Project Ideas and Suggestions

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Description: Tractable Probabilistic Models

Please read the following paper to get started on tractable probabilistic model:

- Tahrima Rahman, Prasanna Kothalkar, and Vibhav Gogate, "*Cutset Networks: A Simple, T ractable, and Scalable Approach for Improving the Accuracy of Chow-Liu Trees*," In European Conferen ce on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML/PKDD), 2014. [**PDF**]

Some newer papers on cutset networks are available here:

- Tahrima Rahman and Vibhav Gogate, "*Learning Ensembles of Cutset Networks*," AAAI 20 16. [**PDF**]

- Tahrima Rahman and Vibhav Gogate, "*Merging Strategies for Sum-Product Networks: Fro m Trees to Graphs*", UAI 2016. [**PDF**]

- Tahrima Rahman, Shasha Jin and Vibhav Gogate, "*Cutset Bayesian Networks: A New Repr esentation for Learning Rao-Blackwellised Graphical Models*", IJCAI 2019. [**PDF**]

- Tahrima Rahman, Shasha Jin and Vibhav Gogate, "*Look Ma, No Latent Variables: Accura te Cutset Networks via Compilation*", ICML 2019. [**PDF**]

Sample Projects:

- Develop GPU-aware fast algorithms for learning cutset networks (namely use tensor-flow or other libraries for learning cutset networks)

- Develop learning algorithms so that cutset networks can be used for solving multi-label classification problems. Use the IJCAI 2019 paper described above as a reference.

- Extend cutset networks to continuous/hyrbid domains (hybrid domains have both discrete and continuous variables) and develop learning algorithms for such networks

- The Chow-Liu algorithm scales quadratically with the number of attributes/variables. Develop an approximate version of the Chow-Liu algorithm so that it scales linearly with the number of attributes and

examples. Use this algorithm to learn cutset networks and their mixtures and compare the performance with the conventional cutset networks learning algorithm both in terms of time and test-set log likelihood score.

- Learn tractable models by approximately compiling them from Bayesian networks. Several Bayesian networks are available here. Compare the log-likelihood score of the compiled cutset networks with the Bayesian networks (the Bayesian networks are the true models). Use the ICML 2019 paper as a reference for this.

- Use the conditional cutset networks (see the IJCAI 2019 paper) to solve the face completion task. Use Caltech-101 and Olivetti datasets for this. Reference paper is available here

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