

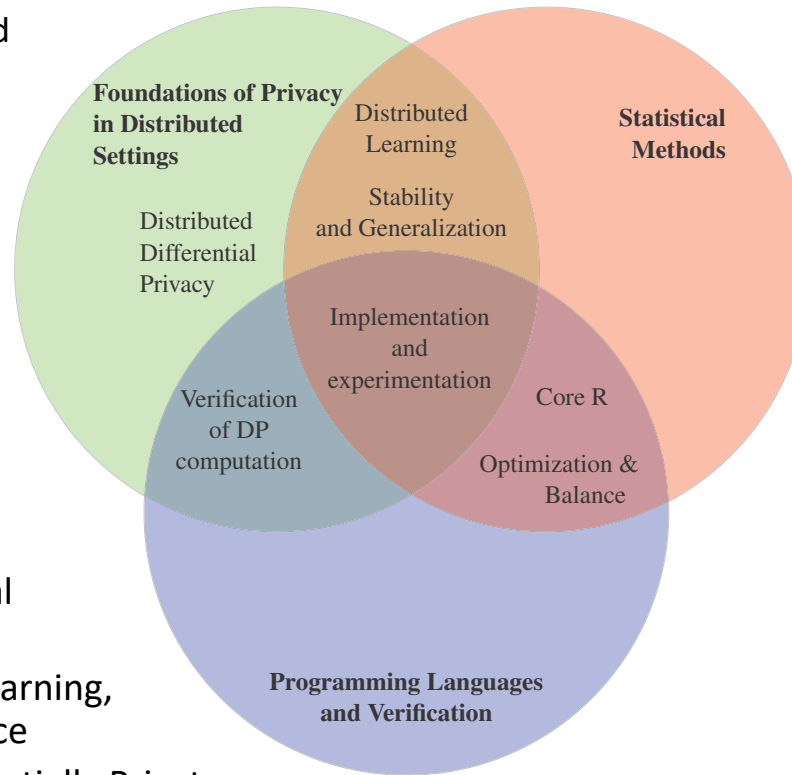
Computing Over Distributed Sensitive Data

Challenge:

- Sensitive data about individuals siloed at different organizations
- Much value in combined data
- But data can not be shared!

Solution:

- Protocols and tools to share computation (and not the data) between entities
- Distributed Differential Privacy
- Differential Privacy, Learning, and Statistical Inference
- Verification for Differentially Private Programs
- Simplified version of R suitable for analysis, verification, distributed execution in Trusted Execution Environments



Scientific Impact (recent results):

- Optimal differentially private histograms over large data universes that are strict poly-time on discrete computers
Balcer & Vadhan, ITCS 2018
- Logic for reasoning about higher-order probabilistic programs
Sato, Gaboardi, et al., POPL 2019
- New Masters-level course “Applied Privacy for Data Science”
Honaker and Vadhan, 2019
- Optimal differentially private summation in the shuffle model
Balle, Bell, Gascon, Nissim CRYPTO 2019
- Computing center points and learning half spaces
Beimel, Moran, Nissim, Stemmer COLT 2019
- Control information-flow in distributed applications using SGX
Gollamudi, Arden, Chong CSF 2019
- Algorithms for Locally Private Mean Estimation
Gaboardi, Rogers, Sheffet, AISTATS19
- Secure MPC protocols to get “best of both worlds” from local and centralized DP
Balcer, Vadhan, and collaborators - in progress
- The complexity of verifying circuits as differentially private
Gaboardi, Nissim, Purser - in progress
- Relational Symbolic Execution for Differential Privacy
Farina, Chong, Gaboardi - in progress
- For more results, see <https://privacytools.seas.harvard.edu/>

Broader Impact:

- Enable collaboration between multiple data curators
- Increase understanding of how Differential Privacy can work in practical systems
- Curricula development

Award #1565387

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