization, 139–140
 - input variables, 179
 - limitation of, 180–181
 - in Python, 179–180
- Not A Number (NaN), 989
- null hypothesis, 292–293
- numerical variables
 - continuous, 15
 - discrete, 15
- NumPy/Numeric Python, 156–157
- occipital lobe and CNN, 971
- OneHotEncoder, 319
- one-hot encoding, 170–175
- online video streaming platforms, 4
- optimal hyperplane, 504
- optimal number of epochs, 925–930
- optimal weights, 845
- ordinal variables, 15
- output gate, 1000–1001
- output layer, 945–946
- overfitting model, 926–928
- Pandas library, 157
- parietal lobe and ANN, RNN, 971–972
- partitioning clustering
 - defined, 622
 - k-means (*see* k-means clustering)
- plot of salary *versus* rank, 302
- polynomial linear regression
 - behavior of COVID confirmed cases, 299–300
 - chemistry lab experiment, 348–355
 - complex curves, 309–310
 - cubic relationship, 309
 - dataset import, 329
 - defined, 327
 - independent variables, 303–305
 - institutional position dataset, 328
 - linear, 301
 - linear relationship, 309
 - mathematical representation, 300
 - multiple input attributes, 308
 - quadratic relationship, 309
 - rank–salary problem, 302–303
 - vs.* simple linear regression, 344–347
 - variable explorer, 329
- pooling layer, 915–916, 943–944
- positive and negative hyperplane, 505–506
- Posteriori classification, 362
- predict() method, 250
- principal component analysis (PCA)
 - algorithm, 148
 - concept of, 147
 - covariance matrix, 144–145
 - description, 143
 - eigenvectors and eigenvalues, 145–147
 - standardization process, 144
- priori classification, 362
- Purchase Alexa Dataset, 533–534, 536
- purchased variable, 168
- P-value (probability value)
 - actual observed results, 281
 - Chi-square distribution table, 284
 - Chi-square value, 282–283
 - degree of freedom, 281–282
 - expected results, 280–281
 - experiment, 280
 - null hypothesis, 278–279
 - significance level, 279
 - value of significance level, 283
- Python dictionary, 88–95
- Python functions, 110–114
- Python list
 - description, 73–74
 - features of, 74
 - operations on, 74–81
- Python numbers, 68–69
- Python set, 96–101
- Python strings, 69–73

Q-learning

- Q-matrix, 37–44
- reinforcement learning algorithm, 35
- representation house, 35–36
- reward matrix, 36–37

Q-matrix, 37–44

quality of classifier

- confusion matrix, 480–481
- defined, 478
- false negative, 480
- false positive, 480
- F-measure, 483
- precision, 481–482
- recall, 482–483
- true negative, 479
- true positive, 479

Quinlan, John Ross, 370

radial basis function (RBF), 516–519

random forest classification model

- Alexa Purchase Problem, 554
- confusion matrix, 557–559
- fitting training set, 555–556
- performance metrics and visualization, 557
- principle of ensemble learning, 446
- test set predictions, 556–557
- visualization of test set, 560–561
- visualization of training, 560
- working of, 446–447

random selection, 1064

ranking of computer programming languages, 53–54

rank selection, 1063–1064

recombination/crossover process, 1044–1046

rectified linear unit (ReLU) activation function, 915

rectifier linear unit function, 839–840

recurrent neural network (RNN). *See also* limitations of RNN

- backpropagation, 985
- case study of coaching center, 977–980
- exploding gradient, 988–989
- frontal lobe and, 971

mathematical modeling, 980–983

- single arrow between layers, 973
- temporal loop, 973–974
- vanishing gradient, 986–988
- vertical representation of layers, 973
- working inside cell, 992–993
- working principle of, 976–977

regression metrics, 136–137

- evaluation, 257
- MAE, 257–258
- MSE, 258–259
- RMSE, 259–260

regularization parameter, 527–528

reinforcement learning. *See also* Q-learning

- defined, 27
- exploitation, 33
- exploration, 32
- Markov's decision process, 34–35
- reward maximization and discount, 31–32
- SAR triples, 33
- vs. supervised and unsupervised, 28
- working principle of, 28–31

right-fitted model, 928

role of recombination

- defined, 1065
- double-point crossover, 1068–1071
- single-point crossover, 1065–1067

role of weights, 833–835

root mean squared error (RMSE), 259–260, 325

root nodes, 373–374

R-squared (R^2), 260–264

Samuel, Arthur, 10–11

scatter() method, 252, 333

Scikit-Learn Library, 158

script mode programming, 59–60

seed records, 634–635, 641

self-driving cars, 7

sentiment classification, 1003

Shannon, Claude, 371

sigmoid activation function, 838–839, 996–997

simple image classifier, 896–897

simple linear regression (SLR), 986

- datasets, 188
- defined, 187
- equation of straight line, 190
- fitting straight line to model, 192
- five years of research experience, 192
- mathematical equation, 193
- notations, 193
- parameters, 195–197
- ResearchExperience and Stipend, 241–243
- research experience *vs.* stipend plot, 189
- stipend value, 190–191
- training set, 188
- simple transaction storage, 758
- single linkage, 651–652, 659, 663
- single-point crossover, 1065–1067
- sliding window approach, 898–899
- smart home assistants, 2–3
- smoothing/binning methods
 - bin boundary, 134–136
 - bin mean, 134–135
 - bin median, 134–135
 - datasets, 134
 - discretizing, 133
- social media services, 5
- social network analysis, 25
- spam emails, 613
- speech recognition, 2–3, 1002
- Spyder software, 60
 - dataset data frame, 161–162
 - dataset import, 161
 - File Explorer, 159
 - File explorer, 243
 - IDE, 61
 - libraries, 244
 - row and column selection, 162–164
 - save and run file options, 160
 - variable explorer, 244
- standardization, 140
 - process, 144
 - in Python, 181–182
- stationary kernel, 516–519
- stochastic gradient descent algorithm, 856–858
- stochastic universal sampling (SUS), 1062
- sum of square errors, 196
- supervised learning
 - considered label data, 16
 - data plot, 20
 - datasets, 19
 - defined, 15–16
 - features for classification, 21
 - prediction of cost of plot, 17–18
 - predictions, 20
 - price prediction dataset, 16–17
 - regression and classification, 22
 - vs.* unsupervised, 26–27
- support vector machines (SVMs). *See also*
 - classifiers of SVMs; hyperplane; kernel trick; tuning parameters
 - dataset distribution, 496
 - hyperplane separation, 497–499
 - ML models, 495
 - terminologies, 503
- SVM linear model, 581–587
- tanh* activation function, 993–995
- temperature and vapor pressure readings, 306
- temporal lobe and ANNs, 971
- text classification, 594–604
- text generation/language modeling, 1001
- three-class classifier, 484–485
- three-step learning process, 835–842
- threshold function, 837–838
- time series analysis, 1003
- tournament selection, 1063
- traditional programming *vs.* ML, 13–15
- training and testing datasets, 175–177, 246–249
- training set, 188
- `train_test_split()` method, 247
- transaction database storage
 - horizontal, 758–759
 - simple, 758
 - vertical representation, 759–760
- tuning parameters
 - defined, 526
 - gamma parameter, 526–527
 - regularization parameter, 527–528
- tuples
 - data type, 81–82

1096 Machine Learning with Python

- features of, 82
- and lists, 87–88
- operations over, 83–87
- underfitting model, 926
- univariate regression, 187
- unsupervised learning
 - anomaly detection, 26
 - applications of, 24
 - association rule mining, 24, 26
 - astronomical data analysis, 26
 - computing clusters, 25
 - defined, 23
 - Google News, 24–25
 - market segmentation, 25
 - social network analysis, 25
 - vs. supervised, 26–27
 - working of, 23
- updated distance matrix, 661–662, 668–674
- U.S. arrests dataset
 - clusters visualization, 724–726, 728–729
 - dendrogram, 726–727
 - HCM, 727
 - instance of, 719–720
 - k-means, 722–724
 - libraries and dataset, 720–721
 - optimal number of clusters, 721–722
- Vapnik, Vladimir, 506
- variable explorer tab, 250, 317
- variables in Python
 - declaring and assignment of values, 66–67
 - defined, 65
- video activity recognition, 1002
- video surveillance, 5–6
- virtual personal assistants, 2–3
- weak AI systems, 47
- while* loop, 105–107
- wrappers, 141
- X and Y matrices, 165–166
- Yann LeCun, 892
- zig-zag curve (overfitted model), 927