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Exercise: The Chow-Liu Algorithm

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Exercise: The Chow-Liu Algorithm

1/1 point (graded)

Consider four variables with the following empirical mutual information:

| $\hat{I}(X_i; X_j)$ | 1 | 2 | 3 | 4 |
|---------------------|--------|--------|--------|--------|
| 1 | 0.3415 | 0.2845 | 0.0003 | 0.0822 |
| 2 | 0.2845 | 0.3457 | 0.0005 | 0.0726 |
| 3 | 0.0003 | 0.0005 | 0.5852 | 0.0002 |
| 4 | 0.0822 | 0.0726 | 0.0002 | 0.5948 |

Find the Chow-Liu tree of the four variables by specifying which edges are present in the tree.

☒ (1, 2)

☐ (1, 3)

Week 9: Mini-project on**Email Spam Detection**

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**Week 10: Parameter Learning - Finite Random Variables and Trees**

due Nov 24, 2016 03:30 IST

**Week 10: Structure Learning - Trees**

due Nov 24, 2016 03:30 IST

**Week 10: Homework 7**

due Nov 24, 2016 03:30 IST

☒ (1, 4)☒ (2, 3)☐ (2, 4)☐ (3, 4)**Solution:**

If we sort the mutual information values from the largest to the smallest, we get:

$$\hat{I}(X_1; X_2), \hat{I}(X_1; X_4), \hat{I}(X_2; X_4), \hat{I}(X_2; X_3), \hat{I}(X_1; X_3), \hat{I}(X_3; X_4).$$

Note that we only consider when $\hat{I}(X_i; X_j)$ for $i < j$ here because mutual information is symmetric and $\hat{I}(X_i; X_i)$ is irrelevant. Then the Chow-Liu algorithm says that we begin with a fully disconnected graph and start adding edges with the largest empirical mutual information. Thus, we add edges (1, 2) and (1, 4). If the next edge (2, 4) is added, the resulting graph has a cycle $1 - 2 - 4$, so instead, we add (2, 3). Since there are 4 variables, a tree over 4 nodes has 3 edges, so the algorithm terminates.

Thus, the edges in the tree are (1, 2), (1, 4), (2, 3).

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You have used 1 of 5 attempts

✓ Correct (1/1 point)

Discussion

Topic: Structure Learning - Trees / Exercise: The Chow-Liu Algorithm[Show Discussion](#)

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