2019
Research Experience for Undergraduates

Parameterizing Fingerprints to Protect Against “Sniff and Suppress” Attacks

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Motivation

- Passwords: easy to generate and replace, near infinite possibilities
  - Do not guarantee authenticity of the user
- Biometrics: Unique to each person and guarantee authenticity
  - Not easily replaceable if compromised
  - Vulnerable to Sniff and Suppress attacks

Goal

Prototype a method of protecting fingerprint data in transit from sniffing attacks

Objectives

- Determine a method to parameterize fingerprint data
- Create a mathematical function to call on those parameterizations that will scramble a fingerprint, making it useless if intercepted without knowing the right key
- Develop prototype software that utilizes the function

Expected Impact

- Creation of a method of fingerprint parameterization allows for others to improve on current method and implement similar schemes in a real world environment
- Step towards securing biometrics for authentication

Deliverables

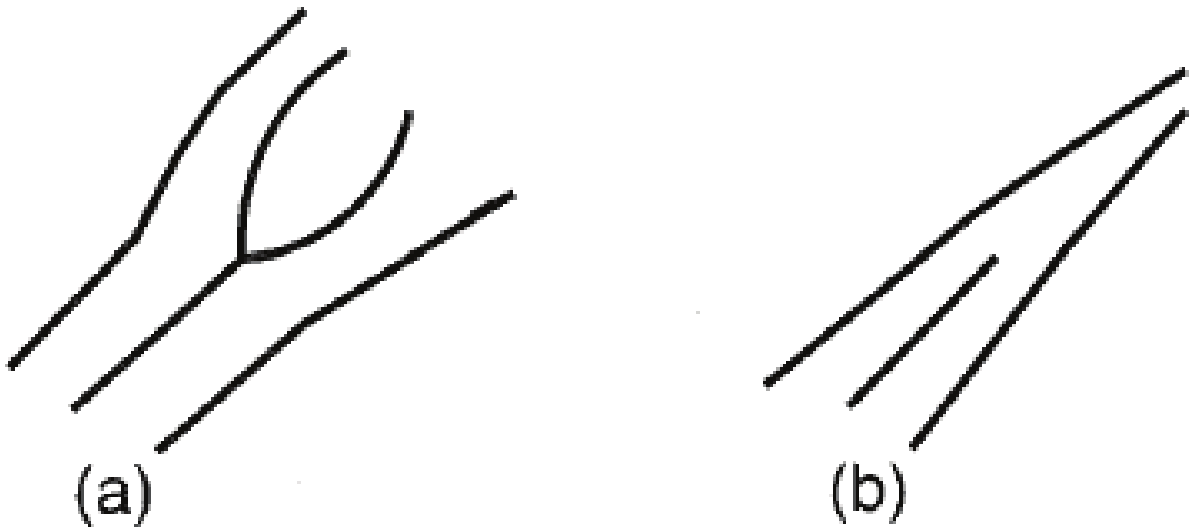
- C++ source and executable that will scramble and unscramble the internal representation of a fingerprint
- Various Bash scripts, including:
  - massUnscrambler and massScrambler: call the C++ executable with certain parameters
  - fingerprintMatcher: compares xyt files for matches, output stored in <testedFile>.txt

Methods: Objective 1

- Generate xyt files from fingerprint data with mindtct algorithm
- Read the documentation about the xyt files
- Set the xyt files as the parameter for the code

Results: Objective 1

- Read in each minutia, maximum, and minimum values for the x and y coordinates from the xyt files



Methods: Objective 2

Using the given parameters in addition to the key, compute a formula that allows a wide range of output but reversible

Results: Objective 2

- Developed two formulae, one for theta and one for the x and y coordinates.
- Each is based on adding or subtracting some constant to the original values, with the constant based on various attributes and the random numbers generated from key attributes. The new value is bounded by a range determined by the input xyt file

Methods: Objective 3

- Write scripts that executes the bozorth3 algorithm, which compares fingerprint data
- Devise tests for scrambled print data vs original print data and unscrambled print data vs original print data

Results: Objective 3

- The bozorth3 script iterates through a set folder of print data and records the results in a txt file

Original

1_1_1_1.xyt - Notepad

File Edit Format View

```
46 280 56 14
51 290 225 33
55 321 214 15
56 352 34 13
68 217 236 77
69 331 34 76
74 266 225 78
79 178 56 79
83 129 67 65
99 101 79 14
106 137 67 79
114 123 90 75
115 181 56 81
```


Scrambled

1_1_1_1_e.xyt - Notepad

File Edit Format View

```
46 384 244 14
51 343 60 33
55 340 107 15
56 175 227 13
68 219 123 77
100 331 237 76
74 326 107 78
185 178 257 79
83 261 317 65
263 101 339 14
106 312 312 79
114 439 338 75
219 181 268 81
```

Original

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File Edit Format View

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68 217 236 77
69 331 34 76
74 266 225 78
79 178 56 79
83 129 67 65
99 101 79 14
106 137 67 79
114 123 90 75
115 181 56 81
```

Unscrambled

1_1_1_1_e_e.xyt - Notep

File Edit Format View

```
46 280 56 14
51 290 225 33
55 321 214 15
56 352 34 13
68 217 236 77
69 331 34 76
74 266 225 78
79 178 56 79
83 129 67 65
99 101 79 14
106 137 67 79
114 123 90 75
115 181 56 81
```

Remaining Work

- Run more tests with different keys: determine factors of key quality
- Simulate more “Sniff and Suppress” attacks
- Collect all the separate scripts and executables into a single program

Conclusions

- Based on the current test results, the function proves successful: the 11 keys all produced scrambled versions of the fingerprint that did not match the original versions, but whose unscrambled forms were identical to the original version
- If unscrambled with the wrong key, resulting fingerprint is not a match to originals

Acknowledgements

The REU project is sponsored by NSF under award NSF-1659755. Special thanks to the following UH offices for providing financial support to the project: Department of Computer Science; College of Natural Sciences and Mathematics; Dean of Graduate and Professional Studies; VP for Research; and the Provost's Office. The views and conclusions contained in this presentation are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the sponsors.

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