364 INDEX

| Risk. See also Hierarchical Risk Parity (HRP) approach; Strategy risk backtest statistics for uncovering, 195 entropy application to portfolio concentration and, 276 liquidity and, 7, 286 ML algorithms for monitoring, 14 PCA weights and, 35–36, 35f portfolio oversight and, 8 profit taking and stop-loss limits and, 44 structural breaks and, 249 walk-forward (WF) approach and, 161 Risk-based asset allocation approaches, 222 HRP approach comparisons in, 236–238 structural breaks and, 249 Risk parity, 222. See also Hierarchical | Scalability bagging for, 101 sample size in ML algorithms and, 38, 101 Scikit-learn (sklearn) class weights in, 71 cross-validation (CV) bugs in, 109–110 grid search cross-validation in, 129–130 labels and bug in, 55, 72, 94 mean decrease impurity (MDI) and, 115 neg log loss as scoring statistic and bug in, 134 observation redundancy and bagging classifiers in, 97 random forest (RF) overfitting and, 98–99 support vector machine (SVM) |
|---|---|
| Risk Parity (HRP) approach HRP approach compared with traditional approach to, 231–232, 233t, 234, 235f | implementation in, 101 synthetic dataset generation in, 122 walk-forward timefolds method in, 155 |
| Rolled prices, 37 | Selection bias, 153–154, 167 |
| Roll model, 282–283 | Sequential bootstraps, 63–68 description of, 63–64 implementation of, 64–65 |
| Sample weights, 59–72 | leakage reduction using, 105 |
| average uniqueness of labels over lifespan and, 61–62, 61 <i>f</i> | Monte Carlo experiments evaluating, 66–68, 68 <i>f</i> |
| bagging classifiers and uniqueness | numerical example of, 65-66 |
| and, 62–63 | Shannon, Claude, 263–264 |
| indicator matrix for, 64–65 | Sharpe ratio (SR) in efficiency |
| mean decrease accuracy (MDA) | measurements |
| feature importance with, 116 | annualized, 205 |
| number of concurrent labels and, 60–61 | definition of, 203 deflated (DSR), 204, 205 <i>f</i> |
| overlapping outcomes and, 59-60 | information ratio and, 205 |
| return attribution method and, 68–69 | probabilistic (PSR), 203–204, 204 <i>f</i> , |
| sequential bootstrap and, 63–68 | 205–206, 218 |
| time-decay factors and, 70–71, 72 <i>f</i> | purpose of, 203 |
| Sampling features, 38–40 | targeting, for various betting |
| downsampling and, 38 | frequencies, 212–213 Shorting in quantitative investing, 152 |
| event-based sampling and, 38–40, 40f | Shorting, in quantitative investing, 152 |

INDEX 365

| Signal order flows, 295 | optimal trading rule (OTR) algorithm |
|---|---------------------------------------|
| Simulations, overfitting of, 154 | for, 173–174, 176–177, 192 |
| Single feature importance (SFI), | strategy risk and, 211 |
| 117–118, 125–127, 126 <i>f</i> | triple-barrier labeling method for, |
| Single future roll, 36–37 | 45–46, 47 <i>f</i> |
| Sklearn. See Scikit-learn | Storytelling, 162 |
| Stacked feature importance, 121–122 | Strategists, 7 |
| Standard bars (table rows), 26–28 | Strategy risk, 211–218 |
| dollar bars, 27–28, 28f, 44 | asymmetric payouts and, 213–216 |
| purpose of, 26 | calculating, 217, 218 |
| tick bars, 26–27 | implied betting frequency and, |
| time bars, 26, 43–44 | 215–216, 216 <i>f</i> |
| volume bars, 27, 44 | implied precision and, 214–215, |
| Stationarity | 215 <i>f</i> |
| data transformation method to ensure, | investment strategies and |
| 77–78 | understanding of, 211 |
| fractional differentiation applied to, | portfolio risk differentiated from, |
| 76–77 | 217 |
| fractional differentiation | probabilistic Sharpe ratio (PSR) |
| implementation methods for, | similarity to, 218 |
| 80–84 | strategy failure probability and, |
| integer transformation for, 76 | 216–218 |
| maximum memory preservation for, | symmetric payouts and, 211-213, |
| 84–85, 84 <i>f</i> , 86 <i>t</i> –87 <i>t</i> | 212f |
| memory loss dilemma and, 75-76 | Structural breaks, 249–261 |
| Stop-loss, and investment strategy exit, | CUSUM tests in, 250–251 |
| 211 | explosiveness tests in, 249, 251–259 |
| Stop-loss limits | sub- and super-martingale tests in, |
| asymmetric payoff dilemma and, | 259–261 |
| 178–180 | types of tests in, 249–250 |
| cases with negative long-run | Sub- and super-martingale tests, 250, |
| equilibrium and, 182–187, 186f, | 259–261 |
| 187 <i>f</i> –191 <i>f</i> | Supernova research, 337–338, 338f |
| cases with positive long-run | Support vector machines (SVMs), 38, |
| equilibrium and, 180–182, 181 <i>f</i> , | 101 |
| 182 <i>f</i> , 183 <i>f</i> –186 <i>f</i> | Supremum augmented Dickey-Fuller |
| cases with zero long-run equilibrium | (SADF) test, 252–259, 253f, 257f |
| and, 177–180, 177f, 178f, 179f | conditional ADF, 256, 256f, |
| daily volatility computation and, | 257 <i>f</i> |
| 44–45 | implementation of, 258–259 |
| fixed-time horizon labeling method | quantile ADF, 255–256 |
| and, 44 | Survivorship bias, 152 |
| investment strategies using, 170–171, | SymPy Live, 214 |
| 172, 211 | Synthetic data |
| learning side and size and, 48 | backtesting using, 169–192 |

366 INDEX

| Synthetic data (Continued) | optimal trading rule (OTR) |
|---|---|
| experimental results using simulation | framework for, 173–176 |
| combinations with, 176–191 | overfitting in, 171–172 |
| optimal trading rule (OTR) | Transaction costs, in quantitative |
| framework using, 173-176 | investing, 152 |
| - | Tree clustering approaches, in asset allocation, 224–229, 225 <i>f</i> , 228 <i>f</i> , |
| Tick bars, 26–27 | 232f |
| Tick imbalance bars (TIBs), 29–30 | Triple-barrier labeling method, 45–46, |
| Tick rule, 282 | 47 <i>f</i> , 145 |
| Tick runs bars (TRBs), 31 | Turnover costs, 202–203 |
| Time bars | |
| description of, 26 | |
| fixed-time horizon labeling method using, 43–44 | Variance boosting to reduce, 100 |
| Time-decay factors, and sample | causes of, 93 |
| weights, 70–71, 72f | ensemble methods to reduce, 94 |
| Time period, in backtesting, 196 | random forest (RF) method for, 97–98 |
| Time series | Vectorization, 303–304 |
| fractional differentiation applied to, | Volume bars, 27, 44 |
| 76 | Volume imbalance bars (VIBs), 30–31 |
| integer transformation for stationarity | Volume runs bars (VRBs), 31–32 |
| in, 76 | Volume-synchronized probability of |
| stationarity vs. memory loss dilemma | informed trading (VPIN), 276, 282, |
| in, 75–76 | 292 |
| Time under water (TuW) | • |
| definition of, 201 | |
| deriving, 201 | Walk-forward (WF) method |
| example of, 202f | backtesting using, 161–162 |
| run measurements using, 202 | overfitting in, 155, 162 |
| Time-weighted average price (TWAP), | pitfalls of, 162 |
| 24, 294 | Sharpe ratio estimation in, 166 |
| Time-weighted rate of returns (TWRR), | two key advantages of, 161–162 |
| 198–199 | Walk-forward timefolds method, 155 |
| Trading rules | Weighted Kendall's tau, 120–121 |
| investment strategies and algorithms | Weights. See Class weights; Sample |
| in, 169–170 | weights |
| , | · · · · · · · · · · · · · · · · · · · |