Efficient and Private Marginal Reconstruction with Local Non-negativity

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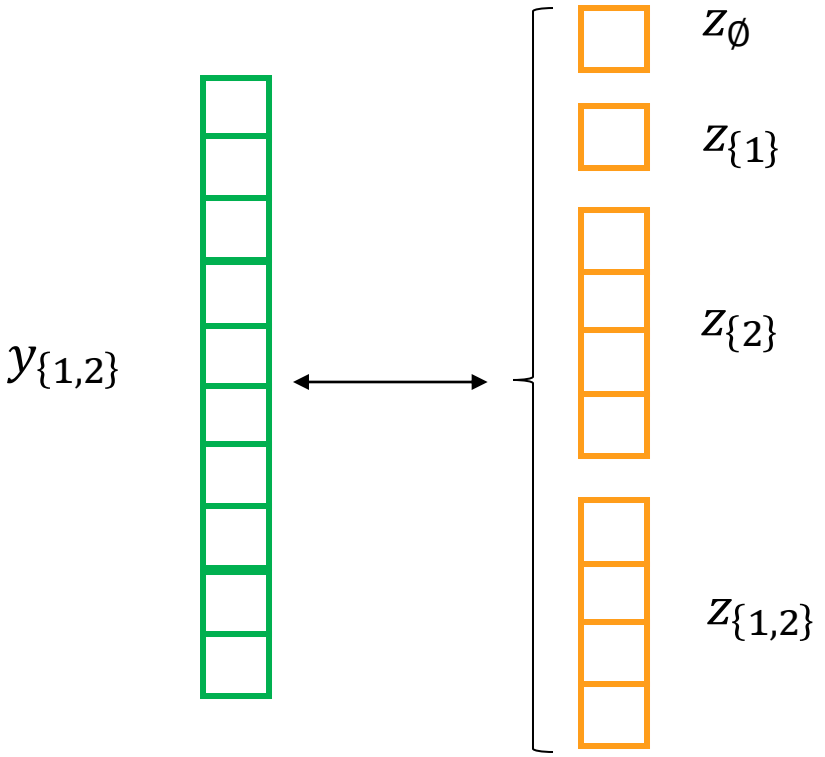
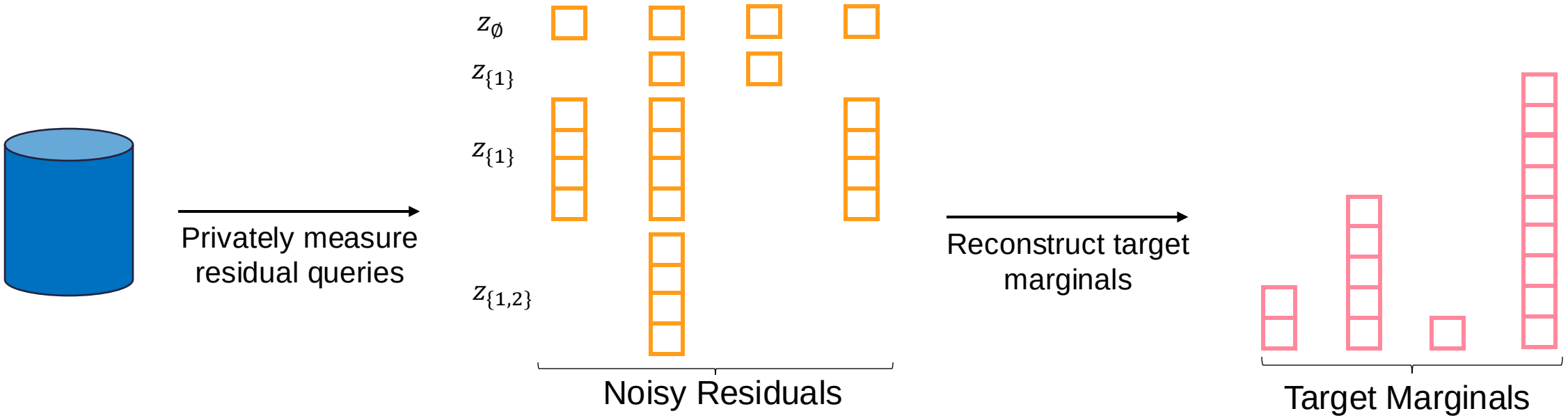
Private Marginals & Residuals

- **Marginals** are counts over all possible values a set of attributes can take
  - ➢Example: how many people are there of each *age* and in each *state*
- **Residuals** capture specific interactions within a marginal
  - ➢Invertible transformation between a marginal and a set of residuals
  - ➢Recently introduced into the privacy literature (Xiao et al. 2023)
  - ➢Studied in statistics literature as “variable interactions” (Feinberg et al. 2006)



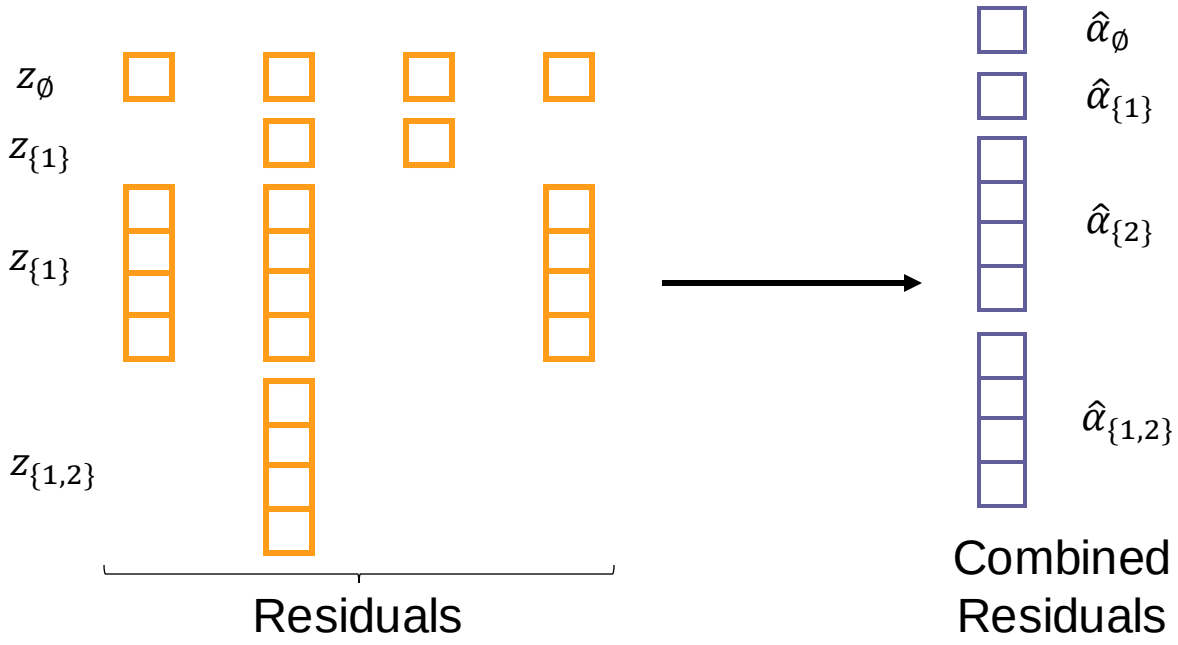
Problem

Given noisy residual measurements, reconstruct answers to a set of marginals

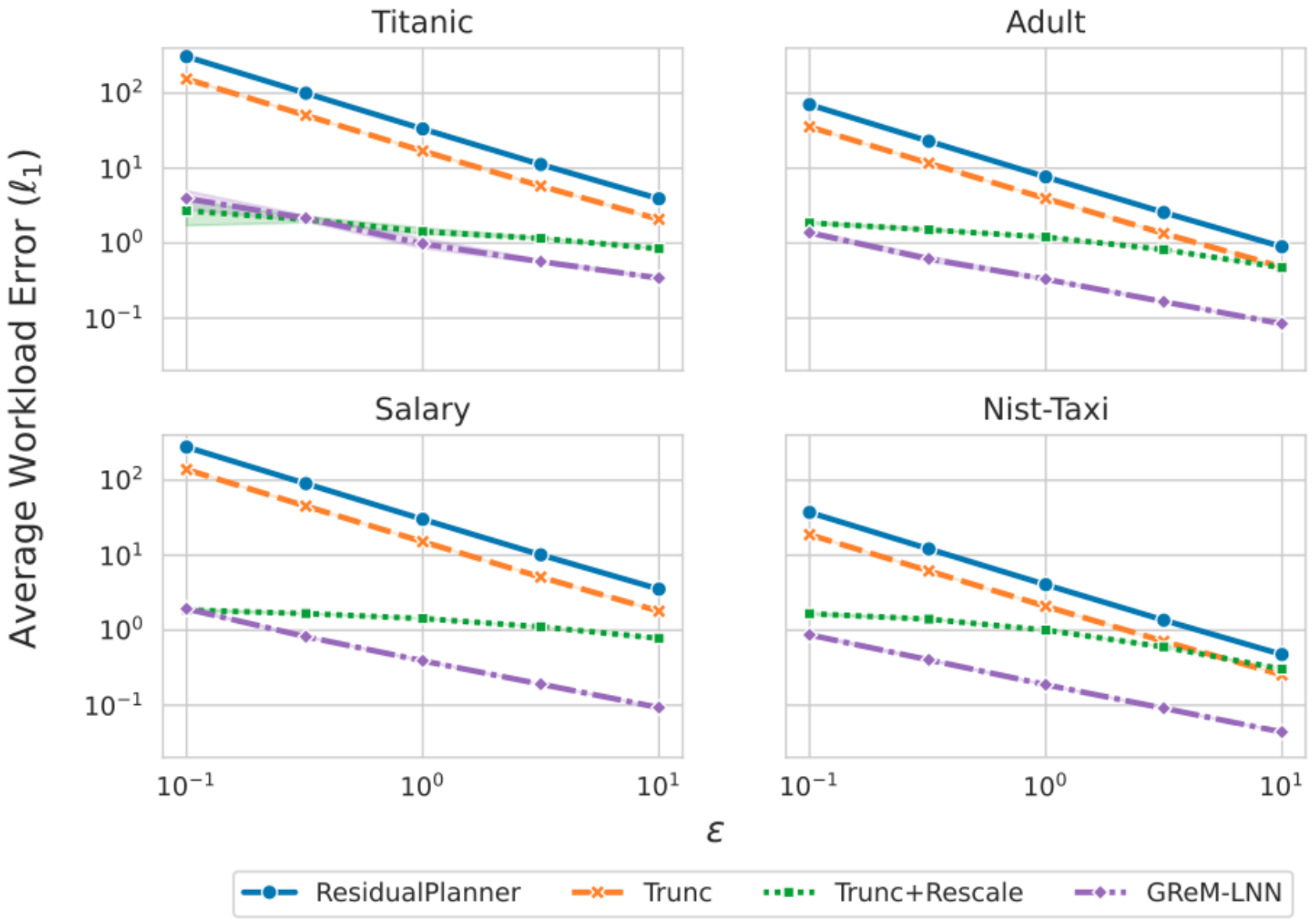


GReM-LNN

- Gaussian Residuals-to-Marginals with Local Non-Negativity
  - ➢ Combines multiple measurements of same residual
  - ➢ Minimizes negative log-likelihood
  - ➢ Such that reconstructed marginals are non-negative (local non-negativity)
  - ➢ Use scalable Dual Assent solver
  - ➢ Apply invertible transformation to reconstruct target marginals
  - ➢ Generalizes ResidualPlanner (Xiao et al. 2023)



Experiment: ResidualPlanner



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