Function Secret Sharing

Abstract:

Motivated by the goal of securely searching and updating distributed data, we introduce the notion of function secret sharing (FSS), a form of “additive secret sharing” for \( f: \{0,1\}^n \rightarrow G \), where \( G \) is an abelian group.

An \( m \)-party FSS scheme for function class \( F \) allows one to split any function \( f \) from \( F \) into \( m \) succinctly described functions \( f_i \), such that: (1) for every input \( x \), \( f(x) \) is equal to the sum of evaluations \( \sum_i f_i(x) \), and (2) any strict subset of "share functions" \( f_i \) hides \( f \). FSS provides a natural generalization of distributed point functions, as introduced by (Gilboa-Ishai Eurocrypt 2014), which coincide with the special case of two parties and the class \( F \) of point functions (which evaluate to 0 at all but one point).

We present two types of results:
- We obtain efficiency improvements and extensions of the original distributed point function construction.
- We then initiate a systematic study of general FSS, providing constructions for richer function classes, and establishing relations with other cryptographic primitives.

Joint work with Niv Gilboa and Yuval Ishai.