Information Theory and Applications

Part II (Prof. Garello)

Academic year 2019/2020

List of questions, final version

1. Present the problem of finding the minimum cost trajectory of a discrete system. Discuss the brute-force exhaustive approach. Present the Bellman theorem.
2. Present the Bellman theorem. Present the Viterbi algorithm for a generic discrete system.
3. Present the application of the Viterbi algorithm to convolutional codes decoding.
4. Present the early decision Viterbi algorithm. Discuss the advantages and the disadvantages.
5. Discuss the ideas of distributed computing, message propagation and extrinsic information.
6. Present an example of distributed computation of the number of nodes in a network and discuss the idea of extrinsic information.
7. Provide the definition of factor graph and present an example.
8. Present the marginalization problem and discuss the problems of the brute-force approach.
9. For a binary block code, provide the definitions of generator matrix, codebook, parity check matrix, indicator function.
10. For a binary block code, consider an example and show how it is possible to factorize the indicator function by using the parity check matrix H.
11. Given a factor graph, present the variable node update rule.
12. Discuss the ideas of statistical classification and statistical classification by decision trees.
13. Present the definitions of instance, feature, class, training set and classifier.
14. Present and discuss the definition of Information Gain and Information Gain Ratio.
15. Describe the ID3 classifier algorithm.
16. Describe how the C4.5 classifier algorithm deals with numerical features.
17. Discuss the advantages and the problem of tree classifiers.
18. Discuss the Decision Tree Ensemble approach.