

Assignment Sheet 12

Assignment 12.1

Given are the following points: $A(1, 2)$, $B(2, 1)$, $C(3, 4)$, $D(4, 1)$, $E(4, 4)$ and $F(5, 3)$. In the graphs below are two clustering results for those 6 points.

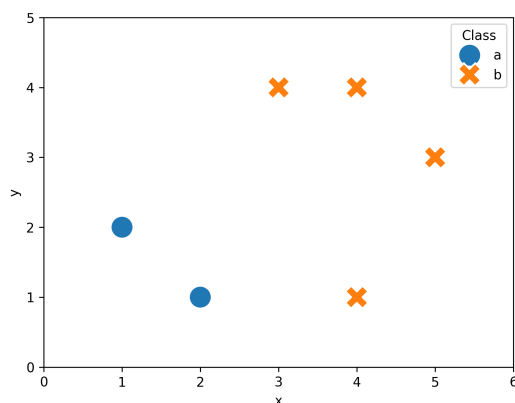


Figure 1: Clustering A

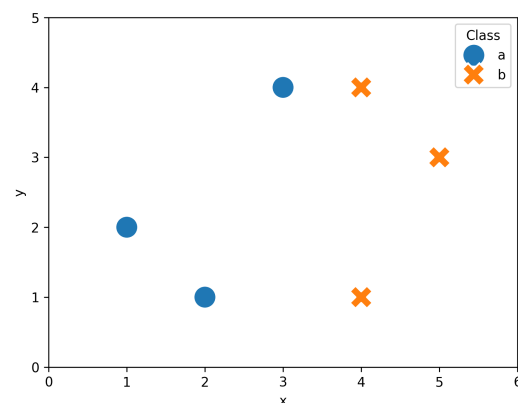


Figure 2: Clustering B

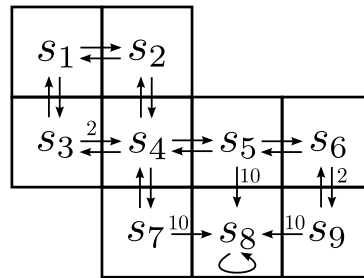
- Summarize shortly, how we evaluate clusterings. Especially discuss the differences between internal and external evaluation measures. Which type of measure is used when?
- Calculate the quality measure q (intra-cluster distance) for both clusterings!
- Calculate the rand index between the two clusterings!

Assignment 12.2

Explain shortly the topic of reinforcement learning. What is the learning task? How is learning done? Try to restrict to the most important points and be as clear as possible. Additionally, extend the table from 10.1 to include Reinforcement Learning.

Assignment 12.3

Consider the following deterministic grid world. s_8 is an absorbing goal state. If not specified otherwise, transitions have a reward of 0. Use $\gamma = 0.8$.



- Apply the Value-Iteration-Algorithm to learn V^* for each state. How does the Q table looks like? What is an optimal policy?
- Suggest a modification of the reward function $r(s, a)$ that alters $Q(s, a)$ but not the optimal policy. Suggest a modification of the reward function $r(s, a)$ that alters $Q(s, a)$ but not $V^*(s)$.

Assignment 12.4

Consider again the deterministic grid world of the previous assignment. Again, s_8 is an absorbing goal state. If not specified otherwise, transitions have a reward of 0 and $\gamma = 0.8$.

Use Q-Learning to determine the \hat{Q} table. Consider the following path of the agent: $s_7 - s_4 - s_2 - s_1 - s_3 - s_4 - s_5 - s_6 - s_9 - s_8$. How does the \hat{Q} table changes after this training episode? How does it change, if the same episode is repeated two more times? Is it sufficient to repeat this episode an adequate number of times to learn the true Q function? If yes, give reasons. If not, what is required to learn Q ?