

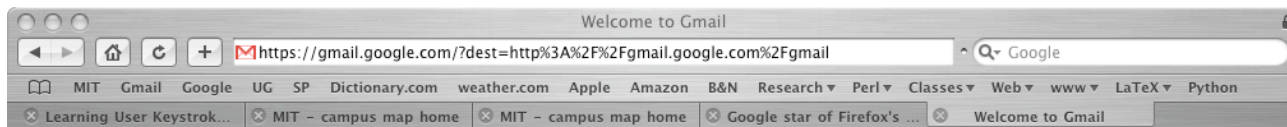
Enhanced User Authentication Through Keystroke Biometrics



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Logging into a Web Service



Welcome to Gmail

A Google approach to email.

Gmail is an experiment in a new kind of webmail, built on the idea that you should never have to delete mail and you should always be able to find the message you want. The key features are:

- **Search, don't sort.**
Use Google search to **find the exact message** you want, no matter when it was sent or received.
- **Don't throw anything away.**
1000 megabytes of free storage so you'll never need to delete another message.
- **Keep it all in context.**
Each message is grouped with all its replies and displayed as a conversation.
- **No pop-up ads. No untargeted banners.**
You see only [relevant text ads](#) and links to related web pages of interest.

Gmail Sign In

Username:

Password:

Don't ask for my password for 2 weeks.

[Forgot your password?](#)

Learn more [about Gmail](#).

A few words about [privacy and Gmail](#).

Experimental Setup



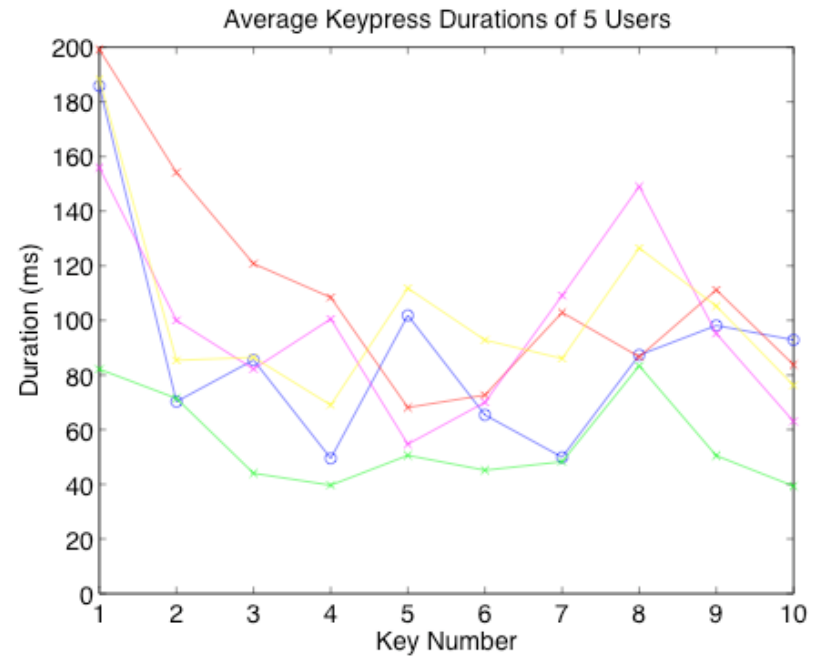
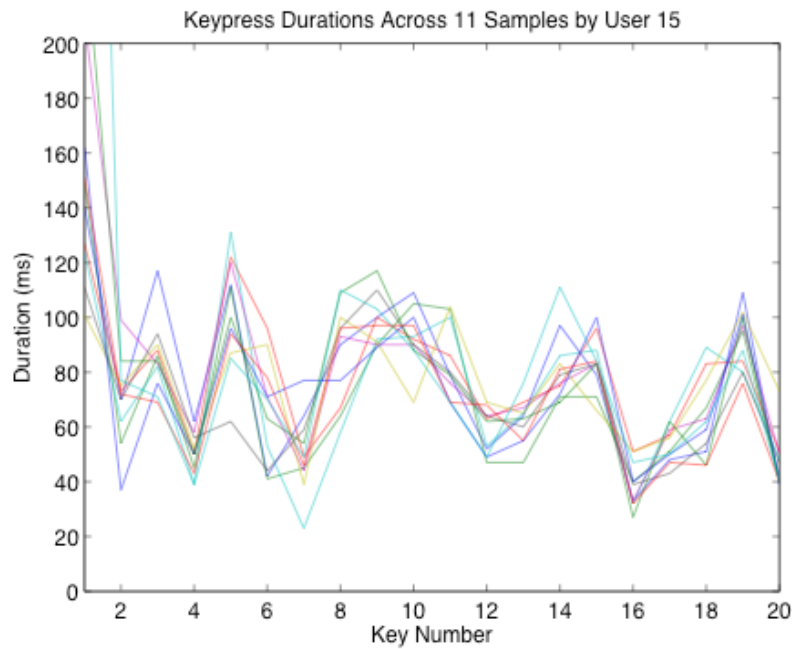
- 15 users
- ~10 typing samples each
- “A quick brown fox jumps over the lazy dog.”

Keypress Duration



- Some consistency found across users
- Mean & standard dev. profiling
- Variations across different users

Keypress Duration



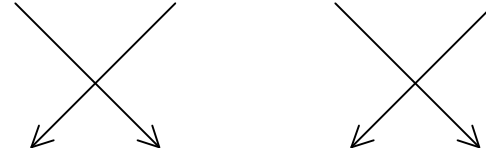
Press/Release Ordering



- Ordering differences
- Distance metric (relative ordering)

■ Trial 1: P1 - R1 - P2 - P3 - R2 - R3

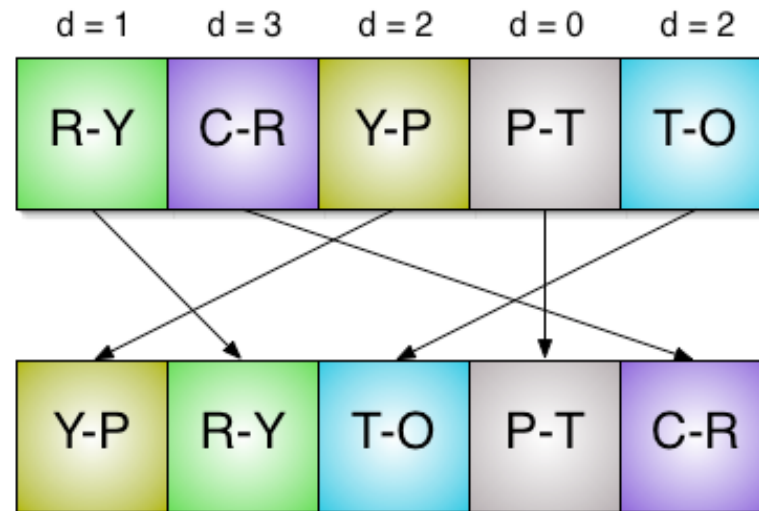
■ Trial 2: P1 - P2 - R1 - R2 - P3 - R3



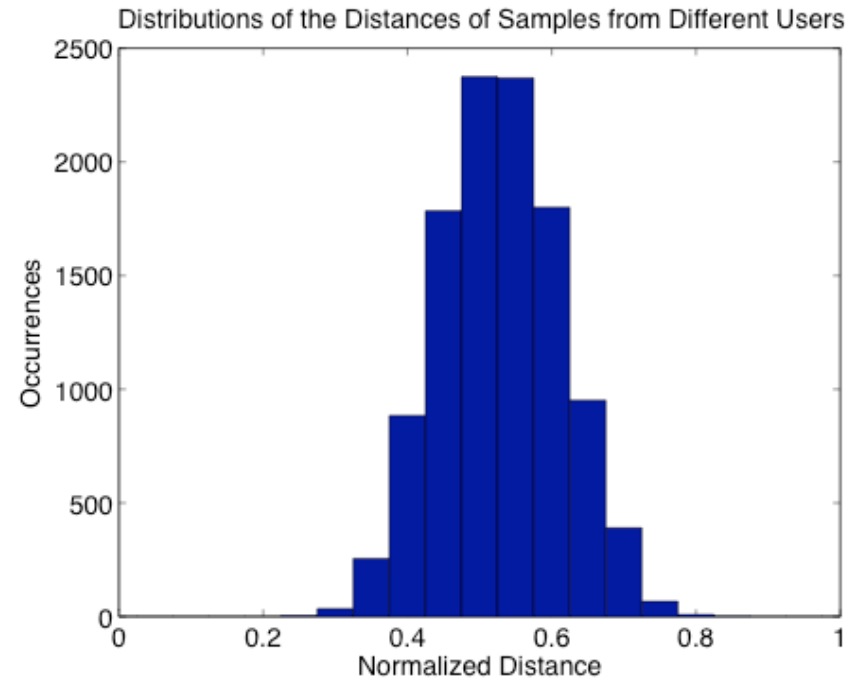
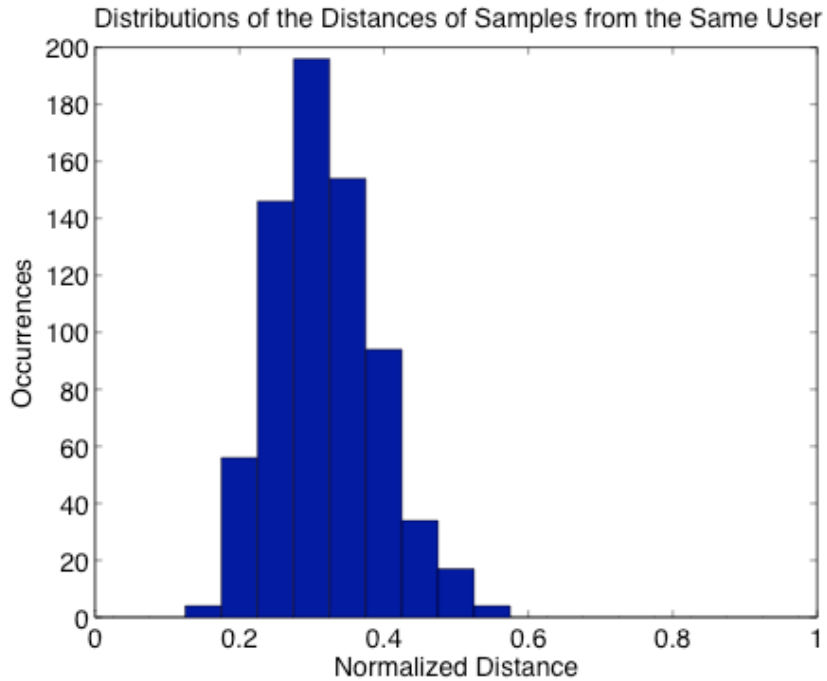
Relative Keystroke Speeds



- Relative speed of particular keys may remain consistent
- Distance metric between two samples



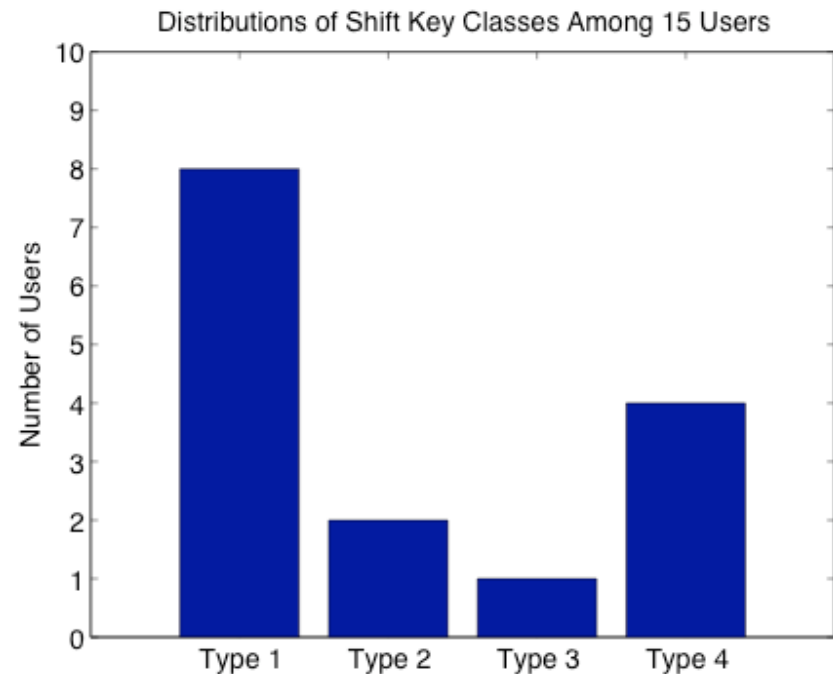
Relative Keystroke Speeds



Shift Key Usage



- 4 classes of shift-key users
 - Type 1 - LEFT-SHIFT
 - Type 2 - RIGHT-SHIFT
 - Type 3 - MIXED CONSISTENT
 - Type 4 - MIXED INCONSISTENT



Contributions



- Applied statistical analysis methods for password scenario
- Proposed four metrics for distinguishing typing patterns
- Conducted experiments to validate and assess goodness of each metric