Input Privacy-Preservation Techniques Project

Presented to 2021 Workshop on the Modernisation of Official Statistics

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The work from great(*) group of people, their numerous collaborations and supporters

Very happily presented to 2021 Workshop on the Modernisation of Official Statistics

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(*)Great = professional, engaged, talented, perseverant and very pleasant

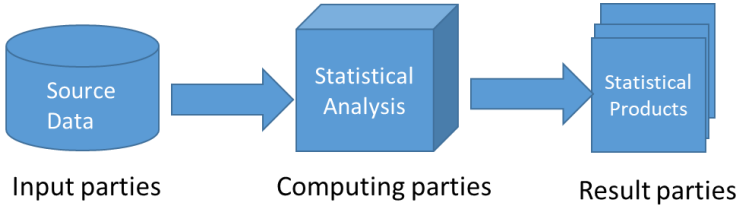
Why Privacy preserving techniques?

Modern statistical organizations:

- **needs to become part of a data ecosystem**
- **acquire and integrate data from multiple sources**
- **provide richer statistical products**

Risk for disclosing information violating individual privacy rights

Overview Privacy protection



Output side: By design applied by NSO's

Input privacy *means that the Computing Party cannot access or derive any input value provided by Input Parties, nor access intermediate values or statistical results during processing of the data (unless the value has been specifically selected for disclosure)*

Objective

"*to investigate statistical use cases that require protection on the input side*,
assess and determine applicability of selected classes of techniques for main scenarios,
identify opportunities for sharing across statistical community and create community of practice across statistical organizations and external partners (academia, private sector)."

Work package 1, Documenting Use cases

- A template how to document IPP use cases
- Documentation of IPP use cases
- Generalization for wider usability and use within project

Work package 2, Elaboration of Use Cases

- Private set intersection
- Private machine learning
- Organize external consultancy

Private set intersection

- Investigate four different scenario’s
- Mini pilot
- Lessons learned

Private machine learning

Pilot goal:

- Build a simulated environment to validate the concept of multi party privacy preserving Machine Learning (PPML) for both, training and inference

Scope:

- Investigate best practises and open source tools for disturbed and collaborative ML training among multiple organisations in a low trust environment whilst mutually benefitting from the outcomes (the final model) or allowing safe 3rd party access

Environment :

- Simulated multi organisational set-up with several NSO's gathering data from individuals (sensors) to predict their activities (time use and well-being surveys).

Private machine learning, next steps

- Extend the scope to more complex models and other distributed data related to members of HLG-MOS
- Incorporate Secure Multi-party Computation for secure aggregation of weights during training, as well as inference
- Integrate Differential Privacy as part of the protocol to protect output privacy
- Collaborate with the Openmined community to use their software stack
- On Board the project to the UN PET-Lab infrastructure

Organize public consultation

Context:

- Increasing **appetite** for producing information (e.g., statistics, analyses) from combination of data held by different organizations (private companies, public institutions)
    - Statistical authority/ies acting as output party, input party or both
- Increasing **pressure** to strengthen safeguards, “technical and organisational measures” for protecting the data
    - Legal requirement by Data Protection Authorities
    - Necessary condition to archive public trust, public acceptance

Organize public consultation

Goal:

- Secure Private Computing-as-a-service
    - Designed/produced/deployed/certified/advertised/etc by public institution (or consortium thereof) acting as SPC provider
    - Used on demand by SPC clients
    - NB: the marginal costs (per project) for clients is not zero, but should be anyway much lower than setting up a ad hoc infrastructure to a single use-case
- Public consultation to pull expert knowledge
    - Key challenge: how to build trust into the infrastructure?
    - Idea: ask the question to experts from various domains, via a public consultation (informal, technical)
    - Public consultation as a way to pull expert knowledge

Recommendations

- Apply collaboration more to complex problems
- Continuation of the project

Q & A