Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index <u>More Information</u>

Index

A/B testing, 3, 328, 337-340, 345 accountability (machine learning), 356-358 accuracy association rule, 128-129 machine learning modeling criteria, 111 ACM Conference on Fairness, Accountability, and Transparency (ACM FAccT), 352 adversarial learning, 344 agglomerative clustering defined, 186 dendogram with maximum clustering, 187 dendogram with minimum clustering, 32, 188 steps to create, 186 Akaike Information Criterion (AIC), 195, 196, 200, 334-335 algorithmic accountability, 356-358 algorithmic bias, 353-354 AlphaZero, 304 Amazon Web Services (AWS) account set-up, 66-68 versus Microsoft Azure, 66 purpose of, 66 Amazon Web Services (AWS) Cloud9 create Cloud9 environment, 71 interface, 70 pricing, 73 work in Cloud9 environment, 71-72 Amazon Web Services (AWS) connect PuTTY 68-69 SSH session, 69 Anaconda installing and configuring, 383-384 Python language access, 28 anomaly detection approaches for, 164 defined, 166 process of, 164-165 uses for, 164 arithmetic operators (Python), 30 artificial intelligence (AI) defined. 20 differences with machine learning, 10, 19 responsible, 352-353 artificial neural networks (ANN) copying human brain interactions, 227 versus human neurons, 228-229

human versus artificial neurons, 228-229 learning by example, 228 supervised, 228 ASIMO robot, 306 association rule, 128-129 autoencoder network architecture, 243-244 defined, 243, 260 unsupervised learning example, 244-246 axon, 228, 260 backward propagation methods defined, 237 process of, 237 bandits (reinforcement learning) contextual, 316-317 exploration-exploitation dilemma, 315-316 multi-arm. 316-322 one-armed, 315 batch gradient descent in action, 102 defined. 114 example, 104-109 methodology, 20, 102 Bayes' theorem, 382 Bayesian classification defined, 154 Thompson sampling, 317 Bayesian Information Criterion (BIC), 195, 196, 200, 335 Beauty AI, 348-349 bias (machine learning) versus fairness, 355-356 pervasiveness, 354 Simpson's paradox, 355 bias, statistical, 90 bias, systemic, 353-354 bias types (machine learning) algorithmic/systemic, 353-354 cognitive, 354 data, 354 bidirectional encoder representations from transformers (BERT), 287-297 Boolean values (Python), 30 bootstrap sampling technique (random forest), 133

405

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index <u>More Information</u>

406	Index		
	-		
	categorical variable, 145, 367	correlation	
	central tendency	defined, 45, 377	
	defined, 372	example, 378	
	mean, 372–373	Pearson's r correlation, 378	
	median, 373	Python, 44	
	mode, 373–374	counterfactual evaluation, 340-343, 345	
	classification. See also decision tree	counterfactual explanation, 360, 363	
	context of, 118	coverage (association rule), 128	
	deep learning, 272–278		
	defined, 9	data bias, 354	
	k-nearest neighbors (kNN), 119–123	data mining, 330–331, 345	
	logistic regression, 145–152	data types	
	naïve Bayes, 154–158	defined, 30–31	
	neural networks example, 240-242	Python, 30	
	as process of supervised learning, 118	dataframe, Python, 54–55	
	R language, 388–389, 392–393	decision rule, 127	
	softmax regression, 152-153	decision tree. See also classification	
	support vector machine (SVM), 159-164	association rule, 128-129	
	classification rule, 45, 127-128	classification rule, 45, 128-129	
	cloud computing	decision rule, 127	
	defined, 49-50	entropy, 124–125	
	essential nature of, 50	information gain, 126	
	Google Cloud Platform (GCP), 50-59	purpose of, 123–124	
	Microsoft Azure, 59–66	steps to create, 127	
	cloud platform	deep learning. See also machine learning	
	certification, 74	classifier building, 272–278	
	defined, 76	defined, 264, 298	
	moving between, 75	embeddings, 278–282	
	clustering	encoders and transformers, 283-297	
	defined, 10, 175, 200	as next level of machine learning, 264-265	
	density estimation, 196-199	popularity of, 297–298	
	elbow method, 185-186	Python model, 266	
	expectation maximization (EM), 176, 192-196	shortcomings, 298	
	model goodness indicators, 195-196	simple model, 267–272	
	R language, 394–395	when to use, 265–266	
	in unsupervised learning, 10	deep networks, 264, 298	
	clustering algorithms	dendogram	
	agglomerative, 175, 186–191	defined, 189, 200	
	divisive, 175–186	with maximum clustering, 187	
	cognitive bias, 354	with minimum clustering, 188	
	collaborative filtering (CF), 7–8	dendrites, 228	
	COMPAS (Correctional Offender Management	density estimation	
	Profiling for Alternative Sanctions), 348	defined, 10	
	comprehensibility (machine learning), 359, 363	Meanshift technique, 196–197	
	conditional probability, 382	dependent variable (linear regression), 82.	
	confidence. See accuracy	114, 367	
	content filtering, 8–9	differential calculus functions, 380	
	context. 327	differential privacy, 362	
	contextual bandits, 316–317	dimensionality, 222	
	continuous bag of words (CBOW) 298	dimensionality reduction	
	continuous variable 145 367	curse of 206–207	
	convolution 247–248 260	feature selection 207–213	
	convolution neural network (CNN)	linear discrimination analysis (IDA) 288 280	
	and MLP 247	218_221	
	and VILL, 27	maximum likelihood estimation (MLE) 212	
	$\frac{1}{2}$	overfitting 207	
		0 v G H H H H H Z V /	
	Correctional Offender Management	nrincipal component analysis (BCA) 214 219	

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index

More Information

disinformation, 363	feed-forward neural network, 231
distributed filesystem (Hadoop), 54	filesystem, 54
distributed learning, 362	F-measure, 332
divisive clustering	focus groups, 336–337
with <i>k</i> -means, 179–182	for loop (Python), 32
with <i>k</i> -modes, 182–185	forget gate (LTSM), 257
steps to create, 176	forward propagation methods (neural networks), 236
elbow method (clustering), 185-186	generalizability (model), 337
elif command (Python), 32	Google biases, 19
embeddings	Google Cloud Platform (GCP)
deep learning and, 278	background, 50
defined, 278, 298	Google Colab, 56–59
input, 285	Hadoop, 53–55
pretrained word embeddings, 279	new project creation, 50-51
word embeddings, 278-279	SSG key addition, 52–53
encoders	virtual machine creation, 50-51
layers in, 286–287	Google Colab
positional, 285	accessibility of, 56
Enron scandal, 356	getting started running with Python, 56-59
ensemble methods, 132, 138	installing Python packages, 37-38
entropy	versus Microsoft Azure, 66
decision tree, 124–125	Google or Not misinformation, 349-351
defined, 138	gradient ascent, 147
types of, 126–127	gradient descent, 98-102, 113, 114
epsilon-greedy algorithm, 317	graph-based neural networks (GNN), 297
estimator choice modeling criteria, 27, 112	
evaluation (machine learning)	Hadoop
A/B testing, 337–340	as backbone of big-data operations, 53-54
adversarial learning, 344	defined, 54
counterfactual evaluation, 340-343	modules, 54–55
goodness and, 331	Hadoop Common (Hadoop), 55
offline, 331–335	HD Insight cluster, 60–61
user research, 335–337	Hello World program (Java), 14
expectation maximization (EM)	hidden layer, 235
definition, 192	histogram, 368–369
log likelihood, 192	hyperparameters modeling criteria, 112
maximum likelihood estimation (MLE), 192 tossing coin example, 192	hyperplane, 159–160
uses for, 192	if command (Python), 32
explainability (machine learning), 359, 360, 363	if-else command (Python), 32-33
exploding gradient (RNN), 256	incremental gradient descent. See stochastic gradient
exploration-exploitation dilemma, 315-316	descent
- • *	independent variable (linear regression), 82, 114, 367
Fairness, Accountability, Transparency (FAT)	information gain
conference, 352	decision tree, 125
Fairness, Accountability, Transparency,	defined, 138
Ethics (FATE), 352	input embeddings, 285
fairness versus bias in machine learning, 355-356	input gate (LSTM), 257
false negative statement, 332	integrated development environment (IDE)
false positive rate (FPR), 166	defined, 45
false positive statement, 332	Python language access, 27–28
feature, defined, 114, 222	interim gradient descent. See stochastic gradient
feature selection	descent
defined, 222	interpretability (machine learning), 359, 363
importance of, 207	interval variable, 367
univariate feature selection, 208–210	interviews, 336–337

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index

More Information

408	Index		
	Java language Hello World program, 14	algorithms adjusting own parameters, 4–5 defined, 3, 20, 113	
	versus Python, 14	differences with artificial intelligence (AI), 10, 30	
	Jupyter Notebook	learn from experience, 4	
	installing Python packages 37–38	nomenclature differences with statistics 9	
	insuming I ython packages, 57 56	regression at scale. 95	
	kernels	traditional versus machine learning, 5	
	decision boundaries, 166	machine learning careers	
	in SVM, 164	finance, 401	
	k-means	healthcare, 401–402	
	divisive clustering, 179–182	overview, 400–401	
	elbow method (clustering), 185–186	retail, 402–403	
	<i>k</i> -modes, 182–185	tech, 403	
	k-nearest neighbors (kNN)	machine learning design and evaluation	
	anomaly detection, 164–165	complexity of, 326	
	example (trained model) 119–120	learning to rank (LTR) or machine learned ranking	
	major steps 119	(MLR) 329	
	reasons for, 119	recommender system, 327–328	
	shortcomings, 120	machine learning example	
		collaborative filtering (CF), 7–8	
	learning	content filtering, 8–9	
	limitations with computer association, 3	optical character recognition (OCR), 6	
	positive change in system or person, 4, 20	WAYMO car, 5–6	
	learning rate, 30, 114	machine learning issues	
	learning to rank (LTR), 329	fairness, 19	
	likelihood of model, 146–147	flawed data, 18	
	linear model defined 113	racial disparity, 18	
	linear regression See also regression	machine learning modeling criteria	
	defined. 45	accuracy, 111	
	ordinary least squares (OLS), 84-85	estimator choice, 27, 112	
	overfitting, 90	features numbers compared to data	
	overview, 90	points, 112	
	process of, 82	hyperparameters, 112	
	R language, 390–391	linearity, 111	
	relationship between variables, 83	training/testing, 111	
	statistical bias, 90	training time, 111	
	using Python 86,80	certification for cloud platform 74	
	variance 90	onboarding phase 74	
	linearity modeling criteria, 111	machine learning problems	
	log likelihood, 192, 196, 200	accountability, 356–358	
	logical operators (Python), 30	Beauty AI, 348–349	
	logistic regression	bias, 353–356	
	categorical variable, 145	Correctional Offender Management Profiling for	
	continuous variable, 145	Alternative Sanctions (COMPAS), 348	
	defined, 147	differential privacy, 362	
	gradient ascent, 14/ likelihood of model 146, 147	rederated learning, 362	
	receiver operating curve (POC) 151	340_351	
	long short-term memory (LSTM)	577-551 responsible AI in academia industry and	
	defined 257	regulations 352–353	
	gates. 257	transparency, 358–360	
		machine learning, specialized requirements	
	machine learned ranking (MLR), 329	skills, 11–13	
	machine learning. See also deep learning	tools, 13–14	

(C) in this web service Cambridge University Press & Assessment

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index

More Information

Index

machine learning taxonomy reinforcement, 10 summary, 9, 20 supervised, 9 unsupervised, 10 MapReduce (Hadoop), 55 Markov process (reinforcement learning), 306 maximum likelihood estimation (MLE) defined, 200 dimensionality reduction, 213 expectation maximization (EM), 192 maximum marginal hyperplane (MMH), 160-161 McCulloch-Pitts model (MP), 229-230 mean (statistics), 372-373 Meanshift technique, 196-197 median (statistics), 373 Microsoft Azure account set-up, 59-60 versus Amazon Web Services (AWS) Cloud9, 66 cluster details overview. 62 versus Google Colab, 66 HDInsight cluster and, 60-61 interface, 60 as Linux virtual machine, 62 machine learning example, 63-65 storage set-up, 61-62 misinformation, 363 mode (statistics), 373-374 model, defined, 113 multi-arm bandit problem background, 316 solutions, 317-322 multi-headed attention, 286-287 multilayer perceptron (MLP) model forward propagation methods, 236 forward propagation methods example, 237-238 hidden layer, 235 layers in, 236 overview of, 236 multinomial logistic regression, 152. See also softmax regression multiple linear regression, 91 MvSOL Python and, 396-398 R language and, 398-399 naïve Bayes assumption, 154, 165-166 defined, 154 process of, 156 steps to create, 155 neural networks backward propagation methods, 236-237 basics of, 228 classification example, 240-242 construction in Python, 238 design, 242-243

forward propagation methods, 236 graph-based (GNN), 297 and human brain modeling, 227-228 machine learning timing, 256 regression example, 240 neural networks architecture autoencoder, 243-247 convolution neural network (CNN), 247-251 feed-forward network, 231 long short-term memory (LSTM), 256-259 multilayer perceptron (MLP), 234-235 perceptron, 231-232 recurrent neural network (RNN), 251-256 single-layer perceptron (SLP), 232-235 neuron, defined, 260 neuron network architectures McCulloch-Pitts model (MP), 229 - 230single neuron, 230 small, 229-230 neuron physiology axon, 228 dendrites, 228 and human processing power, 231 structure, 229 synapse, 228 nominal variable, 367 normal distribution, 370-372 NumPy package (Python), 39 offline evaluation metrics, 332-333 one-armed bandits, 315 optical character recognition (OCR), 6 ordinal variable, 367 ordinary least squares (OLS), 84-85 outcome. See dependent variable out-of-bag error (random forest), 133 out-of-bag samples (random forest), 133 output gate (LSTM), 257 overfitting decision tree problem, 132 dimensionality reduction, 207 linear regression, 90 overfitting, data, 137 Pandas dataframe, 53-54 Pandas packages, 36 parallel distributed processing (PDP), 227-228 parameter, 114 Pearson's r correlation, 378 perceptron model defined, 231 importance of, 231-232 model representation, 232 multilayer perceptron (MLP), 234-235

single-layer perceptron (SLP), 232-235

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index

More Information

410	Index		
	policies (reinforcement learning), 306	Python statistics	
	positional encoders, 285	bar graph, 41	
	positive predictive value. See precision metrics	correlation, 44	
	precision metrics	data distribution, 39	
	defined, 332	histogram, 40–41	
	example, 332–333	importing data, 42–43	
	F-measure, 332	max, 39	
	recall, 332	mean, 39	
	receiver operating characteristic (ROC) curve,	median, 40	
	334–335	min, 39	
	predictor. See independent variable	plotting data, 43–44	
	predictor variable, 367	standard deviation, 40	
	pretrained word embeddings, 279	variance, 40	
	principal component analysis (PCA)		
	algorithm, 214–215	Q-learning	
	defined, 214, 214	defined, 311	
	process of, 214	goal of, 311	
	singular value decomposition (SVD), 215	process of, 311	
	probability formulas	<i>Q</i> -learning set-up	
	Bayes' theorem, 382	Q matrix, 312	
	conditional probability, 382	reward matrix, 311	
	event probability, 382	states, 311	
	propensity, 342, 345		
	PulTY, AWS connect, 68–69	R language	
	PulTYgen, 52	classification, 388–389, 392–393	
	Python language	clustering, 394–395	
	basic examples, $29-31$	installing and configuring, 386	
	basic operation, $31-32$	linear regression, 390–391	
	door looming model 266	MySQL and, 598–599	
	and Google Colob. 56, 59	ungungruiged learning 202 205	
	vortus Java Janguaga 14	random forest	
	Junyter Notebook 383–384	advantages 132 134-135	
	linear regression 86–89	hootstran sampling technique 133	
	neural network construction 238	versus decision trees 50, 133–136	
	overview 26	reasons for 132	
	usefulness in a work environment 44	steps to create 132	
	Python language access	ratio variable 367	
	Anaconda, 28, 383–384	recall. 332	
	download/install, 26–27	receiver operating curve (ROC)	
	MvSOL and, 396–398	Akaike Information Criterion (AIC).	
	platforms, 26	334–335	
	Spyder, 385, 29	Bayesian Information Criterion (BIC), 335	
	via console. 27	defined. 334	
	via integrated development environment (IDE),	generation, 151	
	27–28	graph, 334	
	Python language functions	recurrent neural network (RNN)	
	form of, 35	architecture, 20, 252	
	interactive, 36	defined, 252, 260	
	write own, 34–35	problems with, 256–257	
	Python language packages	regression. See also linear regression	
	matplotlib.pyplot, 40	defined, 81	
	NumPy, 34, 39	entry point to machine learning, 113	
	Pandas, 36	multiple linear, 91–95	
	using Google Colab, 37–38	neural networks example, 240	
	using Jupyter Notebook, 37–38	R language, 389–391	
	using Snyder 37	Ridge and Lasso 96-98	

© in this web service Cambridge University Press & Assessment

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index

More Information

at scale, 95	interval variable, 367
in supervised learning, 9	nominal variable, 367
reinforcement learning	ordinal variable, 367
ASIMO robot, 306	ratio variable, 367
bandits, 315–322	statistics
as branch of machine learning, 10, 303	log likelihood, 192
conceptual model, 304–306	maximum likelihood estimation (MLE), 192
cumulative award maximization, 304	nomenclature differences with machine learning,
defined, 20, 323	receiver operating curve (ROC), 151
Markov process, 306	stochastic gradient descent, 102, 114
O lassing 211 215	supervised learning
Q-learning, $311-315$	ANN, 228
tic tac toe, 306	anomaly detection, 164–165
training limit, 306	classification, 118–138
mai-and-error steps, 505	defined 0 20 112 127 166 222
hige and Lasso regression	discrete 0
gradient descent 08, 102	know truth first in 0, 10
gradient descent, 96–102	predictions about future 118
stochastic gradient descent 102	P language 302 303
stochastic gradient descent, 102	random forest 132–137
scatterplot (Python) 43-44	regression 9 81–113
self-attention (transformers) 283 284	support vector machine (SVM)
Simpson's paradox 355	defined 159
single-layer percentron (SLP) model	hyperplane 159–160
defined, 232	kernels, 164
example for classification, 234–235	maximum marginal hyperplane (MMH), 160–161
model representation, 233	theory, 161–162
overview, 232–233	types of data, 159
singular value decomposition (SVD), 215	surveys, 336
singular values (SVD), 215	synapse, 228, 26, 260
computational thinking, 15–18	systemic bias, 353–354
computer and data literacy, 12	test set, 137, 146
critical thinking, 12–13	Thompson sampling, 317
machine learning algorithms, 12	tic tac toe (reinforcement learning), 306
math, 12	tools for machine learning competence
to obtain job, 13	Python language, 14
programming, 12	R language, 386–395
skip-gram models, 298	training limit (reinforcement learning), 306
Spyder	training time modeling criteria, 111
installing and configuring, 585	training–validation–test data, 137, 146, 166
instailing Python packages, 37	Didirectional Encoder Democratic and from
Puthon language access 20	Transformers (PEPT) 287, 207
SSH (secure client) 76	defined 283
statistical bias linear regression 00	ucilicu, 203
statistical distributions	self-attention 283 284
central tendency 372-374	transparency (machine learning) 358_360 363
dispersion 374–377	true negative statement 332
histogram 368–369	true positive rate (TPR) 166
normal distribution 370–372	true positive statement 332
statistical variables	are positive succinent, 552
continuous variable. 367	understandability, 363
dependent variable (linear regression), 367	understandability (machine learning), 359
discrete variable. 367	univariate feature selection.

Cambridge University Press & Assessment 978-1-009-12330-3 — A Hands-On Introduction to Machine Learning Chirag Shah Index <u>More Information</u>

412 Index unsupervised learning timing for, 335 autoencoder network, 244-246 user studies, 337 clustering, 175-199 user studies, 337 clustering in, 10 defined, 200, 323 validation set, 137 density estimation, 10 vanishing gradient (RNN), 256 dimensionality reduction, variance (linear regression), 90 206-221 R language, 394-395 WAYMO car, 5-6 upper confidence bound, 317 while loop (Python), 32, 33 user research (machine learning evaluation) word embeddings, 278-279 interviews, 336-337 YARN (Hadoop), 55 surveys, 336