Week 05a: Algorithm and Data Ethics

Algorithm and Data Ethics

Data Breaches

2/16

Major incidents ...

- *TJ Maxx credit and debit card theft* (2005–07)

  Hackers gained access to accounts of over 100 million customers
  ⇒ Customers exposed to credit/debit card fraud

- *Yahoo! data breach* (2013–16)

  Hackers gained access to all 3 billion user accounts
  Details taken included names, DOBs, passwords, answers to security questions
  ⇒ Customers exposed to identity theft
  ⇒ Over 20 class–action lawsuits filed against Yahoo!

- *Facebook–Cambridge Analytica data scandal* (2018)

  Millions of people's Facebook profiles used for political purpose without their consent
  ⇒ Cambridge Analytica went bust as a consequence

... Data Breaches

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The Guardian, 30/03/15 ...

Personal details of world leaders accidentally revealed by G20 organisers

Exclusive: Obama, Putin, Merkel, Cameron, Modi and others kept in the dark after passport numbers and other details were disclosed in Australia's accidental privacy breach

- Follow our full coverage of this exclusive story
- Read the immigration department's letter outlining the circumstances of the G20 privacy breach

▲ Tony Abbott and Vladimir Putin cuddle koalas before the start of the first G20 meeting in November 2014. Photograph: Andrew Taylor/G20 Australia/Getty Images

The personal details of world leaders at the last G20 summit were accidentally disclosed by the Australian immigration department, which did not consider it necessary to inform those world leaders of the privacy breach.

The Guardian can reveal an employee of the agency inadvertently sent the passport numbers, visa details and other personal identifiers of all world leaders attending the summit to the organisers of the Asian Cup football tournament.

... Data Breaches

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Australia's *Privacy Act 1988* ...

- outlines how personal information must be used and managed
- applies to government agencies, businesses and organisations with annual turnover of >$3 million, private health services, ...

Individuals have the right to:

- have access to their personal information
- know why and how information is collected and who it will be disclosed to
- ask to stop unwanted direct marketing

Businesses and organisations must comply with the *Australian Privacy Principles*:

- how to collect personal information
- how (not) to use personal information
- how to secure personal information

... Data Breaches

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Australia's Privacy Act 1988 *Notifiable Data Breaches scheme*

In the event of a suspected or known data breach ...

- contain breach where possible
- assess if personal information is likely to result in serious harm to affected individuals

  - individuals must be notified promptly
  - Australian Information Commissioner must also be notified
- take action to prevent future breaches

Data (Mis–)use

6/16

In 2012 several newspapers reported that …

- Target used data analysis to predict whether female customers are likely pregnant
- Target then sent coupons by mail
- A Minneapolis man thus found out about the pregnancy of his teenage daughter

Not based on a factual story, but not implausible either

Who "owns" your data?

- big companies (Google, Facebook, …)?
- governments?
- you?

… Data (Mis–)use

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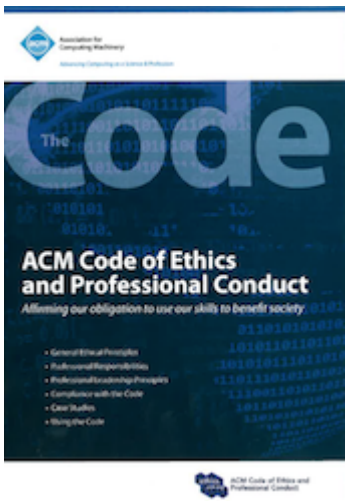

- Respect privacy
  - Store only the minimum amount of personal information necessary
  - Prevent re–identification of anonymised data
- Carefully analyse the consequences of data aggregation
- Access data only when authorised or compelled by the public good
  - Whistleblower Manning's disclosing of classified military data to Wikileaks (2010–11)
  - Paradise papers that disclosed offshore investments (2017)

Source: *ACM Code of Ethics and Professional Conduct*

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Costly Software Errors

NASA's Mars Climate Orbiter ...

- launched 11/12/1998
- reached Mars on 23/9/1999
- came too close to surface and disintegrated

Cause of failure:

- spec said impulse must be calculated in *newton seconds*
- one module calculated impulse in *pound–force seconds*
- 1 newton ≅ 0.2248 pound–force

... Costly Software Errors

9/16

Toyota vehicle recall (2009–11)

- Vehicles experienced sudden unintended acceleration
- 89 deaths have been linked to the failure
- 9 million cars recalled worldwide

Causes of failure included ...

- a deficiency in the electronic throttle control system:
  stack overflow
  ⇒ stack grew out of boundary, overwrote other data

... Costly Software Errors

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Sydney Morning Herald, 05/01/10:

BUSINESS

Welcome to 2016: Eftpos glitch spreads

By Chris Zappone
5 January 2010 — 10:32am

The computer bug that brought Bank of Queensland's Eftpos transactions to a grinding halt in the first days of the New Year has hit other banks - including the Commonwealth Bank-owned BankWest.

The glitch, which started on January 1, left Australian retailers struggling to perform routine electronic point-of-sale transactions.

Merchants instead had to rely on carbon vouchers provided by banks or temporary measures that overrode the machines' internal time stamp.

Because of the error, Eftpos terminals recognise the year as 2016.

EFTPOS terminals inoperable for several days in early 2010

- customers' cards rejected as expired

Cause of failure:

- one module interpreted the current year as hexadecimal
  - `0x09 = 09`
  - `0x10 = 16 (≠ 10)`

Sidetrack: Year 2038 Problem

11/16

Recall:

```
#include <time.h>
time(NULL) // returns the time as the number of seconds
           // since the Epoch, 1970-01-01 00:00:00 +0000
```

Year 2038 problem ...

- `time(NULL)` on 19 January 2038 at 03:14:07 (UTC) will be `2147483647 = 0x7FFFFFFF`
- a second later it will be `0x80000000` = –2,147,483,648
- ⇒ -2^{31} seconds since 01/01/1970 ("Epoch") is 13 December 1901 ...

Programming Ethics

12/16

From the *ACM/IEEE Software Engineering Code* ...

- Software engineers shall ensure that their products meet the highest professional standards possible
  - Strive to fully understand the specifications for software
  - Ensure that specifications have been well documented and satisfy the users' requirements
  - Ensure adequate testing, debugging, and review of software and related documents
- Approve software only if it
  - is safe
  - meets specifications
  - passes appropriate tests
  - does not diminish quality of life, diminish privacy or harm the environment

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... Programming Ethics

13/16

Algorithms can save lives.

Uberlingen airplane collision 1/7/02 at 11:35pm ...

- passenger jet V9 2937 and cargo jet QY 611 on collision course at 36,000 feet
- ground air traffic controller instructed V9 pilot to descend
- seconds later, the automatic Traffic Collision Avoidance System (TCAS)
  - instructed V9 2937 to climb
  - instructed QY 611 to descend
- flight 611's pilot followed TCAS, flight 2937's pilot ignored TCAS
- all 71 people on board the two planes killed

⇒ Collision would not have occurred had both pilots followed TCAS

Exercise #1: Collision Avoidance Algorithm

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The TCAS ...

- builds 3D map of aircraft in the airspace
- determines if collision threat occurs
- automatically negotiates mutual avoidance manoeuvre
- gives synthesised voice instructions to pilots ("climb, climb")

What algorithm would you use for reaching an agreement (climb vs. descent)?

Moral Dilemmas

15/16

How to program an autonomous car ...

- for a potential crash scenario
- when you have to choose between two actions that are both harmful

This is a modern version of the *Trolley Problem* ...

- A runaway trolley is on course to kill five people
- You stand next to a lever that controls a switch
- If the trolley is diverted, it will kill one person on the side track

Is it ethical to pull the lever and kill the one in order to save the five?

Exercise #2: Moral Dilemmas

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What would you do?

Variations:

- Fat man on bridge
- Transplant

⇒ try it yourself on the Moral Machine

Produced: 6 Jan 2020