



# Acceleration of Functional Encryption for Privacy-Preserving Machine Learning

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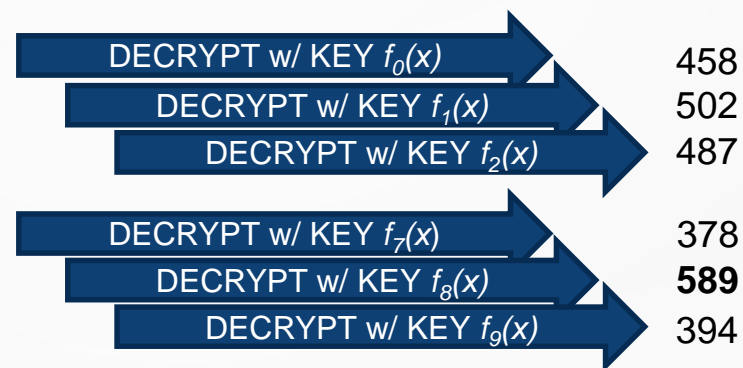




# FUNCTIONAL ENCRYPTION (FE)

Cryptosystems where decryption does not give the plaintext  $x$  but  $f(x)$

- Show great promise for privacy-enhancing technologies
- Different keys allow computing different functions
- In practice, very limited functions (linear or quadratic) are feasible
- Statistics, simple machine learning or pattern recognition applications are possible





# FUNCTIONAL ENCRYPTION ACCELERATION

## FE schemes are computationally heavy

- E.g., the MNIST handwritten digit classification from the previous slide takes about 20 seconds per image (Stopar et al., ESORICS 2019)

## HW/SW codesign on reprogrammable SoC (e.g., Xilinx UltraScale+) combines the best of hardware and software

- Several parallel accelerator cores on HW
- SW for control, table searches, and less critical operations

## We have designed several accelerators for FE

- Multi-input FE based on Paillier encryption
- FE for quadratic functions based on pairings and discrete logs

