1. autocorr

$$\hat{\gamma}(h) = \frac{1}{n}\sum_{i=1}^{n-h}\Big(X_t - \overline{X}\Big)\Big(X_{t+h} - \overline{X}\Big), \quad h \in \mathbb{N}$$
$$\hat{\rho}(h) = \frac{\hat{\gamma}(h)}{\hat{\gamma}(0)}, \quad h \in \mathbb{N}$$

2. autocorr1

$$Q_n(x) = \kappa \times \{|x_j - x_k|; j < k\}_{(\tau)}$$
$$\hat{\gamma}_{Q_N}(h) = \frac{1}{4}\left[Q^2_{N-h}(u+v) - Q^2_{N-h}(u-v)\right]$$
$$\hat{\rho}(h)_{Q_N} = \frac{Q^2_{N-h}(u+v) - Q^2_{N-h}(u-v)}{Q^2_{N-h}(u+v) + Q^2_{N-h}(u-v)}$$

3. autocorr2

$$\hat{\gamma}(h)_{Q_n} = \frac{1}{\sum_{t=1}^{n-h} L_t^{(\alpha)} L_{t+h}^{(\alpha)}}\left\{\sum_{t=1}^{n-h}\left(X_t - \overline{X}^{(\alpha)}\right)\left(X_{t+h} - \overline{X}^{(\alpha)}\right) L_t^{(\alpha)} L_{t+h}^{(\alpha)}\right\}$$

gdzie:

$$\overline{X}^{(\alpha)} = \frac{1}{\sum_{t=1}^{n} L_t^{(\alpha)}}\sum_{t=1}^{n} X_t L_t^{(\alpha)}$$
$$L_t^{(\alpha)} = \begin{cases} 1, & X_{(g)} < X_t < X_{(n-g+1)} \\ 0, & \text{poza tym} \end{cases} \quad g = \lfloor \alpha \cdot n \rfloor, \quad \text{dla } 0 \leqslant \alpha \leqslant 0.5$$
$$\hat{\rho}(h) = \frac{\hat{\gamma}(h)}{\hat{\gamma}(0)}$$

4. autocorr3

$$c = \frac{1}{\sum_{i=1}^{n} J\left(\frac{R_i}{n+1}\right)^2},$$
$$J(x) = \Phi^{-1}(x), \quad x \in (0,1)$$
$$\hat{\rho}(h) = c\sum_{i=1}^{n-h} J\left(\frac{R_i}{n+1}\right) \cdot J\left(\frac{R_{i+h}}{n+1}\right)$$

Φ^{-1} — dystrybuanta odwrotna rozkładu normalnego
R_i — i-ta ranga w szeregu

5. autocorr4

$$\hat{\rho}(h) = \frac{\operatorname{med}\left(\tilde{X}_i \tilde{X}_{1+h}, \ldots, \tilde{X}_{n-h} \tilde{X}_n\right)}{\operatorname{med}\left(\tilde{X}_1^2, \ldots, \tilde{X}_n^2\right)}$$

6. autocorr5

$$\hat{\rho}(h) = \frac{1}{(n-h)(n-h-1)} \sum_{i>j} \operatorname{sign}((X_i - X_j)(X_{i+h} - X_{j+h}))$$

7. autocorr6

$$\hat{\rho}(h) = \frac{1}{n-h} \sum_{i=1}^{n-h} \operatorname{sign}((X_i - \hat{\mu})(X_{i+h} - \hat{\mu}))$$

gdzie $\hat{\mu}$ to mediana szeregu X

8. autocorr7

$$\Xi_{i,j}^{(k)} = \frac{\Gamma_{i,j}^{(k)}}{\sqrt{\Gamma_{i,i}^{(k)} \cdot \Gamma_{j,j}^{(k)}}}$$

$$\Gamma^{(k)} = \frac{Z_k' Z_k}{n}$$

$$Z_k' = \begin{bmatrix} \tilde{X}_1 & \tilde{X}_2 & \ldots & \tilde{X}_{k+1} & \ldots & \tilde{X}_n & 0 & \ldots & 0 \\ 0 & \tilde{X}_1 & \ldots & \tilde{X}_k & \ldots & \tilde{X}_{n-1} & \tilde{X}_n & \ddots & \vdots \\ \vdots & \ddots & \ddots & \vdots & & \vdots & \vdots & \ddots & 0 \\ 0 & \ldots & 0 & \tilde{X}_1 & \ldots & \tilde{X}_{n-k} & \tilde{X}_{n-k+1} & \ldots & \tilde{X}_n \end{bmatrix} \in \mathbb{R}^{(k+1)\times(n+k)}$$

$$\tilde{X}_t = X_t - \overline{X}$$

$$\hat{\rho}(h) = \frac{1}{k-h+1} \sum_{i=1}^{k-h+1} \hat{\Xi}_{i,i+h}^{(k)}$$

9. autocorr8

$$\hat{\rho}(h) = \frac{\operatorname{Var}(X_{t+h} + X_t) - \operatorname{Var}(X_{t+h} - X_t)}{\operatorname{Var}(X_{t+h} + X_t) + \operatorname{Var}(X_{t+h} - X_t)}$$

10. autocorr9

$$\text{MAD} = 1.4826 \cdot \text{med}\{|x_i - x_{\text{med}}|; i = 1, \ldots, n\}$$
$$\hat{\rho}(h) = \frac{\text{MAD}(X_{t+h} + X_t) - \text{MAD}(X_{t+h} - X_t)}{\text{MAD}(X_{t+h} + X_t) + \text{MAD}(X_{t+h} - X_t)}$$

11. autocorr10

$$\text{IQR} = 0.7413 \cdot (Q_3 - Q_1)$$
$$\hat{\rho}(h) = \frac{\text{IQR}(X_{t+h} + X_t) - \text{IQR}(X_{t+h} - X_t)}{\text{IQR}(X_{t+h} + X_t) + \text{IQR}(X_{t+h} - X_t)}$$