INSTITUTE FOR EMPLOYMENT RESEARCH
The Research Institute of the Federal Employment Agency

AnigeD

UNDERSTANDING THE TRADE-OFF BETWEEN UTILITY AND RISK IN CART BASED MODELS USING SIMULATION DATA

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SECTION 1: INTRODUCTION

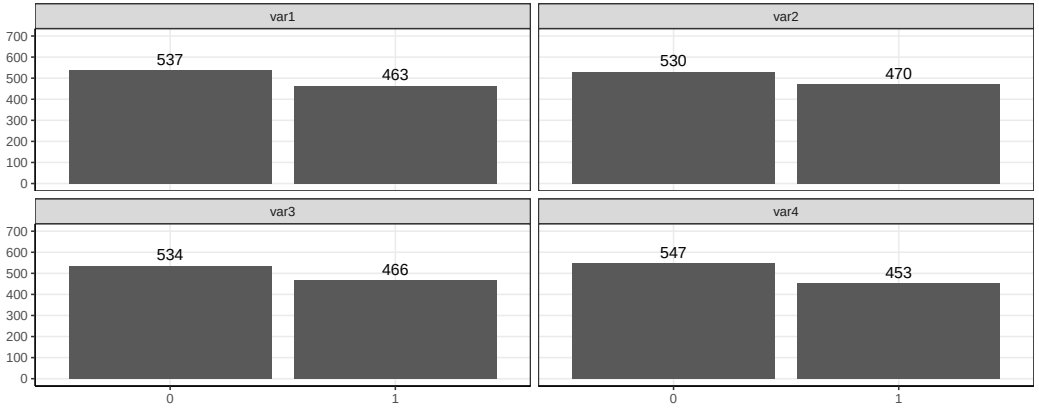
DATA

From Reiter et al., 2014

"We use a simple simulation scenario that illustrates many of the main issues: protecting a 2^4 binary table with fully synthetic data. For $i = 1, \ldots, 1000 = n$, let $y_i = (y_{1i}, y_{2i}, y_{3i}, y_{4i})$ comprise four binary variables. Let each of the $K = 16$ possible combinations be denoted c_k, where $k = 1, \ldots, 16$. Let $c_{16} = (0, 0, 0, 0)$, and let $C_{-16} = (c_1, \ldots, c_{15})$. We generate an observed dataset D as follows. For $i = 1, ..., n - 1 = 999$, sample y_i from a multinomial distribution such that $p(y_i = c_k) = 1/15$ for all $c_k \in C - 16$. Set $y_{1000} = c_{16}$. Since we do full synthesis, $X = \theta$"

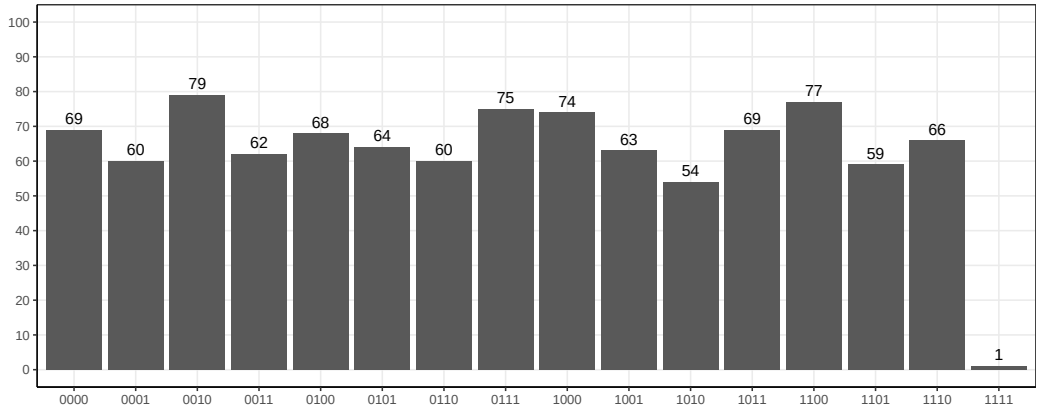
VARIABLE FREQUENCY

Figure 1



HISTOGRAM

Figure 2



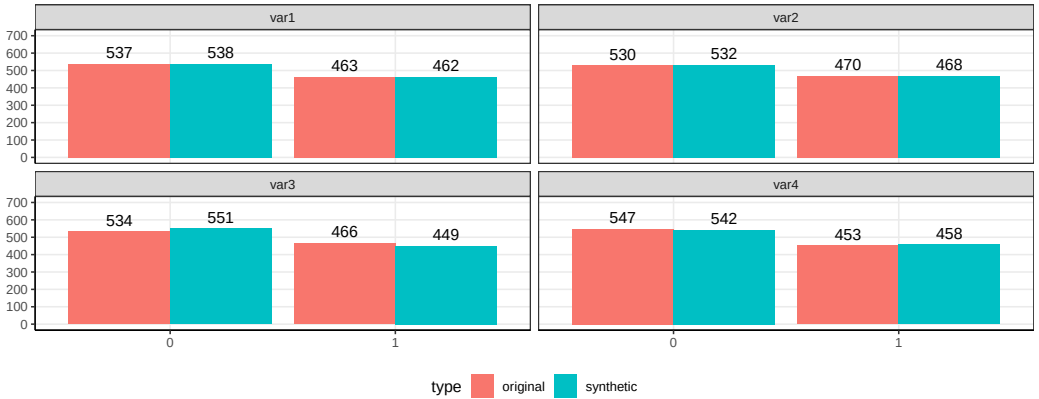
SYNTHPOP

```
> sds <- syn(df_ods, m=1)
Warning: In your synthesis there are numeric variables with 5 or fewer levels: var1, var2, var3, var4.
Consider changing them to factors. You can do it using parameter 'minnumlevels'.

Synthesis
-----------
 var1 var2 var3 var4
```

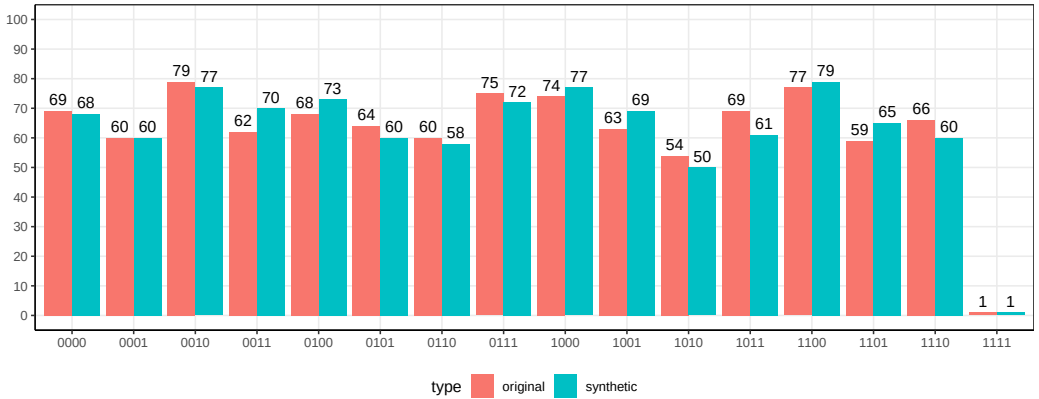
COMPARE FREQUENCY (NUMERICAL)

Figure 3



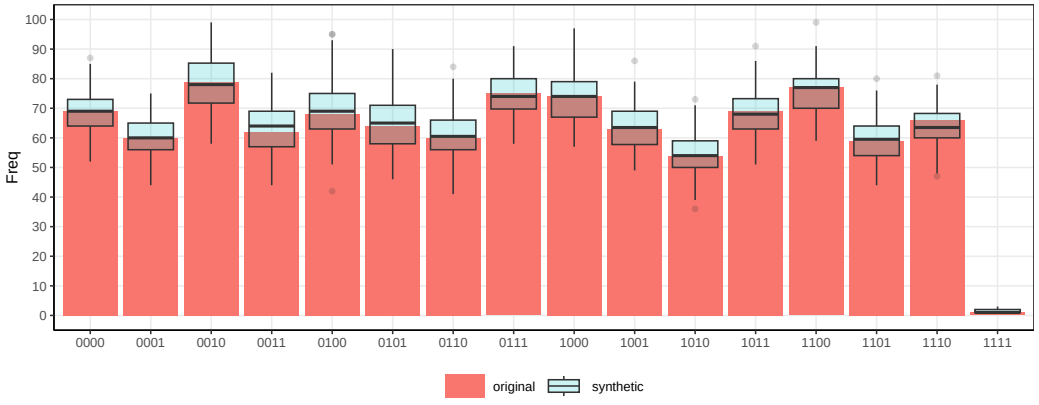
COMPARE HISTOGRAM (NUMERICAL)

Figure 4



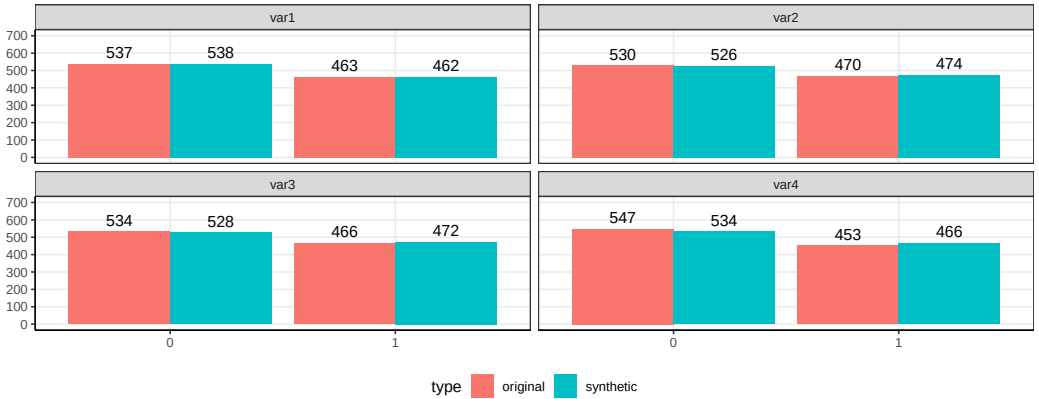
COMPARE HISTOGRAM (NUMERICAL) X 100 SYNTHETIC DATASETS

Figure 5



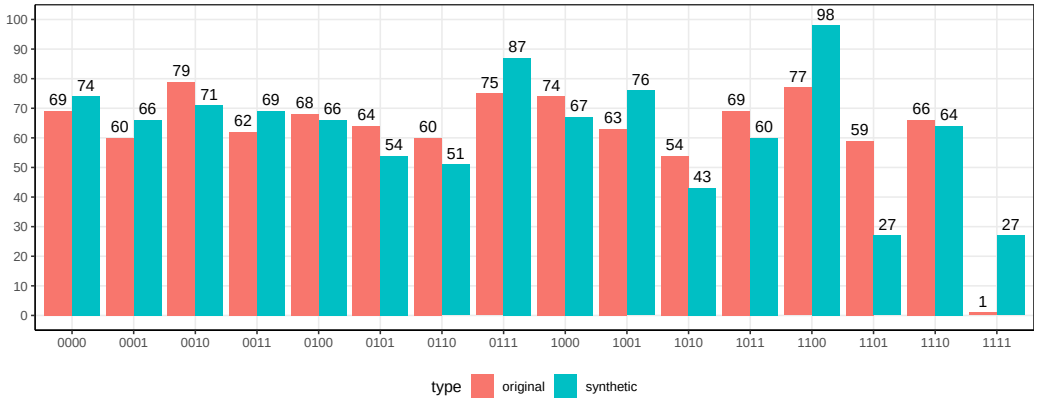
COMPARE FREQUENCY (CATEGORICAL)

Figure 6



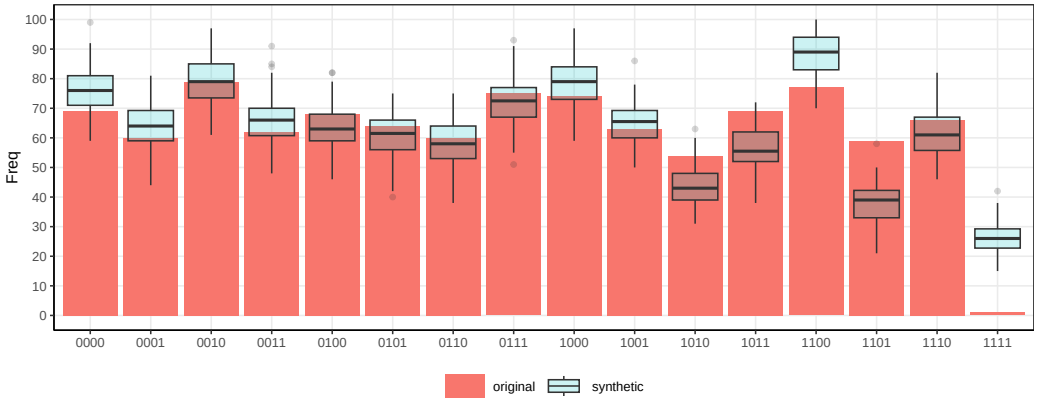
COMPARE HISTOGRAM (CATEGORICAL)

Figure 7



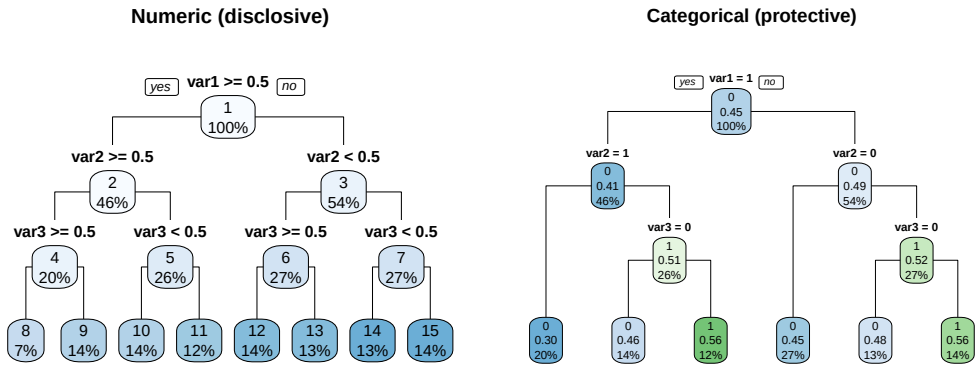
COMPARE HISTOGRAM (CATEGORICAL) X 100 SYNTHETIC DATASETS

Figure 8



HOW DO WE EXPLAIN THIS?

Figure 9



HISTOGRAM WITH DIFFERENTIAL PRIVACY

Figure 10