Large Scale Malware Analysis ‘16

Introductory information

Bojan Kolosnjaji
Mohammad Norouzian
George Webster

Chair of IT Security
TU München
Today’s agenda

1) Introduction to the research area

2) Seminar instructions
   a) Deliverables
   b) Grading
   c) FAQ
Introduction to the research area
Attackers Are Moving Fast, Defenders Are Not
Attacking are Streamlining and Upgrading their Techniques, While Companies Struggle to Fight Old Tactics
Cyberattackers Are Leapfrogging Defenses in Ways Companies Lack Insight to Anticipate
Malware Used In Mass Attacks is Increasing and Adapts
Submissions to VirusTotal (1)
Submissions to VirusTotal (2)
Research and practical challenges

- How to gather, store, process data?
- How to gain the new insight from the data?
- How to use this insight to improve cybersecurity?

Many researchers have been tackling this problem.
First ideas stem from the early 2000’s

Data Mining Approaches for Intrusion detection (1998)

Modeling system calls for intrusion detection with dynamic window sizes (2001)

Intrusion detection using neural networks and support vector Machines (2002)


...

Polonium: Tera-Scale Graph Mining and Inference for Malware Detection (2011)

“Andromaly”: a behavioral malware detection framework for android devices (2011)

Leveraging String Kernels for Malware Detection (2013)

Recognizing Functions in Binaries using Neural Networks (2015)

Ensemble Learning for Low-level Hardware-Supported Malware Detection (2015)

...
Windows Defender harnesses the power of machine learning, contributing to making Windows 10 Microsoft’s most secure client operating system and providing increased protection against security threats facing consumers and commercial enterprises today.
Computer malware can often evade antivirus security software if the author changes a few lines of code or designs the program to automatically mutate before each new infection.

Artificial neural networks, trained to recognize the characteristics of malicious code by looking at millions of examples of malware and normal malware files, could perhaps offer a far better way to catch such nefarious code. An approach known as deep learning, which involves...
Still many problems to tackle

- **Feature extraction** - we have lots of data, but what is important?
- **Scalability** - how to maintain our model?
- **Evasion** in sandboxes
- **Adversarial** environment, **mimicry** attacks
Seminar instructions
Our goal

- Get an **overview** of the academic state-of-the-art
- Extend your **knowledge** in security and/or machine learning
- Get a feeling on **how to apply** machine learning, big data in the security context
Topics from different context

- Windows Malware
- Android, IoT (not this time)
- Malicious Web Pages and Domains
- Botnets
What to deliver?

- 1 presentation
  - 20 minutes + 10 minutes of discussion

- 1 report
  - 14 Pages LNCS (look up LNCS template in Latex)
Presentation
Presentation

Needs to be:

- Correct
- Complete
- Comprehensible
Presentation - Correct

- Present information from the paper correctly
- Don’t speculate without a reason or proof
- Don’t claim something you cannot explain well
Presentation - Complete

- Explain all key points of the paper
- Be careful about time constraints and distribution
- Convey information without leaving out important insight
Presentation - Comprehensible

- Speak loud and clear
- Think about the audience - fellow students
- Motivate the audience for discussion
- Don’t fight your audience, answer all questions friendly
A PPT is just a presentation aid. It should not be a paper in its own right and your bullet points should be, if possible, less than a line long. Specifically, keep bullet points short by making them clear and concise. Do not be afraid from using incomplete sentences or phrases. In reality, this is the preferred method because it helps to highlight the points you are making during your talk.

This is because having lots of text on your slides makes it difficult to understand the point you are trying to make. Furthermore, your audience will end up reading the text and ignoring you.
Presentation - Emphasis

- ONLY USE CAPITALIZATION WHEN NEEDED
- Use color sparingly
- Only bold key words and phrases
- Light text on a dark background is bad
Presentation - Pictures

MLS Salaries per May 1, 2023

Main graph description: Smaller graph is driven by estimated salary cap cost of teams. Maximum of $365,750 with adjustments for lower-paid players and personnel.

It has been noted by MLS clubs that this data (both visualizations) may not be comparable across years.

WHAT DOES THIS MEAN?

wow

such color

much text

not comparable

meaning not clear
Presentation - Structure

- Introduction
- Main Point
- Back up arguments
- Conclusions (key takeaways)
Presentation - Audience

- Read papers, or at least abstracts, prior to each presentation day
- Listen carefully, write down questions
- Ask questions, comment
- Active participation is appreciated!
Presentation - Grading

- **Presentation skills**
  - General organization, use of slides
  - Language, slide text and graphics
  - Pace, use of time

- **Subject-related competence (more important)**
  - Subject knowledge
  - Staying on topic
  - Identifying interesting/important points
Report
Report

- 14 Pages LNCS - fit both papers
- Summarize key points of both papers - not an easy task
- If the papers are related, try to compare them in one section at the end
- Use a typical paper structure:

Abstract -> Introduction -> Methodology -> Results -> Discussion -> Conclusion
Report - Abstract

● Summarize the paper
  ○ Introduction to the problem
  ○ How was the problem solved?
  ○ Short insight in the results
  ○ What is the impact of the paper?
Report - Introduction

● Describe the context
● What is the preexisting work?
● What does the preexisting work lack?
● How does this paper close the gap?
Report - Methodology

- Describe the mechanisms used to tackle the existing problem
- Lead the reader through the problem solving procedure
- Give arguments for the choice of methods
Report - Results

● Give an overview of the important results
● Add tables, graphs... if you have space
● Shortly comment on the figures
● Avoid phrases like: It is obvious from this graph that ...
What do the results actually tell us?

Compare the results with related work

What are the limitations of the paper?

How can the limitations be addressed?
Report - Conclusion

- Summary of the paper in 3-4 sentences
- What are the most interesting results?
- What is the impact of the paper?
Report - Grading

- Paper organization
- Language and grammar
- Subject knowledge
- Ability to summarize
- Proper bibliography and citations (!)
How to do your research

- Seminar - (kind of) simulation of scientific research
- Try to be independent
FAQ

- Allowed to miss 1 presentation day? Yes, if you have a very good reason.
  - Examples of good reason: health issues, schedule clashes at the Uni
  - Examples of bad reason: HiWi work, homework, football training, bad mood
- Can I set a meeting if I have problems with my papers?
  - Yes, but try to do as much as you can yourself.
Need a guided research, BSc/MSc thesis topic? Or perhaps you have your own idea? Feel free to ask!