

Supplementary Material for Chapter 5: comparison with unbounded methods



Table 1: Comparison of the methods in dataset emotions in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|---------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -342.02 | 0.28 | 0.78 | 0.68 | 3 | 3 |
| 1 | Tree-tree | -412.81 | 0.294 | 0.797 | 10.55 | 5 | 3 |
| 1 | Tree-tw | -697.56 | 0.294 | 0.77 | 0.4 | 3 | 3 |
| 1 | GS-MBC | -339.4 | 0.29 | 0.78 | 0.6 | 3 | 3 |
| 1 | GS-tw | -342.02 | 0.28 | 0.78 | 1.16 | 3 | 3 |
| 1 | CDL2 | – | 0.18 | 0.67 | 51.47 | – | – |
| 1 | SVM-struct | – | 0.24 | 0.74 | 769.25 | – | – |
| 2 | GS-pruned | -322.5 | 0.2 | 0.76 | 0.68 | 4 | 3 |
| 2 | Tree-tree | -357.84 | 0.345 | 0.803 | 9.55 | 5 | 3 |
| 2 | Tree-tw | -596.03 | 0.22 | 0.77 | 0.4 | 3 | 3 |
| 2 | GS-MBC | -322.5 | 0.2 | 0.76 | 0.63 | 4 | 3 |
| 2 | GS-tw | -322.5 | 0.2 | 0.76 | 1.36 | 4 | 3 |
| 2 | CDL2 | – | 0.2 | 0.7 | 0.97 | – | – |
| 2 | SVM-struct | – | 0.24 | 0.74 | 575.85 | – | – |
| 3 | GS-pruned | -290.5 | 0.29 | 0.79 | 0.63 | 4 | 3 |
| 3 | Tree-tree | -341.76 | 0.353 | 0.811 | 8.61 | 5 | 3 |
| 3 | Tree-tw | -526.95 | 0.34 | 0.8 | 0.3 | 3 | 3 |
| 3 | GS-MBC | -290.5 | 0.29 | 0.79 | 0.59 | 4 | 3 |
| 3 | GS-tw | -290.5 | 0.29 | 0.79 | 1.28 | 4 | 3 |
| 3 | CDL2 | – | 0.24 | 0.71 | 0.91 | – | – |
| 3 | SVM-struct | – | 0.24 | 0.75 | 553.81 | – | – |
| 4 | GS-pruned | -344 | 0.297 | 0.79 | 0.62 | 4 | 3 |
| 4 | Tree-tree | -403.97 | 0.24 | 0.792 | 9.81 | 5 | 3 |
| 4 | Tree-tw | -598 | 0.26 | 0.78 | 0.4 | 3 | 3 |
| 4 | GS-MBC | -344 | 0.297 | 0.79 | 0.59 | 4 | 3 |
| 4 | GS-tw | -344 | 0.297 | 0.79 | 0.97 | 4 | 3 |
| 4 | CDL2 | – | 0.19 | 0.69 | 0.9 | – | – |
| 4 | SVM-struct | – | 0.18 | 0.73 | 567.53 | – | – |
| 5 | GS-pruned | -340.6 | 0.322 | 0.799 | 0.76 | 4 | 2 |
| 5 | Tree-tree | -409.62 | 0.26 | 0.78 | 9.21 | 5 | 3 |
| 5 | Tree-tw | -708.13 | 0.21 | 0.78 | 0.4 | 3 | 3 |
| 5 | GS-MBC | -340.6 | 0.322 | 0.799 | 0.67 | 4 | 2 |
| 5 | GS-tw | -340.6 | 0.322 | 0.799 | 1.06 | 4 | 2 |
| 5 | CDL2 | – | 0.19 | 0.73 | 0.89 | – | – |
| 5 | SVM-struct | – | 0.18 | 0.73 | 703 | – | – |

Table 2: Comparison of the methods in dataset foodtruck in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|---------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -341.1 | 0.29 | 0.85 | 0.05 | 2 | 2 |
| 1 | Tree-tree | -340.91 | 0.3 | 0.85 | 0.53 | 3 | 1 |
| 1 | Tree-tw | -338.6 | 0.317 | 0.84 | 0.11 | 1 | 1 |
| 1 | GS-MBC | -341.1 | 0.29 | 0.85 | 0 | 2 | 2 |
| 1 | GS-tw | -341.1 | 0.29 | 0.85 | 0.05 | 2 | 2 |
| 1 | CDL2 | – | 0.11 | 0.79 | 0.6 | – | – |
| 1 | SVM-struct | – | 0.2 | 0.853 | 505.33 | – | – |
| 2 | GS-pruned | -366.04 | 0.24 | 0.84 | 0.06 | 2 | 2 |
| 2 | Tree-tree | -366 | 0.23 | 0.84 | 0.4 | 3 | 1 |
| 2 | Tree-tw | -368.19 | 0.22 | 0.84 | 0.1 | 1 | 1 |
| 2 | GS-MBC | -366.04 | 0.24 | 0.84 | 0 | 2 | 2 |
| 2 | GS-tw | -366.04 | 0.24 | 0.84 | 0.07 | 2 | 2 |
| 2 | CDL2 | – | 0.13 | 0.79 | 0.6 | – | – |
| 2 | SVM-struct | – | 0.256 | 0.855 | 417.96 | – | – |
| 3 | GS-pruned | -361.89 | 0.19 | 0.84 | 0.09 | 2 | 2 |
| 3 | Tree-tree | -362.01 | 0.25 | 0.84 | 0.41 | 3 | 1 |
| 3 | Tree-tw | -357.9 | 0.19 | 0.84 | 0.12 | 1 | 1 |
| 3 | GS-MBC | -361.89 | 0.19 | 0.84 | 0.05 | 2 | 2 |
| 3 | GS-tw | -361.89 | 0.19 | 0.84 | 0 | 2 | 2 |
| 3 | CDL2 | – | 0.07 | 0.78 | 0.61 | – | – |
| 3 | SVM-struct | – | 0.296 | 0.856 | 365.62 | – | – |
| 4 | GS-pruned | -367.5 | 0.25 | 0.85 | 0.06 | 2 | 2 |
| 4 | Tree-tree | -368.37 | 0.259 | 0.85 | 0.4 | 3 | 1 |
| 4 | Tree-tw | -370.26 | 0.21 | 0.84 | 0.1 | 1 | 1 |
| 4 | GS-MBC | -367.5 | 0.25 | 0.85 | 0.06 | 2 | 2 |
| 4 | GS-tw | -367.5 | 0.25 | 0.85 | 0.1 | 2 | 2 |
| 4 | CDL2 | – | 0.1 | 0.8 | 0.6 | – | – |
| 4 | SVM-struct | – | 0.21 | 0.85 | 473.76 | – | – |
| 5 | GS-pruned | -405.79 | 0.21 | 0.82 | 0.07 | 2 | 2 |
| 5 | Tree-tree | -407.36 | 0.247 | 0.82 | 0.49 | 2 | 1 |
| 5 | Tree-tw | -403.6 | 0.21 | 0.82 | 0.11 | 1 | 1 |
| 5 | GS-MBC | -405.79 | 0.21 | 0.82 | 0 | 2 | 2 |
| 5 | GS-tw | -405.79 | 0.21 | 0.82 | 0.09 | 2 | 2 |
| 5 | CDL2 | – | 0.09 | 0.78 | 0.6 | – | – |
| 5 | SVM-struct | – | 0.19 | 0.821 | 407.19 | – | – |

Table 3: Comparison of the methods in dataset birds in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|---------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -480.5 | 0.411 | 0.94 | 4.52 | 3 | 3 |
| 1 | Tree-tree | -653.2 | 0.4 | 0.94 | 89.41 | 6 | 3 |
| 1 | Tree-tw | -2183.83 | 0.34 | 0.91 | 2.3 | 3 | 3 |
| 1 | GS-MBC | -480.5 | 0.411 | 0.94 | 4.06 | 3 | 2 |
| 1 | GS-tw | -480.5 | 0.411 | 0.94 | 5.56 | 3 | 2 |
| 1 | CDL2 | – | 0.25 | 0.89 | 2.45 | – | – |
| 1 | SVM-struct | – | 0.27 | 0.9 | 917.6 | – | – |
| 2 | GS-pruned | -446.9 | 0.45 | 0.95 | 4.61 | 3 | 3 |
| 2 | Tree-tree | -568.3 | 0.465 | 0.95 | 89.79 | 5 | 2 |
| 2 | Tree-tw | -2424.34 | 0.31 | 0.93 | 2.4 | 3 | 2 |
| 2 | GS-MBC | -446.9 | 0.45 | 0.95 | 4.12 | 3 | 2 |
| 2 | GS-tw | -446.9 | 0.45 | 0.95 | 5.75 | 4 | 2 |
| 2 | CDL2 | – | 0.29 | 0.91 | 2.45 | – | – |
| 2 | SVM-struct | – | 0.35 | 0.92 | 922.17 | – | – |
| 3 | GS-pruned | -443.3 | 0.45 | 0.945 | 4.52 | 3 | 2 |
| 3 | Tree-tree | -589.25 | 0.457 | 0.94 | 98.93 | 7 | 3 |
| 3 | Tree-tw | -2250.48 | 0.31 | 0.91 | 2.47 | 3 | 3 |
| 3 | GS-MBC | -443.3 | 0.45 | 0.945 | 4.05 | 3 | 2 |
| 3 | GS-tw | -443.3 | 0.45 | 0.945 | 5.63 | 4 | 2 |
| 3 | CDL2 | – | 0.28 | 0.89 | 2.4 | – | – |
| 3 | SVM-struct | – | 0.38 | 0.91 | 907.02 | – | – |
| 4 | GS-pruned | -393.5 | 0.52 | 0.96 | 4.47 | 4 | 2 |
| 4 | Tree-tree | -512.66 | 0.543 | 0.958 | 93.33 | 6 | 3 |
| 4 | Tree-tw | -2323.69 | 0.4 | 0.93 | 2.4 | 3 | 3 |
| 4 | GS-MBC | -393.5 | 0.52 | 0.96 | 4.11 | 4 | 2 |
| 4 | GS-tw | -393.5 | 0.52 | 0.96 | 5.64 | 4 | 2 |
| 4 | CDL2 | – | 0.34 | 0.9 | 2.45 | – | – |
| 4 | SVM-struct | – | 0.37 | 0.93 | 765.05 | – | – |
| 5 | GS-pruned | -399.4 | 0.52 | 0.95 | 4.41 | 4 | 2 |
| 5 | Tree-tree | -498.38 | 0.527 | 0.954 | 96.04 | 5 | 2 |
| 5 | Tree-tw | -1819.08 | 0.4 | 0.93 | 2.4 | 3 | 2 |
| 5 | GS-MBC | -399.4 | 0.52 | 0.95 | 4.12 | 4 | 2 |
| 5 | GS-tw | -399.4 | 0.52 | 0.95 | 5.71 | 4 | 2 |
| 5 | CDL2 | – | 0.36 | 0.92 | 2.49 | – | – |
| 5 | SVM-struct | – | 0.36 | 0.92 | 982.48 | – | – |

Table 4: Comparison of the methods in dataset scene in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|---------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -588.9 | 0.61 | 0.88 | 11.2 | 9 | 5 |
| 1 | Tree-tree | -974.69 | 0.45 | 0.886 | 295.38 | 6 | 3 |
| 1 | Tree-tw | -3233.11 | 0.43 | 0.86 | 5.49 | 3 | 3 |
| 1 | GS-MBC | -645.27 | 0.59 | 0.87 | 9.62 | 9 | 5 |
| 1 | GS-tw | -596.97 | 0.616 | 0.88 | 12.94 | 5 | 5 |
| 1 | CDL2 | – | 0.3 | 0.77 | 5.3 | – | – |
| 1 | SVM-struct | – | 0.51 | 0.87 | 3535.07 | – | – |
| 2 | GS-pruned | -656.6 | 0.57 | 0.87 | 10.82 | 9 | 5 |
| 2 | Tree-tree | -960.74 | 0.44 | 0.87 | 274.32 | 6 | 3 |
| 2 | Tree-tw | -2768.98 | 0.41 | 0.84 | 5.6 | 3 | 3 |
| 2 | GS-MBC | -667.91 | 0.587 | 0.871 | 10.13 | 10 | 5 |
| 2 | GS-tw | -656.63 | 0.57 | 0.87 | 14.84 | 5 | 5 |
| 2 | CDL2 | – | 0.29 | 0.77 | 5.74 | – | – |
| 2 | SVM-struct | – | 0.49 | 0.87 | 5159.37 | – | – |
| 3 | GS-pruned | -668.67 | 0.55 | 0.87 | 11.21 | 9 | 5 |
| 3 | Tree-tree | -952.27 | 0.46 | 0.887 | 261.49 | 5 | 3 |
| 3 | Tree-tw | -2937.92 | 0.37 | 0.85 | 6.06 | 3 | 3 |
| 3 | GS-MBC | -659.9 | 0.576 | 0.88 | 14.38 | 9 | 5 |
| 3 | GS-tw | -672.1 | 0.55 | 0.87 | 13.23 | 5 | 5 |
| 3 | CDL2 | – | 0.28 | 0.77 | 6 | – | – |
| 3 | SVM-struct | – | 0.47 | 0.87 | 3640.36 | – | – |
| 4 | GS-pruned | -612 | 0.59 | 0.88 | 10.63 | 8 | 5 |
| 4 | Tree-tree | -1029.26 | 0.47 | 0.88 | 268.06 | 5 | 3 |
| 4 | Tree-tw | -3398.61 | 0.42 | 0.85 | 5.3 | 3 | 3 |
| 4 | GS-MBC | -596.5 | 0.617 | 0.883 | 9.32 | 7 | 5 |
| 4 | GS-tw | -612 | 0.59 | 0.88 | 14.19 | 5 | 5 |
| 4 | CDL2 | – | 0.33 | 0.78 | 5.66 | – | – |
| 4 | SVM-struct | – | 0.55 | 0.88 | 4809.72 | – | – |
| 5 | GS-pruned | -601.2 | 0.56 | 0.87 | 10.74 | 10 | 5 |
| 5 | Tree-tree | -929.8 | 0.44 | 0.881 | 291.35 | 6 | 3 |
| 5 | Tree-tw | -2833.7 | 0.42 | 0.86 | 5.8 | 3 | 3 |
| 5 | GS-MBC | -613.24 | 0.576 | 0.87 | 9.12 | 9 | 5 |
| 5 | GS-tw | -601.83 | 0.57 | 0.87 | 15.61 | 5 | 5 |
| 5 | CDL2 | – | 0.33 | 0.79 | 6.1 | – | – |
| 5 | SVM-struct | – | 0.52 | 0.88 | 4454.02 | – | – |

Table 5: Comparison of the methods in dataset genbase in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|--------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -19.86 | 0.985 | 1 | 1.98 | 4 | 4 |
| 1 | Tree-tree | -15.34 | 0.985 | 1 | 15.92 | 12 | 3 |
| 1 | Tree-tw | -14.9 | 0.985 | 1 | 1.4 | 3 | 3 |
| 1 | GS-MBC | -19.86 | 0.985 | 1 | 1.5 | 4 | 4 |
| 1 | GS-tw | -19.86 | 0.985 | 1 | 1.77 | 4 | 4 |
| 1 | CDL2 | – | 0.95 | 1 | 1.89 | – | – |
| 1 | SVM-struct | – | 0.985 | 0.999 | 176.2 | – | – |
| 2 | GS-pruned | -23.3 | 0.97 | 0.999 | 1.8 | 4 | 3 |
| 2 | Tree-tree | -29.58 | 0.96 | 1 | 15.09 | 11 | 2 |
| 2 | Tree-tw | -24.48 | 0.96 | 1 | 1.4 | 3 | 2 |
| 2 | GS-MBC | -23.3 | 0.97 | 0.999 | 1.57 | 4 | 3 |
| 2 | GS-tw | -23.3 | 0.97 | 0.999 | 1.93 | 4 | 3 |
| 2 | CDL2 | – | 0.95 | 1 | 1.71 | – | – |
| 2 | SVM-struct | – | 0.97 | 1 | 125.24 | – | – |
| 3 | GS-pruned | -49.2 | 0.955 | 0.998 | 2.13 | 5 | 3 |
| 3 | Tree-tree | -55.09 | 0.955 | 1 | 12.31 | 8 | 3 |
| 3 | Tree-tw | -50.72 | 0.955 | 0.998 | 1.4 | 3 | 3 |
| 3 | GS-MBC | -49.2 | 0.955 | 0.998 | 1.62 | 5 | 3 |
| 3 | GS-tw | -49.2 | 0.955 | 0.998 | 2.04 | 5 | 3 |
| 3 | CDL2 | – | 0.92 | 1 | 1.65 | – | – |
| 3 | SVM-struct | – | 0.95 | 1 | 226.38 | – | – |
| 4 | GS-pruned | -19.1 | 0.962 | 0.999 | 1.99 | 5 | 4 |
| 4 | Tree-tree | -24.76 | 0.95 | 1 | 11 | 10 | 3 |
| 4 | Tree-tw | -20.43 | 0.95 | 1 | 1.4 | 3 | 3 |
| 4 | GS-MBC | -19.1 | 0.962 | 0.999 | 1.4 | 5 | 4 |
| 4 | GS-tw | -19.1 | 0.962 | 0.999 | 1.85 | 5 | 4 |
| 4 | CDL2 | – | 0.9 | 1 | 1.72 | – | – |
| 4 | SVM-struct | – | 0.962 | 0.999 | 171.99 | – | – |
| 5 | GS-pruned | -12.1 | 0.98 | 1 | 1.96 | 4 | 3 |
| 5 | Tree-tree | -19.39 | 0.98 | 1 | 12.91 | 10 | 3 |
| 5 | Tree-tw | -12.15 | 0.992 | 1 | 1.5 | 3 | 3 |
| 5 | GS-MBC | -12.1 | 0.98 | 1 | 1.4 | 4 | 3 |
| 5 | GS-tw | -12.1 | 0.98 | 1 | 1.88 | 4 | 3 |
| 5 | CDL2 | – | 0.96 | 1 | 1.78 | – | – |
| 5 | SVM-struct | – | 0.98 | 1 | 209.97 | – | – |

Table 6: Comparison of the methods in dataset yeast in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|----------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -1998.8 | 0.18 | 0.772 | 2.64 | 6 | 5 |
| 1 | Tree-tree | -2654.28 | 0.15 | 0.77 | 34.63 | 8 | 4 |
| 1 | Tree-tw | -3351.42 | 0.13 | 0.76 | 1.2 | 4 | 4 |
| 1 | GS-MBC | -2016.63 | 0.17 | 0.77 | 2.04 | 6 | 6 |
| 1 | GS-tw | -2013.88 | 0.184 | 0.77 | 2.93 | 5 | 5 |
| 1 | CDL2 | – | 0.03 | 0.64 | 6.68 | – | – |
| 1 | SVM-struct | – | 0.1 | 0.77 | 1543.07 | – | – |
| 2 | GS-pruned | -2004.35 | 0.178 | 0.78 | 2.4 | 5 | 5 |
| 2 | Tree-tree | -2581.22 | 0.18 | 0.788 | 32.41 | 7 | 3 |
| 2 | Tree-tw | -3313.69 | 0.12 | 0.77 | 1.1 | 3 | 3 |
| 2 | GS-MBC | -1989.1 | 0.178 | 0.78 | 1.9 | 5 | 5 |
| 2 | GS-tw | -2006.09 | 0.17 | 0.78 | 3.62 | 5 | 5 |
| 2 | CDL2 | – | 0.01 | 0.64 | 22.75 | – | – |
| 2 | SVM-struct | – | 0.13 | 0.78 | 1561.43 | – | – |
| 3 | GS-pruned | -2025.88 | 0.182 | 0.79 | 2.53 | 7 | 5 |
| 3 | Tree-tree | -2771.64 | 0.16 | 0.786 | 32.59 | 8 | 4 |
| 3 | Tree-tw | -3506.54 | 0.12 | 0.77 | 1.2 | 4 | 4 |
| 3 | GS-MBC | -2020.4 | 0.18 | 0.78 | 2 | 7 | 6 |
| 3 | GS-tw | -2031.66 | 0.17 | 0.79 | 3.88 | 5 | 5 |
| 3 | CDL2 | – | 0.02 | 0.63 | 49.42 | – | – |
| 3 | SVM-struct | – | 0.12 | 0.78 | 1461.21 | – | – |
| 4 | GS-pruned | -2011.83 | 0.159 | 0.77 | 2.38 | 6 | 5 |
| 4 | Tree-tree | -2629.21 | 0.15 | 0.782 | 35 | 8 | 4 |
| 4 | Tree-tw | -3265.65 | 0.13 | 0.76 | 1.2 | 4 | 4 |
| 4 | GS-MBC | -2001.6 | 0.15 | 0.78 | 2.15 | 6 | 5 |
| 4 | GS-tw | -2003.42 | 0.15 | 0.78 | 2.87 | 5 | 4 |
| 4 | CDL2 | – | 0.02 | 0.63 | 609.58 | – | – |
| 4 | SVM-struct | – | 0.1 | 0.78 | 1535.1 | – | – |
| 5 | GS-pruned | -1931.96 | 0.209 | 0.79 | 3.09 | 6 | 5 |
| 5 | Tree-tree | -2576.03 | 0.18 | 0.794 | 33.46 | 8 | 4 |
| 5 | Tree-tw | -3113.29 | 0.14 | 0.77 | 1.1 | 4 | 4 |
| 5 | GS-MBC | -1918.9 | 0.2 | 0.79 | 2.43 | 6 | 6 |
| 5 | GS-tw | -1947.22 | 0.2 | 0.79 | 3.73 | 5 | 5 |
| 5 | CDL2 | – | 0.01 | 0.64 | 7.51 | – | – |
| 5 | SVM-struct | – | 0.13 | 0.79 | 1697.14 | – | – |

Table 7: Comparison of the methods in dataset medical in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|---------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -296.8 | 0.658 | 0.989 | 5.95 | 11 | 3 |
| 1 | Tree-tree | -298.14 | 0.6 | 0.99 | 201.94 | 19 | 3 |
| 1 | Tree-tw | -436.09 | 0.6 | 0.99 | 4.6 | 3 | 3 |
| 1 | GS-MBC | -296.8 | 0.658 | 0.989 | 5.5 | 11 | 3 |
| 1 | GS-tw | -307.01 | 0.62 | 0.99 | 6.59 | 5 | 3 |
| 1 | CDL2 | – | 0.45 | 0.97 | 6.6 | – | – |
| 1 | SVM-struct | – | 0.64 | 0.99 | 340.23 | – | – |
| 2 | GS-pruned | -333.13 | 0.63 | 0.99 | 8.17 | 12 | 4 |
| 2 | Tree-tree | -305.6 | 0.689 | 0.99 | 188.58 | 18 | 3 |
| 2 | Tree-tw | -462.7 | 0.58 | 0.98 | 5.4 | 3 | 3 |
| 2 | GS-MBC | -333.13 | 0.63 | 0.99 | 5.39 | 12 | 4 |
| 2 | GS-tw | -324.62 | 0.64 | 0.99 | 10.23 | 5 | 4 |
| 2 | CDL2 | – | 0.44 | 0.98 | 7.01 | – | – |
| 2 | SVM-struct | – | 0.63 | 0.99 | 222.1 | – | – |
| 3 | GS-pruned | -266.28 | 0.714 | 0.992 | 5.69 | 9 | 3 |
| 3 | Tree-tree | -259.2 | 0.67 | 0.99 | 214.86 | 18 | 3 |
| 3 | Tree-tw | -356.51 | 0.58 | 0.99 | 4.6 | 3 | 3 |
| 3 | GS-MBC | -266.28 | 0.714 | 0.992 | 5.43 | 9 | 3 |
| 3 | GS-tw | -267.69 | 0.7 | 0.99 | 6.88 | 5 | 3 |
| 3 | CDL2 | – | 0.48 | 0.98 | 6.81 | – | – |
| 3 | SVM-struct | – | 0.69 | 0.99 | 282.68 | – | – |
| 4 | GS-pruned | -345.34 | 0.626 | 0.99 | 5.91 | 12 | 3 |
| 4 | Tree-tree | -315.8 | 0.58 | 0.99 | 193.59 | 17 | 4 |
| 4 | Tree-tw | -413.3 | 0.59 | 0.99 | 4.7 | 4 | 4 |
| 4 | GS-MBC | -345.34 | 0.626 | 0.99 | 8.8 | 12 | 3 |
| 4 | GS-tw | -353.99 | 0.62 | 0.99 | 6.54 | 5 | 3 |
| 4 | CDL2 | – | 0.47 | 0.98 | 6.84 | – | – |
| 4 | SVM-struct | – | 0.59 | 0.988 | 237.36 | – | – |
| 5 | GS-pruned | -286.08 | 0.672 | 0.99 | 6.32 | 10 | 3 |
| 5 | Tree-tree | -294.75 | 0.672 | 0.99 | 187.73 | 18 | 3 |
| 5 | Tree-tw | -380.58 | 0.61 | 0.99 | 4.5 | 3 | 3 |
| 5 | GS-MBC | -286.08 | 0.672 | 0.99 | 6.1 | 10 | 3 |
| 5 | GS-tw | -272.2 | 0.67 | 0.99 | 6.27 | 5 | 3 |
| 5 | CDL2 | – | 0.44 | 0.97 | 6.61 | – | – |
| 5 | SVM-struct | – | 0.65 | 0.99 | 225.1 | – | – |

Table 8: Comparison of the methods in dataset enron in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|----------------|--------------|--------------|-------------|----|-------|
| 1 | GS-pruned | -2350.3 | 0.191 | 0.95 | 18.18 | 62 | 5 |
| 1 | Tree-tree | -2794.99 | 0.17 | 0.95 | 255.43 | 8 | 4 |
| 1 | Tree-tw | -3314.49 | 0.15 | 0.95 | 11 | 4 | 4 |
| 1 | GS-MBC | -2350.3 | 0.191 | 0.95 | 24.95 | 62 | 4 |
| 1 | GS-tw | -2441.65 | 0.18 | 0.95 | 24.94 | 5 | 4 |
| 1 | CDL2 | – | 0.01 | 0.89 | 62.51 | – | – |
| 1 | SVM-struct | – | 0.13 | 0.94 | 10556.4 | – | – |
| 2 | GS-pruned | -2540.6 | 0.117 | 0.95 | 17.31 | 56 | 4 |
| 2 | Tree-tree | -3046.92 | 0.1 | 0.95 | 255 | 7 | 4 |
| 2 | Tree-tw | -4239.91 | 0.1 | 0.94 | 13.9 | 4 | 4 |
| 2 | GS-MBC | -2543.5 | 0.117 | 0.95 | 25.8 | 60 | 4 |
| 2 | GS-tw | -2663.5 | 0.11 | 0.946 | 19.34 | 5 | 4 |
| 2 | CDL2 | – | 0.01 | 0.89 | 57.89 | – | – |
| 2 | SVM-struct | – | 0.09 | 0.94 | 14445.1 | – | – |
| 3 | GS-pruned | -2721.9 | 0.141 | 0.944 | 18.34 | 58 | 5 |
| 3 | Tree-tree | -3498.1 | 0.141 | 0.94 | 253.35 | 7 | 4 |
| 3 | Tree-tw | -5802.86 | 0.141 | 0.94 | 11.8 | 4 | 4 |
| 3 | GS-MBC | -2733.72 | 0.141 | 0.94 | 38.56 | 48 | 5 |
| 3 | GS-tw | -3029.32 | 0.14 | 0.94 | 28.78 | 5 | 5 |
| 3 | CDL2 | – | 0.01 | 0.89 | 52.37 | – | – |
| 3 | SVM-struct | – | 0.1 | 0.94 | 8694.95 | – | – |
| 4 | GS-pruned | -2469.9 | 0.156 | 0.947 | 18.53 | 54 | 5 |
| 4 | Tree-tree | -2891.81 | 0.13 | 0.95 | 254.53 | 7 | 4 |
| 4 | Tree-tw | -3381.6 | 0.13 | 0.94 | 12.6 | 4 | 4 |
| 4 | GS-MBC | -2476.57 | 0.156 | 0.95 | 26.17 | 58 | 4 |
| 4 | GS-tw | -2603.69 | 0.15 | 0.95 | 19.47 | 5 | 5 |
| 4 | CDL2 | – | 0 | 0.9 | 44.25 | – | – |
| 4 | SVM-struct | – | 0.09 | 0.94 | 7641.37 | – | – |
| 5 | GS-pruned | -2629.4 | 0.126 | 0.948 | 18.28 | 67 | 4 |
| 5 | Tree-tree | -3252.28 | 0.12 | 0.95 | 253.74 | 8 | 4 |
| 5 | Tree-tw | -5202.88 | 0.12 | 0.94 | 10.4 | 4 | 4 |
| 5 | GS-MBC | -2657.38 | 0.126 | 0.95 | 30.84 | 59 | 4 |
| 5 | GS-tw | -2923.77 | 0.12 | 0.95 | 16.61 | 5 | 5 |
| 5 | CDL2 | – | 0 | 0.9 | 87.61 | – | – |
| 5 | SVM-struct | – | 0.08 | 0.94 | 9373.92 | – | – |

Table 9: Comparison of the methods in dataset ohsumed in 5-fold cross-validation. For each fold and method, the conditional log-likelihood in the test dataset (CLL), the global accuracy (acc_ G), the mean accuracy (acc_ M), the learning time (time), the treewidth (tw) and the treewidth of the pruned graph (tw-pr) are shown. The optimal results are denoted in boldface.

| Fold | Method | CLL | acc_ G | acc_ M | time | tw | tw-pr |
|------|------------|-----------------|--------------|--------------|------------|----|-------|
| 1 | GS-pruned | -10431.23 | 0.25 | 0.94 | 14.35 | 25 | 5 |
| 1 | Tree-tree | -10721.18 | 0.23 | 0.94 | 701.3 | 18 | 8 |
| 1 | Tree-tw | -12013.61 | 0.21 | 0.94 | 8.9 | 5 | 5 |
| 1 | GS-MBC | -10415.3 | 0.25 | 0.94 | 16.28 | 27 | 8 |
| 1 | GS-tw | -10684.21 | 0.25 | 0.94 | 14.37 | 5 | 5 |
| 1 | CDL2 | – | 0.21 | 0.94 | 186.85 | – | – |
| 1 | SVM-struct | – | 0.24 | 0.946 | 14315.04 | – | – |
| 2 | GS-pruned | -10478 | 0.253 | 0.95 | 17.01 | 32 | 5 |
| 2 | Tree-tree | -10711.78 | 0.23 | 0.94 | 689.99 | 17 | 8 |
| 2 | Tree-tw | -11963.32 | 0.22 | 0.94 | 7.2 | 5 | 5 |
| 2 | GS-MBC | -10445.4 | 0.25 | 0.95 | 15.76 | 28 | 8 |
| 2 | GS-tw | -10682.71 | 0.25 | 0.94 | 15.29 | 5 | 5 |
| 2 | CDL2 | – | 0.22 | 0.94 | 189.33 | – | – |
| 2 | SVM-struct | – | 0.25 | 0.947 | 10083.66 | – | – |
| 3 | GS-pruned | -10569.64 | 0.256 | 0.94 | 15.75 | 32 | 5 |
| 3 | Tree-tree | -10851.95 | 0.24 | 0.94 | 690.33 | 17 | 7 |
| 3 | Tree-tw | -12043.44 | 0.23 | 0.94 | 7.6 | 5 | 5 |
| 3 | GS-MBC | -10550.9 | 0.256 | 0.94 | 15.73 | 29 | 7 |
| 3 | GS-tw | -10841.38 | 0.24 | 0.94 | 15.65 | 5 | 5 |
| 3 | CDL2 | – | 0.21 | 0.94 | 194.95 | – | – |
| 3 | SVM-struct | – | 0.24 | 0.945 | 10097.59 | – | – |
| 4 | GS-pruned | -10680.53 | 0.24 | 0.94 | 13.54 | 31 | 5 |
| 4 | Tree-tree | -10950.69 | 0.24 | 0.94 | 717.65 | 19 | 8 |
| 4 | Tree-tw | -12170.59 | 0.21 | 0.94 | 7.5 | 5 | 5 |
| 4 | GS-MBC | -10624.9 | 0.247 | 0.94 | 15.95 | 32 | 7 |
| 4 | GS-tw | -10928.12 | 0.247 | 0.94 | 13.86 | 5 | 5 |
| 4 | CDL2 | – | 0.21 | 0.94 | 195.7 | – | – |
| 4 | SVM-struct | – | 0.24 | 0.944 | 11213.44 | – | – |
| 5 | GS-pruned | -10739.03 | 0.24 | 0.94 | 13.4 | 32 | 5 |
| 5 | Tree-tree | -11093.44 | 0.22 | 0.94 | 673.97 | 17 | 8 |
| 5 | Tree-tw | -12428.24 | 0.2 | 0.94 | 8.8 | 5 | 5 |
| 5 | GS-MBC | -10701.2 | 0.246 | 0.944 | 15.74 | 29 | 8 |
| 5 | GS-tw | -11067.44 | 0.24 | 0.94 | 12.98 | 5 | 5 |
| 5 | CDL2 | – | 0.22 | 0.94 | 167.96 | – | – |
| 5 | SVM-struct | – | 0.23 | 0.94 | 16703.34 | – | – |