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.