Annex I-A

**THE UNIVERSITY OF HONG KONG**

**IMPACT CASE HISTORY**

**Title of case study: Fighting High-Tech Crime in Cyberspace**

## 1. Summary

Dr K.P. Chow, Associate Professor in the Department of Computer Science, and his team in the Centre for Information Security and Cryptography (CISC) have been working closely with local law enforcement agencies for over 10 years to develop technologies and tools to protect against cyberspace crime in Hong Kong. The team assisted the Hong Kong Customs and Excise Department in the deployment of the latest software systems to protect against Internet pirates. They have developed Lineament I, which detects suspected infringement of intellectual property rights over the Internet using BitTorrent; Lineament II, which uses cybercriminal profiling and artificial intelligence to detect potential auction fraud; Lineament I Plus, which analyses suspected criminal items in the cyberlocker; and SocNet Monitoring System, which monitors and detects illegal activities on social networking platforms. The impressive performance of these systems was recognized by the aforementioned government department for enhancing cyberspace safety in Hong Kong. The project demonstrated how excellence in research at the University could be applied to real problems which are of importance to the community.

## 2. Underpinning research

The number of cybercrime incidents has been increasing significantly, such as online piracy, child pornography and auction fraud. Technologies adopted by cybercriminals are also increasingly sophisticated, having evolved from traditional computer hacking to sharing of confidential information using peer-to-peer network, sharing of copyrighted videos and music using cloud based storage cyberlocker. CISC has been active in cybercrime research since 2005. In 2007, CISC developed the first cybercrime monitoring system, Lineament I. By 2010, Dr Chow had architected the cybercrime research roadmap for CISC. He has supervised PhD students' research projects on cybercrime investigation and forensics, cybercriminal profiling and cybercrime modelling.

Dr Chow's cybercrime research has contributed to the local community in the areas of Internet piracy monitoring (the basis of Lineament I), file timestamp analysis (paper has been submitted to the Hong Kong courts several times by digital forensics experts), and software copyright piracy (Dr Chow has appeared as prosecution expert at the Court). In 2011, CISC has received an applied research fund from the Innovation and Technology Fund on cybercriminal profiling.

Dr Chow has been aware of the importance of data privacy during investigation and believes that there should be a balance between investigation and data privacy protection. He has published two research papers in the area.

## 3. References to the research

**Key publications**:

K.P. Chow, K.Y. Cheng, L.Y. Man, Pierre K.Y. Lai, Lucas C.K. Hui, C.F. Chong, K.H. Pun, W.W. Tsang, H.W. Chan, S.M. Yiu, BTM - An Automated Rule-based BT Monitoring System for Piracy Detection, *Proceedings of the Second International Conference on Internet Monitoring and Protection* (*ICIMP 2007)*

M. Kwan, R.E. Overill, K.P. Chow, J.A.M. Silomon, H. Tse, F. Law & P. Lai, Evaluation of Evidence in Internet Auction Fraud Investigations, Proc.6th Annual IFIP WG 11.9 International Conference on Digital Forensics, Hong Kong, 3-6 January 2010, Advances in Digital Forensics VI, Ch.7, pp.95-1 06, Springer (2010)

K.P. Chow, Frank Y.W. Law, Michael Y.K. Kwan, Pierre K.Y. Lai, The Rules of Time on NTFS File System, *Proceedings of the Second International Workshop on Systematic Approaches to Digital Forensic Engineering* (SADFE 2007), Seattle, Washington, USA, April 10-12, 2007 (peer-reviewed) – the paper has been submitted to courts of Hong Kong by digital forensics experts multiple times to assist judges and lawyers to understand digital evidence for several child pornography criminal cases since 2010.

Law, FYW; Lai, PKY; Jiang, ZL; Ieong, RSC; Kwan, MYK; Chow, KP; Hui, LCK; Yiu, SM; Chong, CF, Protecting Digital Legal Professional Privilege (LPP) Data, *Proceedings of the 3rd International Workshop on Systematic Approaches to Digital Forensic Engineering* (SADFE 2008), Oakland, California, USA, May 18-22, 2008 (peer-reviewed, best paper award)

Frank Y.W. Law, P. Chan, S.M. Yiu, K.P. Chow, Michael Y.K. Kwan, Hayson Tse, Pierre K.Y. Lai, Protecting Digital Data Privacy in Computer Forensic Examination, *Proceedings of the sixth International Workshop on Systematic Approaches to Digital Forensic Engineering* (SADFE 2011), Oakland, California, USA, 2011 (peer-reviewed, best paper award)

Pierre K.Y. Lai, K.P. Chow, X. Fan and V. Chan, An Empirical Study for Profiling Internet Pirates, *Ninth Annual lFIP WG 11.9 International Conference on Digital Forensics*, Orlando, USA, January 27 - 30, 2013 (peer-reviewed)

**Selected external grant funding**:

1. The Lineaments Systems for HKSAR Customs & Excise Department: Software systems to monitor Internet Piracy
   - Lineament I: monitor illegal sharing of files using BitTorrent
   - Lineament II: monitor online auction site for auction fraud
   - LineamentI Plus: monitor illegal sharing of files using cloud-based storage cyberlocker
   - SocNet Monitoring System: monitor illegal activities on social networking platforms

   Funding Source: Customs and Excise Department of the HKSAR Government (contract research)
   Principal Investigator: Dr K.P. Chow
   Period: 2009 – 2015
   Amount Awarded: HK$1.9M

2. Cyberspace Investigation Technology Using Criminal Profiling (ITS/085/11)
   Funding Scheme: Innovation and Technology Support Programme (Tier 3)
   Principal Investigator: Dr C.K. Hui
   Co-Investigator: Dr K.P. Chow
   Period: 2011 – 2012
   Amount Awarded: HK$999,810

3. Trial: Cyberspace Investigation Technology Using Criminal Profiling (ITT/018/13GP)
   Funding Scheme: Public Sector Trial Scheme
   Principal Investigator: Dr K.P. Chow
   Period: 2014
   Amount Awarded: HK$299,000

**4. Details of the impact or benefit**

In 2011-2012, several key cybercrime incidents happened in Hong Kong, such as closing down of cyberlocker Megaupload who was registered in Hong Kong and DDoS attack of Hong Kong Stock Exchange website. Local law enforcement agencies then contacted CISC about the latest technologies developed by CISC that they could adopt to fight against cybercrime. In late 2012, the HK Police established the Cyber Security Center, and the Customs and Excise Department (C&ED) established the Electronic Crime Investigation Center. Dr Chow and CISC have been working closely with both government departments on the latest R&D in cybercrime investigation and forensics.

The Lineament I & II systems have been deployed to C&ED in 2007 and 2010 respectively to support their daily operations:

- Lineament I (LMS-I) (2007): LMS-I detects suspected infringement of IP rights activities over the Internet using BitTorrent

- Lineament II (LMS-II) (2010): LMS-II uses cybercriminal profiling and artificial intelligence techniques to analyse behaviour of individual user account for potential auction fraud. Since its launch in January 2011, LMS-II had assisted the officers in investigating 120 cases, of which 70 were solved in the first six months of its deployment.

In recent years, CISC research reported that Linker sites have been used to access cyberlocker. Lineament I Plus (LMS-I+) was then developed to analyse suspected criminal items in the cyberlocker through those Linker sites. Lineament I Plus was deployed to C&ED in 2014 to help monitor illegal usage of cyberlocker. This year (2015), CISC cooperated with C&ED again to study the monitoring and automatic detection of illegal activities on social network platforms. SocNet Monitoring System has been deployed to C&ED for trial use to monitor the illegal activities on different social network platforms. CISC has also helped analyze complex crime cases involving Internet and digital technologies for the HK Police and C&ED.

CISC has actively engaged the community, industry and government bodies about its research results of cybercrime through workshops and exhibitions as well as the media. For example, CISC hosted the IFIP WG11.9 International Conference on Digital Forensics in 2010, which attracted over 80 international and local researchers and practitioners. The Lineament suites were widely published in different forms of media. Dr Chow has also invited to give talks by the Office of the Privacy Commissioner for Personal Data, government departments such as the Office of the Government Chief Information Officer (OGCIO), and professional organizations.

**5. References to the corroboration of impact or benefit**

- Statements of support from the HKSAR law enforcement agencies are available for corroboration purpose.

- Press Release from Customs & Excise Department, HKSAR on January 31, 2011 (http://www.customs.gov.hk/en/publication_press/press/index_id_790.html):

  'For the combat of copyright infringing activities through "peer-to-peer" network on the Internet, we worked in collaboration with the Centre for Information Security and Cryptography of The University of Hong Kong and developed a monitoring system named "Lineament Monitoring System I" in 2007. Thereafter, we co-operated with the Centre again and successfully developed a monitoring system named "Lineament Monitoring System II", targeting the activities of Internet auction sites selling intellectual property infringement articles. By entering some relevant information into the system, we can impose a 24-hour monitoring of the local Internet auction sites and suspected infringing activities are recorded to facilitate follow-up action and investigation by Customs officers. As "Lineament Monitoring System II" can be operated automatically, not only can it enhance the efficiency in monitoring Internet auction sites, it can also enhance the enforcement effectiveness of combating the sale of infringing articles through Internet auction sites as it can operate round the clock.'

  The press release on the statement by the Commissioner of Customs & Excise, Mr Richard Yuen, was followed by numerous newspaper reports, reflecting the excellence of the project in research that has achieved the impacts and benefits to the community.