

StegoAppDB and how prevalent mobile steganography is

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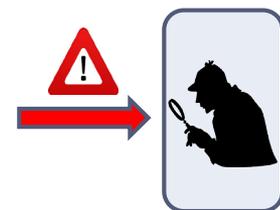
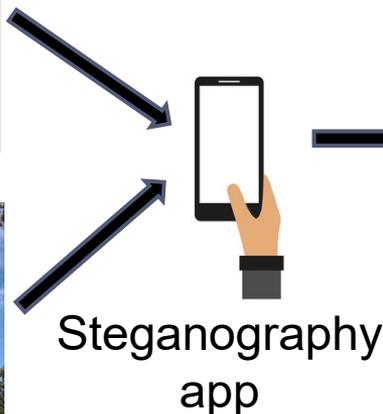
American Academy of Forensic Sciences Annual Meeting
February 21, 2019

Today's presentation

- What is steganography? Steganalysis?
- How do you detect it?
- Can we determine the prevalence of steganography in mobile device photographs?
- What is the Steganography App Database - StegoAppDB and why do we need a large reference database of smartphone camera images?
- StegoAppDB is now available for use and download

Steganography and Steganalysis

- **Steganography:** sending a message without the appearance of a message in the media
- “Hiding in plain sight”
- **Steganalysis or steg detection:** detection of steganography



Steganography
detection

Steganography Apps on Google Play

| App Name | Installs | Open Source | Output Format | Image Resizing | Payload Pre-processing | | | Embedding Technique |
|--------------------------------------|----------|-------------|---------------|----------------------------|------------------------|-------------------|-------------|------------------------|
| | | | | | Encryption | Signature Strings | Length Data | |
| PixelKnot | 100,000+ | Yes | JPG | Downsampling | Yes | No | Yes | F5 |
| Steganography Master | 10,000+ | No | PNG | No | No | Yes | No | 1's digit replacement |
| Steganography_M | 10,000+ | No | PNG | No | No | Yes | No | LSB replacement |
| DaVinci Secret Image | 5,000+ | No | PNG | User specified | No | Yes | Yes | Alpha channel encoding |
| Steganography_T | 5,000+ | No | PNG | No | No | No | Yes | LSB replacement |
| Stegais | 1,000+ | No | JPG | Downsampling | No | No | Yes | Unknown |
| PocketStego | 1,000+ | No | PNG | Downsampling | No | Yes | No | LSB |
| MobiStego | 1,000+ | Yes | PNG | Downsampling | Yes | Yes | No | RGB channels LS2B |
| NiaStego | 1,000+ | No | PNG | Upsampling | Yes | Yes | No | RGB channels LSB |
| Passlok | 1,000+ | Yes | JPG | No | Yes | Yes | No | Non-shrinkage F5 |

Steganography uses ...

- Intellectual property crimes
- Industrial espionage
- Other spy activities
- Financial crimes – bookkeeping, etc.
- Other criminal activities

... and steg detection users

- Crime labs
- Companies producing cyber security software
- Companies that require data and IP protection



Do we know the prevalence of mobile steganography?

- What is the prevalence of steganography in mobile phone photographs?
- **It is not known**
 - No known software package that can test for steganography content in *mobile phone photographs from stego apps on mobile phones*
- A forensic corpora that supports this investigation can help answer this and more questions by supporting software tool development to perform steg detection on such images



Why a large reference database of smartphone camera images?

- Landmark report by National Academy of Sciences (2009)
 - Creating effective tools for forensic practitioners requires developers have access to standardized forensic corpora
 - A reference database:
 - Allows software tools to be developed and benchmarked
 - Allows an experiment to be tested for its reproducibility
 - Allows weak results to be identified, leading to improvements
 - We identified a gap in datasets for mobile steg detection
 - StegoAppDB is publicly available, large (> 810,000 images), and richly annotated and provenanced
 - Image data from 24 mobile phones using 7 stego apps on mobile devices
 - <https://forensicstats.org/stegoappdb/>
-

How to steg detect

1. If image is an exact copy of another image: use hash tables
 - **StegoHunt (Wetstone)**
2. If a known signature is suspected, extract and test for it
3. If unknown or known to be random, use artificial intelligence

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 - **DC3 StegDetect (government lab)**
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How to steg detect

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2. If a known signature is suspected, extract and test for it
 - Stego Hunt (Wetstone); DC3 StegDetect (government lab)
3. If unknown or known to be random, use artificial intelligence or create your own software tool
 - **Hard problem, academics making good progress using Machine Learning/AI techniques and LOTS of data**
 - **10,000s to millions of image data**



need a large reference dataset!



StegoAppDB: A Forensics Image Database for Mobile Steganography

[Go to the Database](#)

StegoAppDB

StegoAppDB, a steganography apps forensics image database, is a database of image data from mobile phones. It is the first database consisting of mobile phone photographs and stego images produced from mobile stego apps, including a rich set of side information. StegoAppDB contains over 810,000 innocent and stego images using 10 different phone models from 24 distinct devices, with detailed provenanced data such as a wide range of ISO and exposure settings, EXIF data, stego app APKs, message information, embedding rate, and other information.

A search on the database can be separated into two main categories, searching on stego and related images, and searching on original images. Stego images are created using Android and iOS mobile stego apps. We provide cover-stego image pairs for each stego image so that the data may be used for machine learning applications of steganalysis. Original images are acquired using our own Cameraw camera app, and saved in both DNG and high-quality JPEG formats. Cameraw is available on Github for both iOS and Androids. We retain the original devices and continue to add to the database. While designed for steganography, other digital image forensic areas may find this database to be suitable.

This database is publicly available and has no copyright or privacy issues associated with it.

For more information about the data in the database, please go to [FAQ](#).

FAQ

Q: How can I download portions of the data?

Contact Us

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jlnewman@iastate.edu

Learn More about Steganography

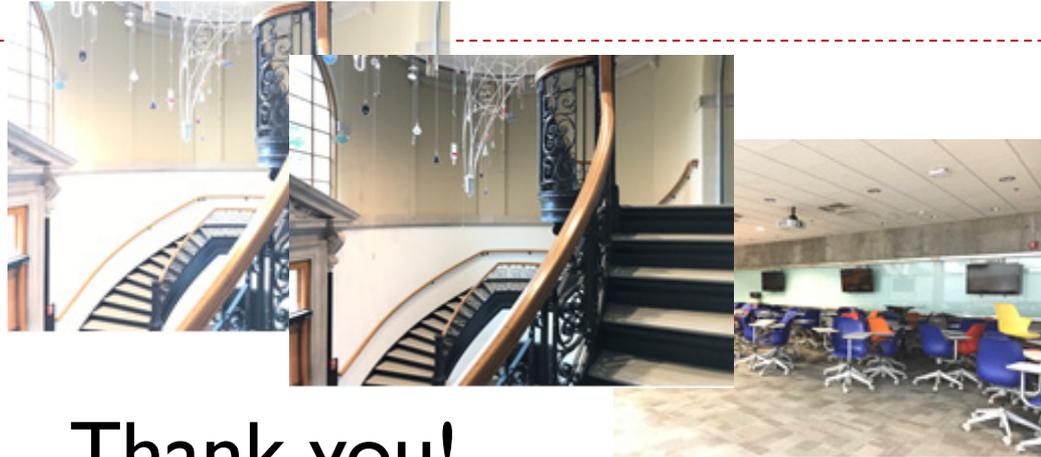
Download Information and Instructions

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Sample Images



Questions?



Thank you!

