Sharing without Scaring: Enabling Smartphones to Become Aware of Temporary Sharing

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Temporary Device Sharing

Motivation
- Helping
- Convenience
- Social purposes

Sharing practice
- Supervision
- Sharing protection

Privacy concern
- Personal data
- Sensitive operations

Social implication
- Trust
- Relationship
- Culture

Owner
Sharee
Device Sharing Protection Solutions

Guest account

App pinning

Vault

App lock
Owner’s Failure to Enable Sharing Protection

- Forgetfulness
- Lack of risk perception
- Avoiding signaling mistrust

Need for proactive device sharing protection solution
Device Sharing Awareness (DSA)

**Determine when to activate and deactivate sharing protection**

- Normal Sharing Locked
- Non-owner detected
- Owner verified
- Sharing starts (Handover detected)
- Sharing ends (Owner verified)
- Violations
- Manual exit
- Locked
- Owner verified
Sharing Gesture Detection

• Start a sharing event
• Handover gesture
  • Owner handing device to sharee
  • Distinguishing handover from other common movements
• Pre-trained cross-user model
• Adaptive sensing
Owner Detection

• End a sharing event

• Behavioral biometrics
  • Implicit Authentication (IA)
  • User recognition by how they interact with device
  • E.g., touch patterns, keystroke dynamics

• Handle exceptions
  • Prevent unauthorized access
  • Handle false sharing detection
Implementation

• DSA Service
  • Sharing detection
  • App-level access control
  • Notification management

• Interaction with apps
  • Tracking the current app
  • Notifying apps of device sharing

Hiding sensitive notifications

Hiding sensitive operations

Pre-sharing  Sharing mode  Post-sharing
Evaluation Setup

• Handover detection evaluation
  • 18 participants, 5 device models
  • 2044 handover, 1737 non-handover data clips
  • Evaluating cross-user, cross-device detection accuracy
  • Building a pre-trained model with tuned hyperparameters

• Sharing handling evaluation
  • 10 participants, 50 sessions
  • Webpage sharing tasks
  • Adopting Touchalytics IA [1] for owner detection
  • Evaluating how DSA handles complete device sharing events

Handover Detection Results

Performance
- precision: 0.98
- recall: 0.95
- reaction time: 2.33s

Best settings
- segment size = 2s
- interval = 1s
- window size = 2
- threshold = 0.3 m/s²
Device Sharing Trace

DSA started sharing mode right after detecting a handover.

DSA automatically handled 41/50 sessions without exceptions. 7/9 sessions were corrected by owner detection.

DSA ended sharing mode only after confirming owner’s identity.
Conclusion

• We proposed DSA to proactively detect and handle temporary device sharing.
• We implemented DSA Service on Android for demonstration.
• A user study showed the effectiveness of DSA in handover gesture detection and sharing handling.
• Data and source code are available at: https://github.com/cryspuwaterloo/DSA-Framework.

• Future avenues
  • Extending sharing gesture detection under more contexts
  • Conducting a long-term user study to evaluate user acceptance of DSA

• Thank you for listening! Email: jiayi.chen@uwaterloo.ca