September 8, 2025

Successful Synthetic Dataset Generation from Python pgmpy Package

This summarizes the **successful synthetic dataset generation** of DEP State of the Community Survey data using python's pgmpy package. Recall that the objective is to create a model from from the original dataset for synthetic data generation, to protect privacy. This attempt was successful in meeting three output criteria:

1. No duplicates of synthetic vs. original dataset to protect privacy
2. Distribution of all columns of synthetic should match original distributions
3. Quick check: Salary split by Education status should match

OUTCOMES: All technical and output criteria met.

1. Bayesian Network Model used here has 70 arcs and zero duplicates vs. Original dataset for all 5 runs of parameter tuning. (Attachment 1 – Figure 1). Other attempts also successful, but this model has the lowest arcs and lowest prior weights while meeting 'no isolated nodes' technical criteria.
2. Distribution of synthetic dataset matches original dataset. (See accompanying pdf: Distribution of Original vs. Synthetic Datasets.pdf)
3. Further split of salary ranges by latest education status is also comparable to original dataset. (Attachment 1 -Figure 2)

NEXT STEPS:

Document the results, the workflow process (Attachment 2) and technical details (e.g. parameter tuning) in github and prepare synthetic dataset for release.

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Attachment 1 Bayesian network model from python's pgmpy vs. R's bnlearn

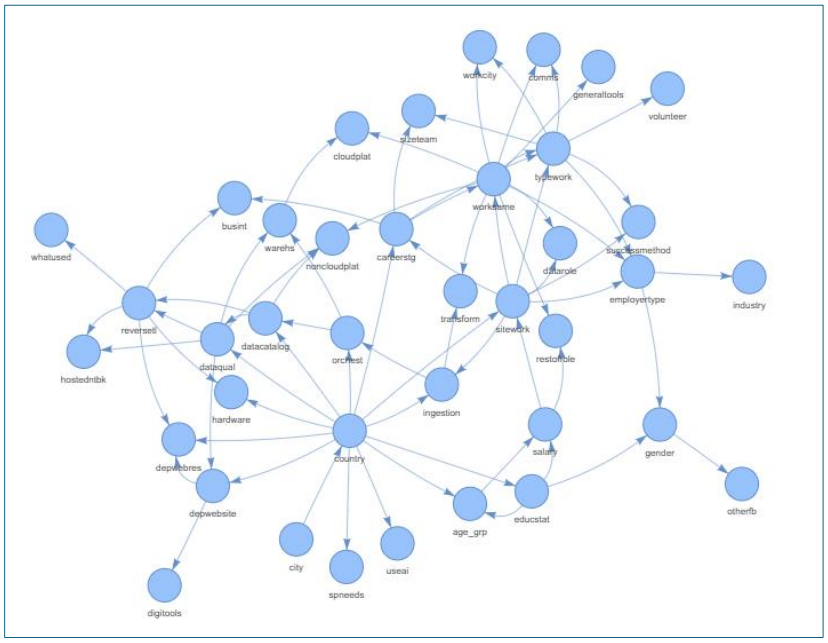


*Figure 1 - Bayesian network from **PYTHON's** pgmpy ess = 1500*

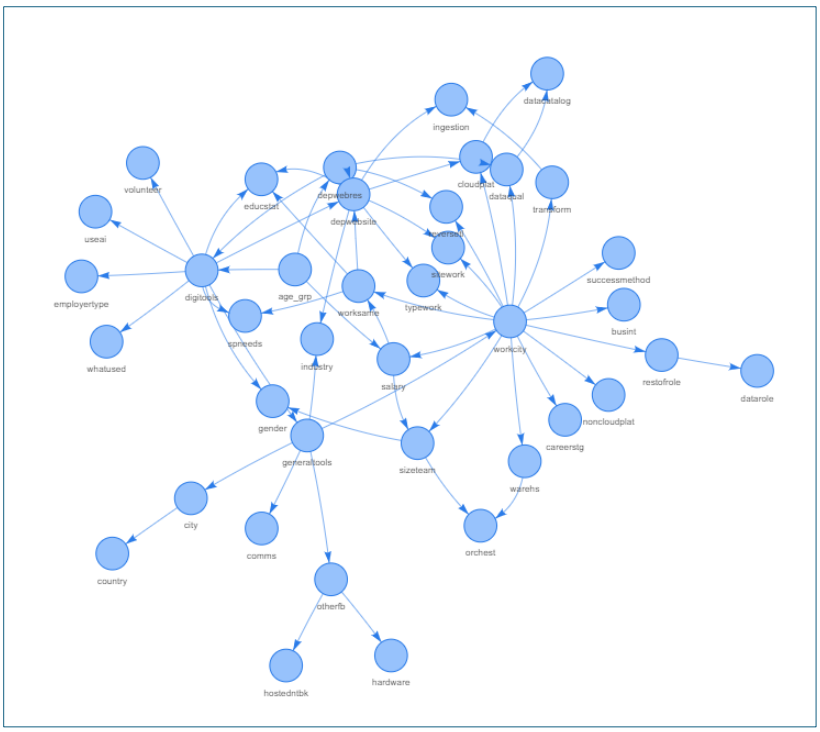
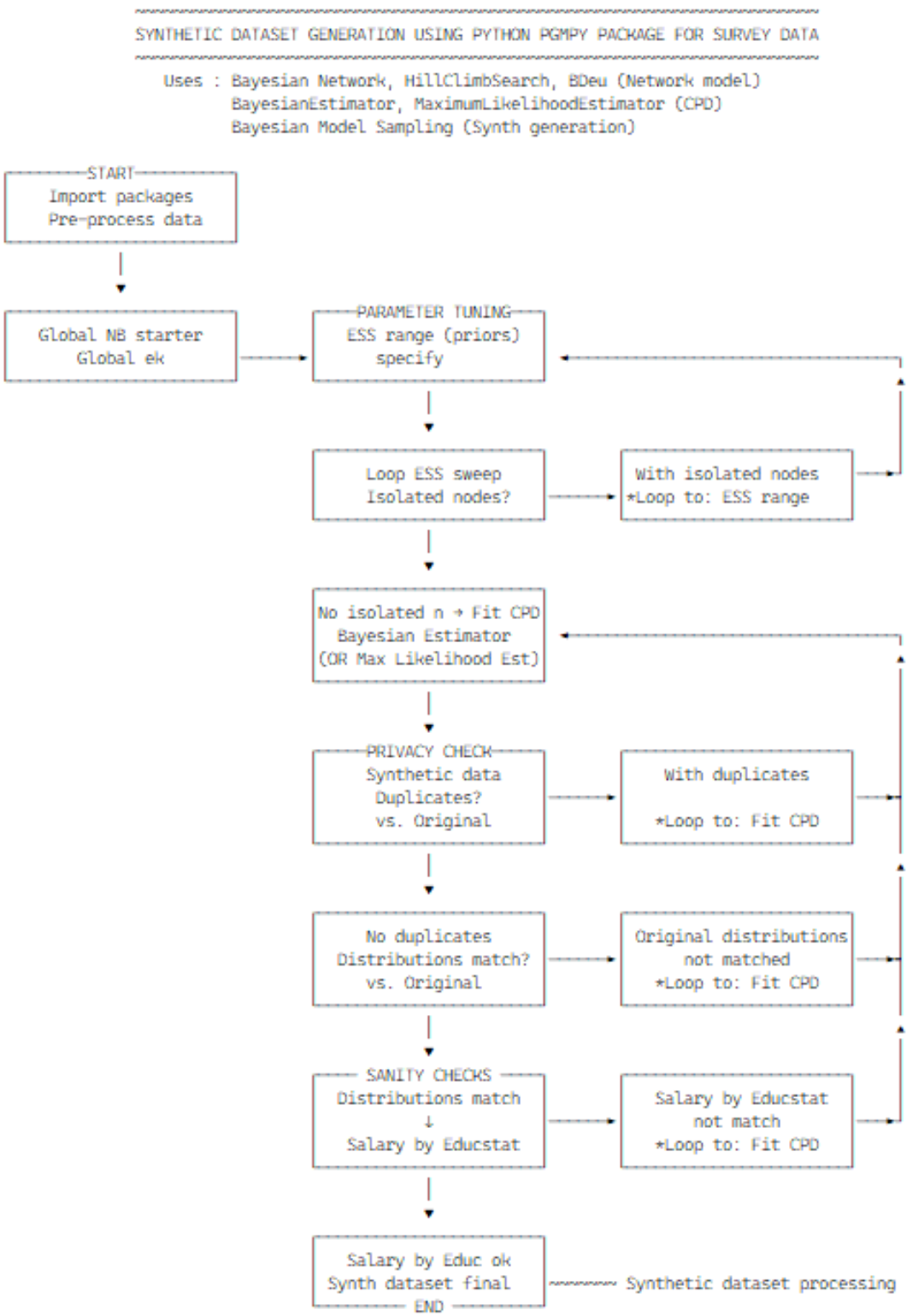


*Figure 2 - Bayesian network from **R's bnlearn***

Attachment 2: Workflow flowchart



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Beyond surveys. Data-driven decisions.
Draft Flowchart app: https://github.com/SandyGCabanes/Unicode-Flowchart-Builder-App