

1. Estimate probability density (PD) using KNN estimator

$$f(R = r_{ij}|S = s_w) = \frac{k}{N_w V_d z(R = r_{ij}|S = s_w)_k^d}$$

2. Calculate conditional PDs

$$f(R_i = r_{ij}|S = s_i)$$

2. Calculate non-conditional PDs

$$f(R = r_{ij}) = \sum_{w=1}^m q_w f(R = r_{ij}|S = s_w)$$

3. Calculate conditional entropy

$$H_{\text{diff}}(R|S) = - \sum_{i=1}^m \frac{q_i}{n_i} \sum_{j=1}^{n_i} \log_2(f(R_i = r_{ij}|S = s_i))$$

3. Calculate non-conditional entropy

$$H_{\text{diff}}(R) = - \sum_{i=1}^m \frac{q_i}{n_i} \sum_{j=1}^{n_i} \log_2(f(R = r_{ij}))$$

4. Mutual Information

$$I(R; S) = H(R) - H(R|S)$$

5. Information transfer

$$C(R; S) = \max_Q I(R; S) \left\{ \begin{array}{l} \sum_{i=1}^m q_i = 1 \\ q_i \geq 0 \end{array} \right.$$

$$Q = [q_1, q_2, \dots, q_m]$$