Topics in Security: Forensic Signal Analysis

Markus Kuhn, Andrew Lewis

UNIVERSITY OF CAMBRIDGE
Computer Laboratory

http://www.cl.cam.ac.uk/teaching/1011/R08/

Michaelmas 2010 – MPhil ACS

Introductory examples:
manipulation of photographs
Fact or fiction?

Hans D. Baumann, DOCMA

Real

Hans D. Baumann, DOCMA
or fantasy

Political photos may suddenly lack past company ...

Stalin, 1930

http://www.cs.dartmouth.edu/farid/research/digitaltampering/
... unreliable government hardware ...

Iranian missile test, July 2008

http://www.cs.dartmouth.edu/farid/research/digitaltampering/

... or even body parts.


http://www.cs.dartmouth.edu/farid/research/digitaltampering/ ... with many more
Forensic Signal Analysis

This course looks at the use of digital signal processing techniques in a security context, to uncover hidden information from image, video, audio, electromagnetic, etc. signals, in particular to

- identify manipulation;
- identify/verify processing history;
- identify/verify type or instance of the acquiring sensor;
- eavesdrop on persons or computer systems;
- communicate covertly (steganography).

This is a “reading class”, i.e. the “lecture notes” are selected recent original research publications and the material is mostly presented by the students.

Prerequisites

A background in digital signal processing, image processing, linear algebra, probability, statistics, data compression, communication technology (modulation and detection) will be useful.

Some background reading beyond the presented papers will be helpful, in particular on

- Fourier transform, linear time-invariant systems, filters
  http://www.cl.cam.ac.uk/teaching/0809/DSP/

- Discrete Cosine Transform, JPEG, MPEG
  http://www.w3.org/Graphics/JPEG/itu-t81.pdf
  Pennebaker, Mitchell: JPEG still image data compression standard. (Moore Library)

- Digital photography
  CCD/CMOS sensors, Bayer pattern and interpolation, “raw” formats, noise reduction algorithms, . . .