**BACKGROUND**

- Automated Teller Machines (ATMs) require an ATM card and a Personal Identification Number (PIN) to access an account.
- ATMs typically display symbols (i.e., dots or asterisks) to track the number of PIN digits a user has entered while protecting against low-effort attempts to steal the PIN.
- Displaying symbols does not immediately leak the PIN, but unintentionally leaks information about the inter-key press timings.

**HYPOTHESES**

We test two different hypotheses on what features predict inter-key timing effectively for potential use in PIN inference.

**Distance Hypothesis**

Inter-key timing correlates with physical distance - that is, a pair of keys with greater physical distance from one another will also have a correspondingly longer inter-key latency than a pair of keys closer together.

**Direction Hypothesis**

Inter-key timing varies with physical orientation - that is, a pair of keys that are equal distances from one another but lie in different directions from one another will have different inter-key latencies. This may be limited to horizontal vs. vertical directions (e.g., 1 to 3 vs. 1 to 7), or may be any direction (e.g., left vs. right, as in 2 to 1 vs. 2 to 3).

**EXPERIMENT & RESULTS**

In order to observe keystroke timings, we designed and executed an experiment featuring:

- An ATM simulation with a real ATM keypad
- A camcorder recording the screen from a fixed location
- 22 users, with a total of 61 sessions and over 40,000 data points collected

The PINs used were generated specifically to test our hypotheses. Each session had:

- A total of fifteen 4-digit PINs
- 4 fifteen second breaks throughout the session
- Each PIN presented 3 separate times
- Each PIN typed correctly a total of 12 times
- No PIN repeated across different sessions per user

**TIMING DETECTION**

We designed a system to automatically detect, from videos of the ATM screen, the appearance of symbols and log the times that were observed. The system:

- Scans each frame for dots using OpenCV.
- Logs the frame and timestamp when a new dot is discovered.
- Logs the frame and timestamp when multiple dots disappear as when an Enter was pressed.

From this, all inter-key latencies are then derived.

**FUTURE WORK**

Further work is needed in evaluating alternative measures of the timing data available and in identifying what other features may be used in conjunction with timing features to improve PIN inference.

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