

CS5340 ASSIGNMENT 2-PART 1

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1 Build a Junction Tree

1.1 Get Junction Clique and Edges: `_get_jt_clique_and_edges()`

First, create the graph from the given nodes and edges, and create the maximal cliques. Then, find maximal cliques in the graph. After that, creating the clique graph with weights. Finally, compute the maximum-weight spanning tree, and restore the edges of the spanning tree.

1.2 Creating the clique graph with weights: `_get_clique_factors()`

First, using the provided node factors, we build a potential list. Get the list of relevant potential items for each clique in the cliques (if the nodes are a subset of the clique). Next, compute the cliques' potential. Finally, remove the items from the possible list and repeat the process.

2 Sum Product Algorithm for Junction Tree

2.1 Update the MRF graph from Evidence: `_update_mrf_w_evidence()`

First, obtain the query nodes and delete the query nodes appear in the evidence dictionary. Second, obtain the updated edges by deleting the edges that contain the evidence nodes. Finally modify the factors with the given evidence.

2.2 Get Clique Potentials: `_get_clique_potentials()`

The basic steps of sum-product algorithm for the clique are similar as in lab 1. Before applying the sum-product algorithm, the graph needs to be confirmed connected. We obtain the connected components of clusters, choose one as the root for each connected and apply sum-product algorithm to each component. The steps in the sum-product are similar.

2.3 Get Node Marginal Probabilities: `_get_node_marginal_probabilities()`

For each node of the query node, transverse the clique lists. For each clique, first we do the normalization and then we do the marginalization by using the factor marginalize function. At last, we obtain the marginal probability for each query node.

3 Basic Factor Operations

`factor_product()`: Compute the product of two input factors.

`factor_marginalize()`: Sums over the variables to be marginalized to obtain the marginal of the factor.

`observe_evidence()`: Modify and reduce a factor with given evidence and remove the observed variables.